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COMMENTS

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PRE

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How might China-US industrial policies affect the Philippines?: a quantitative exercise

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The recent industrial policy competition between the two economic hegemons, US and China, prompts developing countries to consider if and how they should respond. Using a multicountry, multisector Ricardian trade model with sectoral scale economies, we simulate different scenarios when a developing country like the Philippines takes a passive and active stance. We find welfare gains for the Philippines when it responds by implementing its own industrial policy, and welfare losses from inaction. Timing, however, matters. If the Philippines moved earlier before China and US engaged in industrial policy competition, the welfare gains are larger. Although the magnitude of gains is small, the results suggest an increased demand for industrial policy when the guardrails of the international trading system are lost due to the defiance of its benefactors.

JEL classification: F12, F13, F17
Keywords: Industrial policy, scale economies, new quantitative trade models

1. Introduction

For decades, developing economies were admonished to abide by the "Washington Consensus", a set of market-based policy prescriptions that include trade and financial liberalization. But as the global landscape and zeitgeist evolve with geopolitical frictions, so has the mantra of development crusaders. In the corridors of Washington, Beijing, and Brussels, building national industries through government subsidies and trade restrictions—"the policy that shall not be named"[1]—is having a revival, after past rebuke from academics and policymakers [Cherif and Hasanov 2019].

Industrial policy (IP), referring to targeted government measures to promote specific firms, industries or sectors for national economic development or competitiveness, is ubiquitous. The Global Trade Alert (GTA) reports that nearly

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[1] This phrase is attributed to Cherif and Hasanov [2019].

half (48 percent) of market interventions in 2021 qualify as IP, against a mere eight percent in 2010 [Juhász et al. 2023]. Between 2010 and 2022, more than 18,000 IP measures were tracked globally. Three out of four measures originated from Western Europe and longstanding OECD members; the balance came from rest of the world including Asia and Africa.[2] In 2023, GTA logged a total 1,806 IP interventions—15 percent more than the previous year. Significantly, China, US and EU accounted for 48 percent of these interventions [Evenett et al. 2024].

Arguably, all governments implement some form of IP. But the surge of IP interventions began in 2018 when the US abandoned free market rules and weaponized trade against economic rival, China. In 2015, China launched a medium-term industrial plan called Made in China 2025 (hereafter, MIC 2025), to catapult the country into the position of "leading high-end manufacturing superpower" [Glaser 2019:2]. The EU announced in 2020 the Green Deal Industrial Plan to support manufacturing industries that would be instrumental in achieving the region's ambitious climate targets, including achieving net-zero greenhouse gas emissions by 2050. In 2022, the US sealed its break from rules-based trading system by dangling subsidies to reshore production of semiconductors and by adopting restrictive local content regulation on electric vehicles (EV).[3]

What might explain the IP renaissance is a change in perspective. Instead of posing IP as correction to market failures (such as infant industry, knowledge spillovers and coordination problems), the new IP is framed as a means to shape markets, create positive externalities, direct innovation, and supply missing public inputs. In brief, the new IP is a "policy with purpose" [Mazzucato 2023]. That purpose could take several forms: climate change mitigation, protection of supply chain, national security, countering risk from geopolitical frictions, and competitiveness in strategic sectors.

Yet there is little difference between traditional and new IP with respect to policy instruments. Domestic subsidy (financial grant and state aid), import tariff, export subsidy, export barrier and localization are still the main forms of intervention to provide targeted support. Thus, even while the new IP can stimulate desired changes (such as reducing the cost of green transition), it can entail the same costs, including fiscal ones, and create the same market distortions that earned it bad repute in the past.

Acceptance of new IP logic, therefore, comes with a fair amount of skepticism on whether it could deliver the intended outcome. But such skepticism seems to be directed more on developing economies than advanced economies. IP is seen as a riskier and more precarious proposition for developing economies than it is for developed economies. The usual criticisms of government's inability to

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[2] Specifically, the share of Eastern Europe and Central Asia was nine percent; Latin America and Carribean, 6.8 percent; East Asia and Pacific, 3.7 perent; South Asia, 3.1 percent; and Africa, 3.2 percent [Juhász et al. 2023].

[3] Evenett et al. [2024] report the stated motivations for IP interventions in 2023 are competitiveness of strategic sectors (37 percent), climate change (28 percent), supply chain resilience (15 percent), and geopolitical risk and national security (20 percent).

pick winners, ineffectiveness in stimulating desired behavioral changes and vulnerability to political capture are perceived to apply more in developing economies than in richer economies. Tighter fiscal condition in the former adds to the apprehension, and elicits suggestion that scarce public funds are better directed to infrastructure and other social goals than dispensed to domestic industries.

The issue at hand is whether developing economies should venture on, or refrain from, undertaking a similar policy experiment as advanced economies have done. When foremost hegemons, US and China, undermine the multilateral guardrails on the use of subsidies and trade barriers by their policies, developing countries face a dilemma about how to respond. Should it fence-sit or bandwagon? Conceptually, Harrison and Rodriguez-Clare [2010] show that a small, price-taking economy may realize its latent comparative advantage using Pigouvian subsidy if it could target the sector that can survive on its own after the support is withdrawn (Mill test) and the policy can generate discounted future benefits greater than its cost (Bastable test). The possibility of hurdling these conditions builds a case for implementing IP. On the other hand, the risks of wasting scarce resources in case of failure, of causing additional resource misallocation and market distortions, and of sacrificing gains previously reaped from participating in the global trading system loom large in the decision to remain passive.

This paper examines the dilemma of the Philippines, a developing economy, caught in the crosshair of US-China rivalry and yet remains deeply integrated with these two economies. China is the largest source of Philippine imports, while US is the largest market for Philippine exports. Since China is the hub of factory Asia, nearly half of its gross trade with the Philippines is in intermediates, making China the country's critical link to the global value chain. On the other hand, US is the country's fourth largest source of foreign direct investments and a military ally against China's increasing aggression in the South China Sea.

We compare the simulated welfare effects of sticking to laissez-faire principles and joining the bandwagon of IP implementers. We find welfare gains from implementing own IP, albeit small, and welfare losses from inaction. Timing, however, matters. If the Philippines moved earlier before the China-US IP competition, the welfare gains would have been larger.

In the next section, we discuss the recent tit-for-tat dynamics between US and China, how it undermines multilateral agreements in trade and investments, and how it induces other governments to behave in a similar way. Section 3 describes the Ricardian model with industry-level economies of scale of Ju et al. [2024]. This model is simulated to assess the impact on the Philippines of the US-China IP competition and to identify optimal responses for the country. Section 4 presents the results of simulation, showing the negative cumulative impact of US-China rivalry on the Philippines and how it could fend off such impact. The final section discusses caveats in reading the results. Depending on one's perspective, the results may be regarded as either support for, or counsel against, the use of IP. Yet they clearly signal the potential of ongoing US-China tiff to spread and deepen geoeconomic fragmentation.

2. The race for technological supremacy

The US-China trade friction began almost as soon as China acceded to the World Trade Organization (WTO) in 2001. Since then, US has initiated 23 disputes against China, while China has filed 18 cases against US. The first US complaint against China in 2004 was triggered by the latter's policy allowing a refund of value-added tax (VAT) to local producers and designers of integrated circuits. That policy was deemed inconsistent with the principles of most-favored nation (MFN) and national treatment (NT) and obligations of state trading enterprises in the 1994 General Agreement on Trade and Tariffs (GATT). In 2009, US complained about China's export restraints on mineral products that are critical inputs in manufacturing technology products. US argued that the restraints were designed to create scarcity so as to raise prices of raw materials in the global market. This allowed Chinese producers to take advantage of domestic supply in order to forge ahead of market competition. Earlier in 2002, China disputed the additional duties that US imposed specifically on Chinese aluminum and steel, in contravention of MFN and NT principles. These disputes were, however, mere harbingers of the IP competition between the two economic hegemons that followed.

In 2015, China launched MIC 2025, purportedly in response to the reindustrialization strategies (notably Germany's Industry 4.0) of several developed countries post-2008 financial crisis. The new industrial plan aims to turn China into a high-end manufacturing powerhouse by promoting ten key sectors, namely: information technology, smart manufacturing, aerospace, maritime engineering, advanced rail, electric vehicles, electrical equipment, new materials, biomedicine, and agricultural machinery and equipment. Central to the plan is the semiconductor industry, specifically chips manufacturing. China's foundries specialize in producing legacy chips for low profit margins. Leading chip makers like Taiwan Semiconductor Manufacturing Company and South Korea's Samsung manufacture more advanced and profitable chips. It is widely held in the industry that advances in chip technology would be the foundation of breakthroughs in other technologies. Thus, if China were to become the global leader in manufacturing by 2049, the 100th founding anniversary of the People's Republic of China, it should have the capacity to produce the best chips.

