Who Gains the Most from Trade Wars? Evidence from U.S. Import Shifting to Third Countries During the U.S.-China Trade Conflict

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Abstract

I study the impact of Section 301 tariffs, focusing on how the reduction in Chinese exports was distributed between U.S. domestic suppliers and other foreign exporters. Using fixed effects regressions, I find that exports of tariffed goods increased significantly for third-country exporters that already held substantial U.S. market shares. This suggests that the benefits of the tariffs were concentrated among large foreign suppliers rather than small exporters or domestic producers. To explain this pattern, I develop a theoretical model based on the Ramsey-Cass-Koopmans framework while incorporating investment efficiency in the capital accumulation process. The model shows that high capital endowments and low input prices allow large exporters to capture the majority of gains from the tariffs. This result has clear policy implications: Section 301 tariffs could be ineffective at revitalizing U.S. industries. Instead, the gains were likely to be concentrated on large foreign exporters in both the short and long run. The model also implies that foreign governments might find wage restraint strategically advantageous in sustaining their export competitiveness.

Keywords: U.S.–China Trade War, Third-Country Exporters, Ramsey-Cass-Koopmans Framework, Investment Efficiency, Tariff Effects

JEL Classification: F10 , F13 , F14

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1 Introduction

The U.S.–China trade conflict intensified during the Trump administration. In response, the United States imposed Section 301 tariffs in four successive tranches between 2018 and 2019. A likely objective was to reduce U.S. industries' dependence on China. Evidence from the U.S. International Trade Commission, hereafter USITC, (2023) supports this view: the tariffs primarily targeted chemical products, textiles, machinery, and electronic goods—sectors in which imports from China remained consistently high.

Another likely objective was to reinvigorate U.S. industries. The tariffs may have aimed to promote domestic production by encouraging U.S. firms to replace Chinese suppliers. However, the U.S. Bureau of Economic Analysis suggests that the tariffs may have failed to achieve this goal. Specifically, although Chinese imports in these industries declined by approximately 10% between 2016 and 2020, domestic production increased by only about 2%. On the other hand, overall U.S. imports rose by more than 10%. This suggests that domestic suppliers saw limited gains from the tariffs, while third-country exporters likely captured the majority of the benefits.

This raises an important question: who gained most from the Section 301 tariffs. The paper examines how imposing tariffs on a specific country-such as the Section 301 tariffs on China-may inadvertently benefit that country's rivals, particularly the largest alternative exporters. It also explores why such tariffs may fail to promote domestic suppliers. To investigate these dynamics, I provide empirical evidence of the uneven distribution of gains from the tariffs, and develop a model that compares production changes among large and small foreign exporters under domestic market equilibrium.

The model categorizes foreign exporters into three groups. The first group held a large share of U.S. imports prior to the tariffs and is subject to them. The second group also had a large import share but is not subject to the tariffs. The third group is exempt from the tariffs but had a relatively small import share. The model assumes perfect competition, where exporters take the domestic price, local wages, the price of investment goods and the global interest rate as given. Production depends on two inputs: labor, which is immobile across borders, and capital, which is accumulated through immobile investment goods. The model examines which group of exporters experiences the greatest increase in production—and thus exports-thereby identifying the primary beneficiary of the tariff policy.

My model builds on the Ramsey-Cass-Koopmans framework, as thoroughly discussed by Barro and Sala-i-Martin (2003), Blanchard and Fischer (1989), and Romer (2019). However, it extends the capital accumulation process to incorporate three key components: investment, depreciation, and investment inefficiency. Investment inefficiency depends solely on former capital endowments and is negatively correlated with them. As a result, larger exporters can expand production more efficiently than smaller ones, which eventually explains the uneven distribution of gains from the tariff policy.

The model also distinguishes between the short-run and long-run effects of the tariff policy. Short-run effects reflect changes in exporters' production without wage adjustments. In contrast, long-run effects capture production changes following wage adjustments. These long-run effects are likely smaller in magnitude, suggesting that initial production increase may diminish over time as exporters respond to changes in their labor market.

The model shows three key theoretical results. First, in the short run, gains tend to be concentrated among large exporters, driven by their greater initial capital endowments—which improve investment efficiency—and their relatively low wages or investment goods prices. Second, although rising wages may reduce these gains over time, large exporters are still likely to benefit more than smaller ones. Third, if wages remain constant, exporters can preserve their initial gains. Taken together, the results suggest that Section 301 tariffs primarily benefited the United States' major trading partners—excluding China—while offering only modest support to U.S. industries. Moreover, the model suggests that foreign governments may have an incentive to suppress wage growth to maintain export competitiveness over time.

These theoretical findings offer a new perspective on the effects of Section 301 tariffs relative to prior studies. USITC (2023) examined the tariffs' impact on the decline in Chinese imports, as well as the subsequent rise in U.S. production. Fajgelbaum et al. (2020) and Amiti et al. (2019) showed that the tariffs were largely passed through to import prices, eventually reducing consumer welfare and real incomes in the United States. Handley et al. (2025) and Bown (2021) found that U.S. firms whose supply chains were exposed to the tariffs may have experienced slower export growth and job losses. While these studies assess the tariffs' impact from the U.S. perspective, they devote less attention to the gains or losses experienced by alternative exporters to the U.S. market.

In contrast, Freund et al. (2023) analyzed how global supply chains adjusted in response to Section 301 tariffs, showing that countries with large populations and low labor costs were more likely to replace Chinese exports. Fajgelbaum et al. (2024) further argued that these countries expanded their production to serve broader global markets. Collectively, these studies suggest that some gains from the tariffs may have leaked to foreign suppliers.

However, these studies also have important limitations. First, they paid less attention to major U.S. trading partners such as Germany, Canada, South Korea, and Japan. These countries, despite relatively high wages and modest populations, benefited the most from the tariffs. This suggests that large populations and low labor costs alone cannot fully explain the uneven distribution of gains. Second, they gave less consideration to investment efficiency, which can vary significantly across exporters. Rapposelli, Birindelli, and Modina (2023) found that larger firms tend to outperform smaller ones in terms of capital strength and economic-financial performance. This implies that large exporters may invest more efficiently, which partly explains why some countries benefited more. Third, while these studies provided empirical evidence of uneven gains, they offered insufficient theoretical explanation for the underlying mechanisms. Consequently, this study addresses these gaps by introducing a model in which large exporters benefit more due to greater capital endowments—enhancing investment efficiency—and more favorable input prices.

The remainder of the paper is organized as follows. Section 2 presents empirical evidence of the uneven distribution of gains, which motivates the study. Section 3 develops a theoretical model and derives the production decisions of different types of exporters under domestic market equilibrium. Section 4 analyzes the short-run and long-run effects of the tariffs. Section 5 concludes.

2 Background and Motivation

This section reviews U.S. tariff policy on China and examines subsequent changes in U.S. imports, which motivates the theoretical model developed in the next section.

2.1 U.S. Trade Policy: Tariffs on China

Between 2018 and 2020, the Trump administration implemented several tranches of tariffs on Chinese imports. According to USITC (2023) and the Office of the U.S. Trade Representative (USTR), the first tranche took effect on July 6, 2018, and imposed a 25% tariff on 818 products at the 8-digit Harmonized Tariff Schedule (HTS) level, primarily targeting machinery and electronic goods. The total value of imports affected by this tranche was approximately $34 billion. The second tranche, effective August 23, 2018, extended the 25% tariff to an additional 279 products. These products were mainly from the chemical and machinery sectors, covering roughly $16 billion in trade. The third tranche, effective September 24, 2018, initially imposed a 10% tariff on 5,745 products—primarily from the chemical, agricultural, and textile industries—covering imports worth around $200 billion. The tariff rate was later raised to 25% on May 10, 2019. The final tranche began on September 1, 2019, targeting 3,279 products valued at approximately $300 billion. These products were initially subject to a 15% tariff, which was later reduced to 7.5% following a trade agreement between the United States and China.

The trade conflict between the United States and China prompted U.S. markets to seek alternative suppliers. These alternatives included both domestic producers and foreign exporters other than China. Panel A of Table 1 shows changes in domestic supply and imports for industries subject to Section 301 tariffs. Between 2016 and 2020, U.S. imports increased by approximately 10%, while domestic production rose by only 2%. Excluding agricultural products, U.S. imports increased by 10%, whereas domestic production grew by just 0.4%. This relatively stronger growth in imports suggests that foreign suppliers, rather than domestic producers, likely replaced Chinese exporters.

Panel B of Table 1 shows changes in U.S. imports of tariff-targeted products from China, primary trade partners, and the rest of the world over the same period. While imports from China declined by 10%, imports from primary partners and the rest of the world rose by more than 20%. This is consistent with Panel A, suggesting that Section 301 tariffs may not have effectively supported domestic producers, despite the decline in imports from China. At the same time, the stronger growth in imports from primary partners indicates that large foreign suppliers had an advantage over both domestic producers and smaller exporters. In other words, tariffs on specific countries may primarily benefit the next-largest foreign competitors—those with already large-scale production. The following subsections examine this hypothesis more formally using regression analysis. They begin by describing the data, followed by a presentation of the regression results.

2.2 Data

The regression analysis relies on two main datasets. The first dataset identifies the products subject to Section 301 tariffs, based on lists published by USTR. [1] The products are classified at the 8-digit HTS subheading level, covering 818 subheadings in Tranche 1, 279 in Tranche 2, 5,734 in Tranche 3, and 3,233 in Tranche 4. The number of subheadings in Tranches 1 and 2 matches exactly those reported by USITC (2023). By contrast, the counts for Tranches 3 (5,745) and 4 (3,279) differ slightly. However, these discrepancies are minor and do not compromise the dataset's ability to accurately represent the tariff-targeted products.

[1] See: https://ustr.gov/issue-areas/enforcement/section-301-investigations/tariff-actions. The HTS codes for all four tranches are available in PDF format. These codes are also compiled by the American Action Forum (Lee and Varas, 2022): https://www.americanactionforum.org/research/the-total-cost-of-tariffs/?utm_source=chatgpt.com#_ftn2.

Table 1: U.S. Imports and Domestic Supply Changes in Industries Affected by Section 301 Tariffs ($ billion), 2016 vs 2020

	Panel A. Total Imports & Domestic Supply[1]		
	2016	2020	% change
U.S. Imports	1125.9	1245	+10.57%
U.S. Domestic Production	2615.8	2664.7	+1.87%

	Panel B. Imports from China, Primary Partners, and the Rest of the World[2]		
	2016	2020	% change
China	258.5	230.4	-10.87%
Primary Partners	728.5	935.2	+28.36%
Rest of World	450.7	563.3	+24.98%

[1]Source: U.S. Bureau of Economic Analysis (BEA) and author's calculations. All figures are in billions of U.S. dollars. Estimates reflect the sum of imports and domestic supply across 11 industries, identified by BEA industry codes: 111CA, 113FF, 325, 313TT, 315AL, 327, 331, 332, 333, 334, and 335. These industries—covering agriculture, chemical products, textiles and apparel, nonmetallic minerals and metals, machinery, and electronic products—represent 84% of the goods subject to Section 301 tariffs, according to USITC (2023). Excluding agriculture (111CA and 113FF), U.S. imports increased from $1,070.9 billion to $1,184.3 billion, while domestic supply rose from $2,171.9 billion to $2,181.3 billion.

