Trade Wars and Industrial Policy Competitions*

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Abstract

In this paper, we provide the first quantitative evaluation of the impacts and interactions of the US-China trade wars and industrial policy competitions. To that end, we extend the model in Caliendo and Parro (2015) by incorporating sectoral external economies of scale. We find that (i) in the presence of sectoral economies of scale, the “Made-in-China 2025” (MIC2025) industrial policy tends to improve the welfare of both China and the U.S.; (ii) the US gains from Trumpian tariffs if China does not retaliate, and the gain is larger if China had already implemented its optimal subsidies to the “MIC2025” sectors; (iii) in a non-cooperative tariff game on the “MIC 2025” sectors, both China and the U.S. impose high tariffs and endure welfare losses; and (iv) if it is feasible for the U.S. to subsidize its own high-tech sectors, the U.S. would reduce its tariffs on imports from China and benefit from its own industrial subsidies. Our results, therefore, provide a rationale for trade and industrial policy competitions in the U.S. and China.

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1 Introduction

Industry policy has been the primary concern in the US-China economic conflicts. In preparation for launching the trade war with China, the United States Trade Representative Office (USTR) under Trump administration published the “Section 301” report on April 3, 2018. The report openly criticized China’s industrial policies as aggressive and distorting. Most notable among these industrial policies is the “Made in China 2025” (MIC2025) program, which aimed to develop advanced technology sectors deemed to be essential to the future competitiveness of China’s manufacturing industry. To further counter China’s rising economic and political power, the U.S. government under the Biden administration has also turned to industrial policies. For example, the “CHIPS and Science Act”, signed by President Biden on August 9, 2022, aimed to support American semiconductor manufacturing with huge subsides. The economic conflicts between the US and China have evolved from a trade war to competition in industrial policies.

Recent studies about the trade war between the United States and China, such as Amiti, Redding, and Weinstein (2019) and Fajgelbaum, Goldberg, Kennedy, and Khan-delwal (2020), find that the increases in US tariffs against China and several other countries have resulted in significant real income losses for the US consumers and firms. This raises some natural questions: What is the motivation of the trade war? How are the protectionism tariffs implemented by the Trump administration related to China’s industrial policy? Why did the Biden Administration moved from a trade war to industrial policy competition? And, what are the welfare consequences of the trade war and industrial policy competition?

In this paper, we provide the first quantitative evaluation of the impacts and interactions of the US-China trade war and industrial policy competition. To set the stage, we document two facts. First, the initial wave of Trumpian tariffs on imports from China actually targets China’s industrial policies rather than Chinese exports. We show that the tariffs are not correlated with the size of US imports from China, nor the revealed compar-
ative advantage of Chinese products, nor the US sectoral employment losses associated with the Chinese export penetration. Instead, the initial “Section 301” tariffs explicitly targeted Chinese products that benefit from the “MIC2025” program. More recent industrial policies initiated by the Biden administration also targeted many sectors promoted by the “MIC2025” program. Second, we document that the sectors in the “MIC2025” program exhibit strong economies of scale. These facts suggest that competitions in sectors with strong economies of scale are at the heart of the US-China economic conflicts. Therefore, any evaluation of the impacts of such conflicts should seriously consider sector-level scale economies.

To that end, we extend the quantitative trade model in Caliendo and Parro (2015) by incorporating sectoral external economies of scale à la Bartelme, Costinot, Donaldson, and Rodriguez-Clare (2021) and Lashkaripour and Lugovskyy (2022). We first show analytically, in a stylized version of our model, that (i) subsidies on sectors with medium economies of scale could benefit both the implementation country and other countries; and (ii) subsidies on increasing-return-to-scale sectors would increase foreign countries’ incentives to impose import tariffs on these sectors. Our theoretical results highlight the importance of industrial policies in understanding the incentives and consequences of trade wars.

We then calibrate our model to 7 major economies and 44 sectors (including 22 tradable sectors). Armed with the calibrated model, we quantitatively evaluate the impacts of various trade and industrial policies, including the Chinese subsides to the “MIC 2025” sectors, the Trumpian tariffs, and the optimal tariffs and subsidies by the US and China in a non-cooperative Nash equilibrium. Our quantitative analysis reveals some key insights about the US-China economic conflicts. We highlight four of them below.

First, given the strong external economies of scale in the “MIC 2025” sectors, it is optimal for the Chinese government to subsidize these industries. We show that the optimal uniform subsidy rate for these sectors is 7.96% (of sales). This policy results in a 2.5% increase in China’s welfare, and, surprisingly, a 0.44% increase in the US welfare as well.
Because many “MIC 2025” sectors in China export intermediate goods to the US, the Chinese subsidy lowers the intermediate input costs of the US producers and therefore increases the US welfare.

Second, we show that the welfare effects of the Trumpian tariffs depend critically on China’s industrial policies. If China does not subsidize the “MIC 2025” sectors, Trumpian tariffs (Wave 1) would lead to a small welfare gain for the U.S. (0.027%), which is close to that in Caliendo and Parro (2021) (0.024%). However, if China subsidizes the “MIC 2025” sectors by implementing its optimal subsidy rate of 7.96%, then the U.S. gain from Trumpian tariffs (Wave 1) would be larger, (0.033%). Our result shows that taking into account external economies of scale and industrial policies is important in evaluating trade policies.

Third, assuming that China had already implemented its optimal subsidies to the “MIC2025” industries before the US-China trade war, we evaluate equilibrium tariffs on the “MIC 2025” high-tech sectors for both countries in a non-cooperative Nash game. We find that the US optimal tariff on the Chinese high-tech imports is 13.23%, higher than the average of the first wave Trumpian tariffs (6.23%) but lower than the average of the final wave Trumpian tariffs (21.52%), and the Chinese optimal tariff on the US high-tech imports is 20.42%. These non-cooperative tariffs result in considerable welfare losses for both the U.S. (-0.017%) and China (-0.251%).

Finally, if it is feasible for the U.S. to subsidize its own high-tech industries in the US-China trade war, we show that, in this Nash game, the optimal policy for the US is a much lower tariff on Chinese high-tech imports (5.57%) plus a subsidy rate of 9.59% for its own high-tech industries. This policy combination would increase the U.S. welfare by 0.26%, even under the Chinese optimal retaliation tariffs. This result suggests that tariff may not be an efficient instrument in the US-China economic competition and provides a rationale for Biden administration’s move towards industrial policy.

**Related Literature.** Our work is closely related to recent quantitative explorations about trade and industrial policies. Bartelme et al. (2021) and Lashkaripour and Lugov-
show that if one country implements its import tariffs and export subsidies optimally, then its optimal industrial policies depend only on the sectoral economies of scale. These two papers also empirically estimate sectoral economies of scale using different instrument. However, in reality, it is often politically infeasible for countries to impose unilaterally optimal trade policies. How countries should implement industrial subsidies in the real world is still an open question. Our work contributes to this literature by quantitatively evaluate the interdependence of trade and industrial policies in the context of US-China trade war.

Our paper also relates to the quantitative frameworks on trade policies (Caliendo and Parro, 2015; Ossa, 2014; Caliendo, Feenstra, Romalis, and Taylor, 2017). We extend these frameworks by incorporating sectoral economies of scale, which are shown to be relevant in characterizing high-tech industries targeted by the U.S. tariffs. In the real-word context of the US-China economic conflicts, we show that our model can be a useful tool in analyzing trade and industrial policy competitions among major economies.

Finally, our work relates to empirical and quantitative assessment of the US-China trade war starting in 2018. A growing literature, such as Amiti et al. (2019), Amiti, Redding, and Weinstein (2020), Fajgelbaum et al. (2020), Cavallo, Gopinath, Neiman, and Tang (2020), and Ma and Meng (2021)), focuses on price, employment, and welfare effects of the Trumpian tariffs and China’s retaliation. However, these studies do not pay much attention to industrial policies, which have been emphasized both in the announcements and in the implementations of various trade policies during the US-China trade war. Our paper is the first attempt to evaluate the interactions of trade and industrial policies in the US-China trade war.

The remaining sections are arranged as follows. Section 2 presents motivational facts about the US-China trade conflicts. Section 3 builds and characterizes our general equilibrium model. Section 4 calibrates our model. Section 5 conduct counterfactual exercises. Section 6 concludes.
2 Background and Motivational Facts

2.1 The “Made-in-China 2025” Program

Initially announced in 2015, China’s “Made-in-China 2025” (henceforth “MIC 2025”) program set forth a plan to develop certain advanced technology sectors that are deemed essential to the future competitiveness of China’s manufacturing industry. These sectors include next-generation information technology, CNC machine tools and robotics, aero-plane and aerospace, high-tech shipping, advanced railway, new energy vehicles, power equipment, new materials, biotech, and agricultural machinery.

The “MIC 2025” also sets explicit goals to be achieved by 2020 and 2025, including share of R&D expenditure, domestic market share of Chinese producers, self-reliance of key materials and components, and other targets. To achieve these goals, a set of supportive policy instruments, including financial access and fiscal incentives and subsidies, are provided to these key advanced technology sectors. The “MIC 2025” quickly became the backbone of a national grand strategy to build a powerful manufacturing nation and was written into the Thirteenth Five-Year National Economic and Social Development Plan Outline (13th Five-Year Plan). The 13th Five-Year Plan was published in 2016 during the National People’s Congress meeting. Chapters 22 and 23 of the Plan outline laid out a guideline to implement the “MIC 2025” and a roadmap to support emerging strategic industries to gain international competitiveness.

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2 See “Made in China 2025 Key Area Technology Roadmap”, issued by the National Strategic Advisory Committee on Building a Powerful Manufacturing Nation on Oct. 10, 2015.
3 The “Five-Year Plan” is published every five years by the National People’s Congress and is the most important and authoritative national development plan.
2.2 Timeline of the US-China Trade War

Regarding the “MIC 2025” as a set of aggressive and distorting industrial policies, particularly in the high-tech sectors, the U.S. then-president Donald J. Trump instructed the U.S. Trade Representative (USTR) to initiate a “Section 301” investigation targeting China. The final official “Section 301” report was released on March 22, 2018, which marked the start of tariff wars and retaliations between the two largest countries in the world.

The original “Section 301” tariffs included a list of 1,333 eight-digit HS products, which was then revised on June 15: 818 HS-8 products remained on the list and was subject to an additional 25 percent tariff effective since July 6, 2018. A new set of 284 HS-8 products were added to the list and was subject to an additional 25 percent tariff effective since August 23, 2018. The proposed list particularly targets the products regarded as “strategically important to and benefit from” China’s distorting industrial policies, including the “MIC 2025” program.4

We label this revised list of tariff lines as wave 1. To report the changes in tariffs, we aggregate tariffs and trade data into 22 tradable sectors as classified in the OECD Inter-Country Input-Output (ICIO) Tables. As shown in Figure 1 panel (a), only a few sectors (red bar) were affected by the wave 1 tariffs, and these are mostly high-tech sectors.5

China almost immediately announced its retaliation plan: on June 16, 2018, the Chinese government issued a notice concerning additional tariffs on $50 billion of imported US goods (China’s wave 1 in panel (b) of Figure 1). The retaliation induced the United States to respond by imposing an additional 10 percent tariff on about $200 billion of Chinese imports since September 24, 2019. We label this new list as the wave 2 tariffs, which covers nearly 6,000 HS-8 products. Figure 1 panel (a) shows that wave 2 substantially expands the list of products subject to the additional tariffs. As a response, China also

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5In Appendix A.1, we illustrate the escalation of the US-China tariff wars in two-digit HS industries. Basic patterns hold in these more disaggregated industries.
Notes: Note: Panel (a) illustrates tariff increases in the five waves of Trumpian tariffs on Chinese imports. Panel (b) shows China’s retaliation tariff increases, implemented immediately after each wave of U.S. tariffs. Both use weighted average of tariffs at six-digit HS products within the same ICIO sector.

Figure 1: Trumpian Tariffs and China’s Retaliation
imposed additional tariffs of 5-10% on $60 billion worth of U.S. goods (China’s wave 1 in panel (b) of Figure 1).