MIC 2025 had been in the wings for quite a while because of rising labor costs and slowdown in investment and export growth. China needed to shift production focus from cheap low-tech goods to more value-added high-tech products, hence a new industrial plan was expected. What was unexpected and a blow to the trading order is the plan's bold defiance of multilateral rules. It calls for indigenizing key technologies by requiring local content of 40 percent by 2020 and 70 percent by 2025—conditions that potentially violate the Agreement on Trade-Related Investment Measures (TRIMS). To develop national champions in these technologies, the plan wields the power of the state to facilitate technology transfers, and mergers and acquisitions of foreign technology companies. More importantly, subsidies are provided through tax incentives, loans, state-funding of R&D and equity investments. There is difficulty ascertaining if these initiatives are consistent with the Agreement on Subsidies and Countervailing Measures (SCM) because of the "overall lack of transparency" in China's use of public resources [WTO 2024:12]. But it appears that China is prepared to use the full weight of the state to achieve its goals.

At the onset, MIC 2025 was perceived by US as threat to national security. To counter the plan, US implemented several measures to decouple technologically from China. These include banning the use of Chinese-made technology in universities, preventing Chinese companies from participating in US infrastructure projects, investigating certain Chinese companies participating in MIC 2025 over concerns of technology theft, limiting transfer of aerospace technology from the US to China, and closely examining China's involvement in US government-funded research. Until the Trump tariffs, these responses to the MIC 2025 challenge were ad hoc and within bounds of multilateral rules.

Backed up by an investigation report (under Section 301 of the 1974 US Trade Act) that found China's technology practices unfair and distortive, amounting to "state-sanctioned theft", the Trump administration imposed additional duties on selected imports from China. The first in the series of tariff impositions consisted of 25 percent additional duties on a set of products with an approximate annual trade value of USD 34 billion (List 1) in July 2018, and on imports worth USD 16 billion (List 2) in August 2018. China implemented retaliatory tariffs, initially on goods under List 1; later, on other goods covered in subsequent lists. In September 2018, Trump imposed ten percent additional duties on imports valued at USD 200 billion (List 3); these additional duties were increased to 25 percent in June 2019. Another round of tariff adjustment was implemented in September 2019—additional 15 percent on USD 102 billion worth of imports (List 4A), lowered to 7.5 percent after the US-China Phase One trade deal was signed in February 2020. The rest of US imports from China, estimated at USD 160 billion, would have formed List 4B and subjected to additional duties effective December 2019. But in anticipation of the Phase One deal, that plan was scuttled.

Lists 1, 2 and 3 cover semiconductors, auto parts, furniture and selected IT hardware and consumer electronics, while List 4B includes clothing and footwear, personal protective equipment and COVID-19 products, exercise equipment, lithium batteries for electric vehicles. These selective tariff impositions against China remained under the Biden administration; a few more were added recently. Following the statutory review of the Section 301 tariffs, published in May 2024, the Biden administration imposed higher rates on USD 18 billion worth of imports that include semiconductors, steel and aluminum products, electric vehicles, batteries and battery parts, natural graphite and other critical materials, medical goods, magnets, cranes, and solar cells. Some of the new tariff adjustments will be implemented in 2025 or 2026 yet.

Underlying the trade war is a race for technological supremacy. Popular press reports that China has gained global leadership in five key technologies (high-speed rail, graphene, unmanned aerial vehicles, solar panels, and electric vehicles and lithium batteries), and is closing the gap in others. The US reckoned that it could not arrest China's technological ascent without an industrial plan to counter MIC 2025.

While retaining the Trump-era tariffs, the Biden administration unveiled the American IP, without the label. The plan consists of three legislations that are seen as parts of an integrated strategy to improve US competitiveness, innovation and industrial productivity, while achieving sustainable and inclusive economic growth. These are the Bipartisan Infrastructure Law (BIL), Creating Helpful Incentives to Produce Semiconductors (CHIPS) and Science Act, and the Inflation Reduction Act (IRA). These initiatives have overlapping objectives, with a total budget of USD 2 trillion over a ten-year period. But the centerpiece program is the IRA that aims to mobilize investments in domestic manufacturing and spur R&D in leading-edge technologies to reduce carbon emissions.[4] Hence, even those availing themselves of incentives for non-climate concerns are expected to contribute to the goals of IRA. For example, a company seeking funding from CHIPS must commit to climate and workforce development plans [Mazzucato 2023].

Like MIC 2025, subsidies under the IRA are linked to domestic-production or domestic-procurement requirements. To illustrate, the eligibility of electric vehicle manufacturers to consumer tax credit is conditional on manufacturing or assembling the battery in North America or in a country that has a free-trade agreement with the US [McKinsey and Co. 2022]. Thus, the design of IRA lends itself to dispute complaint before the WTO.

As expected, China has recently manifested its concern that IRA subsidies are contingent on the use of domestic inputs or goods from selected origins. China deemed these provisions discriminatory against Chinese producers, hence inconsistent with MFN and NT principles, TRIMS Agreement, and SCM Agreement. Ironically, the same violations could have been used by the US against MIC 2025. But by framing IRA as a tool to transition the country to a clean energy economy, the US might be able to defend its policy by invoking public and environmental health under Article XX or national security exception under Article XXI of GATT.

With the US and China ignoring multilateral rules that constrain IP choices of WTO members, several members are now emboldened to follow their lead. Indonesia's export ban of nickel ore despite an earlier WTO decision against this

[4] The IRA is not only a "green industrial plan" [Reenen 2023] as it also provides for lowering healthcare costs, funding the Internal Revenue Service and improving taxpayer compliance [McKenzie and Co. 2022].

practice is a case in point. The South Korean government is reported to have made its subsidy for electric vehicle conditional on the recipient firm running a service center in the country, thereby excluding most foreign companies. And in the EU, there is an increasing clamor to relax state-aid rules so that more subsidies can be directed to strategic sectors.

In view of the foregoing, it is sensible to inquire whether a developing country like the Philippines stands to gain from implementing IP to pursue its development goals. We explore this possibility using a general equilibrium framework described in the next section.

3. The model and calibration

3.1. Structure of the model

This section presents the model of Ju et al. [2024] that extends Caliendo-Parro [2015] in an increasing returns-to-scale environment. The model accounts for the presence of external scale economies in the manner of Lashkaripour and Lugovskyy [2023] and Bartelme et al. [2024]. Consider an economy consisting of N countries, each with J sectors. Countries are indexed by i, n and h; sectors by j, s and k.

3.1.1. Preferences

In each country, there are L_i households whose preference is represented by a nested utility function

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

with an outer Cobb-Douglas nest for final goods C_i^j and an inner CES nest for varieties ω within sector j.[5] The parameter σ^j is the elasticity of substitution across product varieties in sector j. Household income Y_i emanates from labor supply L_i at wage w_i and from lump-sum transfers.

3.1.2. Technology

Each sector is a mass of single-good firms, producing a continuum of intermediate goods $\omega^j \in [0,1]$ that uses intermediate inputs (materials) and labor.[6] The former may be tradable or not, while the latter is perfectly mobile across sectors but completely immobile across countries. The production of ω^j in country i is

$$q_i^j(\omega^j) = z_i^j(\omega^j) E_j (L_i^j) [l_i^j(\omega^j)]^{\beta_i^j} \left[\prod_{s=1}^{J} \left(m_i^{s,j}(\omega^j) \right)^{\gamma_i^{s,j}} \right]^{1-\beta_i^j}, \; \Sigma_{s=1}^{J} \gamma_i^{s,j} = 1 \quad (2)$$

[5] Consumer perceives ω^j as product variety, while the sector or industry perceives the same ω^j as intermediate good.

[6] This feature is equivalent to single-variety firms in Krugman [1980] model.

where $z^j_i(\omega^j)$ is the efficiency of producing ω^j; $E_j(L^j_i)$ represents external economies of scale that depends on L^j_i, total labor employed in the sector; $l^j_i(\omega^j)$ is labor input in the production of ω^j; and $m^{s,j}_i(\omega^j)$ is the amount of ω^s required by a unit of (ω^j). The parameters β^j_i and $\gamma^{s,j}_i$ are, respectively, shares of labor value-added and of intermediate good from sector s that goes into production of ω^j.

To allow for differences in Hicks-neutral productivity across countries and sectors, the efficiency factor $z^j_i(\omega^j)$ is drawn from Frechet distribution

$$Pr\,[z^j_i(\omega) \leq z] = exp\{-T^j_i z^{-\theta j}\}, z > 0 \tag{3}$$

with location parameter $T^j_i \geq 0$ and shape parameter θ^j. The parameter T^j_i also denotes the average productivity of sector j in country i, while θ^j measures the degree of productivity dispersion in sector j. A lower value of θ^j implies higher dispersion of productivity across goods ω^j.