[2]Source: U.S. Census Bureau and author's calculations. All figures are in billions of U.S. dollars. Estimates reflect the sum of imports of products classified at the 8-digit HTS level and subject to Section 301 tariffs. Primary partners refer to nine countries—Mexico, Canada, Japan, Germany, South Korea, the United Kingdom, France, India, and Italy—which comprised the top 10 sources of U.S. imports in 2016, excluding China.

The second dataset reports semiannual U.S. imports from 232 countries (excluding China) between 2016 and 2020. It includes 9,229 products, classified at the 8-digit HTS level, with import values reported in U.S. dollars. Among them, 1,171 products (12.7%) were not subject to Section 301 tariffs. Including these comparable non-tariffed products improves the accuracy of estimating the tariffs' impact on foreign exporters. The dataset is compiled from the USITC's DataWeb platform, which sources its trade data from the U.S. Census Bureau.

Table 2 shows the mean, median, and standard deviation of U.S. import values for tariffed and non-tariffed products from 2016 to 2020. Although the medians of the two groups are similar, the mean for non-tariffed products ($34.99 million) is substantially higher than that for tariffed products ($ 15.14 million). This difference is partly explained by the larger standard deviation among non-tariffed products, reflecting a more heavily skewed distribution with a longer right tail. This suggests underlying heterogeneity between the two groups.

Table 2: Summary Statistics for U.S. Imports: Tariffed vs Non-Tariffed Products, 2016-2020

	Tariffed	Non-Tariffed
Number	8,058	1,171
mean	15.14	34.99
median	1.48	1.54
s.d.	170.43	284.10

Source: U.S. Census Bureau and author's calculation. All figures are in millions of U.S. dollars, except for the Number row. *s.d.* denotes the standard deviation.

2.3 Regression Results: Effects of Section 301 Tariffs on Third-Country Imports

This section performs a regression analysis to examine how Section 301 tariffs influenced U.S. imports from third countries. In particular, the analysis explores whether the tariffs disproportionately benefited major trade partners over smaller exporters. Let k denote a country, g an 8-digit HTS product, and t a half-year period spanning from the first half of 2016 to the second half of 2020. Let $s(g)$ and $i(g)$ denote the 4-digit HTS sector and 2-digit HTS industry associated with product g, respectively. The regression specification, similar to the approach of Fajgelbaum et al. (2020), is given by

$$\Delta m_{k,g,t} = \omega_{s(g)} + \omega_{i(g),t} + \omega_{k,t} + B\Delta\tau_{China,g,t} + \kappa\Delta\tau_{China,g,t} * \Omega_{k,s(g)} + \epsilon_{k,g,t}, \quad (1)$$

where $m_{k,g,t}$ denotes the import value of product g from country k in period t, measured in millions of U.S. dollars. $\tau_{China,g,t}$ denotes the tariff rate on product g imported from China in period t. $\Omega_{k,s(g)}$ measures the import share of country k in sector $s(g)$. It is calculated as the ratio of U.S. imports from country k to total U.S. imports in that sector during the 2016–2018 period.[2] In addition, $\omega_{s(g)}$, $\omega_{i(g),t}$ and $\omega_{k,t}$ represent sector, industry-time, and country-time fixed effects, respectively. The coefficients of interest are B and κ. The coefficient B captures the average effect of Section 301 tariffs on U.S. imports from countries other than China. A positive estimate of B indicates that these foreign exporters partially replaced Chinese suppliers in the U.S. market. The coefficient κ assesses whether the substitution effect varies with exporters' relative market shares. A positive estimate of κ, alongside a positive B, suggests that larger foreign exporters benefited more than smaller ones.

The regression results are presented in Table 3. Columns (1)-(3) estimate the impact of tariffs on imports from third countries, using semiannual changes. Column (1) estimates a specification without the interaction between tariffs and import shares. The positive coefficient of 4.622 on tariff changes implies that a 10-percentage-point increase in tariffs typically leads to an increase of \$0.46 million in imports from third countries. Column (2) includes the interaction term between tariff changes and countries' import shares. The two positive estimates suggest that larger foreign exporters gained more than smaller ones in replacing Chinese suppliers. For example, if a country accounts for 10% of total imports in sector $s(g)$, a 10-percentage-point tariff increase on products within that sector is associated with an increase of \$0.60 million in imports from that country. In contrast, if a country holds a 50% import share, the same tariff increase brings a rise of up to \$1.73 million.

Column (3) examines whether gains are more heavily concentrated among larger exporters than earlier estimates suggest. Positive coefficients on tariff changes and their interaction with squared import shares support this. For example, a 10-percentage-point increase in tariffs leads to an increase of \$0.45 million in imports from a country with a 10% import share. In contrast, the same tariff increase corresponds to an export gain of \$1.77 million for a country with a 50% share. Namely, the difference in gains-\$1.32 million in Column (3) compared to \$1.13 million in Column (2)-underscores the concentration of benefits among larger exporters.

[2] $\Omega_{k,s(g)} = \frac{\sum_{g\in s(g)}\sum_{y=2016}^{2018} m_{k,g,y}}{\sum_{k'}\sum_{g\in s(g)}\sum_{y=2016}^{2018} m_{k',g,y}}$. The years 2019 and 2020 are excluded as they are likely to reflect the impact of Section 301 tariffs.

Column (4) assesses the sensitivity of the results to the frequency of measurement by employing annual changes in import values. If the estimates differ substantially from previous ones, this could indicate that the effects of the tariffs are either short-lived or driven by specific features of the data, raising concerns about robustness. However, the results are similar to those in Column (2), with positive coefficients on both the tariff changes and their interaction with import share. In other words, the findings in Column (4) further support the robustness of the earlier results.

Table 3: Interaction Between Tariffs and Import Shares

	(1) No import share	(2) Baseline	(3) Squared import share	(4) Yearly
$\Delta\tau_{China,g,t}$	4.622**	3.240	4.001**	2.154
	(1.948)	(2.034)	(1.961)	(4.850)
$\Delta\tau_{China,g,t} * \Omega_{k,s(g)}$		28.31**		54.89**
		(12.20)		(26.36)
$\Delta\tau_{China,g,t} * \Omega^2_{k,s(g)}$			54.97***	
			(20.08)	
Observations	460,911	460,682	460,682	187,750
R-squared	0.022	0.022	0.022	0.047
Sector FE	Y	Y	Y	Y
Industry x Time FE	Y	Y	Y	Y
Country x Time FE	Y	Y	Y	Y

Source: U.S. Census Bureau and author's calculations. Columns (1)–(3) present regression results using semiannual changes in import values and tariffs, while Column (4) reports results based on annual changes in both variables. All regressions include sector, industry-time, and country-time fixed effects. Standard errors are reported in parentheses. Statistical significance is indicated by *, **, and ***, corresponding to the 10%, 5%, and 1% levels, respectively.

Consequently, Table 3 demonstrates that countries with higher import shares experienced greater gains from the tariffs. In other words, tariffs imposed on a specific country primarily benefit its major foreign competitors, whose exports are already substantial. The next section develops a model to capture the underlying mechanisms that generate this uneven distribution of gains.

3 Model Development

This section develops a theoretical framework to examine why Section 301 tariffs on China disproportionately benefited countries with higher import shares. It begins by outlining the structure of the model. It then examines the optimization problems faced by Chinese exporters, and foreign exporters with relatively high and low import shares. In particular, it focuses on the exporters' steady-state production levels.

3.1 Model Setup

There are three distinct types of foreign exporters to the domestic (U.S.) market. Let Group A represent exporters with a high import share but subject to tariffs, modeled after Chinese exporters. Group B consists of major competitors to Group A-exporters with comparable import shares but not subject to tariffs. Group C consists of smaller exporters with the lowest import shares, who are also not subject to tariffs. Let N_A, N_B, and N_C denote the number of exporters in Groups A, B, and C, respectively.

The model is grounded in the framework of perfect competition. Exporters are price takers who face the domestic market price P^{Dom} for their output and input costs specific to their respective groups. Labor is immobile across borders, with wages denoted by W_A, W_B and W_C, for groups A, B, and C, respectively. Similarly, investment goods have distinct price levels P_A^I, P_B^I, and P_C^I for each group. These heterogeneous investment prices align with findings by Rapposelli et al. (2023) and Chatterjee and Eyigungor (2023), who show that large firms typically face lower investment costs owing to stronger ties with financial institutions and higher leverage. In contrast, all exporters share a common production function and face a uniform interest rate r. The subsequent subsection describes how these exporters decide their steady-state production levels.

Since interest rates vary across countries, the assumption of a uniform rate may not be realistic. Nonetheless, Henriksen et al. (2009) argued that countries tend to exhibit similar fluctuations in price levels and nominal interest rates, resulting in broadly similar movements in real interest rates. This observation partially justifies the assumption of a uniform interest rate. Moreover, this simplification enables the model to focus more directly on investment efficiency—closely linked to capital endowments—and input prices. Therefore, the model still offers valuable insights into how variations in capital endowments and input prices drive production disparities between large and small exporters.

3.2 Firm-Level Optimization Problem

Exporters determine their production levels based on the wage W and the price of investment goods P^I.[3] Their production technology follows a Cobb-Douglas specification with labor and capital as inputs. The profit function at time t is given by

$$\Pi(L_t, K_t, I_t, P_t^{Dom}, W_t, P_t^I) = P_t^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_t L_t - P_t^I I_t \tag{2}$$

where α represents the output elasticity of capital, and $1-\alpha$ represents the output elasticity of labor. For simplicity, the domestic price level P^{Dom} and wages W are held constant in the pre-tariff period. In contrast, the investment goods price P^I is held constant over time. Capital accumulation for exporters is governed by the following dynamic equation:

$$\dot{K}_t = I_t - \Psi(K_t) - \delta K_t \tag{3}$$

Here, δ denotes the depreciation rate, and $\Psi(K_t)$ captures investment inefficiency in the capital accumulation process. The function $\Psi(K_t)$ is decreasing in K_t, implying that investment inefficiency declines as the capital stock increases. Consequently, larger exporters—who possess greater capital stock—can expand production more efficiently than smaller exporters. This is consistent with models incorporating adjustment costs in capital accumulation, as discussed by Wang and Wen (2012) and Hayashi (1982). For simplicity, the inefficiency function is specified as $\Psi(K_t) = \frac{1}{K_t}$.