The trade war continued to escalate, after a short ceasefire when President Trump met with President Xi at the G20 summit in Buenos Aires on December 1, 2018. So in what follows and in panel (a) of Figure 1, we use wave 3 to refer to the event that the Trump administration decided to further increase tariffs on the wave 2 products to 25 percent, on May 10, 2019. As shown in panel (b), the Chinese government also increased its retaliation tariffs on almost all categories, except in motor vehicles, which reflects the suspension of tariffs on automobiles after the Xi-Trump meeting. Wave 4 refers to the 15 percent tariffs on additional Chinese imports of about 110 billion dollars, imposed on September 1, 2019. Finally, Wave 5 covers the rest of about 160 billion Chinese imports which was schedule to be levied an additional 15 percent tariff on December 15, 2019. Correspondingly, for each round of US tariffs, China also retaliated by raising its import tariffs against US goods.

In summary, there have been altogether five waves of protectionism tariffs implemented or proposed by the Trump administration, on July and August 2018 (wave 1), September 2018 (wave 2), May 2019 (wave 3), September 2019 (wave 4), and December 2019 (wave 5), respectively. Adopting a “tic-for-tat” strategy, China’s retaliation immediately followed each wave of the U.S. tariffs. As shown in Figure 1, after the last wave of protectionism tariffs, both countries impose the tariffs to levels that are much higher than the ongoing MFN rates.

2.3 What is the Motivation of Trumpian Trade War?

We have shown in the last subsection that Trumpian tariffs were initially concentrated in only a few sectors. What is the motivation of these tariffs? Are they for reducing the US-China trade imbalances? Or about the U.S. jobs? To examine these possibilities, we first look at the

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6 An update on December 13, 2019: According to the Phase I deal principally agreed upon by both countries’ negotiators, the Wave 5 tariffs were cancelled and the Wave 4 tariffs were cut in half — it is now 7.5 percent. Our study does not reflect this change yet. Bown (2019) also provides a summary of the Trump trade war timeline.
relationship between Trumpian tariffs (wave 1) and the sectoral distribution of the U.S. imports from China prior to the US-China trade war. If the Trumpian tariffs are indeed for reducing the US trade deficits, they should target on industries that the U.S. imports most from China.

Figure 2: Initial Trumpian Tariffs (July & August 2018) and US imports from China

Figure 2 suggests that Trumpian tariffs did not initially target on the goods that the U.S. imports most from China, such as personal computers and mobile phones. In contrast, these tariffs were concentrated in various machinery and equipment industries that the U.S. rarely imports from China. As robustness checks, we also explore the linkage between Trumpian tariffs (Wave 1) and the U.S. imports from China at the four-digit HS sectors, with different measures of trade shares (see details in Appendix A.2). The main message delivered by Figure 2 holds in these robustness exercises.

Second, we investigate the relationship between Trumpian tariffs (wave 1) and the exposure of U.S. jobs to China trade shocks. A growing body of literature emphasizes the negative impact of import competition from China on the sectoral or regional employment in the U.S. (Autor, Dorn, and Hanson, 2013; Acemoglu, Autor, Dorn, Hanson, and Price, 2016; Pierce and Schott, 2016). Figure 3 shows that there is almost no correlation
between the initial Trumpian tariffs and the change in import penetration measured by changes in imports from China relative to sectoral domestic absorption during the period 2000-2014 (left panel), or changes in employment from 2000-2014 (right panel) at the four-digit SIC level.

Notes: In the left panel, sectoral import penetration is measured by the changes in imports from China during the period 2000-2014 over the initial (2000) domestic absorption (i.e., domestic output + imports - exports). In the right panel, we use log change in sectoral employment from 2000 to 2014. Sectors are defined at 4-digit SIC level, following Acemoglu et al., 2016.

Figure 3: Trumpian Tariffs (Wave 1) and the Exposure of U.S. jobs to “China Shocks”

Figure 2 and 3 indicate that there is no evidence that the initial Trumpian tariffs are for reducing the US-China trade imbalances or about the U.S. jobs. Then what are they for? As claimed in the Section 301 report, Trumpian tariffs targeted on products that are “strategically important to and benefit from” the “MIC 2025” program and other Chinese industrial policies (USTR, 2018 June Notice). 7 We turn to investigate whether this claim is consistent with sectoral patterns of Trumpian tariffs (wave 1). In particular, we identify four-digit HS products associated with the strategic industries listed by the “MIC 2025” program, and then compare Trumpian tariffs (wave 1) on these industries with those on

7See the Section 301 Fact Sheet at https://ustr.gov/about-us/policy-offices/press-office/fact-sheets/2018/june/section-301-investigation-fact-sheet. Also see the official Section 301 report by the United State Trade Representative Office (henceforth USTR) where “MIC 2025” is cited for 119 times.
other manufacturing industries.

Figure 4 suggests that Trumpian tariffs (wave 1) were indeed concentrated on the “MIC 2025” industries. This result provides a rationale of the initial Trumpian tariffs: the U.S. has criticized China for using distorting industrial policies (like “MIC 2025”) to seize economic dominance of certain advanced technology sectors. To counter the effects of China’s industrial subsidies, the U.S. imposes penalty tariffs on these high-tech industries.

However, why did China subsidize its “MIC 2025” sectors at the first place? To answer this question, we employ sectoral economies of scale estimated by Lashkaripour and Lugovskyy (2022) and show in Figure 5 that the “MIC 2025” sectors on average have stronger economies of scale than other manufacturing sectors. We will show in Section 3 and 5 that the strong economies of scale in the “MIC 2025” sectors could justify tariffs and industrial subsidies on these sectors. Notably, in this paper we do not consider the dynamic knowledge accumulation of high-tech industries. This dynamic effect would strengthen the incentives the U.S. and China to intervene these industries. We leave it for the future exploration.

In sum, we find that there is no evidence that the initial Trumpian tariffs are for reducing the US-China trade imbalances or about the U.S. jobs. In contrast, these tariffs are
Notes: The left bar calculates the simple average of the economies of scale of the ICIO industries supported by the “MIC 2025” project, calibrated from Lashkaripour and Lugovskyy (2022). The right bar calculates that of the industries that are not supported by the “MIC 2025” project. We exclude the industry with extreme economies of scale, Petroleum.

Figure 5: Sectoral Economies of Scale and the “MIC 2025” Program

concentrated in the sectors that are supported by China’s “MIC 2025” program and exhibit stronger economies of scale than other manufacturing sectors. These results indicate that the US-China trade conflict starting from 2018 is essentially a technology competition between two largest economies in the world.

2.4 From Tariff War to Industry Policy Competition

The facts presented in Section 2.3 suggest that the initial Trumpian tariffs did not aim at correcting US-China trade imbalances, as claimed by President Trump. These tariffs are not correlated with the size of US imports from China, nor the revealed comparative advantage of Chinese products, nor the US sectoral employment losses associated with the Chinese export penetration. Instead, they targeted on the high-tech industries emphasized by the “MIC 2025” program. Furthermore, the sectors in the “MIC 2025” program exhibit strong economies of scale.

To counter China’s rising economic and political power, and to take advantage of the gains in scale economy, the U.S. government under the Biden administration has also
turned to industrial policies. The White House published the *National Strategy for Advanced Manufacturing*, initially in 2018 and updated in 2022, which emphasized the importance of regaining American leadership and competitiveness in advanced manufacturing. Among these strategies the most notable one is the *CHIPS and Science Act*, signed by President Biden on August 9, 2022, which aimed to support American semiconductor manufacturing with huge subsidies. Other examples include the *Executive Order on Advancing Biotechnology and Biomanufacturing* by President Biden, and more recently the *Inflation Reduction Act*, which also unleashed vast subsidies for green energy and electric cars. The economic conflicts between the US and China have evolved quickly from a trade war to the competition in industrial policies.

In summary, competitions in sectors with strong economies of scale are now at the heart of the US-China economic conflicts. Will the Trumpian protectionism tariffs on high-tech industries prevent China from implementing MIC 2025? What characterize the nature and effects of the interactions of industrial policy interventions by the two largest nations in the world? In this paper, we provide the first quantitative evaluation of the impacts and interactions of the US-China trade wars and industrial policy competitions.

3 Model

In this section, we build a multi-country-multi-sector general equilibrium model to quantify the incentives of trade wars and industrial policy competition between the U.S. and China. In particular, we extend the model developed by Caliendo and Parro (2015) by incorporating sectoral economies of scale à la Bartelme et al. (2021) and Lashkaripour and Lugovskyy (2022). In this section, We set up the model, define the equilibrium, and analytically characterize the global effects of tariffs and industrial subsidies in a stylized version of our model.
3.1 Environment

Consider a world with \( N \) countries, indexed by \( i \) and \( n \), with a mass \( L_i \) workers in each \( i \). There are \( J \) sectors, indexed by \( j \) and \( s \). Workers are immobile across countries but perfectly mobile across sectors. Each sector consists a unit mass of varieties.

**Demand and Frictions.** The representative consumer of country \( i \) has a two-tiered preference:

\[
U_i = \sum_{j=1}^{J} \alpha_i^j \log \left( \int_0^1 \left[ C^j_i(\omega) \right] \frac{c_j^i}{c_j^j} d\omega \right) \frac{c_j^i}{c_j^j-1}
\]

where \( \sigma_j \) is the elasticity of substitution across consumption varieties in sector \( j \). We assume that each variety is produced under perfect competition using labor and composite intermediates.

International trade is subject to three types of trade costs. First, there is an iceberg trade cost \( \tau^i_j \) of shipping goods from \( i \) to \( n \), with \( \tau^i_i = 1 \). Second, there is an *ad valorem* tariff \( \tilde{t}^i_j \) imposed by importing country \( n \) on goods \( j \) from country \( i \), with \( \tilde{t}^i_i = 0 \). Third, there is an *ad valorem* tariff \( \tilde{e}^j_i \) imposed by exporting country \( i \) on goods \( j \) from country \( i \). Notably, this export tariff is isomorphic as industrial subsidies once it is negative and uniform for all destination country \( n \), including \( n = i \). We denote \( t^i_j \equiv 1 + \tilde{t}^i_j \) and \( e^j_i \equiv 1 + \tilde{e}^j_i \).

**Technology.** We extend the production technology in Caliendo and Parro (2015) by incorporating sectoral external economies of scale. We summarize our production technology by the following unit cost function: the unit cost of variety \( \omega \) of intermediate \( j \) in country \( i \) is \( c_i^j(\omega) = \frac{1}{z_i^j(\omega)} c_i^j \) where

\[
c_i^j = \frac{1}{(L_i^j)^{\psi_j}} w_i^{\beta_j^j} \left[ \prod_{s=1}^{J} (P_{i}^{s})^{\gamma_i^j} \right]^{1-\beta_i^j}, \quad \sum_{s=1}^{J} \gamma_i^j = 1, \tag{2}
\]

**Sectoral Scale Economy**
where $P_i^s$ is the price index of good $s$ in country $i$ and $L_i^j$ is the labor allocated to sector $j$ of country $i$. Notably, $\psi_j \geq 0$ characterizes the external economies of scale in sector $j$.

The Hicks-neutral productivity $z_i^j(\omega)$ is drawn independently from the following Frechét distribution:

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

where $T_i^j$ characterizes the average productivity of sector $j$ in country $i$ and $\theta_j$ characterizes the dispersion of productivities in sector $j$.