Without loss of generality, external scale economies are assumed sector-specific even as they can be both country- and sector-specific, thus $E_j = E_{j,k}$ [Bartelme et al. 2024:11]. Further, as in Bartleme et al. [2024], E_j takes the functional form

$$E_j(L^j_i) = (L^j_i)^{\psi j} \tag{4}$$

Accordingly, scale elasticity $\psi_j \geq 0$ is unique within each sector but may vary across sectors.

Following Caliendo and Parro [2015], the intermediate goods in sector j of country i are aggregated a la Dixit and Stiglitz [1977] or Ethier [1982] into

$$Q^j_i = \left[\int r^j_i(\omega^j)^{\frac{\sigma^j-1}{\sigma^j}} d\omega^j\right]^{\frac{\sigma^j}{\sigma^j-1}} \tag{5}$$

with $r^j_i(\omega^j)$ representing the demand for intermediate good ω^j and σ^j denoting the elasticity of substitution across intermediate goods in sector j. The composite intermediate good Q^j_i is used as input to the production of ω^k and as final consumption good C^j_i. Thus, the market for the composite intermediate good in sector j clears when supply Q^j_i satisfies demand by households and firms, hence

$$Q^j_i = C^j_i + \Sigma^j_{k=1} \int m^{j,k}_i(\omega^j)\, d\omega \tag{6}$$

Given the production function in equation (2), the unit cost of intermediate good ω^j is

$$c^j_i(\omega) = \frac{1}{z^j_i(\omega)(L^j_i)^{\psi_j}}\, w_i^{\beta^j_i} [\Pi^J_{s=1}(P^s_i)^{\gamma^{s,j}_i}]^{1-\beta^j_i} \tag{7}$$

where P^s_i is the price of composite intermediate good Q^s_i. Any exogenous change in the price of sector s affects the cost (hence price) of sector j because of sectoral linkages.

3.1.3. Trade costs and prices

If ω^j is tradable, its price is also affected by Samuelson's [1954] iceberg trade cost, which is expressed in physical units of ω^j. Transporting ω^j from country n to country i requires more than one unit of ω^j, or $d^j_{in} \geq 1$, while $d^j_{ii} = 1$.

Besides transport cost, industrial and trade policy instruments change price also. Import tax t^j_{in} imposed by country i on good j from country n raises price, while industrial subsidy e^j_{in} ($e^j_{in} < 0$) levied by country i on good j destined to country n reduces it. The latter specification accommodates export subsidy that is applied to all destinations except $n=i$. The total trade cost is then represented by

$$K^j_{in} = \tilde{t}^j_{in} \tilde{e}^j_{in} d^j_{in} \tag{8}$$

where $\tilde{t}^j_{in} = 1 + t^j_{in}$ and $\tilde{e}^j_{in} = 1 + e^j_{in}$. Triangular inequality is assumed, hence $K^j_{in} K^j_{hn} \geq K^j_{in}$.

Firms seek the lowest cost supplier for their materials input, therefore the price of intermediate good ω^j is $p^j(\omega^j) = \min_n \{c^j_n K^j_{in}\}$.

For nontradable ω^j, the condition $K^j_{in} = \infty$ is imposed so that local supply or q^j_i has the lowest cost. Thus, $p^j_i(\omega^j) = c^j_i$ and $r^j_i(\omega^j) = q^j_i(\omega^j)$.

A crucial assumption in the Caliendo-Parro [2015] model is the distribution of productivities are independent across goods, sectors and countries. Further, $1 + \theta^j > \sigma^j$ [Caliendo-Parro 2015:10]. In the Ricardian tradition, trade outcomes are driven by productivity differences. A larger θ^j implies smaller change in trade flow due to a change in trade policy, e.g., higher tariff. This follows as narrower productivity differences across goods means cheaper substitutes are less easy to find. Conversely, a lower value of θ^j, thus larger productivity differences, suggests a policy change can lead to larger adjustment in trade flows as there are more substitutes available.

Beyond Ricardian, the presence of external scale economies provides additional trade driver. The substitutability of goods across countries depends also on the employment size of the sector L^j_i, as it affects cost based on ψ^j. Differences in labor allocation matters if sectors with higher-than-average scale elasticity are favored in some countries.

The price of composite intermediate good Q^j_i can then be expressed as

$$P^j_i = [\Sigma^N_{n=1} T^j_i (c^j_i K^j_{in})^{-\theta^j}]^{-\frac{1}{\theta^j}} \textit{ if } Q^j_i \textit{ is tradeable};$$

$$P^j_i = (T^j_i)^{-\frac{1}{\theta^j}} c^j_i \quad \textit{if } Q^j_i \textit{ is nontradeable.} \tag{9}$$

Since consumers buy at P^j_i prices, the consumer price index is

$$P_i = \Pi^J_{j=1} (P^j_i)^{\alpha^j_i} \tag{10}$$

3.1.4. Equilibrium

The general equilibrium is attained if in every country $i \in N$, goods and labor markets clear. The conditions required to reach the equilibrium state are outlined below.

Denote total expenditure on goods j in country i by $X_i^j = P_i^j Q_i^j$. Let K_{in}^j stand for expenditure in country i of goods j exported by country n. Then the share of expenditure in sector j of goods from country n is $\pi_{in}^j = (X_{in}^j)/(X_i^j)$. From Eaton and Kortum [2002], the expenditure shares can be written as function of technologies, prices and trade costs

$$\pi_{in}^j = T_n^j \left[\frac{c_n^j K_{in}^j}{P_i^j} \right]^{-\theta j} \tag{11}$$

This expression leads to the following inference: smaller θ^j implies larger change in the share of goods supplied by country n in response to a change either its cost c_n^j or trade cost K_{in}^j. In this sense, θ^j determines the elasticity of trade with respect to production or trade cost.

The total demand for goods j in country i consists of demand by foreign and domestic firms for composite intermediate goods and of demand by households for final goods

$$X_i^j = \Sigma_{s=1}^J (1-\beta^s)\gamma_i^{j,s} \Sigma_{n=1}^N X_n^s \frac{\pi_{ni}^s}{(1+t_{ni}^s)(1+e_{ni}^s)} + \alpha_i^j Y_i \tag{12}$$

where Y_i is the sum of labor income $w_i L_i$, and lump-sum transfers from government revenue R_i and deficit D_i. Government revenue R_i is net of output taxes and import tariffs[7]

$$R_i = \Sigma_{j=1}^J \Sigma_{n=1}^N \frac{e_{in}^j}{(1+e_{in}^j)} X_{in}^j + \Sigma_{j=1}^J \Sigma_{k=1}^N \frac{t_{ki}^j}{(1+t_{ki}^j)(1+e_{ki}^j)} X_{ki}^j \tag{13}$$

National deficit D_i is the sum of sectoral deficits given by[8]

$$D_i = \Sigma_{j=1}^J \left(\Sigma_{n=1}^N X_i^j \frac{\pi_{in}^j}{(1+t_{in}^j)(1+e_{in}^j)} - \Sigma_{i=1}^N X_n^j \frac{\pi_{ni}^j}{(1+t_{ni}^j)(1+e_{ni}^j)} \right) \tag{14}$$

Since aggregate deficits $\sum_{(i=1)}^N D_i = 0$, total expenditure in country i minus national deficit equals the sum of all countries' expenditure on goods produced by country i,

$$\Sigma_{j=1}^J \Sigma_{n=1}^N X_i^j \frac{\pi_{in}^j}{(1+t_{in}^j)(1+e_{in}^j)} - D_i = \Sigma_{j=1}^J \Sigma_{n=1}^N X_n^j \frac{\pi_{ni}^j}{(1+t_{ni}^j)(1+e_{ni}^j)} \tag{15}$$

It can be shown that plugging the sum of equation (12) across sectors in equation (15) yields the condition for clearing the labor market in country i

$$w_i L_i = \Sigma_{j=1}^J \beta_i^j \Sigma_{n=1}^N \frac{X_{in}^j}{(1+t_{in}^j)(1+e_{in}^j)} \tag{16}$$

7 Ju et al. [2024] assumes that output taxes are levied before import tariffs.

8 Following Caliendo and Parro [2015], national deficits are considered exogenous in the model, but sectoral deficits are endogenous.