Exporters maximize their profits over an infinite time horizon. Accordingly, their dynamic optimization problem is given by

[3] Exporters are assumed to own their capital, but must continuously purchase investment goods at price P^I to offset depreciation and maintain their capital stock.

$$\max_{L_t, I_t} \int_0^{\infty} e^{-rt} \Pi(L_t, K_t, I_t, P_t^{Dom}, W_t, P_t^I) \tag{4}$$

subject to the capital accumulation equation (3). Here, r denotes the constant interest rate, which serves as the discount factor for future profits. The optimization problem can be solved by formulating it as a current-value Hamiltonian. The next subsection derives the steady-state production levels of exporters from the three groups in the pre-tariff period.

3.3 Steady-State Solutions without Tariffs

This subsection derives the steady-state production levels of exporters from the three groups in the pre-tariff period, given the capital accumulation constraint.

3.3.1 Exporters in Group A

The profits of exporters in Group A depend on the constant domestic price P^{Dom}, the group-specific wage W_A, and the investment goods price P_A^I. Additionally, they are subject to tariffs τ, which are incorporated into their profit function. Their profit function is given by

$$\Pi(L_t, K_t, I_t, P^{Dom}, W_A, P_A^I, \tau) = (1-\tau) P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_A L_t - P_A^I I_t \tag{5}$$

together with the capital accumulation equation (3). In steady-state equilibrium, the shadow value of capital, denoted by q, must remain constant and equal to the investment goods price P_A^I, in accordance with the optimality condition described by Kamien and Schwartz (1991) and Chavas (2023). Furthermore, investment I_t remains constant at $\Psi(K^*) + \delta K^*$, where K^* denotes the steady-state capital stock. Accordingly, the steady-state level of labor, L_A^*, is determined by

$$L_A^* = (\theta_A^L)^{\frac{1}{\alpha}} K_A^* \tag{6}$$

where $\theta_A^L = \frac{(1-\tau)(1-\alpha)P^{Dom}}{W_A}$, a term that depends on the tariff rate τ, the domestic price P^{Dom}, the output elasticity of labor $(1-\alpha)$, and the group-specific wage W_A. This term approximates the ratio of the marginal revenue product of labor to its marginal cost. A higher value of θ_A^L implies that labor is relatively less costly, thereby encouraging greater labor employment. The steady-state level of capital, K_A^*, is given by

$$K_A^* = \frac{1}{\sqrt{r + \delta - \theta_A^K (\theta_A^L)^{\frac{1-\alpha}{\alpha}}}} \tag{7}$$

where $\theta_A^K = \frac{(1-\tau)\alpha P^{Dom}}{P_A^I}$, a term that depends on the tariff rate τ, the domestic price P^{Dom}, the output elasticity of capital α, and the group-specific investment goods price P_A^I. A higher value of θ_A^K implies that investment (capital) is relatively less costly, thereby encouraging greater capital employment. In contrast, the depreciation rate δ and the interest rate r reduce capital employment in the steady state. The detailed solution procedure is provided in *Appendix A.1*.

The steady-state levels of both capital and labor are negatively correlated with the investment goods price, wage, interest rate, depreciation rate, and tariff, but positively associated with the domestic output price. The corresponding production level for Group A exporters is given by

$$F_A^* = (\theta_A^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_A^K (\theta_A^L)^{\frac{1-\alpha}{\alpha}}}} \tag{8}$$

where F_A^* denotes the steady-state production level. Since input and output prices are assumed to be constant, this production level remains stable in the absence of tariff increases. The following subsection examines the production levels of exporters in Groups B and C, which are independent of the tariffs.

3.3.2 Exporters in Groups B and C

For exporters in Groups B and C, profits are unaffected by the tariff τ. Instead, their profits are determined by the group-specific wages W_B and W_C, and the investment goods prices P_B^I and P_C^I, respectively. As a result, their optimization problems are similar to those faced by exporters in Group A.

The steady-state production level for exporters in Group B is given by

$$F_B^* = (\theta_B^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_B^K (\theta_B^L)^{\frac{1-\alpha}{\alpha}}}} \tag{9}$$

where $\theta_B^L = \frac{(1-\alpha)P^{Dom}}{W_B}$ and $\theta_B^K = \frac{\alpha P^{Dom}}{P_B^I}$ capture the marginal revenue-to-cost ratios for labor and capital, respectively. δ denotes the depreciation rate and r represents the interest rate. The steady-state production level for exporters in Group C is given by

$$F_C^* = (\theta_C^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_C^K (\theta_C^L)^{\frac{1-\alpha}{\alpha}}}} \tag{10}$$

where $\theta_C^L = \frac{(1-\alpha)P^{Dom}}{W_C}$ and $\theta_C^K = \frac{\alpha P^{Dom}}{P_C^I}$ are defined analogously to those in Group B. Accordingly, the steady-state production levels of Groups B and C are positively correlated with the domestic price, but negatively associated with the investment goods prices, wages, interest rate, and depreciation rate. The detailed solution procedure for these groups is provided in *Appendix A.2*.

The model assumes that exporters in Group B have higher production levels than those in Group C. However, the uniform interest rate, domestic price level, and depreciation rate do not explain this disparity. Instead, differences in wages and investment goods prices are likely to drive this production gap. In particular, Group B faces lower wages or investment goods prices, which in turn supports higher steady-state production.

Exporters in Group B are broadly consistent with the United States' primary trade partners that account for high import shares. These countries tend to have sizable populations, a well-educated labor force, relatively lower wages compared to the U.S., and advanced financial systems with political stability—factors that lower investment costs. Additionally, they may also resemble U.S. domestic suppliers, who face higher labor costs but benefit from comparatively low investment goods prices due to the exceptionally large, efficient, and highly developed financial markets.

In contrast, Group C may represent smaller exporters from both developed and developing countries. Among developed countries, exporters tend to face higher wages and limited population size. In developing countries, investment goods tend to be more expensive due to underdeveloped financial systems or political uncertainty. These countries also face lower educational attainment, which restricts the supply of skilled labor and narrows the wage gap between them and U.S. primary trade partners in tariff-affected industries. Therefore, the model can explain the uneven distribution of gains between large and small exporters, while also providing a framework for assessing the effectiveness of Section 301 tariffs in supporting domestic producers.

3.4 Firm-Level Equilibrium in the Domestic Market

In the steady-state equilibrium, the combined output of exporters in Groups A, B and C must be fully consumed by the domestic market. At a given domestic price P^{Dom}, aggregate supply would be given as

$$
\begin{aligned}
Q = \underbrace{N_A \cdot (\theta_A^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_A^K(\theta_A^L)^{\frac{1-\alpha}{\alpha}}}}}_{\text{Group } A} &+ \underbrace{N_B \cdot (\theta_B^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}}}}}_{\text{Group } B} \\
&+ \underbrace{N_C \cdot (\theta_C^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_C^K(\theta_C^L)^{\frac{1-\alpha}{\alpha}}}}}_{\text{Group } C}
\end{aligned}
\tag{11}
$$

where N_A, N_B, and N_C denote the number of exporters in Groups A, B and C, respectively. On the other hand, the inverse demand function for the domestic market is defined as

$$
P^{Dom} = \sigma - \eta Q \tag{12}
$$

where σ is a constant, and η denotes the slope governing the price elasticity of demand for tariffed goods. When $\eta = 0$, demand is perfectly elastic, and suppliers fully absorb the tariff costs. Conversely, as $\eta \to \infty$, demand becomes perfectly inelastic, shifting the entire tariff burden onto consumers. To avoid these extremes, the model assumes that η is a finite, positive constant. Domestic market equilibrium requires that aggregate demand equals aggregate supply, which is given by

$$
\begin{aligned}
P^{Dom^*} &= \sigma - \eta Q^* \\
= \sigma - \eta \Bigg\{ N_A \cdot (\theta_A^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_A^{K^*}(\theta_A^{L^*})^{\frac{1-\alpha}{\alpha}}}} &+ N_B \cdot (\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_B^{K^*}(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}}}} \\
&+ N_C \cdot (\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_C^{K^*}(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}}}} \Bigg\}
\end{aligned}
\tag{13}
$$

where P^{Dom^*} and Q^* denote the equilibrium domestic price and quantity in the steady state. The terms $\theta_A^{L^*} = \frac{(1-\tau)(1-\alpha)P^{Dom^*}}{W_A}$, $\theta_A^{K^*} = \frac{(1-\tau)\alpha P^{Dom^*}}{P_A^I}$, $\theta_B^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_B}$, $\theta_B^{K^*} = \frac{\alpha P^{Dom^*}}{P_B^I}$, $\theta_C^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_C}$, and $\theta_C^{K^*} = \frac{\alpha P^{Dom^*}}{P_C^I}$ represent, for each group, the marginal revenue-to-cost ratios for labor and capital at the equilibrium price. In the pre-tariff period ($\tau = 0$), exporters in Groups A and B face lower wages or investment goods prices, leading to higher returns to labor or capital. Consequently, their equilibrium production levels are expected to exceed those of Group C. The next section examines how the imposition of tariffs on Group A affects the production decisions of exporters in Groups B and C.

4 Tariff Effects

This section discusses how the introduction of tariffs alters the production decisions of exporters in Groups B and C. It first analyzes the impact of tariffs on the domestic market equilibrium price, and then derives production changes for Groups B and C, under the assumption of constant wages. This captures the short-run effects. Subsequently, it examines how these exporters adjust their production levels when the wage in Group A remains constant, but their own wages rise due to excess labor demand. This reflects the long-run effects.

4.1 Short-Run Effects of Tariffs on Exporter Output

This subsection analyzes the short-run adjustment in production following the imposition of tariffs, assuming that wages in all three groups are held constant.

4.1.1 New Equilibrium in the Domestic Market

As shown in equation (8), the imposition of tariffs reduces returns to labor and capital, thereby lowering the production levels of exporters in Group A.[4] This results in excess demand in the domestic market at the pre-tariff price level P^{Dom^*}. To restore equilibrium, the domestic price level is expected to rise ($P^{Dom^*} \to P^{Dom^{**}}$), which raises production from Groups B and C. In contrast, although the domestic price increase partially offsets the decline in exports from Group A, its production ultimately falls.

In summary, the new equilibrium occurs at a higher domestic price level ($P^{Dom^{**}} > P^{Dom^*}$). At this higher price, exporters in Groups B and C expand production, while output from Group A contracts. A detailed derivation of this adjustment is provided in *Appendix B.1.* The following subsection compares the production increases in Groups B and C to assess which group benefits most from the imposition of tariffs.