### 3.2 Equilibrium

We proceed by characterizing the aggregate economy and define the equilibrium. Based on the property of Frechét distribution and the ideal price index of CES preferences, the sectoral price index can be expressed as

$$P_i^j = \left[ \sum_{n=1}^N T_i^j \left( c_i^j \tau_{in}^j t_{in}^j e_{in}^j \right)^{-\theta_j} \right]^{-\frac{1}{\theta_j}}. \quad (4)$$

Following Eaton and Kortum (2002), the expenditure share of country $n$ on good $j$ from country $i$ is given by

$$\pi_{in}^j = \frac{X_{in}^j}{X_n^j} = \frac{T_i^j \left( c_i^j \tau_{in}^j t_{in}^j e_{in}^j \right)^{-\theta_j}}{\left( P_n^j \right)^{-\theta_j}}. \quad (5)$$

Sectoral employment satisfies:

$$w_i L_i^j = \beta_i \sum_{n=1}^N X_{in}^j \frac{X_{in}^j}{t_{in}^j e_{in}^j}. \quad (6)$$
Then wage is determined by labor market clearing:

\[
\sum_{j=1}^{I} L_j^i = L_i. \tag{7}
\]

We assume that export tariffs, if there are any, are collected before import tariffs. Therefore, the total income is given by

\[
Y_i = w_i L_i + \sum_{j=1}^{I} \sum_{n=1}^{N} e_{in}^j - 1 \sum_{j=1}^{I} t_{ki}^j X_j^i, \\
\text{Export Tariff Revenue} \qquad \text{Import Tariff Revenue}
\]

\[
N \sum_{n=1}^{N} X_{in} = E_{in} - 1 X_j^i, \\
\text{Export Tariff Revenue} + \sum_{j=1}^{I} \sum_{k=1}^{N} t_{ki}^j X_j^i. \tag{8}
\]

The aggregate price index for final consumption goods can be expressed as

\[
P_n = \prod_{j=1}^{I} (P_n^j)^{\alpha_n^j}. \tag{9}
\]

Finally, the sectoral expenditure can be expressed by

\[
X_j^i = \alpha_i^j Y_i + \sum_{s=1}^{S} (1 - \beta_i^s) \sum_{n=1}^{N} X_{in}^s e_{in}^s. \tag{10}
\]

**Definition 1 (Equilibrium)** Given parameters \(\theta, \psi, \alpha_i^j, \beta_i^s, \gamma_i^s, \mu_i, L_i, e_{in}^j, t_{ki}^j, T_i^j, \tau_i^j\), the equilibrium consists of \((w_i, L_i^i, P_n^i, X_j^i)\) such that

1. Price indices \((P_n^i)\) are given by Equation (4).
2. Sectoral labor allocation satisfies Equation (6).
3. Wage is pinned down by Equation (7).
4. Sectoral good market clearing holds as in Equation (10).
Definition 1 establishes a system of $3NJ + N$ nonlinear equations in the $3NJ + N$ unknowns which can be solved given a numeraire. A challenge is that this system depends on the set of parameters $\left( T^i_j, \tau^i_{in} \right)$ which are difficult to calibrate.

To address this problem, we compute the changes of equilibrium outcomes with respect to tariff changes using the “exact-hat” algebra developed by (Dekle, Eaton, and Kortum, 2008). We denote the value of any variable $Z$ after change as $Z'$ and $\hat{Z} = Z' / Z$.

Suppose that we have the values of $\left( \alpha^i_j, \beta^i_j, \gamma^s_j, \psi_j, \theta_j \right)$ as well as the data on $\left( X^j_{in}, t^j_{in}, e^j_{in} \right)$. Then we can compute the equilibrium changes, $\hat{w}^j_i, \hat{L}^j_i, \hat{P}^j_i, \hat{X}^j_i$, by solving a system of $3NJ + N$ nonlinear equations. The details of the equation system are presented in the Appendix B.1.

Finally, how does incorporating sectoral economies of scale affect our quantitative analysis on the impacts of trade and industrial policies? Inspired by the sufficient statistics approach developed by Arkolakis, Costinot, and Rodriguez-Clare (2012) and Caliendo and Parro (2015), we decompose the welfare effects of policy changes as:

**Proposition 1** The changes in the real wage with respect to policy changes are

$$
\log \left( \frac{\hat{w}^i_j}{\hat{p}^i_j} \right) = \sum_{j=1}^{J} \left[ \alpha^i_j \log \left( \hat{\pi}^i_{ii} \right) - \frac{1}{\theta_j} \log \left( \hat{\pi}_{ii} \right) + \frac{\psi_j}{\beta_j^i} \log \left( \hat{L}^j_i \right) - \frac{1 - \beta_j^i}{\beta_j^i} \left( \log \hat{\xi}^j_i + \frac{1}{\theta_j} \log \left( \hat{\pi}_{ii} \right) \right) \right],
$$

where the sectoral linkages are summarized by

$$
\hat{\xi}^j_i = \prod_{s=1}^{L} \left( \frac{\hat{p}^s_i}{\hat{p}^s_j} \right)^{\gamma^s_j}
$$

Proposition 1 suggests that, other things equal, a country would benefit from increasing production scale in sectors with higher $\psi_j$. We will show analytically in the next
subsection that countries would impose import tariffs and industrial subsidies in order to compete for the scale of sectors with strong economies of scale.

3.3 Welfare Effects of Tariffs and Industrial Subsidies

To characterize the welfare implications of tariffs and industrial subsidies, and in particular, their interactions across countries, we consider the following two-country-two-sector illustrative example:

**Definition 2 (A Two-Country-Two-Sector Illustrative Example)** Consider two countries, \( i = 1, 2 \) and two sectors, \( j = 1, 2 \). Sector 1 is of constant return to scale, i.e. \( \psi_1 = 0 \), and freely traded. We assume that \( \alpha_1 \) and \( \tau^2_{in} (i \neq n) \) are sufficiently large so that every country produces good 1. We assume away intermediates, i.e. \( \beta^j_i = 1 \) for all \( i \) and \( j \). We assume that \( T^1_1 = T^1_2 = 1 \). Therefore, we normalize \( w^1_1 = w^2_2 = 1 \). We assume that initially there are no tariffs or subsidies on sector 2, i.e. \( t_{in} = e_{in} = 1 \) for all \( i, n = 1, 2 \).\(^8\)

In this illustrative example, we first characterize the welfare impacts of unilateral import tariffs on sectors of increasing return to scale:

**Proposition 2 (Home Market Effects of Import Tariffs)** Consider the example in Definition 2. There exist bounds \( 0 < \frac{\psi^j}{\bar{\psi}_i} < \frac{\bar{\psi}_i}{\psi^j} \) such that for all \( \frac{\psi^j}{\bar{\psi}_i} < \psi < \frac{\bar{\psi}_i}{\psi^j} \):

\[
\frac{\partial \log W_1}{\partial \log t_{21}} > 0, \text{ and } \frac{\partial \log W_2}{\partial \log t_{21}} < 0. \tag{13}
\]

Notice that in our illustrative example, nominal wages are exogenously pinned down by the productivities of numeraire goods. Therefore, there is no terms-of-trade effect of tariffs and subsidies. Proposition 2 shows that a country can gain from unilateral import tariffs on the sector of increasing returns to scale, at the expense of the other country. This

\(^8\)In this illustrative example, we drop the superscript for sector 2 in cases that would not lead to confusion.
result reflects the home-market effect: import tariffs on sector 2 increase home production and, correspondingly, decrease foreign production of sector 2. This home-market effect is a standard justification for protectionism tariffs, as figured out by Ossa (2011) whose model is a special case of our illustrative example setting \( \theta \psi = 1 \).

While the home-market effect of import tariffs is standard in the literature, there is lack of characterization of welfare impacts of industrial subsidies. We have the following results in our illustrative example:

**Proposition 3 (Global Welfare Benefits of Industrial Subsidies)** Consider the example in Definition 2. Suppose that two countries are symmetric. There exist bounds \( 0 < \underline{\psi} < \overline{\psi} \) such that for all \( \underline{\psi} < \psi < \overline{\psi} \):

\[
-\frac{\partial \log W_1}{\partial \log e_1} > 0, \quad \text{and} \quad -\frac{\partial \log W_2}{\partial \log e_1} > 0. \tag{14}
\]

Proposition 3 suggests that when sector 2 exhibits medium scale economies, industrial subsidies on sector 2 in country 1 could benefit both countries. Notably, the industry subsidy has three effects: (i) it increases production of sector 2 in country 1 and thereby decreases domestic and export prices of sector 2 in country 1; (ii) it decreases production of sector 2 in country 2; and (iii) it requires lump-sum taxes on workers in country 1. Intuitively, when \( \psi \) is too small, the productivity effect of subsidies in country 1 cannot compensate the cost of subsidies, resulting in \( -\frac{\partial \log W_1}{\partial \log e_1} < 0 \). In contrast, when \( \psi \) is too large, the decrease in production of sector 2 in country 2 would substantially increase the domestic prices of sector 2 in country 2, resulting in \( -\frac{\partial \log W_2}{\partial \log e_1} < 0 \). We have shown that there exists a set of \( \psi \) under which industry subsidy can increase the welfare in both countries.

Our model nests the neoclassical economy without scale economies, i.e. \( \psi = 0 \). In this case, countries have no incentives to impose import tariffs due to the absence of the terms-of-trade effect (by construction) and the home market effect. We show this analytically in the first result of Corollary 4. Moreover, in this neoclassical case, industrial subsidies
would benefit the foreign country at the expense of the welfare in the implementation country, which is shown in the second result of Corollary 4.

**Corollary 4 (Special Case without Scale Economies)**  Consider the example in Definition 2. Suppose that $\psi = 0$. Then we have

1. $\frac{\partial \log W_1}{\partial \log t_{21}} = \frac{\partial \log W_2}{\partial \log t_{21}} = 0$.
2. $-\frac{\partial \log W_1}{\partial \log e_1} < 0$ and $-\frac{\partial \log W_2}{\partial \log e_1} > 0$.

Finally, we investigate the interactions of tariffs and industry subsidies across countries. In particular, we characterize how the welfare effects of import tariffs are affected by the other country’s industrial subsidies.

**Proposition 5 (Import Tariffs and Foreign Industrial Subsidies)**  Consider the example in Definition 2. Suppose that two countries are symmetric. As long as $\psi_t < \psi < \bar{\psi}_t$, we have:

$$-\frac{\partial^2 \log W_1}{\partial \log t_{21} \partial \log e_2} > 0.$$  \hspace{1cm} (15)

The second-order effect shown in Proposition 5 is new in the literature. It suggest that industry subsidies in country 2 would increase the incentives of import tariffs in country 1. Notably, industry subsidies in country 2 lower the prices of sector 2 exported from country 2 to country 1. Intuitively, imposing import tariffs on goods with lower prices would generate higher welfare gains. Moreover, industry subsidies in country 2 would decrease the production of sector 2 in country 1, leading to stronger incentives for country 1 to protect its production of sector 2.

In sum, we show that countries have incentives to implement import tariffs and industrial subsidies on sectors with strong external economies of scale. Moreover, import tariffs are likely to benefit the import country at the expense of the export country, whereas industrial subsidies could benefit both countries. Finally, foreign industrial subsidies would
increase the incentives for a country to impose import tariffs. These analytical results in our illustrative example would facilitate our understanding of the quantitative results in Section 5.

4 Calibration

We now bring our model to data. Guided by the “exact-hat” algebra, our counterfactual exercises require bilateral trade shares \( \pi_{im} \), sectoral consumption shares \( \alpha_i^j \), sectoral value-added shares \( \beta_i^j \), sectoral expenditure \( X_n^j \), input expenditure shares \( \gamma_i^j \), and the tariff rates \( t_{in}^j, e_{in}^j \). We also need the values of parameters \( \psi_j, \theta_j \).

4.1 Data for Trade, Production, Tariffs, and the “MIC 2025” Program

Our study relies on a system of world trade with 6 major economies (the US, China, Japan, EU, Brazil, India) and the rest of world (ROW).\(^9\) We rely the OECD Inter-Country Input-Output database (ICIO) to extract data on production, value-added, bilateral trade flows, and importantly input-output linkages. The ICIO table includes 22 tradable sectors and 22 nontradables.\(^10\)

The MFN tariff data is from the World Integrated Trade System (WITS), while the trade war tariffs are hand collected from the announcements by the USTR and China’s Ministry of Commerce (MofCom). Both are then aggregated into 22 tradable sectors using a self-constructed crosswalk. To avoid the impact of possible policy interventions after the “MIC 2025” program was enacted, we use 2015 MFN tariffs and use 2015 trade flow as weights. The results are similar when we use 2017 tariffs and trade data.

\(^9\)European Union (EU) includes 28 countries including the UK.

\(^10\)The ICIO has 45 industries. We disregard the last one, which is “Activities of households as employers; undifferentiated goods- and services-producing activities of households for own use”, because it has many zeros. For details, see OECD. (2021) OECD Inter-Country Input-Output Database, http://oe.cd/icio.
To identify the “MIC 2025” sectors, we first apply a textual analysis to the descriptions of four-digit HS products (HS4), and then match them with the ten high-tech industrial sectors that the “MIC 2025” program regards as the top priority. We then identifies the ICIIO sectors that are associated with these HS4 products. We end up with seven sectors that are subject to the “MIC 2025” program: Chemical, Pharmaceutical, Computer, Electrical equipment, Machinery nec, Motor vehicles, and Other transport equipment.