In sum, given parameters (σ^j, α^j_i, β^j_i,$\gamma^{j,s}_i$,θ^j,ψ^j, L_i, d^j_{in}, e^j_{in}, t^j_{in}, T^j_i), an equilibrium under industrial and trade intervention structure $\mathbf{\Gamma}$ is a wage vector $\boldsymbol{w} \in \mathbf{R}^N_{++}$ and prices $\{P^j_i\}^{J,N}_{j=1,i=1}$ that satisfy equations (7), (9), (11), (12), (15) and (16). This equilibrium is perturbed by an exogenous change in $\mathbf{\Gamma}$ that causes recursive changes in prices and costs. An intervention that raises the cost of goods j, for example, could diminish its competitiveness and prompt producers and consumers to substitute other goods. Trade and expenditures adjust instantaneously to return the system to equilibrium.

Solving for the equilibrium of the system involves finding $3NJ+N$ unknowns, which is challenging since the equations are nonlinear and many parameters are difficult to calibrate, e.g. productivities T^j_i and iceberg trade costs d^j_{in}. A parsimonious approach in handling a similar problem has been suggested by Dekle et al. [2008]. Referred to as "exact-hat" algebra, the system is solved for changes in wages and prices after a policy shift from $\mathbf{\Gamma}$ to $\mathbf{\Gamma}'$, instead of solving for levels of wages and prices under a particular policy $\mathbf{\Gamma}$. This approach has the advantage of matching the model to the data, without the need to estimate parameters that are difficult to discern from available information. Thus, the change in variable x is hereafter denoted by $\hat{x} = x'/x$ where x' and x are new and old values, respectively.

Representing national welfare W_i by the real income of an average consumer Y_i/P_i , with P_i given by Equation 10, Ju et al. [2024] decompose the impact of policy change in five parts:

$$ln\left(\frac{\hat{Y}_i}{\hat{P}_i}\right) = -\sum_{j=1}^{J} \frac{\alpha^j_i}{\theta^j}\, ln\hat{\pi}^j_{in} - \sum_{j=1}^{J}\left(\frac{\alpha^j_n}{\theta^j}\frac{1-\beta^j_i}{\beta^j_i} ln\hat{\pi}^j_{ii} + \frac{\alpha^j_n}{\beta^j_i} ln \prod_{s=1}^{J}\left(\frac{\hat{P}^s_i}{\hat{P}^j_i}\right)^{\gamma^{s,j}_i}\right)$$

$$+ \sum_{j=1}^{J} \alpha^j_i \frac{\psi^j}{\beta^j_i} ln(\hat{L}^j_i) - \Sigma^J_{j=1}\frac{\alpha^j_i}{\beta^j_i} ln(\hat{e}^j_{ii}) - ln(\widehat{1-\frac{R_i}{Y_i}}) \tag{17}$$

This decomposition highlights the input-output linkages in the economy. The first two terms represent the aggregate effect on trade in final goods and intermediates, respectively. The third term refers to the scale effect as it measures the productivity change following sectoral resource reallocation. The fourth term is the direct effect of production subsidy on prices. The last term captures the welfare effect through income by the change in government revenues.

3.2. Optimal policy intervention

The case for industrial and trade intervention in distorted open economies has been explored in new quantitative trade models that include Costinot and Rodriguez-Clare [2014], Ossa [2014], Bagwell and Lee [2018], Campolmi et al. [2014], and Haaland and Venables [2016]. The underlying triggers for intervention are the wedge between private and social marginal costs in sectors with external economies of scale and the presence of market power in a monopolistic competitive setting. The Pigouvian subsidy closes the gap between social and marginal costs, while trade taxes exploit market power through improvement in terms of trade (TOT). This section delves into the optimal combination of industrial and trade policies in the presence of these distortions, as derived by Lashkaripour and Lugovskyy [2023] and Bartelme et al. [2024].[9] These two papers also provide alternative estimates for scale elasticity ψ^j and trade elasticity θ^j that Ju et al. [2024] use in their counterfactual simulations.

To relate these papers to the model described in the preceding section, note that the specifications of policy instruments of country i, namely t^j_{ni} and e^j_{ni}, are flexible to import tariff/subsidy, export tax/subsidy and production tax/subsidy. Prices faced by consumers in country i, $\{P^j_{ni}\}$, diverge from prices faced by producers in country n, $\{\tilde{P}^j_{ni}\}$, by

$$P^j_{ni} = \frac{(1+t^j_{ni})}{(1+e^j_{ni})} \tilde{P}^j_{ni}, \forall i, n \in N, j \in J.$$

Scale economies and product differentiation generate economic rents that allow firms to maintain markups or profit margins. Kucheryavyy et al. [2023] show that the relation between scale elasticity ψ^j and elasticity of substitution across product varieties σ^j is $\psi^j = 1/(\sigma^j - 1)$. It allows for interpretation of $\bar{\psi}^j$ as uniform firm-level profit margin in sector j.[10] Because labor is mobile across sectors within a country, the average profit margin in country i across all sectors ψ_i adjusts the wage by $\grave{w}_i \equiv (1+\bar{\psi}_i)w_i$. Producer prices incorporate profit-adjusted wage $\grave{w}_i$.

The government in country i chooses a set of industrial and trade policy instruments, $\boldsymbol{\Gamma}$, that maximize national welfare (W_i), while consistent with $\boldsymbol{w}$, wage vector satisfying labor market clearing condition (Equation 16) in every country $i \in N$. Lashkaripour and Lugovskyy [2023] show the optimal policy design is affected by the availability of instruments, where the first-base case corresponds to having all policy instruments at the government's disposal. It permits the assignment of instruments to specific distortions. Pigouvian subsidy addresses domestic resource misallocation due to industry-level scale economies. Import taxes exploit country i's import market power by marking down the producer price of imported goods. Export taxes take advantage of country i's export market power to mark up the consumer price of exported goods. Thus, trade taxes are designed to improve a country's TOT by raising export prices and lowering import prices.

Importantly, Lashkaripour and Lugovskyy [2023] show that while domestic subsidy e^j_{ii} depends only on ψ^j and import tax-cum-subsidy t^j_{ni} is a function only of (inverse) supply elasticity of j from country n, the export tax-cum-subsidy depends on a set of own- and cross-price demand elasticities.

[9] This paper has undergone several versions since 2019. Ju et al. use the estimates in the 2021 version.

[10] Lashkaripour and Lugovskyy [2023:2767] notes that this relation is only an offshoot of the Krugman [1980] specification of product variety and may not be true elsewhere.

It is as if the government is pricing its exports as a multiproduct monopolist rather than a single-product monopolist.

The second-best case, according to Lashkaripour and Lugovskyy [2023], is when the government cannot apply domestic industrial subsidy but can use trade policy instruments. Optimal import tax under this environment is designed to restrict competition in sectors with relatively high-ψ^j, while optimal export subsidy promotes exports in high-ψ^j sectors. The welfare benefits under this scenario are lower than in the first-best case.

When both industrial and export subsidies are unavailable to the government, import taxes are optimally set to address resource misallocation and to extract market rents on imported goods. Since import tariffs are only substitutes to export subsidies, the welfare gains in this third-best case are less than realizable in the previous case.

Notwithstanding potential gains in any of the three cases, the threat of foreign retaliation has held off some countries from taking unilateral interventions. Retaliatory actions from other countries (especially competitors) can minimize or reverse the welfare gains expected from stand-alone policies. Although global efficiency is served if all countries implement scale-correcting Pigouvian subsidies, each country has an incentive to withhold implementation and free ride on the correction of others. A way out of the classic prisoners' dilemma situation is coordination of industrial policies across countries, as suggested by [2023].

But apart from the risk of setting off ruinous subsidy competition, unilateral scale correction can worsen a country's TOT when scale and trade elasticities have strong negative correlation, i.e., $cov(\psi^j, \theta^j) \ll 0$ [Lashkaripour and Lugovskyy 2023:2781]. In this case, a tension emerges between the imperative of correcting misallocation that requires expanding high-ψ sectors and the incentive to improve the TOT by contracting exports in low-θ industries. Thus, when a sector is both high-ψ and low-θ, the policymaker is in a bind—whether to improve the country's TOT but worsen the resource misallocation or correct the misallocation and lose on the TOT. Bartelme et al. (2024) also caution on realizing limited, "hardly transformative" gains because of constraints in reallocating resources across sectors, low elasticities of substitution and trade barriers.

3.3. Calibration

To take the model to the data, we utilize the Inter-Country Input-Output (ICIO) compiled by the Organization for Economic Cooperation and Development (OECD) to deduce bilateral trade shares π^j_{in}, sectoral consumption shares α^j_i, sectoral value-added shares β^j_i, sectoral expenditure X^j_i and input expenditure shares γ^{sj}_i. The crucial policy parameters, trade elasticity θ^j and scale elasticity ψ^j, are taken from Lashkaripour and Lugovskyy [2023]. Bartelme et al. [2024] present alternative estimates of θ^j and ψ^j.