4.1.2 Production Decisions in Group B and C

In the short run, wages in all three groups are assumed to remain constant, while the domestic price level is expected to increase. This suggests that the production increases in Groups B and C can be assessed by examining the rate of change in output with respect to the domestic price. Accordingly, the rate of change in output for exporters in Group B, evaluated at the pre-tariff price level P^*_{Dom}, is given by

$$\left.\frac{\partial F^*_B}{\partial P^{Dom}}\right|_{P^{Dom}=P^{Dom^*},W_B,P^I_B} = \frac{1}{\alpha \cdot P^{Dom^*}}\left\{K^*_B(1-\alpha)(\theta^{L^*}_B)^{\frac{1-\alpha}{\alpha}} + \frac{(K^*_B)^3(\theta^{L^*}_B)^{\frac{2-2\alpha}{\alpha}}\theta^{K^*}_B}{2}\right\} \tag{14}$$

[4]The production level of exporters in Group A at given tariffs τ and the equilibrium domestic price P^{Dom^*} is $(\theta^{L^*}_A)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta^{K^*}_A(\theta^{L^*}_A)^{\frac{1-\alpha}{\alpha}}}}$ where $\theta^{L^*}_A = \frac{(1-\tau)(1-\alpha)P^{Dom^*}}{W_A}$ and $\theta^{K^*}_A = \frac{(1-\tau)\alpha P^{Dom^*}}{P^I_A}$. An increase in τ reduces the production level.

where K_B^* denotes the capital stock employed by exporters in Group B at the pre-tariff equilibrium. The terms $\theta_B^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_B}$ and $\theta_B^{K^*} = \frac{\alpha P^{Dom^*}}{P_B^I}$ represent the marginal revenue-to-cost ratios for labor and capital, respectively. Similarly, the rate of change in output for exporters in Group C is given by

$$\left.\frac{\partial F_C^*}{\partial P^{Dom}}\right|_{P^{Dom}=P^{Dom^*},W_C,P_C^I} = \frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_C^*(1-\alpha)(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\} \tag{15}$$

where K_C^* denotes the capital stock employed by exporters in Group C. The terms $\theta_C^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_C}$ and $\theta_C^{K^*} = \frac{\alpha P^{Dom^*}}{P_C^I}$ represent the marginal revenue-to-cost ratios for labor and capital, respectively. The detailed procedure for deriving the rate of change for both groups is provided in *Appendix B.2.*

Equations (14) and (15) show that heterogeneity in capital endowment and input prices influences the rate of change in output, despite identical production technology α and a common domestic price P^{Dom^*}. A higher capital endowment leads to greater production expansion by reducing investment inefficiency, as reflected in the terms K_B^* and K_C^* in the equations.[5] In addition, lower wages or investment goods prices raise the returns to labor or capital, further amplifying production expansion. Consequently, the increase in production in Group B is expected to exceed that in Group C, reflecting its higher capital endowment and more favorable input prices. This suggests that, in the short run, the gains from Section 301 tariffs are likely to be concentrated in U.S. primary trading partners—characterized in the model by greater capital employment.

However, these equations may not fully explain why the tariffs might be ineffective in supporting U.S. domestic suppliers. This is because the model treats domestic suppliers as analogous to exporters in Group B. In other words, domestic suppliers are assumed to have a high level of capital endowment, K^*. Moreover, although their higher wages reduce the return to labor θ^{L^*}, a relatively low investment goods price may offset this reduction by increasing the return to capital θ^{K^*}. As a result, U.S. domestic suppliers could experience a short-run increase in production levels comparable to that of major U.S. trading partners.

This underscores the importance of examining the long-run effects of tariffs in response to wage changes in Groups B and C. These long-run effects are analyzed in the following subsection.

4.2 Long-Run Tariff Effects Eroded by Wage Increases

This section analyzes the long-run impact of tariffs, leading to the final post-tariff equilibrium in the domestic market, under the assumption that wages in Groups B and C adjust.

4.2.1 Final Equilibrium of the Domestic Market

An increase in the domestic price raises the marginal revenue product of labor, creating excess demand in the labor markets of Groups B and C. As shown in equation (13), this increases their wages, which then reduces exporters' production and further raises the domestic price. Consequently, the final equilibrium price in the domestic goods market is higher than the initial post-tariff equilibrium. This further mitigates the initial production decline experienced by Group A, while the production gains in Groups B and C are partially offset. A detailed discussion

[5] Investment inefficiency is defined as $\Psi(K_t) = \frac{1}{K_t}$ in the model. Greater capital employment reduces investment inefficiency.

of this adjustment is provided in *Appendix C.1.* Table 4 summarizes the changes following the imposition of tariffs in both the short run and the long run. The last column, *Final Effect of Tariffs*, reports the net changes in key variables after long-run adjustments, relative to the pre-tariff period.

Table 4: Summary of Changes Following the Imposition of Tariffs

	Short-run	Long-run	Final Effect of Tariffs
W_A	-	-	-
W_B and W_C	-	$\uparrow$	$\uparrow$
P^{Dom^*}	$\uparrow$	$\uparrow$	$\Uparrow$
F_A^*	$\Downarrow$	$\uparrow$	$\downarrow$
F_B^* and F_C^*	$\Uparrow$	$\downarrow$	$\uparrow$

Notes: The *Short-run* column captures changes in each variable prior to increases in W_B and W_C, while the *Long-run* column reflects the subsequent changes relative to the initial post-tariff equilibrium. The final column, *Final Effect of Tariffs*, reports the net changes in variables at the long-run equilibrium relative to the pre-tariff period. $\Uparrow$ and $\Downarrow$ indicate larger changes in magnitude than $\uparrow$ and $\downarrow$. The wage in Group A is assumed to remain constant throughout.

4.2.2 Production Decisions in Group B and C

In the long run, wages in Groups B and C are expected to increase, while the wage in Group A remains constant. This implies that the long-run change in production for Groups B and C must incorporate the positive relationship between the domestic price and their own wages. Accordingly, the rate of change in output with respect to the domestic price for Group B's exporters, evaluated at the initial price level P^{Dom^*}, is given by

$$\left.\frac{dF_B^*}{dP^{Dom}}\right|_{P^{Dom}=P^{Dom^*},W_B,P_B^I}$$
$$= \underbrace{\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(1-\alpha)(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}}_{\text{Short-run effects}}$$
$$- \underbrace{\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(\theta_B^{L^*})^{\frac{1}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}\frac{\partial W_B}{\partial P^{Dom}}}_{\text{Long-run adjustments}} \tag{16}$$

where K_B^* denotes the capital stock employed by exporters in Group B at the pre-tariff equilibrium. The terms $\theta_B^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_B}$ and $\theta_B^{K^*} = \frac{\alpha P^{Dom^*}}{P_B^I}$ represent the marginal revenue-to-cost ratios for labor and capital, respectively. This equation consists of two components: $\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(1-\alpha)(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}$ captures the short-run increase in production, while $\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(\theta_B^{L^*})^{\frac{1}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}\frac{\partial W_B}{\partial P^{Dom}}$ captures the long-run adjustment due to the subsequent increase in wages. The positive relationship between domestic prices and wages ($\frac{\partial W_B}{\partial P^{Dom}} > 0$) implies that initial production gains are partially offset in the long run. Likewise, the rate of change in output for Group C's exporters is given by

$$
\left.\frac{dF_C^*}{dP^{Dom}}\right|_{P^{Dom}=P^{Dom*},W_C,P_C^I}
$$

$$
= \underbrace{\frac{1}{\alpha \cdot P^{Dom*}}\left\{K_C^*(1-\alpha)(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\}}_{\text{Short-run effects}} \quad (17)
$$

$$
\underbrace{- \frac{1}{\alpha \cdot P^{Dom*}}\left\{K_C^*(\theta_C^{L^*})^{\frac{1}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\}\frac{\partial W_C}{\partial P^{Dom}}}_{\text{Long-run adjustments}}
$$

where K_C^* denotes the capital stock employed by exporters in Group C. The terms $\theta_C^{L^*} = \frac{(1-\alpha)P^{Dom*}}{W_C}$ and $\theta_C^{K^*} = \frac{\alpha P^{Dom*}}{P_C^I}$ represent the marginal revenue-to-cost ratios for labor and capital, respectively. As with Group B, $\frac{\partial W_C}{\partial P^{Dom}}$ is expected to be positive. A detailed derivation of the rate of change for both groups is provided in *Appendix C.2.*

As shown in equations (16) and (17), the magnitude of long-run adjustments depends on the elasticity of wages with respect to the domestic price. For households in Groups B and C, the domestic price corresponds to the price in a foreign market rather than to local output prices. As a result, the wage elasticity with respect to P^{Dom}—that is, $\frac{\partial W_B}{\partial P^{Dom}}$ and $\frac{\partial W_C}{\partial P^{Dom}}$—is expected to be small. This implies that the long-run adjustments are insufficient to fully offset the exporters' initial gains from the tariffs. Consequently, foreign exporters—excluding China—are likely to experience export increases even in the long run as a result of the tariff policy.[6] Furthermore, if wages remain constant, these exporters can sustain their initial export gains without facing a subsequent decline. This dynamic may incentivize governments to limit wage growth in order to support export performance.

These equations also indicate that when the wage elasticity with respect to the domestic price is small—i.e., $\frac{\partial W_B}{\partial P^{Dom}}$ and $\frac{\partial W_C}{\partial P^{Dom}}$—the magnitude of long-run adjustments becomes negligible. As a result, short-run effects largely determine long-run outcomes. Since higher capital endowments amplify short-run effects through greater investment efficiency, exporters in Group B are expected to realize larger net benefits than those in Group C, even in the long run.

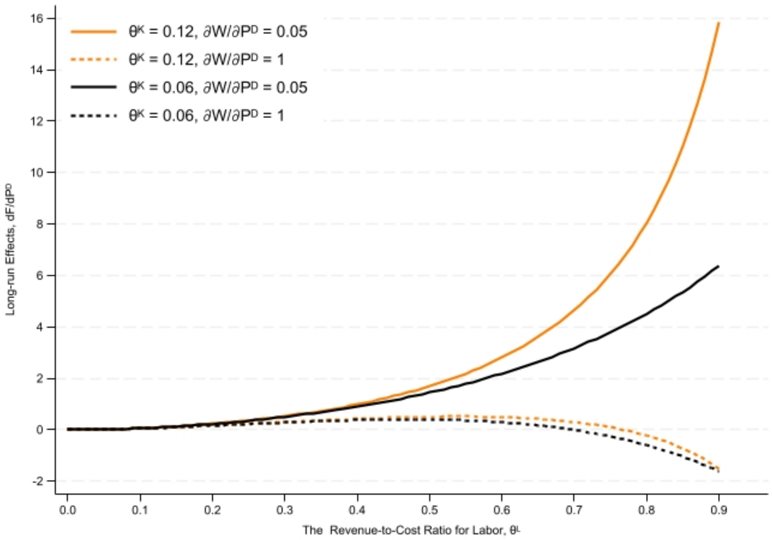
This pattern is illustrated in Figure 1. The model assumes that Group B exporters benefit from lower wages or investment goods prices, which raise the returns to labor or capital, thereby boosting production. When wage elasticity is low—$\frac{\partial W}{\partial P^{Dom}} = 0.05$—the long-run effects of tariffs increase with the labor revenue-to-cost ratio under both high and low capital return scenarios (represented by solid orange and dark lines). This suggests that Group B, which faces lower wages, achieves greater long-run gains than Group C. By contrast, when the wage elasticity is high—$\frac{\partial W}{\partial P^{Dom}} = 1$[7]-Group C exporters can realize greater benefits.