Table 1: US-China Tariff Wars and the “MIC 2025” Program

<table>
<thead>
<tr>
<th>Industry</th>
<th>ICIO code</th>
<th>Description</th>
<th>MFN tariffs (%)</th>
<th>Wave 1 (%)</th>
<th>Wave 5 (%)</th>
<th>MIC 2025</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D01T02</td>
<td>Agriculture</td>
<td>ICUS 1.95</td>
<td>ICUS 1.95</td>
<td>ICUS 1.95</td>
<td>ICUS 1.95</td>
</tr>
<tr>
<td></td>
<td>D03</td>
<td>Fishing</td>
<td>ICUS 0.70</td>
<td>ICUS 0.70</td>
<td>ICUS 0.70</td>
<td>ICUS 0.70</td>
</tr>
<tr>
<td></td>
<td>D05T06</td>
<td>Mining, energy</td>
<td>ICUS 0.00</td>
<td>ICUS 0.00</td>
<td>ICUS 0.00</td>
<td>ICUS 0.00</td>
</tr>
<tr>
<td></td>
<td>D07T08</td>
<td>Mining, non-energy</td>
<td>ICUS 0.27</td>
<td>ICUS 0.27</td>
<td>ICUS 0.27</td>
<td>ICUS 0.27</td>
</tr>
<tr>
<td></td>
<td>D09</td>
<td>Mining support</td>
<td>ICUS 0.25</td>
<td>ICUS 0.25</td>
<td>ICUS 0.25</td>
<td>ICUS 0.25</td>
</tr>
<tr>
<td></td>
<td>D10T12</td>
<td>Food</td>
<td>ICUS 3.84</td>
<td>ICUS 3.84</td>
<td>ICUS 3.84</td>
<td>ICUS 3.84</td>
</tr>
<tr>
<td></td>
<td>D13T15</td>
<td>Textiles</td>
<td>ICUS 7.66</td>
<td>ICUS 7.66</td>
<td>ICUS 7.66</td>
<td>ICUS 7.66</td>
</tr>
<tr>
<td></td>
<td>D16</td>
<td>Wood</td>
<td>ICUS 3.75</td>
<td>ICUS 3.75</td>
<td>ICUS 3.75</td>
<td>ICUS 3.75</td>
</tr>
<tr>
<td></td>
<td>D17T18</td>
<td>Paper</td>
<td>ICUS 2.06</td>
<td>ICUS 2.06</td>
<td>ICUS 2.06</td>
<td>ICUS 2.06</td>
</tr>
<tr>
<td></td>
<td>D19</td>
<td>Petroleum</td>
<td>ICUS 2.96</td>
<td>ICUS 2.96</td>
<td>ICUS 2.96</td>
<td>ICUS 2.96</td>
</tr>
<tr>
<td></td>
<td>D20</td>
<td>Chemical</td>
<td>ICUS 3.17</td>
<td>ICUS 3.17</td>
<td>ICUS 3.17</td>
<td>ICUS 3.17</td>
</tr>
<tr>
<td></td>
<td>D21</td>
<td>Pharmaceutical</td>
<td>ICUS 1.33</td>
<td>ICUS 1.33</td>
<td>ICUS 1.33</td>
<td>ICUS 1.33</td>
</tr>
<tr>
<td></td>
<td>D22</td>
<td>Rubber</td>
<td>ICUS 3.25</td>
<td>ICUS 3.25</td>
<td>ICUS 3.25</td>
<td>ICUS 3.25</td>
</tr>
<tr>
<td></td>
<td>D23</td>
<td>Non-metallic</td>
<td>ICUS 3.24</td>
<td>ICUS 3.24</td>
<td>ICUS 3.24</td>
<td>ICUS 3.24</td>
</tr>
<tr>
<td></td>
<td>D24</td>
<td>Basic metals</td>
<td>ICUS 1.23</td>
<td>ICUS 1.23</td>
<td>ICUS 1.23</td>
<td>ICUS 1.23</td>
</tr>
<tr>
<td></td>
<td>D25</td>
<td>Fabricated metal</td>
<td>ICUS 2.02</td>
<td>ICUS 2.02</td>
<td>ICUS 2.02</td>
<td>ICUS 2.02</td>
</tr>
<tr>
<td></td>
<td>D26</td>
<td>Computer</td>
<td>ICUS 1.90</td>
<td>ICUS 1.90</td>
<td>ICUS 1.90</td>
<td>ICUS 1.90</td>
</tr>
<tr>
<td></td>
<td>D27</td>
<td>Electrical equipment</td>
<td>ICUS 2.14</td>
<td>ICUS 2.14</td>
<td>ICUS 2.14</td>
<td>ICUS 2.14</td>
</tr>
<tr>
<td></td>
<td>D28</td>
<td>Machinery nec</td>
<td>ICUS 1.49</td>
<td>ICUS 1.49</td>
<td>ICUS 1.49</td>
<td>ICUS 1.49</td>
</tr>
<tr>
<td></td>
<td>D29</td>
<td>Motor vehicles</td>
<td>ICUS 1.58</td>
<td>ICUS 1.58</td>
<td>ICUS 1.58</td>
<td>ICUS 1.58</td>
</tr>
<tr>
<td></td>
<td>D30</td>
<td>Other transport equipment</td>
<td>ICUS 1.96</td>
<td>ICUS 1.96</td>
<td>ICUS 1.96</td>
<td>ICUS 1.96</td>
</tr>
<tr>
<td></td>
<td>D31T33</td>
<td>Manufacturing nec</td>
<td>ICUS 2.98</td>
<td>ICUS 2.98</td>
<td>ICUS 2.98</td>
<td>ICUS 2.98</td>
</tr>
</tbody>
</table>

4.2 Calibrating \((\psi_j, \theta_j)\)

Sectoral economies of scale are critical in determining optimal industrial policies. However, estimating economies of scale is empirically challenging since it requires exogenous shocks on sectoral sizes that are uncorrelated with fundamental technology changes. We calibrate \((\psi_j, \theta_j)\) from the literature.

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11 For a complete list of these ten sectors, see http://www.gov.cn/zhengce/content/2015-05/19/content_9784.htm.
Table 2 reports our baseline calibration of \((\psi_j, \theta_j)\) from Lashkaripour and Lugovskyy (2022). They recover \((\psi_j, \theta_j)\) simultaneously from firm-level demand parameters, using transaction-level trade data in Colombia and combining exchange rate shocks lagged export sale into a shift-share instrument. Their estimates of \(\psi_j\) are relatively large in the literature, with the average of 0.27.\(^{12}\) Their estimates of \(\psi_j\) also vary substantially across manufacturing sectors. As discussed in Section 3, this baseline calibration would give us upper bounds on the welfare gains from industrial policies.

<table>
<thead>
<tr>
<th>Industry</th>
<th>ICIO code</th>
<th>Description</th>
<th>(\theta_j)</th>
<th>(\psi_j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D01T02</td>
<td>Agriculture</td>
<td>6.227</td>
<td>0.143</td>
</tr>
<tr>
<td>2</td>
<td>D03</td>
<td>Fishing</td>
<td>6.227</td>
<td>0.143</td>
</tr>
<tr>
<td>3</td>
<td>D05T06</td>
<td>Mining, energy</td>
<td>5.283</td>
<td>0.167</td>
</tr>
<tr>
<td>4</td>
<td>D07T08</td>
<td>Mining, non-energy</td>
<td>5.283</td>
<td>0.167</td>
</tr>
<tr>
<td>5</td>
<td>D09</td>
<td>Mining support</td>
<td>5.283</td>
<td>0.167</td>
</tr>
<tr>
<td>6</td>
<td>D10T12</td>
<td>Food</td>
<td>2.303</td>
<td>0.393</td>
</tr>
<tr>
<td>7</td>
<td>D13T15</td>
<td>Textiles</td>
<td>3.359</td>
<td>0.224</td>
</tr>
<tr>
<td>8</td>
<td>D16</td>
<td>Wood</td>
<td>3.896</td>
<td>0.229</td>
</tr>
<tr>
<td>9</td>
<td>D17T18</td>
<td>Paper</td>
<td>2.646</td>
<td>0.32</td>
</tr>
<tr>
<td>10</td>
<td>D19</td>
<td>Petroleum</td>
<td>0.636</td>
<td>1.22</td>
</tr>
<tr>
<td>11</td>
<td>D20</td>
<td>Chemical</td>
<td>3.966</td>
<td>0.232</td>
</tr>
<tr>
<td>12</td>
<td>D21</td>
<td>Pharmaceutical</td>
<td>3.966</td>
<td>0.232</td>
</tr>
<tr>
<td>13</td>
<td>D22</td>
<td>Rubber</td>
<td>5.157</td>
<td>0.14</td>
</tr>
<tr>
<td>14</td>
<td>D23</td>
<td>Non-metallic</td>
<td>5.283</td>
<td>0.167</td>
</tr>
<tr>
<td>15</td>
<td>D24</td>
<td>Basic metals</td>
<td>3.004</td>
<td>0.209</td>
</tr>
<tr>
<td>16</td>
<td>D25</td>
<td>Fabricated metal</td>
<td>3.004</td>
<td>0.209</td>
</tr>
<tr>
<td>17</td>
<td>D26</td>
<td>Computer</td>
<td>1.235</td>
<td>0.552</td>
</tr>
<tr>
<td>18</td>
<td>D27</td>
<td>Electrical equipment</td>
<td>1.235</td>
<td>0.552</td>
</tr>
<tr>
<td>19</td>
<td>D28</td>
<td>Machinery nec</td>
<td>7.75</td>
<td>0.12</td>
</tr>
<tr>
<td>20</td>
<td>D29</td>
<td>Motor vehicles</td>
<td>2.805</td>
<td>0.129</td>
</tr>
<tr>
<td>21</td>
<td>D30</td>
<td>Other transport equipment</td>
<td>2.805</td>
<td>0.129</td>
</tr>
<tr>
<td>22</td>
<td>D31T33</td>
<td>Manufacturing nec</td>
<td>6.169</td>
<td>0.152</td>
</tr>
</tbody>
</table>

Notes: We calibrate the values of \((\psi_j, \theta_j)\) from Lashkaripour and Lugovskyy (2022). We set \(\theta_j = 10\) and \(\psi_j = 0\) for non-tradable sectors.

Alternatively, we calibrate \((\psi_j, \theta_j)\) from Bartelme et al. (2021). The values of \((\psi_j, \theta_j)\) under this alternative calibration and the corresponding counterfactual results are presented in Appendix C.2. Bartelme et al. (2021) recover \(\psi_j\) from the impact of variation in sector size on equilibrium quantities, exploiting variation in countries’ population and

\(^{12}\text{Excluding the extreme value of } \psi_j \text{ in Petroleum, the average is 0.23.}\)
preferences to construct instruments. Their estimates of $\psi_j$ are much smaller than those in Lashkaripour and Lugovskyy (2022), with the average of 0.17. Their estimates of $\psi_j$ are also relatively uniform across manufacturing sectors. This conservative calibration would give us lower bounds on the welfare gains from industrial policies.

5 Counterfactuals

In this section, we conduct four sets of counterfactual exercises. First, we solve for China’s optimal uniform subsidy on the “MIC 2025” sectors in 2015 to quantify China’s incentives of industrial subsidies and their global welfare impacts. Second, we quantify the welfare impacts of Trumpian tariffs, with and without the “MIC 2025” program. This exercise is to understand the interactions of Trumpian tariffs and China’s industrial policies. Third, we compute the Nash tariffs on the “MIC 2025” sectors between the U.S. and China. Finally, we compute the Nash equilibrium in which the U.S. and China simultaneously decide tariffs and industrial subsidies on the “MIC 2025” sectors. Combining the last two sets of exercises, we can see how industrial policy competitions affect the incentives and consequences of tariff wars.

5.1 “MIC 2025” Industrial Subsidies

Announced in 2015, “MIC 2025” covered 10 high-tech industries which correspond to 7 industries in the ICIO database. Does China have incentives to subsidize these industries? Despite lack of data to uncover the actual subsidies imposed by “MIC 2025”, we utilize our model and the data for the economy in 2015 to characterize China’s incentives for subsidizing “MIC 2025” industries.

In particular, we consider the case in which China imposed a uniform subsidy to “MIC 2025” industries to maximize the Chinese welfare, starting from the economy in 2015.
This case, as a benchmark, provides an extreme characterization suggesting to what extent China could subsidize these “MIC 2025” industries.