The ICIO is comprised of 61 countries and 45 sectors, of which 22 sectors produce goods, while the rest are services. Including all countries and sectors is computationally challenging since the dimension of the problem increases multiple fold with the number of countries and sectors included. This prompted the application to six countries and a residual, Rest of the World (ROW), as in Ossa [2014] and Ju et al. [2024]. The world is envisioned to comprise of US, China, EU, India, Japan, the Philippines and ROW.[11]

Sectors are defined by the International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4 at two-digit level of aggregation. All services are assumed nontradable, hence industrial and trade instruments are applied to only 22 goods sectors. Trade and tariff data are accessed from the World Integrated Trade System (WITS).

MIC 2025 was promulgated in May 2015. Fittingly, the baseline environment matches the ICIO data in 2015 sans MIC 2025. The general equilibrium of the model is then solved several times; each round builds on the preceding solution to mimic the evolution of the world economy from 2015 to present.

The first perturbation is the exogenous application of subsidies to seven MIC sectors. As an upper bound estimate of actual subsidies, a uniform optimal subsidy is calculated and applied to these sectors. The second round imposed Trumpian tariffs on 2017 trade. The third round added China's retaliatory tariffs on 2018 trade. The fourth round implemented uniform optimal subsidy on IRA-priority sectors on 2019 trade.[12] In each round, the impact of US-China industrial and trade interventions on the Philippines and other economies are estimated and decomposed as in equation (17).

The trading system after the fourth round of recalibration serves as base scenario for evaluating the response of the Philippines to US-China policies. Four options are explored: do nothing; use optimal subsidy sans import taxes; apply optimal import tariffs sans subsidy; and combine optimal subsidy and import tariffs. The base scenario is interpreted as outcome of the do-nothing option. The subsidy and import tariffs are applied exclusively on sectors that the Philippine Department of Trade and Industry (DTI) identified as priority for industrial development.[13] Optimal import tariff is capped at the lowest MFN bound rate among the priority sectors.

Next, the four Philippine options are reconceived in a hypothetical setting where the US-China industrial and trade interventions since 2015 did not happen. Here, the baseline is the 2015 ICIO before MIC interventions. The welfare effects of implementing optimal industrial policies are examined, assuming passive response from other economies.

[11] This is the same set of countries in Ossa [2014] and Lashkaripour and Lugovskyy [2023], except for the Philippines, replacing Brazil in the cohort.

[12] Note that the trade volumes used in the simulation do not match the actual dates of intervention, but only their chronological order.

[13] "DTI's Industrialization Plan for 2022-2028" [Pascual 2022].

Finally, the Philippine options are recalibrated by changing the target sectors from DTI-priority to MIC-priority. The changes in welfare are calculated relative to their levels post-IRA scenario.

4. Results and discussion

We present the simulation results of 13 scenarios described in the previous section. Scenario 1 corresponds to the 2015 trade environment following China's implementation of MIC 2025. Scenario 2 mimics the condition when Trumpian tariffs were imposed. Section 3 adds China's retaliatory tariffs to the previous scenario. Section 4 reproduces the environment when US IRA was implemented.

The next scenarios explore the options for the Philippines amid US-China IP competition or post IRA. In Scenario 5, the Philippines applies optimal uniform subsidies to DTI-priority sectors; in Scenario 6, optimal tariffs on competing imports are applied; in Scenario 7, a mix of uniform subsidies to DTI-priority sectors and tariffs is implemented. Scenarios 8 to 10 replicate the exercise in Scenarios 5 to 7 in a pre-MIC environment. Lastly, Scenarios 11 to 13 replace the DTI-priority with MIC-priority sectors in Scenarios 5 to 7.

Of the 22 tradeable goods sectors included in the analysis, 11 are targeted under at least one of the following industrial policy programs: China's MIC 2025, the United States' IRA, and the Philippines' industrial plan. Accordingly, sectors are tagged as MIC, IRA or DTI. Applying Ju et al.'s [2024] method for calculating heterogeneous optimal subsidies,[14] sectors with relatively higher scale elasticities receive relatively larger subsidies.

For completeness, Table A.1 in the Appendix exhibits the changes in welfare and scale on the seven economies under each of the 13 scenarios. Table A.2 presents the sectoral distribution of optimal subsidies under the different scenarios, while the changes in Philippine tradeable outputs in each scenario are shown in Table A.3.

We focus on the Philippine policy options when taken either post-IRA or pre-MIC, and when subsidies are provided to either to DTI-priority and MIC priority sectors.

4.1. The simulated effects of China-US industrial and trade policies

The impact of US-China IP competition on Philippine welfare is summarized in Table 1.

[14] We used (and modified when necessary) Ju et al.'s [2024] replication files to run our simulations. These are posted on Wang's [n.d.] personal webpage .

TABLE 1. Simulated effects of China-US policies on the Philippines (in percent changes unless otherwise specified)

	Scenarios (Implementer/s)				
	MIC subsidies (China)	Tariffs (US)	Tariffs (US & China)	IRA subsidies (US)	Cumulative effect - relative to the baseline prior to Scenario 1
	(1)	(2)	(3)	(4)	
Welfare	-0.550	0.012	0.014	-0.116	-0.641
Components (ppt):					
Final Goods	0.535	-0.005	-0.012	0.080	0.599
Intermediates	1.065	-0.009	-0.027	0.166	1.195
Scale Economy	-2.170	0.025	0.054	-0.364	-2.455
Direct Price Effect + Tax Revenue	0.021	0.001	-0.001	0.001	0.022
Trade shares (ppt change): $\pi_{origin,destination}$					
$\pi_{PHL,WLD}$	-0.013	0.000	0.001	-0.002	-0.014
$\pi_{PHL,CHN}$	-0.014	0.000	0.000	-0.001	-0.015
$\pi_{PHL,USA}$	-0.007	0.001	0.002	-0.009	-0.013
$\pi_{WLD,PHL}$	0.863	0.013	-0.033	0.086	0.929
$\pi_{CHN,PHL}$	2.043	0.015	-0.015	0.043	2.086
$\pi_{USA,PHL}$	-0.079	-0.003	-0.010	0.235	0.143

Source: Authors' calculations.

4.1.1. China's MIC Subsidies (Scenario 1)

As in Ju et al. [2024], subsidizing the MIC 2025 target sectors—in the manner of our stylized exercise—is expected to generate welfare gains for China, as well as small and varied aggregate welfare effects for its partners (Table A.1). With 2015 as baseline year in this scenario, the Philippines' small aggregate welfare loss of 0.550 percent (Scenario 1 in Table 1) is driven by a decrease in its aggregate production scale (-2.170 percentage points or ppt) and mitigated by gains from lower cost imports of final and intermediate goods (0.535 and 1.065 ppt, respectively). This drop in scale is consistent with the influx of Chinese goods displacing domestic production, as seen in the 2.043-ppt increase in the trade share of Chinese imports in Philippine spending on tradeable goods ($\pi_{CHN,PHL}$), as well as with the Philippines' lower trade share with China (a 0.014-ppt decrease in ($\pi_{PHL,CHN}$), with the US (a 0.007-ppt decrease in $\pi_{PHL,USA}$), and with all its trade partners taken together (a 0.013-ppt decrease in $\pi_{PHL,WLD}$). Some of the sector-specific effects are nontrivial, with the Philippines' "Chemical" and "Computer" industries—directly affected by MIC as these are part of the MIC-targeted sectors—each registering a decrease in production larger than 35 percent (Table A.3)[15].

4.1.2. US-China trade war tariffs (Scenarios 2 and 3)

In a post-MIC world, the first round of trade-war tariffs imposed by the US against China, or the so-called US "Wave 1" tariffs,[16] lead to a 0.012 percent welfare gain for the Philippines, mainly driven by the 0.025 ppt increase in its economies of scale (Scenario 2 in Table 1). This increase in scale appears to be mediated by a higher trade share of Chinese imports in Philippine spending (up by 0.015 ppt), possibly reflecting the fact that more intermediates are needed for the latter's increase in scale, concomitant with a small increase (0.001 ppt) in the trade share of Philippine goods in US spending.[17]

When the US and China simultaneously impose tariffs against each other at the height of the trade war (which was also examined by Ju et al. [2024] in a scenario they label as "Wave 5 tariffs"), the Philippines enjoys a small welfare gain of 0.014 percent, once again due to an increase in scale economies (Scenario 3 in Table 1). As expected, both trade war scenarios result in Philippine losing access to cheaper imports, as reflected in the "Final Goods" and "Intermediates" components of welfare; however, these effects are also relatively small—all such declines are less than 0.03 ppt. Due to the Wave 5 tariffs, the share of foreign goods in Philippine spending declines, whether viewed in terms of Philippine imports from all its trade partners ($\pi_{WLD,PHL}$), or imports from China($\pi_{CHN,PHL}$) and from US($\pi_{USA,PHL}$). The shares of Philippine goods in foreign countries' spending go up, but the magnitudes are small.