If Group C exporters face a low return to capital-$\theta^{K^*} = 0.06$-due to high investment goods prices, their long-run gains remain limited across both wage elasticities, compared to Group B exporters whose return is

[6]Equations (16) and (17) can be rewritten as: $\frac{1}{\alpha \cdot P^{Dom*}}\left\{K_B^*(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}}(1-\alpha-\theta_B^{L^*}\frac{\partial W_B}{\partial P^{Dom}}) + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}(1-\theta_B^{L^*}\frac{\partial W_B}{\partial P^{Dom}})\right\}$ and $\frac{1}{\alpha \cdot P^{Dom*}}\left\{K_C^*(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}}(1-\alpha-\theta_C^{L^*}\frac{\partial W_C}{\partial P^{Dom}}) + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_C^{K^*}}{2}(1-\theta_C^{L^*}\frac{\partial W_C}{\partial P^{Dom}})\right\}$. These expressions show that when $\frac{\partial W_B}{\partial P^{Dom}}$ and $\frac{\partial W_C}{\partial P^{Dom}}$ are small, the long-run effects of the tariffs remain positive.

[7]To empirically assess the nominal wage response to price changes, I regress the U.S. Employment Cost Index (Dec 2005=100) on the Consumer Price Index (1982–84=100), using data from the U.S. Bureau of Labor Statistics (2025) for the period 2016 to 2020. The estimated slope of 0.77 suggests that nominal wages increase by approximately 0.77 index points for each one-point increase in the price index. In the figures, $\frac{\partial W}{\partial P^{Dom}} = 1$ serves as a theoretical upper bound.

Fig. 1: Long-Run Effects of Tariffs on Small and Large Exporters



Notes: The horizontal axis represents the labor revenue-to-cost ratio, ranging from 0 to 0.9, while the vertical axis depicts the long-run effects of tariffs. The orange lines correspond to large exporters with low investment goods prices and a high return to capital ($\theta^{K^*} = 0.12$), while the dark lines represent small exporters operating with a lower return to capital ($\theta^{K^*} = 0.06$). Results are shown for two wage elasticity levels: high ($\frac{\partial W}{\partial P^{Dom}} = 1$), represented by dotted lines, and low ($\frac{\partial W}{\partial P^{Dom}} = 0.05$), represented by solid lines. Other parameters are set as follows: $P^{Dom^*} = 1$, $r = 0.05$, $\delta = 0.1$, and $\alpha = 0.34$.

high-$\theta^{K^*} = 0.12$. These results imply that U.S. primary trade partners are likely to benefit more from Section 301 tariffs than smaller exporters from developed countries, who face high wages despite affordable investment goods, and exporters from developing countries, where capital goods are expensive but the wage gap with primary partners is narrowed by low educational attainment.

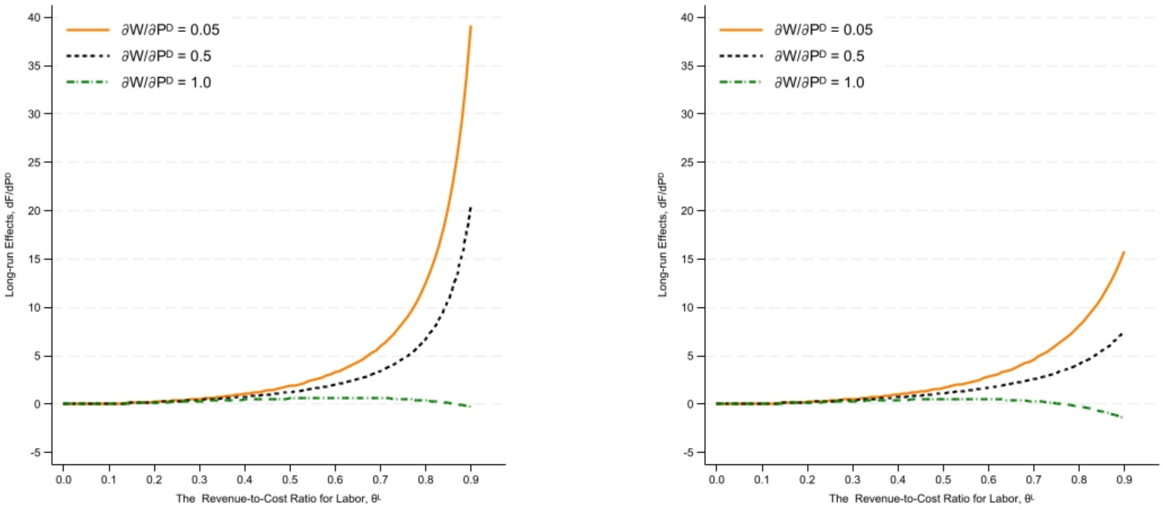
Furthermore, the equations indicate that domestic suppliers experience smaller net gains due to their relatively high wage elasticity with respect to the domestic price. This arises because households supplying labor to domestic suppliers are exposed to higher output prices and, therefore, have stronger incentives to demand wage increases. These wage demands amplify long-run adjustments, significantly reducing their short-run gains.

The left panel of Figure 2 illustrates this pattern: when wage elasticity is low—$\frac{\partial W}{\partial P^{Dom}} = 0.05$—domestic suppliers achieve higher long-run gains (represented by the solid orange line). In contrast, a high wage elasticity—$\frac{\partial W}{\partial P^{Dom}} = 1$—substantially reduces these gains (represented by the green dashed line). Since the gains for domestic suppliers under high wage elasticity are lower than those for large exporters with low wage elasticity (also represented by the solid orange line in the right panel of Figure 2), the model suggests that U.S. primary trade partners may benefit more than domestic producers. Consequently, the model demonstrates that divergent capital endowments and input prices contribute to an unequal distribution of gains from Section 301 tariffs. Specifically, even in the long run, these gains tend to be concentrated among the United States' primary trading partners, rather than smaller exporters or domestic suppliers.

5 Conclusion

The first Trump administration imposed Section 301 tariffs on Chinese imports, which raised economic uncertainty by disrupting global supply chains. Nevertheless, the tariffs appear to have reduced China's trade surplus with the

Fig. 2: Long-Run Effects of Tariffs on Domestic Suppliers and Large Exporters



(a) Domestic Suppliers ($\theta^{K^*} = 0.15$) (b) Large Exporters ($\theta^{K^*} = 0.12$)

Notes: In both panels, the horizontal axis represents the labor revenue-to-cost ratio, ranging from 0 to 0.9, while the vertical axis depicts the long-run effects of tariffs. The left panel illustrates outcomes for domestic suppliers, who face lower investment goods prices and a higher return to capital ($\theta^{K^*} = 0.15$), compared to large foreign exporters shown in the right panel, who operate with a lower return to capital ($\theta^{K^*} = 0.12$). Each panel shows results under three different wage elasticities: high ($\frac{\partial W}{\partial P^{Dom}} = 1$), represented by the solid orange line; moderate ($\frac{\partial W}{\partial P^{Dom}} = 0.5$), represented by the dotted dark line; and low ($\frac{\partial W}{\partial P^{Dom}} = 0.05$), represented by the green dashed line. Other parameters are set as follows: $P^{Dom^*} = 1$, $r = 0.05$, $\delta = 0.1$, and $\alpha = 0.34$.

United States: U.S. imports of tariffed goods from China declined by over 10% between 2016 and 2020. However, the extent to which the tariffs revitalized U.S. domestic production remains uncertain. While U.S. production of the targeted goods rose by only 2% between 2016 and 2020, the top ten U.S. trading partners—excluding China—expanded their exports to the United States by 28% over the same period. These trends raise a central question: Who ultimately benefits from the tariffs?

This paper addresses the question through a combination of empirical analysis and theoretical modeling. First, it presented empirical evidence based on fixed-effects regressions using data from the U.S. Census Bureau and USTR. The results showed that countries with larger U.S. import shares experienced greater increases in their exports of tariffed goods to the U.S. market. The consistency of coefficient estimates—both for tariffs and their interaction with import shares—across regressions on quarterly and yearly data further reinforced this pattern. Second, it developed a model that incorporated investment inefficiency into the capital accumulation process and analyzed firm-level production within a Ramsey-Cass-Koopmans framework. The model showed that tariffs led to substantial increases in production when firms benefited from high investment efficiency—enabled by large capital endowments—and low input prices, in both the short and long run.

These findings yield several key insights. First, the gains from Section 301 tariffs were likely concentrated among large foreign exporters rather than smaller ones, due to their greater capital endowments and more favorable input prices. Second, this uneven distribution can persist in the long run because large exporters tend to exhibit low wage elasticity with respect to the U.S. output price. Third, the long-run gains for U.S. domestic suppliers may be limited, as rising output prices trigger wage growth.

More broadly, the analysis carries important policy implications. For example, imposing tariffs on a single country may be ineffective in revitalizing domestic industries, as the gains can easily shift to third countries with already high production levels. Moreover, domestic wages may rise significantly, further reducing competitiveness of the domestic industries. This may partially explain the rationale behind the uniform and reciprocal tariffs imposed on multiple countries, as announced on Liberation Day (Harithas, Meng, & Mouradian, 2025). Additionally, foreign exporters may sustain their competitive advantage over time by restraining wage growth. This may help explain the limited wage growth in Germany's manufacturing export sector since the introduction of the euro (Carlo & Hoepner, 2022). Lastly, because the model explicitly incorporates capital accumulation and derives steady-state production levels, it may complement traditional models such as the Heckscher–Ohlin framework, which relies on initial factor endowments (Morrow, 2010). Taken together, this paper not only sheds light on past experiences and reinforces existing theory, but also offers meaningful insights into the direction of future international trade policy.