Table 3: China’s Optimal Uniform Subsidies to “MIC 2025” Industries

<table>
<thead>
<tr>
<th>%Δ in:</th>
<th>Welfare</th>
<th>Prod. in $j \in$ MIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2.50</td>
<td>59.09</td>
</tr>
<tr>
<td>United States</td>
<td>0.44</td>
<td>-11.81</td>
</tr>
<tr>
<td>European Union</td>
<td>0.10</td>
<td>-10.96</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.13</td>
<td>-15.57</td>
</tr>
<tr>
<td>India</td>
<td>0.66</td>
<td>-13.98</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.63</td>
<td>-8.13</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>0.53</td>
<td>-28.34</td>
</tr>
</tbody>
</table>

Notes: We start from the economy in 2015. $e_{CHN,n}^j$ is the uniform subsidies (or taxes) on $j \in$ MIC that maximize the change in the Chinese welfare.

Table 3 suggests that China’s optimal uniform subsidy on its “MIC 2025” industries is $-7.96\%$. This enormous subsidy can be justified by the strong scale economies of these “MIC 2025” industries listed in Table 2. Imposing this optimal uniform subsidy in 2015, China would increase the production value of its “MIC 2025” industries by 59.09%, which leads to a 2.5% welfare gain. Interestingly, China’s optimal uniform subsidy on “MIC 2025” industries would increase the welfare in most of the major economies, except for Japan. This result is consistent with Proposition 3 in which a country can gain from the decrease in import prices led by foreign countries’ industrial subsidies.

The welfare impacts of China’s uniform subsidy on “MIC 2025” industries can be seen more clearly in Figure 6. We can see that China loses from taxing the production of these industries but gains from subsidies as long as the subsidy rate is less than 12%. Moreover, China’s uniform subsidy on “MIC 2025” industries generates small welfare gains the U.S. but welfare losses in Japan, suggesting that China and Japan have fierce competitions in these high-tech industries.

We conduct two robustness exercises. First, we consider sectoral heterogeneity in op-

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13 Consistent with our model, we regard subsidy as a negative tax.
Welfare change is relative to the economy in 2015 with zero subsidies in all countries and industries.

Figure 6: Welfare Effects of China’s Uniform Subsidies to “MIC 2025” Industries

Optimal industrial subsidies. Recent studies such as Bartelme et al. (2021) and Lashkaripour and Lugovskyy (2022) link optimal industrial subsidies with sectoral economies of scale. Inspired by this literature, we consider the following scheme of industrial subsidies:

\[ e_{\text{CHN}, n}^{j} = e_{\text{CHN}, n}^{a} + e_{\text{CHN}, n}^{b} \times \frac{\psi_j}{1 + \psi_j}, \quad j = 1, 2, \ldots, 22. \]

(16)

We solve for \( e_{\text{CHN}, n}^{a}, e_{\text{CHN}, n}^{b} \) that maximizes the Chinese welfare. Table 4 suggests that \( e_{\text{CHN}, n}^{a} = -0.0404 \) and \( e_{\text{CHN}, n}^{b} = -0.1557 \) for \( j = 1, \ldots, 22 \) and \( j \neq 10 \). Notably, \( e_{\text{CHN}, n}^{b} < 0 \) is consistent with the insights of Bartelme et al. (2021) and Lashkaripour and Lugovskyy (2022) that the optimal industrial subsidies are positively correlated with sectoral economies of scale. We have shown that the “MIC 2025” sectors exhibit stronger economies of scale than other manufacturing sectors. Therefore, our results in Table 4 rationalize the initial Trumpian tariffs that were concentrated in the “MIC 2025” sectors.

Moreover, the resulted \( e_{\text{CHN}, n}^{j*} \) increase the welfare in China by 4%. This result highlights the importance of sectoral heterogeneity in optimal industrial subsidies. However, it is computationally challenging to solve for the high-dimensional \( e_{\text{CHN}, n}^{j*} \).

\(^{14}\)We exclude Petroleum (\( j = 10 \)) whose \( \psi_j \) is extremely large.
We also compute \( (e_{CHN,n}^{a}, e_{CHN,n}^{b}) \) for \( j \in MIC \). In this case, \( e_{CHN,n}^{b} \) is close to zero and the welfare in China increases by 2.52\% (close to 2.50\% under the optimal uniform subsidies). This result suggests that the heterogeneity within the “MIC 2025” sectors is not very important in considering optimal industrial subsidies. The detailed results are presented in Appendix C.1.

In our second robustness exercise, we compute China’s optimal uniform subsidy on “MIC 2025” industries under the estimates of \((\psi_{j}, \theta_{j})\) in Bartelme et al. (2021). Armed with much smaller scale economies in “MIC 2025” industries, we have a much lower optimal uniform subsidy, \( e_{CHN,n}^{j*} = -1.07\% \). The detailed results are presented in Appendix C.2.

### 5.2 Interactions of Trumpian Tariffs and the “MIC 2025” Subsidies

We turn to characterize the incentives of Trump administration to impose protectionism tariffs on imports from China, in particular how the incentives of Trumpian tariffs rely on the “MIC 2025” industrial subsidies. To this end, we start from the economy in 2017 and assume that China has implemented its optimal uniform subsidies to “MIC 2025” industries (shown in Table 3) in this economy.

Table 5 suggests that Trumpian tariffs (Wave 1) would decrease the production of “MIC
2025” industries in China by 3.249% and thereby reduce the welfare in China by 0.262%. Correspondingly, these tariffs would increase the production of “MIC 2025” industries in the U.S. by 1.458% and increase the welfare in the U.S. by 0.033%. These results are consistent with the home market effect in Proposition 2.

Table 5: Trumpian Tariffs (Wave 1) with and without “MIC 2025”

<table>
<thead>
<tr>
<th>%Δ in:</th>
<th>Welfare</th>
<th>Prod. in $j \in \text{MIC}$</th>
<th>Welfare</th>
<th>Prod. in $j \in \text{MIC}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.033</td>
<td>1.458</td>
<td>0.027</td>
<td>0.264</td>
</tr>
<tr>
<td>China</td>
<td>-0.262</td>
<td>-3.249</td>
<td>-0.253</td>
<td>-1.647</td>
</tr>
<tr>
<td>European Union</td>
<td>-0.009</td>
<td>0.464</td>
<td>0.000</td>
<td>0.116</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.002</td>
<td>0.611</td>
<td>0.002</td>
<td>0.140</td>
</tr>
<tr>
<td>India</td>
<td>-0.009</td>
<td>0.558</td>
<td>0.030</td>
<td>0.330</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.043</td>
<td>0.293</td>
<td>-0.014</td>
<td>0.114</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>-0.030</td>
<td>1.633</td>
<td>-0.008</td>
<td>0.371</td>
</tr>
</tbody>
</table>

Notes: In “MIC 2025”, we start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3. In “No ‘MIC 2025’”, we first eliminate all subsidies in the economy in 2017 and start from this new equilibrium with zero subsidies.

To understand the implications of “MIC 2025” for the incentives of Trumpian tariffs, we eliminate China’s subsidies to “MIC 2025” sectors from the economy in 2017 and recompute the equilibrium. Starting from this new equilibrium with zero subsidies, we recompute the welfare impacts of Trumpian tariffs (Wave 1). Comparing with the baseline case with “MIC 2025” subsidies, the U.S. gains less from the first wave of Trumpian tariffs (0.027%) in the alternative case without “MIC 2025” subsidies. This is consistent with the result in Proposition 5. Notably, Caliendo and Parro (2021) find that the Trumpian tariffs in 2018 (without China’s retaliation) would increase the U.S. real income by 0.024%. This result is close to our estimate without the “MIC 2025” subsidies but lower than that in our baseline case with the “MIC 2025” subsidies.

We also look at the welfare effects of Trumpian tariffs (Wave 1) on other major economies and how these effects depend on the “MIC 2025” subsidies. In the baseline case with the “MIC 2025” subsidies, Trumpian tariffs (Wave 1) concentrated in China’s “MIC 2025” sectors significantly increase the global intermediate prices of these sectors and thereby
decrease the welfare in most of the other major economies. In contrast, without the “MIC 2025” subsidies, the intermediate price effect is overwhelmed by the trade diversion effect. In this case, Trumpian tariffs (Wave 1) increase the welfare in most of the other major economies.

In addition, we investigate the incentives of Trumpian tariffs by characterizing its optimality. In particular, we consider the following shifter $s$ of Trumpian tariffs (Wave 1):

$$t^j_{\text{CHN,USA}} = MFN^j_{\text{CHN,USA}} + s \times (Trump^j_{\text{CHN,USA}} - MFN^j_{\text{CHN,USA}})$$  \hspace{1cm} (17)

Figure 7 links the shifter $s$ with the U.S. welfare gains, with and without “MIC 2025” subsidies. The results suggest that (i) Trumpian tariffs (Wave 1) is smaller than the optimal tariffs, and (ii) “MIC 2025” subsidies increase the U.S. gains from optimal tariffs. Here “optimal” refers to the optimal value of the shifter $s$.

![Figure 7: The Optimality of Trumpian Tariffs (Wave 1)](image)

**Notes:** In “MIC 2025”, we start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3. In this case, the shifter that maximizes the US welfare is $s^* = 1.66$ and it increases the US welfare by 0.037%. In No “MIC 2025”, we first eliminate all subsidies in the economy in 2017 and start from this new economy with zero subsidies. In this case, $s^* = 2.32$ and it increases the US welfare by 0.035%.

Finally, we evaluate the welfare effects of the US-China trade wars (wave 1&5). Table 6 suggests that China loses considerably from both rounds of trade wars, whereas the U.S. gains slightly from wave 1 but loses from wave 5. In addition, the U.S. gains more (loses
less) from trade wars in our baseline case with the “MIC 2025” subsidies than in those without the “MIC 2025” subsidies. Moreover, most of the other major economies lose from the US-China trade wars, in particular in the case with the “MIC 2025” subsidies.

Table 6: The US-China Trade Wars (Wave 1&5) with and without “MIC 2025”

<table>
<thead>
<tr>
<th></th>
<th>Wave 1</th>
<th>Wave 5</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“MIC 2025”</td>
<td>No “MIC 2025”</td>
</tr>
<tr>
<td>United States</td>
<td>0.020</td>
<td>0.018</td>
</tr>
<tr>
<td>China</td>
<td>-0.266</td>
<td>-0.257</td>
</tr>
<tr>
<td>European Union</td>
<td>-0.008</td>
<td>0.000</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.001</td>
<td>0.002</td>
</tr>
<tr>
<td>India</td>
<td>-0.012</td>
<td>0.029</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.042</td>
<td>-0.013</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>-0.030</td>
<td>-0.007</td>
</tr>
</tbody>
</table>

Notes: Here, “Wave 1” refers to Trumpian tariffs (Wave 1) and China’s corresponding retaliation tariffs. “Wave 5” is defined analogously. In “MIC 2025”, we start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3. In “No ‘MIC 2025’”, we first eliminate all subsidies in the economy in 2017 and start from this new equilibrium with zero subsidies.

5.3 Nash Tariffs between the U.S. and China on “MIC 2025” Sectors

We proceed by characterizing the Nash tariffs on “MIC 2025” industries in the U.S. and China. This exercise sheds light on the incentives of the U.S. and China to compete in these high-tech industries via import tariffs. In our baseline case, we start from the economy in 2017 and assume that the optimal uniform subsidies in Table 3 have been implemented.

We consider the Nash game in which each country chooses a uniform tariff rate on imports of “MIC 2025” industries from the other country. The Nash tariffs are shown in the first two columns in the upper panel of Table 7. In the Nash equilibrium, the U.S. tariff on “MIC 2025” industries is 13.23%, whereas the Chinese tariff is 20.42%. Notice that the U.S. Nash tariff is in the middle of Trumpian wave 1 and wave 5 tariffs, whereas the Chinese Nash tariff is much higher than the actual levels.
The first two columns in the lower panel of Table 7 show that Nash tariffs lead to considerable welfare losses in both China and the U.S. China suffers more in this Nash game, both in terms of welfare and the production of “MIC 2025” industries. This result indicates the importance of these high-tech industries in China. Moreover, most of the other major economies loses from the Nash tariffs, primarily due to the increase in intermediate prices.