4.1.3. US IRA subsidies (Scenario 4)

Similar to Scenario 1, but to a lesser degree, subsidies granted under IRA cause a welfare loss to the Philippines of 0.116 percent, with 0.364 ppt of this loss coming from decreases in economies of scale, and where the said loss is mitigated by gains from access to cheaper final and intermediate goods of 0.080 and 0.166 ppt, respectively (Scenario 4 in Table 1). Effects on sectors targeted by IRA are arguably non-trivial: of the IRA sectors in the Philippines, "Other transport equipment" stands to contract the most at 7.4 percent (Table A.3). The "Computer" and "Electrical equipment" industries also register notable production contractions of 5.5 and 5.9 percent, respectively (Table A.3). Like the Scenario 1 results, the implementer's trade share in Philippine spending increases

[15] In percentage terms, the most salient production loss is incurred by "Machinery not-elsewhere-classified (nec)" sector at 99.5 percent, but this loss is due to the sector's small calibrated production value at the baseline.
[16] "Wave 1 tariffs" is the term used by Ju et al. [2024] to refer to the first round of Trumpian trade-war tariffs.
[17] These echo some of the findings of Freund et al. [2024]: for instance, they find that Chinese technology products' share in Vietnam's imports went up as import shares of Vietnamese products in US imports also went up, suggesting that supply chains remain dependent on China. In other words, there is some decoupling, but US tariff increases seemed to have strengthened "indirect linkages between the US and China through the industrial supply chains of their trade partners" [Freund et al. 2024:8].

(specifically, $\pi_{USA,PHL}$) is up by 0.235 ppt). While Philippine trade shares in foreign goods go down, the magnitudes are all below 0.01 ppt.

4.2. The simulated effects of Philippine industrial and trade policies, post-IRA (Scenarios 5 to 7)

We simulate the following stylized Philippine policies in a world where the US has already granted IRA subsidies: granting output subsidies to priority sectors (Scenario 5); raising tariffs on competing imports in all targeted sectors up to the bound rate of 13.66 percent[18] (Scenario 6); and doing both (Scenario 7). Table 2 compares these alternative policies with the passive stance (Scenario 4).

First, we note that other countries are hardly affected by any of the Philippines' policy options, with all welfare effects smaller than 0.01 percent in magnitude (Table A.1). Among the options, raising tariffs (Scenario 6) generates the smallest welfare gain (0.333 percent), while combining subsidies and tariffs (Scenario 7) yields the largest benefit for the Philippines (0.766 percent). This result is consistent with the first-best and third-best cases of Lashkaripour and Lugovskyy [2023]. The gains in Scenario 5 (0.512 percent) are intermediate as it only uses subsidies. Moreover, when tariffs are added to subsidies as a policy instrument, the resulting optimal subsidies are lower than when only subsidies are used (compare subsidies under Scenarios 5 and 7 in Table A.2).

Among the three options, the Philippines' trade shares in foreign spending increase the most under the subsidies-only option (see the ppt changes in $\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$) under Scenario 5 compared to Scenarios 6 and 7 in Table 2), while foreign shares in Philippine spending (i.e., $\pi_{WLD,PHL}$, $\pi_{CHN,PHL}$, and $\pi_{USA,PHL}$) decrease the most under the subsidies-cum-tariffs policy compared to the other two options. This trade-share effect under Scenario 7 is consistent with the country losing access to cheaper goods: -0.659 ppt for final goods and -0.743 ppt for intermediate goods (Table 2).

Certain sectoral effects under the said third policy option are quite pronounced: "Basic metals", "Electrical equipment", "Manufacturing not elsewhere classified", and "Pharmaceuticals" all register gains higher than 65 percent, while some non-targeted sectors, namely some parts of the mining sector and the paper sector, register losses (Scenario 7 in Table A.3).

[18] This magnitude is the smallest bound rate among targeted sectors (the simple tariff line average at the sector level) calculated using data from the World Trade Organization's Integrated Database (WTO-IDB), downloaded via the World Integrated Trade Solution (WITS) website (https://wits.worldbank.org/) of the World Bank.

TABLE 2. Philippine trade and industrial policies' effects—targeting DTI-priority sectors vs. MIC sectors (in percent change unless otherwise specified)

	Scenarios (Implementer)						
		Policies targeting DTI-priority sectors (Philippines)			Policies targeting MIC sectors (Philippines)		
	No action post-IRA	Subsidies	Tariffs	Subsidies and tariffs	Subsidies	Tariffs	Subsidies and tariffs
	(4)	(5)	(6)	(7)	(11)	(12)	(13)
Welfare	-0.116	0.512	0.333	0.766	0.811	0.441	1.066
Components[c] (ppt):							
Final Goods	0.080	-0.587	-0.143	-0.659	-0.807	-0.383	-0.938
Intermediates	0.166	-0.439	-0.353	-0.743	-1.883	-0.781	-2.152
Scale Economy	-0.364	2.515	0.308	2.627	4.039	0.994	4.192
Direct Price Effect + Tax Revenue	0.001	-0.978	0.521	-0.462	-0.539	0.610	-0.043
Trade shares (ppt change): $\pi_{origin,destination}$							
$\pi_{PHL,WLD}$	-0.002	0.021	0.000	0.020	0.044	0.001	0.040
$\pi_{PHL,CHN}$	-0.001	0.017	0.000	0.017	0.023	0.001	0.021
$\pi_{PHL,USA}$	-0.009	0.023	0.001	0.022	0.061	0.001	0.053
$\pi_{WLD,PHL}$	0.086	-1.752	-1.033	-2.438	-2.076	-1.225	-2.964
$\pi_{CHN,PHL}$	0.043	-0.482	-0.307	-0.702	-0.841	-0.502	-1.190
$\pi_{USA,PHL}$	0.235	-0.187	-0.131	-0.260	-0.102	-0.082	-0.162

Source: Authors' calculations.

4.3. The cumulative effects of industrial policies

The cumulative effect[19] of China's MIC subsidies, US-China trade wars, and IRA subsidies on Philippines welfare is negative, or a 0.641 percent loss relative to the pre-Scenario 1 or the pre-MIC baseline (See the last column of Table 1, reproduced in the "No action post-IRA" column in Table 3). This may seem small but the cumulative loss in production scale amounts to 2.455 ppt, although countervailed by gains from access to cheaper foreign final and intermediate goods (0.599 and 1.195 ppt, respectively). Cumulatively, without a Philippine response to China-US IP, foreign shares in Philippine spending all increase ($\pi_{WLD,PHL}$, $\pi_{CHN,PHL}$, and $\pi_{USA,PHL}$ up by 0.929 ppt, 2.087 ppt and 0.143 ppt, respectively), and Philippine shares in foreign spending all decrease ($\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$ down by 0.014 ppt, 0.015 ppt and 0.013 ppt, respectively).

When the Philippines chooses to grant optimal subsidies to target sectors in the previous post-IRA scenarios, the country's cumulative welfare loss, again relative to the pre-Scenario 1 baseline, is smaller at -0.131 percent (Table 3). This is mediated by industrial subsidies essentially "recovering" some of the decreases in scale,[20] but at the cost of smaller tax revenues. The tariff-only policy option hardly helps recover scale, although it is still a better choice than doing nothing (with tariffs, scale cumulatively goes down by 2.147 ppt instead of 2.455 when doing nothing) (Table 3). The largest (though still small) cumulative gains are expected to come from the IP that uses both subsidies and tariffs: welfare grows by 0.122 percent cumulatively, as tariffs help mitigate tax revenue losses while subsidies help rebuild scale.

Cumulative effects on trade shares show that Philippine subsidies—whether used together with tariffs or not—would ultimately increase the share of Philippine goods in foreign spending (see the ppt changes in $\pi_{PHL,WLD}$, $\pi_{PHL,CHN}$, and $\pi_{PHL,USA}$ under the "Subsidies" and "Subsidies and tariffs" columns for the "post-IRA implementation results" in Table 3) whereas a tariff-only policy fails to "recover" the trade-share losses of Philippine goods in foreign markets (see the ppt changes in Philippine trade shares under the "Tariffs" column in Table 3). Also, the cumulative effect on the share of Chinese goods in Philippine spending is positive and above one ppt under any of the policy options.