Despite the model's strengths, several important limitations and open questions remain. One unresolved issue concerns the assumption of constant input prices among exporters subject to the tariffs. If their governments suppress wages or subsidize investment goods, these exporters may maintain production levels, thereby limiting the extent of domestic price increases. This suggests that government responses in targeted countries can significantly influence the distribution of gains—an effect not captured in the current model. Another limitation concerns the assumption of constant investment goods prices. In reality, rising domestic output prices may also increase the cost of investment goods, further eroding short-run gains from tariffs—particularly in countries with underdeveloped financial markets or heightened political uncertainty. This suggests that the model may underestimate the extent of distributional asymmetries between large and small exporters.

The model also oversimplifies the determinants of investment efficiency, assuming that it depends solely on capital endowments. In practice, factors such as managerial quality and firm-level operational efficiency also contribute to investment performance and shape the distribution of gains. Finally, the model abstracts from the behavior of households supplying inputs to foreign exporters. These households maximize utility subject to asset constraints, which may lead to decisions that diverge from those of exporters. As a result, the model's steady-state production outcomes and market equilibrium may not fully represent a general equilibrium framework and are better interpreted as a firm-level equilibrium, as discussed in the paper.

Consequently, despite the paper's contributions and policy implications, there remains substantial scope for future refinement and extension. This underscores the inherent difficulty of fully capturing the complexity of tariff-related dynamics, and the reality that most academic models necessarily involve simplifications. Nonetheless, amid rising international trade tensions, the value of rigorous academic inquiry should not be overlooked. It is increasingly important for policymakers and leaders to engage with such analyses before making major trade policy decisions. Failure to do so risks unintended consequences—not only for individual countries, but for the global economy more broadly.

References

Amiti, M., Redding, S. J., & Weinstein, D. E. (2019). The impact of the 2018 tariffs on prices and welfare. *Journal of Economic Perspectives, 33*(4), 187–210.

Barro, R. J., & Sala-i-Martin, Xavier. (2003). *Economic Growth* (2nd ed., pp. 85-118). MIT Press. https://mitpress.mit.edu/9780262025539/economic-growth/

Blanchard, O., & Fischer, S. (1989). *Lectures on Macroeconomics* (pp. 41–43). Cambridge: MIT Press. https://mitpress.mit.edu/9780262022835/lectures-on-macroeconomics/

Bown, C. P., Conconi, P., Erbahar, A., & Trimarchi, L. (2021). Trade protection along supply chains. *Discussion Paper No. 1739.* Centre for Economic Performance. https://cep.lse.ac.uk/pubs/download/dp1739.pdf

Carlo, D., & Hopner, M. (July 25, 2022). Germany is likely to shift toward wage restraint as inflation concerns mount. *LSE EUROPP Blog.* Accessed June 20, 2025. https://blogs.lse.ac.uk/europpblog/2022/07/25/germany-is-likely-to-shift-toward-wage-restraint-as-inflation-concerns-mount/

Chatterjee, S., & Eyigungor , B. (2023). The firm size-leverage relationship and its implications for entry and business concentration. *Review of Economic Dynamics, 48*, 132-157.

Chavas, Jean-Paul. (2023). Optimal control under nonconvexity: A generalized Hamiltonian approach. *Optimal Control Applications and Methods, 44*(5), 2679-2692.

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

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

Freund, C., Mattoo, A., Mulabdic, A., & Ruta, M. (2023). Is us trade policy reshaping global supply chains? *Policy Research Working Paper No. 10593.* The World Bank. https://documents1.worldbank.org/curated/en/099812010312311610/pdf/IDU0938e50fe0608704ef70b7d005cda58b5af0d.pdf

Handley, K., Kamal, F., & Monarch, R. (2025). Rising import tariffs, falling exports: When modern supply chains meet old-style protectionism. *American Economic Journal: Applied Economics, 17*(1), 208–246.

Harithas, B., Meng, K., Brown, E., & Mouradian, C. (April 3, 2025). "Liberation Day" Tariffs Explained. *Center for Strategic and International Studies.* Accessed June 23, 2025. https://www.csis.org/analysis/liberation-day-tariffs-explained

Hayashi, F. (1982). Tobinís Marginal q and Average q: A Neoclassical Interpretation. *Econometrica, 50*(1), 213-224.

Henriksen, E., Kydland, F. E., & Sustek, R. (2009). Globally Correlated Nominal Fluctuations. *NBER Working Papers.* Retrieved June 26, 2025, from https://www.nber.org/system/files/working_papers/w15123/w15123.pdf

Kamien, M. I., & Schwartz, N. L. (1991). *Dynamic Optimization: The Calculus of Variations and Optimal Control in Economics and Management* (2nd ed., pp. 202-208). Elsevier Science. https://www.amazon.com/Dynamic-Optimization-Variations-Economics-Management/dp/0444016090

Lee, T., & Varas, J. (May 10, 2022). The Total Cost of U.S. Tariffs. *The American Action Forum Research.* Accessed July 10, 2025. https://www.americanactionforum.org/research/the-total-cost-of-tariffs/?utm_source=chatgpt.com#_ftn2

Morrow, P. M. (2010). Ricardian–Heckscher–Ohlin comparative advantage: Theory and evidence. *Journal of International Economics, 82*(2), 137-151.

Rapposelli, A., Birindelli, G., & Modina, M. (2023). The relationship between firm size and efficiency: why does default on bank loans matter? *Quality & Quantity, 58*(4), 3379–3401.

Romer, D. (2019). *Advanced Macroeconomics* (5th ed., pp. 50-72). McGraw-Hill. https://www.mheducation.com/highered/product/Advanced-Macroeconomics-Romer.html

U.S. Bureau of Economic Analysis. (n.d.). The domestic supply of commodities by industries – Summary. Retrieved May 25, 2025, from Input-Output Accounts Data, Supply-Use section: https://apps.bea.gov/iTable/?reqid=1602&step=2&Categories=Core&isURI=1&_gl=1*vqgqr8*_ga*NjkwNTI5MzU3LjE3NDEyMjQ2NDY.*_ga_J4698JNNFT*czE3NTA2OTEzNDQkbzM4JGcwJHQxNzUwNjkxMzQ0JGo2MCRsMCRoMA..

U.S. Bureau of Labor Statistics. (2025). Consumer Price Index for All Urban Consumers: All Items in U.S. City Average [CPIAUCSL]. Retrieved July 4, 2025, from FRED, Federal Reserve Bank of St. Louis: https://fred.stlouisfed.org/series/CPIAUCSL#

U.S. Bureau of Labor Statistics. (2025). Employment Cost Index: Wages and Salaries: Private Industry Workers [ECIWAG]. Retrieved July 4, 2025, from FRED, Federal Reserve Bank of St. Louis: https://fred.stlouisfed.org/series/ECIWAG#

U.S. Census Bureau. (May 12, 2025). Top Trading Partners - May 2016. Retrieved May 23, 2025, from https://www.census.gov/foreign-trade/statistics/highlights/top/top1605yr.html#imports

U.S. Census Bureau. (n.d.). U.S. Merchandise Trade Statistics. Retrieved May 23, 2025, from USITC DataWeb (Imports – General): https://dataweb.usitc.gov/

U.S. International Trade Commission. (March 2023). Economic Impact of Section 232 and 301 Tariffs on U.S. Industries. *USITC Publication No. 5405.* Washington, DC: USITC. https://www.usitc.gov/publications/332/pub5405.pdf

U.S. Trade Representative. (April 6, 2018). Proposed Tariff Action in $34 Billion Trade Action (List 1). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/enforcement/301Investigations/FRN301.pdf

U.S. Trade Representative. (June 20, 2018). Proposed Tariff Action in $16 Billion Trade Action (List 2). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/2018-13248.pdf

U.S. Trade Representative. (July 17, 2018). Proposed Tariff Action in $200 Billion Trade Action (List 3). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/enforcement/301Investigations/2018-0026%20China%20FRN%207-10-2018_0.pdf

U.S. Trade Representative. (May 9, 2019). Modification to Increase Duty from 10 Percent to 25 Percent in $200 Billion Trade Action (List 3). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/enforcement/301Investigations/84_FR_20459.pdf

U.S. Trade Representative. (August 20, 2019). Notice of Modification (List 4) in $300 Billion Trade Action (List 4). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/enforcement/301Investigations/Notice_of_Modification_%28List_4A_and_List_4B%29.pdf

U.S. Trade Representative. (January 22, 2020). Notice of Modification in $300 Billion Trade Action (List 4). Retrieved May 22, 2025, from https://ustr.gov/sites/default/files/enforcement/301Investigations/Notice_of_Modification-January_2020.pdf

Wang, P., & Wen, Y. (2012). Hayashi meets Kiyotaki and Moore: A theory of capital adjustment costs. *Review of Economic Dynamics, 15*(2), 207–225.

World Bank. (June 5, 2025). GDP per capita (current US$). Retrieved May 30, 2025, from World Bank national accounts data and OECD National Accounts data files: https://data.worldbank.org/indicator/NY.GDP.PCAP.CD

Appendices

A Steady-State Solutions without Tariffs

A.1 Exporters in Group A

The representative exporter (firm) in Group A faces the domestic price P^{Dom}, wage W_A, tariff rate τ, investment goods price P_A^I, and interest rate r. Its production function at time t follows a Cobb–Douglas form:

$$F_A(L_t, K_t) = L_t^{1-\alpha} K_t^{\alpha} \tag{1}$$

where α denotes the output elasticity with respect to capital, determined by the production technology. Assuming that the domestic price and input costs remain constant during the pre-tariff period, the profit function is:

$$\Pi(L_t, K_t, I_t, P^{Dom}, W_A, P_A^I, \tau) = (1-\tau)P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_A L_t - P_A^I I_t \tag{2}$$

The exporter maximizes the present discounted value of profits over an infinite horizon:

$$\max_{L_t, I_t} \int_0^{\infty} e^{-rt} \Pi(L_t, K_t, I_t, P^{Dom}, W_A, P_A^I, \tau) \tag{3}$$

subject to the capital accumulation equation:

$$\dot{K}_t = I_t - \Psi(K_t) - \delta K_t \tag{4}$$

where δ is the depreciation rate, and $\Psi(K_t)$ captures investment inefficiency. In this framework, investment inefficiency is simplified as $\Psi(K_t) = \frac{1}{K_t}$, implying that the effectiveness of investment diminishes as capital stocks shrink.