Table 7: Nash Tariffs on “MIC 2025” Industries in the U.S. and China

<table>
<thead>
<tr>
<th></th>
<th>Nash Tariffs (%)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>“MIC 2025”</td>
<td>No “MIC 2025”</td>
<td></td>
</tr>
<tr>
<td></td>
<td>United States</td>
<td>China</td>
<td>United States</td>
</tr>
<tr>
<td>Nash</td>
<td>13.23</td>
<td>20.42</td>
<td>18.81</td>
</tr>
<tr>
<td>Wave 1</td>
<td>6.23</td>
<td>0.18</td>
<td>-</td>
</tr>
<tr>
<td>Wave 5</td>
<td>21.52</td>
<td>9.94</td>
<td>-</td>
</tr>
</tbody>
</table>

Changes under Nash tariffs

<table>
<thead>
<tr>
<th></th>
<th>“MIC 2025”</th>
<th></th>
<th>“MIC 2025”</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Welfare</td>
<td>Prod. in $j \in$ MIC</td>
<td>Welfare</td>
<td>Prod. in $j \in$ MIC</td>
</tr>
<tr>
<td>United States</td>
<td>-0.017</td>
<td>0.671</td>
<td>-0.077</td>
<td>-2.706</td>
</tr>
<tr>
<td>China</td>
<td>-0.251</td>
<td>-3.802</td>
<td>-0.249</td>
<td>-1.766</td>
</tr>
<tr>
<td>European Union</td>
<td>-0.004</td>
<td>0.714</td>
<td>0.018</td>
<td>0.595</td>
</tr>
<tr>
<td>Japan</td>
<td>0.006</td>
<td>0.863</td>
<td>0.025</td>
<td>0.686</td>
</tr>
<tr>
<td>India</td>
<td>-0.047</td>
<td>0.570</td>
<td>-0.012</td>
<td>0.176</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.038</td>
<td>0.431</td>
<td>0.005</td>
<td>0.283</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>-0.025</td>
<td>2.426</td>
<td>0.025</td>
<td>1.610</td>
</tr>
</tbody>
</table>

Notes: We start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3. “Wave 1” refers to the simple averaged tariffs on “MIC 2025” industries in the first wave of the US-China trade war. “Wave 5” refers to the analogous tariffs in the fifth wave of the US-China trade war.

We also compute the Nash tariffs in the world without “MIC 2025” subsidies. The last two columns in the upper panel of Table 7 suggest that the Nash tariffs in this world are much higher than those in our baseline case: 18.81% in the U.S. and 27.77% in China. This is consistent with the result in Figure 7. We find that the U.S. loses more from the Nash tariffs in this world than in our baseline case.
5.4 Industrial Policy Competition between the U.S. and China

Finally, we consider the case in which the U.S. can, in addition to imposing protectionism tariffs, subsidize its own “MIC 2025” industries as China did. The key question is: in this case, would the U.S. still impose high tariffs on the imports of “MIC 2025” industries from China? In our baseline case, we start from the economy in 2017 and assume that the optimal uniform subsidies in Table 3 have been implemented.

We consider the Nash game in which the U.S. chooses a uniform subsidy on “MIC 2025” industries and a uniform tariff on imports of these industries from China, whereas China chooses a uniform tariff on imports of “MIC 2025” industries from the U.S. The first two columns of the upper panel of Table 8 show that when the U.S. can also subsidize its “MIC 2025” industries, it will implement a 9.59% subsidy on the production in these industries and, simultaneously, reduce its protectionism tariffs on these industries to 5.57%, much lower than its Nash tariff 13.23% and even lower than Trumpian tariffs (Wave 1) 6.23% (see Table 7).

What are the welfare effects of the Nash game in which the U.S. can choose both tariffs and industrial subsidies? The first two columns in the lower panel of Table 8 show that, comparing with the Nash tariff game, allowing the U.S. to implement industrial subsidies lead to much larger welfare gains to the U.S. and, correspondingly, smaller welfare losses in China. This result is consistent with the intuition in Proposition 2 and 3: both import tariffs and industrial subsidies can increase the domestic production scale; but industrial subsidies can achieve so without distorting the import prices.

We also consider the Nash game in which the U.S. and China simultaneously choose their tariffs and subsidies on “MIC 2025” industries. To this end, we start from the economy in 2017 without any industrial subsidies. The last two columns of the upper panel of Table 8 show that, comparing with the unilateral optimal subsidies, China would implement a higher uniform subsidy, 12.77%, in this Nash game. In the meanwhile, China’s equilibrium tariff in this Nash game is much lower than those in the Nash tariff game in
Table 8: Nash Tariffs and Subsidies on “MIC 2025” Industries in the U.S. and China

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>China</th>
<th>United States</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Tariffs (%)</strong></td>
<td>5.57</td>
<td>21.23</td>
<td>11.27</td>
<td>10.61</td>
</tr>
<tr>
<td><strong>Subsidies (%)</strong></td>
<td>-9.59</td>
<td>-</td>
<td>-9.44</td>
<td>-12.77</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>United States</th>
<th>China</th>
<th>United States</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Changes under Nash Equilibrium</strong></td>
<td>Welfare</td>
<td>Prod. in $j \in$ MIC</td>
<td>Welfare</td>
<td>Prod. in $j \in$ MIC</td>
</tr>
<tr>
<td>%Δ in: China</td>
<td>0.260</td>
<td>61.556</td>
<td>2.510</td>
<td>138.810</td>
</tr>
<tr>
<td>European Union</td>
<td>-0.007</td>
<td>-3.627</td>
<td>0.953</td>
<td>-15.812</td>
</tr>
<tr>
<td>Brazil</td>
<td>-0.117</td>
<td>-20.403</td>
<td>0.322</td>
<td>-38.845</td>
</tr>
</tbody>
</table>

Notes: We start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3.

Table 7. The last two columns of the lower panel of Table 8 suggest that both the U.S. and China gain substantially from this Nash game and most of the major economies, except for Japan, gain as well.

6 Conclusion

This paper provides the first quantitative assessment of the interactions of protectionism tariffs and industrial policies in the context of the US-China trade war. Empirically, we document that the protectionism tariffs imposed by the Trump administrative were initially concentrated in very few industries that did not reflect China’s export advantage to the U.S. In contrast, these industries were emphasized in the “MIC 2025” industrial project.

To understand the rationale of these policy interactions between the U.S. and China, we incorporate sectoral scale economies into the multi-country-multi-sector GE model
developed by Caliendo and Parro (2015) and quantify the welfare effects of tariff wars and industrial policy competition. The key take-away message of our quantitative exercises is that, comparing with the pure tariff wars, allowing for industrial policy competition would substantially decrease the levels of non-cooperative tariffs and thereby lead to much smaller welfare losses for participation countries.
References


A Data and Facts

A.1 Escalation of the US-China Trade War at the Two-Digit HS Level

Figure A.1 shows that Trumpian tariffs and China’s retaliation tariffs in two-digit HS sectors for five waves. Basic patterns in Section 2.3 hold: the Trumpian tariffs are highly concentrated initially and spread gradually to most of the sectors.

A.2 Sectoral Patterns of Trumpian Tariffs (Wave 1)

Figure A.2 shows that in terms of absolute scale, the wave 1 tariffs were not imposed on the sectors that the US has imported the largest amount from China. In particular, the largest two products in terms of import value are cell phones (HS code: 8517) and computers (HS code: 8471). In 2017, the US imported 72 billion dollars of cell phones and 50 billion dollars of computers from China, however, the wave 1 tariffs on these two products were zero and 0.74 percent, respectively.

We further consider two measures of China’s export advantages: (i) the imports from China as a share of U.S. sectoral imports in 2017, and (ii) the Chinese exports to the U.S. as a share of Chinese sectoral exports. To capture the trade pattern more precisely, we measure these shares at the four-digit HS level.

The left panel of Figure A.3 illustrates the correlation between the import share and Trumpian tariffs (wave 1) for each sector. Clearly, these tariffs did not target on the goods that the U.S. imports the most from China, such as computers & electronics, and textile and apparel products. The right panel of Figure A.3 analogously looks at the correlation between the export share and Trumpian tariffs (wave 1). It shows that Trumpian tariffs (wave 1) were neither imposed on the goods that China disproportionately exports to the U.S. In other words, Trumpian tariffs (wave 1) were not imposed on industries that China have export advantages.
Notes: Panel (a) illustrates tariff increases in the five waves of Trumpian tariffs on Chinese imports. Panel (b) shows China’s retaliation tariff increases, implemented immediately after each wave of U.S. tariffs. Both use weighted average of tariffs at six-digit HS products within the same HS product.

Figure A.1: The Trump Tariffs and China’s Retaliation at the Two-Digit HS Level
Notes: This figure shows the import value (in billion $) by the U.S. from China in 2017 and the wave 1 tariffs. We use weighted average tariffs imposed under Section 301 in July and August. Import data are from US Census Bureau. Each circle represents a HS-4 product.

Figure A.2: Trumpian Tariffs (Wave 1) and Sectoral Imports from China

Notes: Panel (a) examines the import share of Chinese goods relative to total sectoral U.S. imports in 2017 and the wave 1 tariffs. Import data are from US Census Bureau. Panel (b) examines the export share of Chinese goods relative to total sectoral Chinese exports in 2017 and the wave 1 tariffs. Export data are from China Customs General Office. Each circle represents a HS-4 product.

Figure A.3: Trumpian Tariffs (Wave 1) and China’s Export Advantages to the U.S.
B Theory

B.1 Equilibrium in Relative Changes

Changes in unit costs can be expressed as

\[
\hat{c}_i^j = \frac{1}{\hat{L}_i^j} \hat{\psi}_i^j \hat{\beta}_i^j \left[ \prod_{s=1}^{I} (\hat{P}_i^s)^{\hat{r}_i^s} \right]^{1-\hat{\beta}_i^j}.
\] (B.1)

Changes in trade share:

\[
\hat{\pi}_{in}^j = \frac{[\hat{c}_i^j \hat{\pi}_{in}^j \hat{\pi}_{in}^j]^{-\theta_j}}{(\hat{P}_n^j)^{-\theta_j}}.
\] (B.2)

Changes in price indices:

\[
\hat{P}_n^j = \left[ \sum_{i=1}^{N} \hat{\pi}_{in}^j \left[ \hat{c}_i^j \hat{\pi}_{in}^j \hat{\pi}_{in}^j \right]^{-\theta_j} \right]^{\frac{1}{\theta_j}}.
\] (B.3)

Changes in sectoral wage incomes:

\[
\hat{w}_i^j \hat{\omega}_i^j \hat{\omega}_i^j \hat{L}_i^j = \hat{\beta}_i^j \sum_{n=1}^{N} \hat{\pi}_{in}^j \hat{\xi}_n^j X_{in}^j.
\] (B.4)

Changes in sectoral labor allocation satisfy:

\[
\sum_{j=1}^{I} \hat{L}_i^j L_i^j = \bar{L}_i.
\] (B.5)

Changes in the total income:

\[
\hat{Y}_i Y_i = \hat{\omega}_i w_i L_i + \sum_{j=1}^{I} \sum_{n=1}^{N} \left( \hat{c}_i^j \right)^{\prime} \left( \hat{\omega}_i^j \right)^{\prime} \left( X_{in}^j \right)^{\prime} + \sum_{j=1}^{I} \sum_{k=1}^{I} \hat{\theta}_j^k \hat{\xi}_j^k \hat{\xi}_j^k \left( X_{ki}^j \right)^{\prime}.
\] (B.6)
Changes in sectoral expenditure:

\[ \hat{X}_i^j X_i^j = \alpha_i^j \hat{Y}_i Y_i + \sum_{s=1}^J (1 - \beta_i^s) \gamma_i^j s \sum_{n=1}^N (X_{in}^s)' \gamma_i^j n. \]  

(B.7)

Changes in aggregate price indices:

\[ \hat{P}_n = \prod_{j=1}^J (\hat{p}_n^j)^{a_n^j}. \]  

(B.8)

Constrained optimization problem: country 1 maximizes its welfare by manipulating its import and export tariffs

\[
\max_{\{\hat{t}_i^j, \hat{e}_i, \hat{t}_i^j, \hat{l}_i, \hat{x}_i^j\}} \frac{Y_1}{P_1} \\
\text{s.t. (B.3), (B.4), (B.5), (B.7)}
\]

(B.9)

B.2 A Two-Country-Two-Sector Illustrative Example

Since sector 1 is the numeraire good, we ignore the subscript or superscript of sector 2 to save notations. The equilibrium in this example can be characterized by the following equilibrium system:

\[
L_i = \sum_{n=1}^2 \frac{\pi_{in}}{t_{in} e_i} \alpha Y_n \\
Y_i = L_i + \sum_{n=1}^2 \frac{e_i - 1}{e_i} \pi_{in} \alpha Y_n + \sum_{k=1}^2 \frac{t_{ki} - 1}{t_{ki} e_{ki}} \pi_{ki} \alpha Y_i \\
\pi_{in} = \frac{T_i (L_i^{-\psi} \tau_{in} t_{in} e_{in})^{-\theta}}{P_n^{-\theta}} \\
P_n^{-\theta} = \sum_{i=1}^2 T_i (L_i^{-\psi} \tau_{in} t_{in} e_{in})^{-\theta}
\]

(B.10)
and the welfare in this example can be expressed as

\[ W_i = \frac{Y_i}{P_i}. \]  

(B.11)

We define the following shares: \( \chi_{in} \equiv \frac{X_{in}}{\sum_k X_{ik}} \), \( t_i \equiv \frac{\sum X_{in}}{Y_i} \), and \( \zeta_i = \frac{X_{ii}}{Y_i} \) for \( k \neq i \).