Now consider the case of the Philippines implementing its IP before China and the US implement theirs (see the "pre-MIC implementation" scenarios in Table 3). Compared to the previous results of Philippine implementation of IP post-IRA, the welfare gains from executing policies earlier are larger, despite smaller access to

[19] The cumulative effect for percent changes is calculated using the following formula: $100 \times \ln((1 + x_1/100) \times \ldots \times (1 + x_4/100))$, where x_i is the percentage change due to ith scenario relative to its own immediately preceding baseline. For percentage-point (ppt) changes, the cumulative effect is the sum of the individual scenarios' ppt changes.

[20] Cumulatively, scale economy gains total 0.060 ppt when subsidies are granted to Philippine priority sectors post-IRA, compared with -2.455 ppt cumulative effect mentioned earlier when the Philippines does nothing post-IRA (see the first and second column of results in Table 3).

cheaper imports. When the Philippines uses both subsidies and tariffs pre-MIC, welfare can grow by up to 0.644 percent, as opposed to 0.641 cumulative welfare loss from doing nothing post-IRA. This result is explained by the 2.161 ppt increase in scale that more than offsets the tax revenue losses and effects of higher prices (Table 3). In sum, it matters when a country implements IP. There first-mover benefits that could accrue to the implementer.

4.4. Targeting DTI-priority sectors versus those directly affected by MIC Project

To what extent the reported welfare effects depend on the sectors targeted by IP? Table 2 compares the welfare changes when targeting DTI-priority sectors versus MIC-priority sectors. The welfare changes are measured relative to the post-IRA baseline. Targeting sectors directly affected by China's MIC subsidies result in higher welfare gains compared to targeting sectors identified in the Philippine Industrialization Plan under each of the three policy options for the Philippines. This pattern is evident when we compare results between Scenarios 11 and 5, 12 and 6, and 13 and 7 in Table 2.[21] For example, under the subsidies-and-tariffs option, DTI-targeting results in a 0.766 percent increase in welfare, which is less than the 1.066 percent increase under MIC-targeting by the Philippines (Table 2). These aggregate effects are consistent with the higher increases in sectoral production of certain sectors when the country targets MIC industries rather than the DTI-priority sectors. For instance, the "Chemical" and "Pharmaceutical" industries increase production by 10.9 and 46.5 percent, respectively, when DTI sectors receive optimal subsidies, whereas they register production gains of 147.8 and 73.5 percent when MIC sectors are targeted.

While it might appear that employing a "rebuilding strategy" by supporting MIC-priority sectors is a Pareto improvement to targeting DTI-priority sectors, decomposing the welfare effects once again reveals a more nuanced story. Targeting MIC sectors leads to larger decreases in access to cheaper imports (i.e., decreases in the "Final Goods" and "Intermediates" components of welfare) compared to targeting DTI sectors (Table 2). Under the subsidies-and-tariffs policy option, the loss of access to cheap imported final goods has more negative welfare effects (-0.938 ppt) when targeting MIC sectors than when targeting DTI sectors (-0.659 ppt). MIC targeting also results in larger ppt decreases in foreign countries' trade shares in Philippine spending, but higher increases in Philippine trade shares in foreign markets. Using again the subsidies-and-tariff policy option as reference, MIC targeting reduces foreign countries' trade share in Philippine spending ($\pi_{WLD,PHL}$) by 2.964 ppt, while DTI targeting lowers the same metric by

[21] In this subsection, we again stress that these results are based on stylized exercises—optimal subsidies granted to an entire targeted sector and calculated proportional to sectoral scale economies a la Ju et al. [2024] (Table 1)—and are not the actual subsidies stipulated in any official government document. As such, this is more of an exercise illustrating how results might change depending on sectoral targets, rather than an actual evaluation of or prescription for the Philippine government regarding which sectors to target.

2.438 ppt; MIC targeting increases the Philippine trade share in foreign countries' spending ($\pi_{PHL,WLD}$) by 0.04 ppt versus 0.02 ppt under DTI targeting (Table 2). All told, the choice of target sectors matters.

TABLE 3. Philippine trade and industrial policies' effects—different implementation times (in percent change unless otherwise specified)

		Policies targeted at DTI-priority sectors, by time of implementation					
(cumulative effects relative to the pre-MIC baseline)		**post-IRA implementation (cumulative effects relative to the pre-MIC baseline)**			**pre-MIC implementation (effects relative to the pre-MIC baseline)**		
	No action post-IRA	**Subsidies**	**Tariffs**	**Subsidies and tariffs**	**Subsidies**	**Tariffs**	**Subsidies and tariffs**
					(8)	(9)	(10)
Welfare	-0.641	-0.131	-0.309	0.122	0.437	0.267	0.644
Components[c] (ppt):							
Final Goods	0.599	0.012	0.455	-0.060	-0.410	-0.106	-0.465
Intermediates	1.195	0.756	0.841	0.452	-0.256	-0.251	-0.499
Scale Economy	-2.455	0.060	-2.147	0.172	2.085	0.222	2.161
Direct Price Effect + Tax Revenue	0.022	-0.956	0.543	-0.440	-0.983	0.402	-0.555
Trade shares (ppt change): $\pi_{origin,destination}$							
$\pi_{PHL,WLD}$	-0.014	0.007	-0.013	0.006	0.020	0.000	0.019
$\pi_{PHL,CHN}$	-0.015	0.003	-0.014	0.002	0.020	0.000	0.019
$\pi_{PHL,USA}$	-0.013	0.009	-0.013	0.008	0.018	0.000	0.017
$\pi_{WLD,PHL}$	0.929	-0.824	-0.104	-1.510	-1.207	-0.843	-1.802
$\pi_{CHN,PHL}$	2.087	1.604	1.779	1.384	-0.232	-0.205	-0.378
$\pi_{USA,PHL}$	0.143	-0.044	0.012	-0.117	-0.155	-0.112	-0.231

Source: Authors' calculations.

5. Conclusion

We analyze quantitatively the implications of IP competition between China and US on the Philippines, a developing economy with deep links to the rivalling superpowers. Our quantitative exercises suggest that IP interventions conducted by large economies can have negative spillovers on small economies. Although the overall impact on the Philippines is modest, the contraction in production of sectors targeted by China's IP is nontrivial.

Should the Philippines fend off these negative externalities by implementing its own IP? Between doing nothing and providing Pigouvian subsidy to firms, the latter can potentially help the country recover its lost production scale, without having much effect on the welfare of its trade partners. At least for a small country, the need to rebuild lost production scale can justify the policy in a world where external scale economies exists. But this also means there will be greater demand for IP especially when multilateral restraints in designing IP (e.g., localization requirement) are attenuated.

The current IP competition between economic hegemons presents a real danger that can escalate into a subsidy war. When this happens, IP can beggar-thy-neighbor in the sense that production is diverted to whoever pays the biggest subsidy. Small economies with very limited fiscal firepower are likely collaterals of this war.

Our simulations suggest there is an advantage in implementing IP earlier than others. However, this has limited value to a developing country facing much skepticism in its capacity to target correctly, avoid political capture and make IP deliver its promised benefits [McKenzie 2023]. In practice, without a loss of scale as justification, it would be difficult for government of a developing country to rationalize IP and win public support for it, when some sectors are inevitably favored over others and public resources are limited.

We also find gains from IP can be larger by targeting sectors directly affected by foreign subsidies. However, the choice of targets reflects national priorities that often do not align across economies. And subsidizing the same sectors means foregoing gains from accessing possibly cheaper foreign goods that have been benefitted by foreign subsidies.

Finally, we do not consider "soft" IP in the analysis and focus on "hard" IP. Soft IP involves "develop(ing) a process whereby government, industry and cluster-level private organizations can collaborate on interventions that can directly increase productivity" [Harrison and Rodríguez-Clare 2010:4112]; hard IP employs traditional instruments such as subsidy and trade tax. Soft IP is consistent with rules-based international trade, while hard IP is potentially not. It might be the case that the two are complementary to some degree. It is, however, unclear if they are substitutes or one is a more effective strategy than the other to achieve a country's development goals.