For any \( x > 0 \), we denote \( \bar{x} = d \log x \). Taking total differentiation at \( t_{in} = e_i = 1 \) for all \( (i, n) \), we have the following equilibrium system:

\[ -\theta \dot{P}_n = \sum_i \pi_{in} (\theta \psi \bar{L}_i - \theta \bar{i}_{in} - \theta \bar{e}_i). \]  

(B.12)

And

\[ \dot{\pi}_{in} = \theta \psi \bar{L}_i - \theta \bar{i}_{in} - \theta \bar{e}_i + \theta \dot{P}_n. \]  

(B.13)

And

\[ \bar{L}_i = \sum_n \chi_{in} (\bar{\pi}_{in} + \bar{X}_n - \bar{i}_{in} - \bar{e}_i). \]  

(B.14)

Finally

\[ \bar{X}_i = \bar{Y}_i = t_i \bar{e}_i + \zeta_i \bar{i}_{ki}. \]  

(B.15)

Inserting Equation (B.12) into (B.13), we have

\[ \bar{\pi}_{in} = \pi_{kn} [\theta \psi \bar{L}_i - \theta \bar{i}_{in} - \theta \bar{e}_i] - \pi_{kn} [\theta \psi \bar{L}_k - \theta \bar{i}_{kn} - \theta \bar{e}_k], \quad k \neq i. \]  

(B.16)

We then insert Equation (B.16) into (B.14) and have

\[ (1 - \psi \Omega_1) \bar{L}_1 + \psi \Omega_1 \bar{L}_2 = - (1 - \chi_{11} + \Omega_1) \bar{e}_1 + (\Omega_1 + \chi_{12} \bar{e}_2) \\
+ \chi_{11} (\zeta_1 + \theta \pi_{21}) \bar{i}_{21} - \chi_{12} (1 - \zeta_2 + \theta \pi_{22}) \bar{i}_{12}, \]  

(B.17)

\[ \psi \Omega_2 L_1 + (1 - \psi \Omega_2) L_2 = (\Omega_2 + \chi_{21} \bar{e}_1) \bar{i}_1 - (1 - \chi_{22} \bar{e}_2 + \Omega_2) \bar{e}_2 \\
- \chi_{21} (1 - \zeta_1 + \theta \pi_{11}) \bar{i}_{21} + \chi_{22} (\zeta_2 + \theta \pi_{12}) \bar{i}_{12}, \]
where $\Omega_i \equiv \theta \sum_k \chi_{ik} \pi_{-i,k}$. 

Then the impacts of industrial subsidies on labor allocation can be expressed as

\[
- \frac{L_1}{\tilde{e}_1} = \frac{(1 - \psi \Omega_2) (1 - \chi_{11} \ell_1 + \Omega_1) + \psi \Omega_1 (\Omega_2 + \chi_{21} \ell_1)}{1 - \psi \Omega_1 - \psi \Omega_2},
- \frac{L_2}{\tilde{e}_1} = - \frac{\psi \Omega_2 (1 - \chi_{11} \ell_1 + \Omega_1) + (1 - \psi \Omega_1) (\Omega_2 + \chi_{21} \ell_1)}{1 - \psi \Omega_1 - \psi \Omega_2}.
\]

The impacts of import tariffs on labor allocation can be expressed as

\[
\frac{\tilde{L}_1}{\tilde{t}_{21}} = \frac{(1 - \psi \Omega_2) \chi_{11} (\zeta_1 + \theta \pi_{21}) + \psi \Omega_1 \chi_{21} (1 - \zeta_1 + \theta \pi_{11})}{1 - \psi \Omega_1 - \psi \Omega_2},
\frac{\tilde{L}_2}{\tilde{t}_{21}} = - \frac{\psi \Omega_2 \chi_{11} (\zeta_1 + \theta \pi_{21}) + (1 - \psi \Omega_1) \chi_{21} (1 - \zeta_1 + \theta \pi_{11})}{1 - \psi \Omega_1 - \psi \Omega_2}.
\]

Changes in welfare: $\tilde{W}_i = \tilde{Y}_i - \alpha_i \tilde{p}_i$. So we have

\[
\tilde{W}_1 = (\ell_1 - \alpha_1 \pi_{11}) \tilde{e}_1 + (\zeta_1 - \alpha_1 \pi_{21}) \tilde{t}_{21} - \alpha_1 \pi_{21} \tilde{e}_2 + \psi \alpha_1 [\pi_{11} \tilde{L}_1 + \pi_{21} \tilde{L}_2],
= \chi_{12}^{\ell_1} \geq 0
= \chi_{12}^{\tilde{e}_2} = 0
\]

\[
\tilde{W}_2 = (\ell_2 - \alpha_2 \pi_{22}) \tilde{e}_2 + (\zeta_2 - \alpha_2 \pi_{12}) \tilde{t}_{12} - \alpha_2 \pi_{12} \tilde{e}_1 + \psi \alpha_2 [\pi_{22} \tilde{L}_2 + \pi_{12} \tilde{L}_1],
= \chi_{21}^{\ell_2} \geq 0
= \chi_{21}^{\tilde{e}_1} = 0
\]

**Proof to Proposition 2** Inserting Equation (B.19) into (B.20), we have

\[
\frac{\tilde{W}_1}{\tilde{t}_{21}} = \frac{\chi_{12}^{\psi}}{1 - \psi \Omega_1 - \psi \Omega_2} \left[ (\pi_{11} - \psi \Omega_2) \chi_{11} (\zeta_1 + \theta \pi_{21}) + (\psi \Omega_1 - \pi_{21}) \chi_{21} (1 - \zeta_1 + \theta \pi_{11}) \right],
\]

\[
\frac{\tilde{W}_2}{\tilde{t}_{21}} = \frac{-\chi_{12}^{\psi}}{1 - \psi \Omega_1 - \psi \Omega_2} \left[ (\psi \Omega_2 - \pi_{12}) \chi_{11} (\zeta_1 + \theta \pi_{21}) + (\pi_{22} - \psi \Omega_1) \chi_{21} (1 - \zeta_1 + \theta \pi_{11}) \right].
\]

As long as $\max \left\{ \frac{\pi_{21}}{\ell_{11}}, \frac{\pi_{12}}{\ell_{12}} \right\} \leq \psi \leq \min \left\{ \frac{\pi_{11}}{\ell_{11}}, \frac{\pi_{22}}{\ell_{12}} \right\}$, we have $\frac{\tilde{W}_1}{\tilde{t}_{21}} > 0$ and $\frac{\tilde{W}_2}{\tilde{t}_{21}} < 0$.

Q.E.D.
Proof to Proposition 3 Inserting Equation (B.18) into (B.20), we have

\[-\frac{1}{\alpha} \tilde{W}_1 \tilde{e}_1 = \frac{\psi}{1 - \psi \Omega_1 - \psi \Omega_2} \left[ (\pi_{11} - \psi \Omega_2) (1 - \chi_{11} \chi_1 + \Omega_1) + (\psi \Omega_1 - \pi_{21}) (\Omega_2 + \chi_{21} \chi_1) \right] - \frac{X_{12}}{X_1}, \tag{B.22} \]

and

\[-\frac{1}{\alpha} \tilde{W}_2 \tilde{e}_1 = \pi_{12} - \frac{\psi}{1 - \psi \Omega_1 - \psi \Omega_2} \left[ (\psi \Omega_2 - \pi_{12}) (1 - \chi_{11} \chi_1 + \Omega_1) + (\pi_{22} - \psi \Omega_1) (\Omega_2 + \chi_{21} \chi_1) \right]. \tag{B.23} \]

Under symmetry, we have \( \chi_{ii} = \pi_{ii} = \pi_H \) and \( \chi_{ii'} = \pi_{ii'} = \pi_L \) for \( i \neq i' \). Since trade costs are sufficiently large, \( \pi_H > \pi_L \). We also have \( \iota = \alpha \) and \( \Omega = 2 \theta \pi_H \pi_L \).

Then we have

\[-\frac{1}{\alpha} \tilde{W}_1 \tilde{e}_1 = \frac{\psi}{1 - 2\Omega \psi} \left[ \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 + \Omega (\pi_H - \pi_L) - (1 - \alpha) \Omega \psi \right] - \pi_L. \tag{B.24} \]

Denote \( f_1(\psi) = \frac{\psi}{1 - 2\Omega \psi} \left[ \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 + \Omega (\pi_H - \pi_L) - (1 - \alpha) \Omega \psi \right] \). Note that \( f_1(0) = 0 \). \( f'_1(\psi) > 0 \) if \( 2\Omega \left[ \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 + \Omega (\pi_H - \pi_L) \right] > (1 - \alpha) \). Notice that \( \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 > \pi_H (1 - \alpha \pi_H) - \alpha \pi_L \pi_H = (1 - \alpha) \pi_H > \frac{1}{2} (1 - \alpha) \). We then have \( f'_1(\psi) > 0 \) for all \( \psi < \frac{1}{2\Omega} \). Therefore, there exists \( \psi_{\tilde{e}} > 0 \) such that for all \( \psi > \psi_{\tilde{e}} \), we have \(-\frac{\tilde{W}_1}{\tilde{e}_1} > 0 \).

We also have

\[-\frac{1}{\alpha} \tilde{W}_2 \tilde{e}_1 = \pi_L - \frac{\psi}{1 - 2\Omega \psi} \left[ 2\alpha \pi_L \pi_H - \pi_L + \Omega (\pi_H - \pi_L) + (1 - \alpha) \Omega \psi \right]. \tag{B.25} \]

Denote \( f_2(\psi) = \frac{\psi}{1 - 2\Omega \psi} \left[ 2\alpha \pi_L \pi_H - \pi_L + \Omega (\pi_H - \pi_L) + (1 - \alpha) \Omega \psi \right] \). Note that \( f_2(0) = 0 \). It is obvious that \( f'_2(\psi) > 0 \) for all \( \psi < \frac{1}{2\Omega} \). Therefore, there there exists \( \bar{\psi}_e > 0 \) such that for all \( \psi < \bar{\psi}_e \) we have \(-\frac{\tilde{W}_2}{\tilde{e}_1} > 0 \).