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Annexes

TABLE A.1 Welfare and scale effects - by country and scenario

Countries or regions	Scenarios - by implementer and scenario number[a]												
	China	US	US & China	US	Philippines								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Welfare effects (percent)													
China	2.945	-0.167	-0.386	-0.103	0.001	-0.007	-0.004	-0.004	-0.003	-0.006	0.001	-0.007	-0.005
European Union	-0.060	-0.002	0.001	-0.063	-0.001	-0.001	-0.002	-0.001	-0.001	-0.001	-0.003	-0.001	-0.003
India	0.338	0.008	0.043	-0.085	-0.002	-0.002	-0.004	-0.002	-0.001	-0.002	-0.004	-0.002	-0.005
Japan	-0.129	-0.005	-0.005	-0.103	-0.003	-0.007	-0.008	-0.003	-0.005	-0.007	-0.010	-0.007	-0.015
Philippines	-0.550	0.012	0.014	-0.116	0.512	0.441	0.766	0.437	0.267	0.644	0.811	0.441	1.066
Rest-of-the-world	0.235	-0.010	0.001	-0.076	-0.003	-0.006	-0.007	-0.002	-0.004	-0.006	-0.005	-0.006	-0.011
US	0.114	0.051	0.010	0.230	0.000	-0.001	-0.001	-0.001	-0.001	-0.002	0.000	-0.001	-0.001
Scale effects(ppt)													
China	5.945	-0.259	-0.281	-0.205	-0.023	-0.001	-0.023	-0.023	0.002	-0.021	-0.027	-0.001	-0.026
European Union	-0.710	0.003	0.009	-0.146	-0.006	0.000	-0.006	-0.006	-0.001	-0.006	-0.007	0.000	-0.006
India	-3.500	0.030	0.052	-0.136	-0.002	0.000	-0.001	-0.002	0.000	-0.002	-0.006	0.000	-0.005
Japan	-1.774	0.017	0.014	-0.163	-0.024	-0.009	-0.030	-0.024	-0.006	-0.029	-0.025	-0.009	-0.032
Philippines	-2.170	0.025	0.054	-0.364	2.515	0.994	2.627	2.085	0.222	2.161	4.039	0.994	4.192
Rest-of-the-world	-3.367	0.024	0.047	-0.517	-0.017	-0.010	-0.023	-0.017	-0.006	-0.022	-0.029	-0.010	-0.036
US	-0.527	0.067	0.160	0.804	-0.004	0.000	-0.004	-0.004	-0.001	-0.004	-0.005	0.000	-0.005

Source: Authors' calculations

TABLE A.2 Output subsidies (percent) - tradeable goods sectors - by scenario

Sector	Scale elasticity (ψ)[a]	Sector tags			Scenarios by implementer and scenario number												
		MIC	IRA	DTI	China	US	US & China	US	Philippines								
					(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Agriculture	0.14			✓	-	-	-	-	6.0	-	5.1	4.7	-	3.8	-	-	-
Fishing	0.14				-	-	-	-	-	-	-	-	-	-	-	-	-
Mining, energy	0.17				-	-	-	-	-	-	-	-	-	-	-	-	-
Mining, non-energy	0.17				-	-	-	-	-	-	-	-	-	-	-	-	-
Mining support	0.17				-	-	-	-	-	-	-	-	-	-	-	-	-
Food	0.39				-	-	-	-	-	-	-	-	-	-	-	-	-
Textiles	0.22				-	-	-	-	-	-	-	-	-	-	-	-	-
Wood	0.23				-	-	-	-	-	-	-	-	-	-	-	-	-
Paper	0.32				-	-	-	-	-	-	-	-	-	-	-	-	-
Petroleum	1.22				-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical	0.23	✓			9.6	-	-	-	-	-	-	-	-	-	8.5	-	8.3
Pharmaceutical	0.23	✓		✓	9.6	-	-	-	6.8	-	6.1	5.7	-	5.0	8.5	-	8.3
Rubber	0.14				-	-	-	-	-	-	-	-	-	-	-	-	-
Non-metallic	0.17				-	-	-	-	-	-	-	-	-	-	-	-	-
Basic metals	0.21		✓	✓	-	-	-	7.6	6.6	-	5.9	5.5	-	4.8	-	-	-
Fabricated metal	0.21		✓		-	-	-	7.6	-	-	-	-	-	-	-	-	-
Computer	0.55	✓	✓	✓	11.4	-	-	15.6	8.7	-	8.5	8.4	-	8.2	8.3	-	7.7
Electrical equip.	0.55	✓	✓	✓	11.4	-	-	15.6	8.7	-	8.5	8.4	-	8.2	8.3	-	7.7
Machinery nec	0.12	✓			8.8	-	-	-	-	-	-	-	-	-	8.6	-	8.6
Motor vehicles	0.13	✓	✓	✓	8.8	-	-	5.1	5.9	-	5.0	4.6	-	3.7	8.6	-	8.5
Other transport equip.	0.13	✓	✓		8.8	-	-	5.1	-	-	-	-	-	-	8.6	-	8.5
Manufacturing nec	0.15			✓	-	-	-	-	6.1	-	5.3	4.8	-	4.0	-	-	-

Source: Authors' calculations using Ju et al.'s [2024] method for calculating heterogeneous optimal subsidies (see their Equation 13 in p. 51.)
[a] Scale elasticities are from Lashkaripour and Lugovskyy [2023]

TABLE A.3 Philippine production (percent change) - by tradeable goods sector, scenario, and implementer

Sector	Scale elasticity (ψ)[a]	Sector tags			Scenarios - implementer and number												
		MIC	IRA	DTI	China	US	US & China	US	Philippines								
					(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
Agriculture	0.14			✓	-12.4	0.5	1.0	0.3	9.6	2.5	9.9	7.3	2.0	7.5	2.0	0.8	2.4
Fishing	0.14				-13.5	0.5	1.0	0.1	1.8	0.6	2.2	1.9	0.6	2.3	5.6	1.4	6.4
Mining, energy	0.17				32.7	-3.7	-8.9	-14.7	-56.6	8.8	-49.5	-68.7	-5.6	-67.9	-84.1	-20.9	-84.8
Mining, non-energy	0.17				-13.8	0.3	0.5	-1.6	20.9	10.4	29.5	13.2	6.2	17.6	8.4	-1.5	6.1
Mining support	0.17				-16.9	0.9	1.8	0.2	-10.2	-2.1	-10.3	-7.0	-1.4	-7.2	-17.9	-6.2	-19.7
Food	0.39				-13.3	0.5	1.0	0.2	2.6	0.6	2.9	2.5	0.6	2.8	4.7	1.0	5.1
Textiles	0.22				-10.3	0.3	1.5	-0.2	1.0	0.6	1.4	1.4	0.5	1.8	5.1	0.8	5.2
Wood	0.23				-14.1	0.7	2.4	-2.4	4.4	-1.4	1.1	1.5	-0.8	-0.3	-14.8	-3.5	-16.2
Paper	0.32				-15.6	0.6	1.2	-0.2	0.2	-2.0	-0.9	0.9	-1.4	0.2	-1.7	-1.7	-2.5
Petroleum	1.22				-13.4	0.4	0.9	-0.3	2.7	1.2	3.9	2.7	0.7	3.4	3.2	-0.1	2.9
Chemical	0.23	✓			-37.4	0.3	1.3	-1.7	10.9	-0.9	9.8	8.7	0.0	8.4	147.8	46.7	177.0
Pharmaceutical	0.23	✓		✓	-20.5	0.2	0.4	-1.3	46.5	51.0	83.6	31.2	40.9	62.7	73.5	53.2	111.3
Rubber	0.14				-26.0	0.7	2.8	-1.9	4.0	-3.1	1.5	5.6	-1.3	4.5	67.1	-2.3	62.7
Non-metallic	0.17				-12.7	0.2	0.8	-1.0	2.1	0.4	2.7	4.2	0.5	4.5	13.4	-0.3	11.2
Basic metals	0.21		✓	✓	-17.8	0.7	1.3	-3.4	49.6	22.6	67.8	28.7	12.2	37.4	28.5	-0.5	24.5
Fabricated metal	0.21		✓		-21.0	0.7	1.1	-3.6	30.0	-0.8	28.6	21.7	0.3	21.4	75.1	0.7	66.4
Computer	0.55	✓	✓	✓	-38.1	1.0	1.4	-5.5	63.1	4.2	65.9	59.5	3.5	62.0	62.9	4.7	62.9
Electrical equip.	0.55	✓	✓	✓	-28.9	1.2	1.3	-5.9	58.2	5.7	63.4	35.3	3.5	38.0	56.0	5.8	58.1
Machinery nec	0.12	✓			-99.5	11.0	17.7	-40.9	221.5	-57.4	41.1	133.3	-50.0	17.0	>500[e]	>500[e]	>500[e]
Motor vehicles	0.13	✓	✓	✓	-19.1	0.6	1.0	-0.4	27.5	0.5	24.8	20.5	0.5	18.2	35.9	0.5	36.2
Other transport equip.	0.13	✓	✓		-30.2	1.0	1.7	-7.4	20.2	-6.9	13.0	18.5	-5.2	13.1	71.4	2.3	73.4
Manufacturing nec	0.15			✓	-15.3	1.2	3.0	-2.1	67.0	13.2	66.9	42.4	8.7	43.3	53.9	-0.9	46.5

Source: Authors' calculations
[a]Scale elasticities are from Lashkaripour and Lugovskyy [2023].

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