Now we want to show that \( \psi_{\tilde{e}} < \bar{\psi}_e \).
We first define that \( g_1(\psi) = \psi \left[ \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 + \Omega (\pi_H - \pi_L) - (1 - \alpha) \Omega \psi \right] \) and \( g_2(\psi) = \psi \left[ 2 \alpha \pi_L \pi_H - \pi_L + \Omega (\pi_H - \pi_L) + (1 - \alpha) \Omega \psi \right]. \) Then \( -\frac{\dot{\psi}_1}{\bar{t}_1} > 0 \) if \( g_1(\psi) > \pi_L (1 - 2 \Omega \psi) \) and \( -\frac{\dot{\psi}_2}{\bar{t}_1} > 0 \) if \( g_2(\psi) < \pi_L (1 - 2 \Omega \psi). \)

Notice that \( \pi_H (1 - \alpha \pi_H) - \alpha \pi_L^2 + \Omega (\pi_H - \pi_L) - 2 \alpha \pi_L \pi_H + \pi_L - \Omega (\pi_H - \pi_L) = (1 - \alpha) (\pi_H - \pi_L) > 0. \) Therefore, \( g'_1(\psi) > g'_2(\psi) \) as long as \( 0 < \psi < \frac{\pi_H - \pi_L}{4 \Omega \psi}. \) \( \underline{\psi} \) and \( \underline{\psi}^e \) can be illustrated by the following graph:

\[
\frac{\partial \log W_1}{\partial \log \bar{t}_{21}} = \frac{\alpha_1 \psi}{1 - \psi \Omega_1 - \psi \Omega_2} \left[ (\alpha_1 + \theta) (\pi_{11} - \psi \Omega_2) \chi_{11} \pi_{21} + (\psi \Omega_1 - \pi_{21}) \chi_{21} (1 - \alpha_1 \pi_{21} + \theta \pi_{11}) \right].
\]

(B.26)
Then we have

\[
\frac{\partial^2 \log W_1}{\partial \log t_{21} \partial \log e_2} = \\
\left[ (\alpha_1 + \theta) (\pi_{11} - \psi \Omega_2) \chi_{11} \pi_{21} + (\psi \Omega_1 - \pi_{21}) \chi_{21} (1 - \alpha_1 \pi_{21} + \theta \pi_{11}) \right] \frac{\psi \Omega_1 \left[ \frac{\partial \Omega_1}{\partial e_2} + \frac{\partial \Omega_2}{\partial e_2} \right]}{[1 - \psi \Omega_1 - \psi \Omega_2]^2} \\
+ \alpha_1 \psi \left[ (\alpha_1 + \theta) \left[ \left( \frac{\partial \pi_{11}}{\partial e_2} - \psi \frac{\partial \Omega_2}{\partial e_2} \right) \chi_{11} \pi_{21} + (\pi_{11} - \psi \Omega_2) \frac{\partial \chi_{11}}{\partial e_2} \pi_{21} + (\pi_{11} - \psi \Omega_2) \chi_{11} \frac{\partial \pi_{21}}{\partial e_2} \right] \right] \\
+ \left( \psi \frac{\partial \Omega_1}{\partial e_2} - \frac{\partial \pi_{21}}{\partial e_2} \right) \chi_{21} (1 - \alpha_1 \pi_{21} + \theta \pi_{11}) + (\psi \Omega_1 - \pi_{21}) \frac{\partial \chi_{21}}{\partial e_2} (1 - \alpha_1 \pi_{21} + \theta \pi_{11}) \\
+ (\psi \Omega_1 - \pi_{21}) \chi_{21} \left( 1 - \alpha_1 \frac{\partial \pi_{21}}{\partial e_2} + \theta \frac{\partial \pi_{11}}{\partial e_2} \right) \right].
\]

Equation (B.17) implies that

\[
\frac{\hat{L}_1}{\hat{e}_2} = \frac{(1 - \psi \Omega_2) (\Omega_1 + \chi_{12} t_2) + \psi \Omega_1 (1 - \chi_{22} t_2 + \Omega_2)}{1 - \psi \Omega_1 - \psi \Omega_2} \\
\frac{\hat{L}_2}{\hat{e}_2} = -\frac{\psi \Omega_2 (\Omega_1 + \chi_{12} t_2) + (1 - \psi \Omega_1) (1 - \chi_{22} t_2 + \Omega_2)}{1 - \psi \Omega_1 - \psi \Omega_2} \tag{B.28}
\]

Inserting Equation (B.28) into (B.16) and then (B.27), we can show that \(- \frac{\partial^2 \log W_1}{\partial \log t_{21} \partial \log e_2} > 0\) under symmetry as long as \(\frac{\partial \log W_1}{\partial \log t_{21}} > 0\).

Q.E.D.

C Quantification

C.1 Optimal Subsidies on the “MIC 2025” Sectors Proportional to Sectoral Economies of Scale

We solve for the optimal \((e_{CHN,n}^a, e_{CHN,n}^b)\) for \(j \in MIC\). The results, reported in Table C.1, suggest that (i) \(e_{CHN,n}^b\) is close to zero and (ii) China’s welfare gain from the optimal
subsidies is very close to that from the optimal uniform subsidies on the “MIC 2025” sectors. These results indicate that sectoral heterogeneity within the “MIC 2025” sectors is not very important in understanding the optimal subsidies on these sectors.

Table C.1: China’s Optimal Subsidies on the “MIC 2025” Sectors Proportional to Sectoral Economies of Scale

<table>
<thead>
<tr>
<th>%Δ in:</th>
<th>Welfare</th>
<th>Prod. in j ∈ MIC</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>2.52</td>
<td>60.14</td>
</tr>
<tr>
<td>United States</td>
<td>0.39</td>
<td>-12.20</td>
</tr>
<tr>
<td>European Union</td>
<td>0.07</td>
<td>-11.33</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.16</td>
<td>-16.07</td>
</tr>
<tr>
<td>India</td>
<td>0.60</td>
<td>-15.15</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.62</td>
<td>-8.48</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>0.47</td>
<td>-28.75</td>
</tr>
</tbody>
</table>

Notes: We start from the economy in 2015. \( e_{CHN,n}^a \) results in \( e_{CHN,n}^b \) defined by Equation 16 for \( j \in \text{MIC} \) that maximize the change in the Chinese welfare.

C.2 An Alternative Calibration of \((\psi_j, \theta_j)\)

In this section, we calibrate \((\psi_j, \theta_j)\) from Bartelme et al. (2021) and compute China’s optimal uniform subsidy on the “MIC 2025” sectors. Listed below, the alternative calibration of \((\psi_j, \theta_j)\) suggests much smaller economies of scale than in our baseline case.

Table C.3 suggests that under the alternative calibration of \((\psi_j, \theta_j)\) from Bartelme et al. (2021), China has weaker incentives to subsidize its “MIC 2025” industries than in our baseline case. Moreover, the welfare effects of the optimal subsidies are also much smaller. However, the welfare results in Table C.3 is qualitatively in line with those in Table 3.

Table C.4 shows that under alternative \((\psi_j, \theta_j)\) calibrated from Bartelme et al. (2021) China’s “MIC 2025” program still strengthens the U.S. incentives to impose protectionism tariffs. In the presence of the “MIC 2025” program, Trumpian tariffs (Wave 1) increased the U.S. welfare by 0.053%, whereas in the absence of the “MIC 2025” program the U.S. welfare only increased by 0.013%.
Table C.2: Alternative Calibration of \((\psi_j, \theta_j)\) from Bartelme et al. (2021)

<table>
<thead>
<tr>
<th>Industry</th>
<th>ICIO code</th>
<th>Description</th>
<th>(\theta_j)</th>
<th>(\psi_j)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D01T02</td>
<td>Agriculture</td>
<td>3.6</td>
<td>0.22</td>
</tr>
<tr>
<td>2</td>
<td>D03</td>
<td>Fishing</td>
<td>3.6</td>
<td>0.22</td>
</tr>
<tr>
<td>3</td>
<td>D05T06</td>
<td>Mining, energy</td>
<td>5.1</td>
<td>0.17</td>
</tr>
<tr>
<td>4</td>
<td>D07T08</td>
<td>Mining, non-energy</td>
<td>5.1</td>
<td>0.17</td>
</tr>
<tr>
<td>5</td>
<td>D09</td>
<td>Mining support</td>
<td>5.1</td>
<td>0.17</td>
</tr>
<tr>
<td>6</td>
<td>D10T12</td>
<td>Food</td>
<td>3.6</td>
<td>0.22</td>
</tr>
<tr>
<td>7</td>
<td>D13T15</td>
<td>Textiles</td>
<td>8.1</td>
<td>0.12</td>
</tr>
<tr>
<td>8</td>
<td>D16</td>
<td>Wood</td>
<td>5.9</td>
<td>0.13</td>
</tr>
<tr>
<td>9</td>
<td>D17T18</td>
<td>Paper</td>
<td>5.8</td>
<td>0.15</td>
</tr>
<tr>
<td>10</td>
<td>D19</td>
<td>Petroleum</td>
<td>9</td>
<td>0.09</td>
</tr>
<tr>
<td>11</td>
<td>D20</td>
<td>Chemical</td>
<td>3.1</td>
<td>0.24</td>
</tr>
<tr>
<td>12</td>
<td>D21</td>
<td>Pharmaceutical</td>
<td>3.1</td>
<td>0.24</td>
</tr>
<tr>
<td>13</td>
<td>D22</td>
<td>Rubber</td>
<td>1.7</td>
<td>0.42</td>
</tr>
<tr>
<td>14</td>
<td>D23</td>
<td>Non-metallic</td>
<td>5.1</td>
<td>0.17</td>
</tr>
<tr>
<td>15</td>
<td>D24</td>
<td>Basic metals</td>
<td>8.9</td>
<td>0.09</td>
</tr>
<tr>
<td>16</td>
<td>D25</td>
<td>Fabricated metal</td>
<td>7</td>
<td>0.12</td>
</tr>
<tr>
<td>17</td>
<td>D26</td>
<td>Computer</td>
<td>10.8</td>
<td>0.08</td>
</tr>
<tr>
<td>18</td>
<td>D27</td>
<td>Electrical equipment</td>
<td>10.8</td>
<td>0.08</td>
</tr>
<tr>
<td>19</td>
<td>D28</td>
<td>Machinery nec</td>
<td>3.3</td>
<td>0.24</td>
</tr>
<tr>
<td>20</td>
<td>D29</td>
<td>Motor vehicles</td>
<td>4.5</td>
<td>0.18</td>
</tr>
<tr>
<td>21</td>
<td>D30</td>
<td>Other transport equipment</td>
<td>4.5</td>
<td>0.18</td>
</tr>
<tr>
<td>22</td>
<td>D31T33</td>
<td>Manufacturing nec</td>
<td>5.8</td>
<td>0</td>
</tr>
</tbody>
</table>

Notes: We set \(\theta_j = 5.8\) and \(\psi_j = 0\) for non-tradable sectors.

Table C.3: China’s Optimal Uniform Subsidies to “MIC 2025” Industries: Alternative \((\psi_j, \theta_j)\)

\[ e^{j*}_{\text{CHN}, n} = -0.0107 \text{ for all } n \text{ and } j \in \text{MIC} \]

<table>
<thead>
<tr>
<th>%(\Delta) in:</th>
<th>Welfare</th>
<th>Prod. in (j \in \text{MIC})</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>0.056</td>
<td>22.680</td>
</tr>
<tr>
<td>United States</td>
<td>0.037</td>
<td>-3.871</td>
</tr>
<tr>
<td>European Union</td>
<td>0.017</td>
<td>-2.755</td>
</tr>
<tr>
<td>Japan</td>
<td>-0.008</td>
<td>-3.661</td>
</tr>
<tr>
<td>India</td>
<td>0.056</td>
<td>-3.198</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.097</td>
<td>-3.049</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>0.092</td>
<td>-17.041</td>
</tr>
</tbody>
</table>

Notes: We start from the economy in 2015. \(e^{j*}_{\text{CHN}, n}\) is the uniform subsidies (or taxes) on \(j \in \text{MIC}\) that maximize the change in the Chinese welfare.
Table C.4: Trumpian Tariffs (Wave 1): Alternative \((\psi_j, \theta_j)\)

<table>
<thead>
<tr>
<th>%Δ in:</th>
<th>Welfare</th>
<th>Prod. in (j \in \text{MIC})</th>
<th>Welfare</th>
<th>Prod. in (j \in \text{MIC})</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>0.053</td>
<td>1.635</td>
<td>0.013</td>
<td>0.406</td>
</tr>
<tr>
<td>China</td>
<td>0.606</td>
<td>-20.738</td>
<td>-0.076</td>
<td>-1.045</td>
</tr>
<tr>
<td>European Union</td>
<td>0.041</td>
<td>1.922</td>
<td>0.002</td>
<td>0.147</td>
</tr>
<tr>
<td>Japan</td>
<td>0.121</td>
<td>2.136</td>
<td>0.006</td>
<td>0.093</td>
</tr>
<tr>
<td>India</td>
<td>-0.035</td>
<td>1.439</td>
<td>-0.001</td>
<td>0.021</td>
</tr>
<tr>
<td>Brazil</td>
<td>0.098</td>
<td>0.867</td>
<td>0.001</td>
<td>0.091</td>
</tr>
<tr>
<td>Rest of the World</td>
<td>0.086</td>
<td>20.966</td>
<td>0.011</td>
<td>0.354</td>
</tr>
</tbody>
</table>

Notes: In “MIC 2025”, we start from the economy in 2017 in which China subsidizes “MIC 2025” at the rate in Table 3. In “No MIC 2025”, we first eliminate all subsidies in the economy in 2017 and start from this new economy with zero subsidies.