The corresponding current-value Hamiltonian is:

$$H_t = (1-\tau)P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_A L_t - P_A^I I_t + q_t(I_t - \Psi(K_t) - \delta K_t) \tag{5}$$

where q_t denotes the shadow value of capital at time t. The necessary first-order conditions are:

$$\frac{\partial H_t}{\partial L_t} = 0 \tag{6}$$

$$\frac{\partial H_t}{\partial I_t} = 0 \tag{7}$$

$$\frac{\partial H_t}{\partial K_t} = rq_t - \dot{q}_t \tag{8}$$

The first condition, corresponding to equation (6), yields the optimal labor–capital ratio at time t:

$$L_t = (\theta_A^L)^{\frac{1}{\alpha}} K_t \tag{9}$$

where $\theta_A^L = \frac{(1-\tau)(1-\alpha)P^{Dom}}{W_A}$. The second condition, from equation (7), determines the optimal investment level. If $P_A^I > q_t$, the marginal cost of investment exceeds its value, so exporters minimize investment ($I_t = I_{min}$), reducing capital stocks ($\dot{K}_t < 0$). Conversely, if $P_A^I < q_t$, exporters maximize investment ($I_t = I_{max}$), causing capital to accumulate ($\dot{K}_t > 0$).[1] When $P_A^I = q_t$, the marginal cost of investment equals its shadow value, and exporters invest exactly enough to maintain the capital stock: $I_t = \Psi(K_t) + \delta K_t$. In this case, capital stocks remain constant $\dot{K}_t = 0$, and the shadow value of capital remains fixed at $q_t = P_A^I$. This condition characterizes the steady-state equilibrium in which both production and capital stock are constant over time.

Let K_A^* denote the steady-state capital stock of the representative exporter at which investment just offsets depreciation and inefficiency:

$$I_t = \Psi(K_A^*) + \delta K_A^* \tag{10}$$

Given the optimal labor–capital ratio from the first-order condition, the steady-state labor level is:

[1] Instead of taking $I_t \to \infty$ or $I_t \to -\infty$, I impose upper and lower bounds I_{max} and I_{min} to reflect physical investment constraints.

$$L_A^* = (\theta_A^L)^{\frac{1}{\alpha}} K_A^* \tag{11}$$

where $\theta_A^L = \frac{(1-\tau)(1-\alpha)P^{Dom}}{W_A}$. Since K_A^* remains constant at steady state, labor employment L_A^* also remains fixed. Applying the third condition (from equation (8)) in steady state ($\dot{q}_t = 0$), and substituting $q_t = P_A^I$, yields:

$$rP_A^I = (1-\tau)\alpha P^{Dom}(\frac{L_A^*}{K_A^*})^{1-\alpha} + \frac{P_A^I}{(K_A^*)^2} - \delta P_A^I \tag{12}$$

Solving this equation yields the steady-state capital stock:

$$K_A^* = \frac{1}{\sqrt{r + \delta - \theta_A^K (\theta_A^L)^{\frac{1-\alpha}{\alpha}}}} \tag{13}$$

where $\theta_A^L = \frac{(1-\tau)(1-\alpha)P^{Dom}}{W_A}$ and $\theta_A^K = \frac{(1-\tau)\alpha P^{Dom}}{P_A^I}$. Finally, substituting into the production function yields steady-state output:

$$F_A^* = (\theta_A^L)^{\frac{1-\alpha}{\alpha}} \frac{1}{\sqrt{r + \delta - \theta_A^K (\theta_A^L)^{\frac{1-\alpha}{\alpha}}}} \tag{14}$$

The next subsection derives the steady-state production levels for exporters in Groups B and C.

A.2 Exporters in Group B and C

The steady-state production levels for exporters in Groups B and C can be derived following the same procedure used for Group A. These exporters operate under the same domestic output price P^{Dom}, and interest rate r, but face different input costs and are not subject to tariffs. Therefore, the profit functions for Groups B and C exclude the tariff term $1-\tau$.

For Group B, the representative exporter faces wage W_B, and investment goods price P_B^I. The profit function is:

$$\Pi(L_t, K_t, I_t, P^{Dom}, W_B, P_B^I) = P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_B L_t - P_B^I I_t \tag{15}$$

For Group C, the exporter faces wage W_C and investment goods price P_C^I, resulting in the profit function:

$$\Pi(L_t, K_t, I_t, P^{Dom}, W_C, P_C^I) = P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_C L_t - P_C^I I_t \tag{16}$$

Each exporter maximizes the present discounted value of profits over an infinite horizon:

$$\max_{L_t, I_t} \int_0^{\infty} e^{-rt} \Pi(L_t, K_t, I_t, P^{Dom}, W_B, P_B^I) \tag{17}$$

$$\max_{L_t, I_t} \int_0^{\infty} e^{-rt} \Pi(L_t, K_t, I_t, P^{Dom}, W_C, P_C^I) \tag{18}$$

subject to the common capital accumulation constraint:

$$\dot{K}_t = I_t - \Psi(K_t) - \delta K_t \tag{19}$$

where δ is the depreciation rate, and $\Psi(K_t)$ represents investment inefficiency, simplified as $\Psi(K_t) = \frac{1}{K_t}$.

The corresponding current-value Hamiltonians are:

$$H_{B,t} = P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_B L_t - P_B^I I_t + q_{B,t}(I_t - \Psi(K_t) - \delta K_t) \tag{20}$$

$$H_{C,t} = P^{Dom} L_t^{1-\alpha} K_t^{\alpha} - W_C L_t - P_C^I I_t + q_{C,t}(I_t - \Psi(K_t) - \delta K_t) \tag{21}$$

where $H_{B,t}$ and $H_{C,t}$ denote the current-value Hamiltonians for Groups B and C, respectively, and $q_{B,t}$ and $q_{C,t}$ represent the corresponding shadow values of capital.[2]

[2]The Hamiltonians and shadow values are indexed by group to distinguish them from those of Group A, denoted by H_t and q_t.

Following the first-order conditions, the optimal labor–capital ratios at time t are:

$$L_t = (\theta_B^L)^{\frac{1}{\alpha}} K_t \tag{22}$$

$$L_t = (\theta_C^L)^{\frac{1}{\alpha}} K_t \tag{23}$$

where $\theta_B^L = \frac{(1-\alpha)P^{Dom}}{W_B}$ and $\theta_C^L = \frac{(1-\alpha)P^{Dom}}{W_C}$. In steady state, the first-order conditions with respect to investment imply:

$$q_{B,t} = P_B^I \tag{24}$$

$$q_{C,t} = P_C^I \tag{25}$$

These conditions ensure that, as in Group A, both production and capital stock remain constant over time. Consequently, labor is also fixed in the steady state through its proportional relationship to capital.

Let K_B^* and K_C^* denote the steady-state capital stocks of representative exporters in Groups B and C, respectively. Given the optimal labor–capital ratios, the corresponding steady-state labor levels are:

$$L_B^* = (\theta_B^L)^{\frac{1}{\alpha}} K_B^* \tag{26}$$

$$L_C^* = (\theta_C^L)^{\frac{1}{\alpha}} K_C^* \tag{27}$$

where $\theta_B^L = \frac{(1-\alpha)P^{Dom}}{W_B}$ and $\theta_C^L = \frac{(1-\alpha)P^{Dom}}{W_C}$. Applying the first-order condition for the state variable, and substituting $q_{B,t} = P_B^I$ and $q_{C,t} = P_C^I$, yields:

$$K_B^* = \frac{1}{\sqrt{r + \delta - \theta_B^K (\theta_B^L)^{\frac{1-\alpha}{\alpha}}}} \tag{28}$$

$$K_C^* = \frac{1}{\sqrt{r + \delta - \theta_C^K (\theta_C^L)^{\frac{1-\alpha}{\alpha}}}} \tag{29}$$

where $\theta_B^K = \frac{\alpha P^{Dom}}{P_B^I}$ and $\theta_C^K = \frac{\alpha P^{Dom}}{P_C^I}$. Substituting into the production function yields the steady-state outputs:

$$F_B^* = (\theta_B^L)^{\frac{1-\alpha}{\alpha}} \frac{1}{\sqrt{r + \delta - \theta_B^K (\theta_B^L)^{\frac{1-\alpha}{\alpha}}}} \tag{30}$$

$$F_C^* = (\theta_C^L)^{\frac{1-\alpha}{\alpha}} \frac{1}{\sqrt{r + \delta - \theta_C^K (\theta_C^L)^{\frac{1-\alpha}{\alpha}}}} \tag{31}$$

The next section analyzes how the imposition of tariffs shifts the domestic market equilibrium and affects the production levels of Groups B and C.

B Short-Run Effects of Tariffs on Exporter Output

B.1 New Equilibrium in the Domestic Market

Let P^{Dom^*} denote the domestic price at the pre-tariff market equilibrium. At this price level, the total supply from Groups A, B, and C matches aggregate demand in the domestic market, leading to the following equilibrium condition:

$$\begin{aligned} P^{Dom^*} &= \sigma - \eta Q^* \\ &= \sigma - \eta \Bigg\{ N_A \cdot (\theta_A^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_A^{K^*} (\theta_A^{L^*})^{\frac{1-\alpha}{\alpha}}}} + N_B \cdot (\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_B^{K^*} (\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}}}} \\ &\qquad + N_C \cdot (\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r + \delta - \theta_C^{K^*} (\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}}}} \Bigg\} \end{aligned} \tag{32}$$

where $\theta_A^{L^*} = \frac{(1-\tau)(1-\alpha)P^{Dom^*}}{W_A}$, $\theta_A^{K^*} = \frac{(1-\tau)\alpha P^{Dom^*}}{P_A^I}$, $\theta_B^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_B}$, $\theta_B^{K^*} = \frac{\alpha P^{Dom^*}}{P_B^I}$, $\theta_C^{L^*} = \frac{(1-\alpha)P^{Dom^*}}{W_C}$, and $\theta_C^{K^*} = \frac{\alpha P^{Dom^*}}{P_C^I}$. The imposition of tariffs ($\tau \to \tau'$) reduces the returns to labor (θ_A^L) and capital (θ_A^K) for Group A, thereby lowering their production. As a result, the total supply at the initial price P^{Dom^*} becomes insufficient to meet demand, generating excess demand:

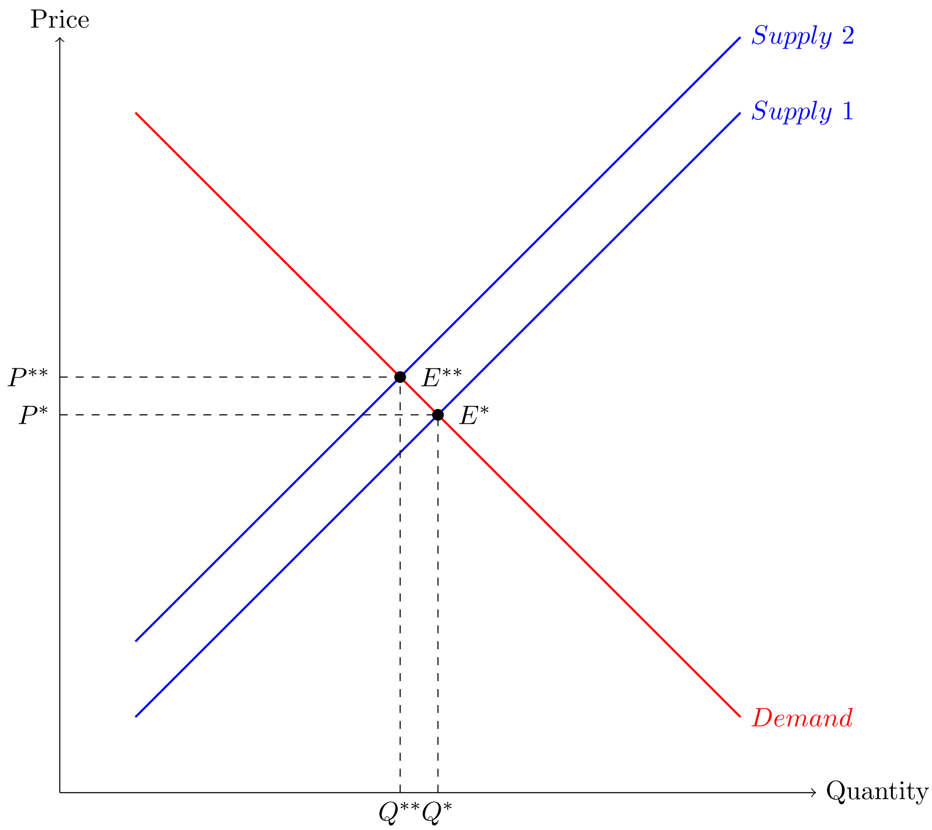
$$P^{Dom^*} < \sigma - \eta \Bigg\{ N_A \cdot (\theta_A^{L'})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_A^{K'}(\theta_A^{L'})^{\frac{1-\alpha}{\alpha}}}} + N_B \cdot (\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_B^{K^*}(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}}}} + N_C \cdot (\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{\sqrt{r+\delta-\theta_C^{K^*}(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}}}} \Bigg\} \tag{33}$$

where $\theta_A^{L'} = \frac{(1-\tau')(1-\alpha)P^{Dom^*}}{W_A}$ and $\theta_A^{K'} = \frac{(1-\tau')\alpha P^{Dom^*}}{P_A^I}$. To restore market equilibrium, the domestic price must increase ($P^{Dom^*} \to P^{Dom^{**}}$). This higher price induces greater production from Groups B and C, while partially offsetting the initial production decline in Group A. Ultimately, Groups B and C expand output relative to the pre-tariff period, whereas Group A's production remains lower than before.

Figure (1) illustrates this adjustment. The introduction of tariffs reduces Group A's output, shifting the total supply curve leftward (*Supply* 1 $\to$ *Supply* 2), and generating excess demand at the pre-tariff price level P^*. This imbalance causes the domestic price to rise ($P^* \to P^{**}$), establishing a new equilibrium E^{**} characterized by a higher price and lower total quantity Q^{**} compared to the pre-tariff equilibrium E^*.

Since wages and investment goods prices remain unchanged for Groups B and C, these exporters increase output. Conversely, since total output is lower at the new equilibrium ($Q^{**} < Q^*$) and Groups B and C increase output in response to higher prices, it is evident that Group A's production must have declined. The price increase is insufficient to fully offset the production loss in this group.

Figure 1: Pre-Tariff and New Equilibria in the Domestic Market



B.2 Production Decisions in Group B and C

The steady-state output levels for Groups B and C can be written as:

$$F_B^* = (\theta_B^L)^{\frac{1-\alpha}{\alpha}}(r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \tag{34}$$

$$F_C^* = (\theta_C^L)^{\frac{1-\alpha}{\alpha}}(r + \delta - \theta_C^K(\theta_C^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \tag{35}$$

To evaluate the short-run effects of tariffs on production, consider the partial derivative of steady-state output in Group B with respect to the domestic price P^{Dom}:

$$\begin{aligned}\frac{\partial F_B^*}{\partial P^{Dom}} &= \frac{1-\alpha}{\alpha}\frac{1-\alpha}{W_B}(\theta_B^L)^{\frac{1-2\alpha}{\alpha}} \cdot (r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \\ &+ (\theta_B^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{2}(\frac{\alpha}{P_B^I}(\theta_B^L)^{\frac{1-\alpha}{\alpha}} + \theta_B^K\frac{1-\alpha}{\alpha}\frac{1-\alpha}{W_B}(\theta_B^L)^{\frac{1-2\alpha}{\alpha}})(r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{3}{2}}\end{aligned} \tag{36}$$

where the returns to labor and capital are given by $\theta_B^L = \frac{(1-\alpha)P^{Dom}}{W_B}$ and $\theta_B^K = \frac{\alpha P^{Dom}}{P_B^I}$ with their derivatives: $\frac{\partial \theta_B^L}{\partial P^{Dom}} = \frac{(1-\alpha)}{W_B}$ and $\frac{\partial \theta_B^K}{\partial P^{Dom}} = \frac{\alpha}{P_B^I}$. Substituting the steady-state capital stock $K_B^* = (r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}}$, the derivative simplifies to:

$$\frac{\partial F_B^*}{\partial P^{Dom}} = \frac{1-\alpha}{\alpha}\frac{1-\alpha}{W_B}(\theta_B^L)^{\frac{1-2\alpha}{\alpha}}K_B^* + (\theta_B^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{2}(\frac{\alpha}{P_B^I}(\theta_B^L)^{\frac{1-\alpha}{\alpha}} + \frac{1-\alpha}{P_B^I}(\theta_B^L)^{\frac{1-\alpha}{\alpha}})(K_B^*)^3 \tag{37}$$

The expression can be further simplified to:

$$\left.\frac{\partial F_B^*}{\partial P^{Dom}}\right|_{P^{Dom}=P^{Dom*}, W_B, P_B^I} = \frac{1}{\alpha \cdot P^{Dom*}}\left\{K_B^*(1-\alpha)(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\} \tag{38}$$

when evaluated at the pre-tariff equilibrium price P^{Dom^*}, holding input prices W_B and P_B^I constant. This derivative characterizes the short-run response of output in Group B to changes in the domestic price. It shows that short-run effects of tariffs depend not only on capital endowments, but also on the returns to labor and capital, as captured by θ_B^L and θ_B^K.

Similarly, the short-run effect for Group C, evaluated at the same pre-tariff price P^{Dom^*}, and given input prices W_C and P_C^I, is:

$$\left.\frac{\partial F_C^*}{\partial P^{Dom}}\right|_{P^{Dom}=P^{Dom*}, W_C, P_C^I} = \frac{1}{\alpha \cdot P^{Dom*}}\left\{K_C^*(1-\alpha)(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\} \tag{39}$$

As in Group B, the output response in Group C depends on both capital endowments and the returns to labor and capital.

C Long-Run Tariff Effects Eroded by Wage Increases

C.1 Final Equilibrium of the Domestic Market

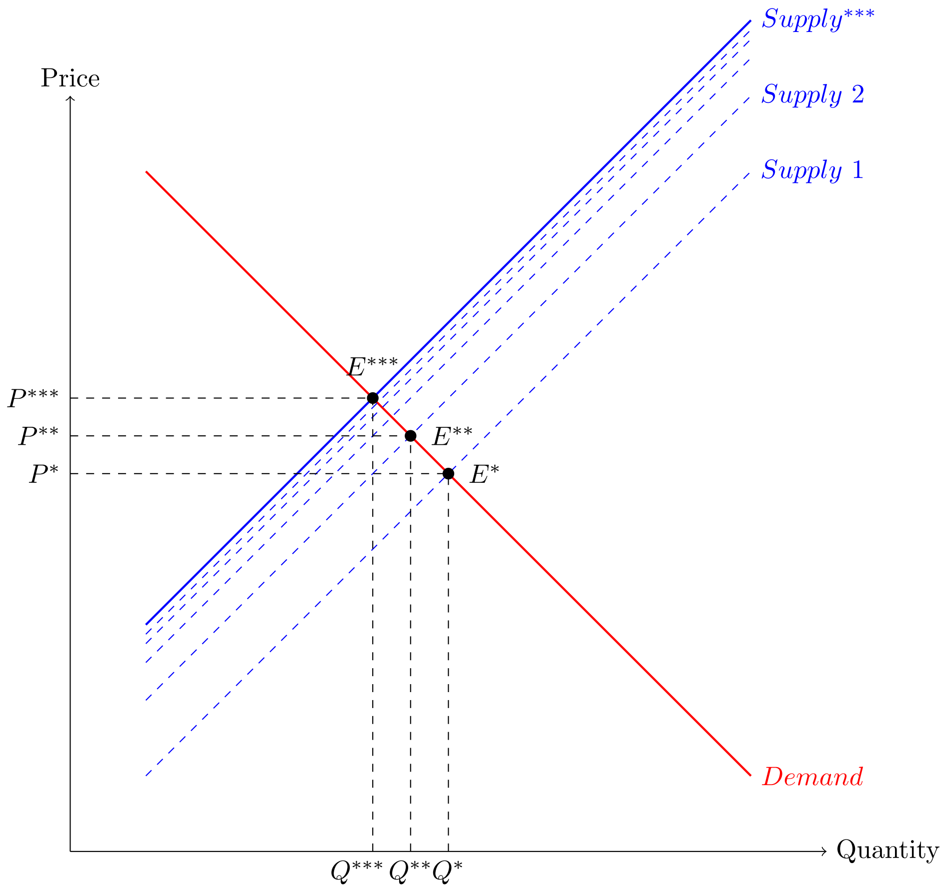
Let $P^{Dom^{**}}$ represent the domestic price at the initial post-tariff equilibrium. This new equilibrium captures the short-run effects of tariffs—namely, the price increase from P^{Dom^*} to $P^{Dom^{**}}$—while holding nominal wages constant. However, in the long run, a rise in the marginal revenue product of labor leads to higher wages. These wage increases reduce the returns to labor in Groups B and C, thereby lowering their production and creating excess demand at the price $P^{Dom^{**}}$. As a result, the domestic price continues to rise beyond the initial post-tariff level.

This process initiates a recursive cycle: each increase in the domestic price induces further wage demands, which reduce production and trigger additional price increases through excess demand. However, the magnitude of each successive adjustment—both in wages and prices—is expected to diminish over time. This outcome relies on two key assumptions: the wage elasticity with respect to the domestic price is less than one ($\frac{\partial W}{\partial P^{Dom}} < 1$), and the demand curve is not perfectly inelastic ($\eta < \infty$). Under these conditions, the size of the price and wage adjustments converges to zero, leading to a stable long-run equilibrium characterized by a higher domestic price and lower total output than in the initial post-tariff equilibrium.

Figure (2) illustrates this recursive adjustment process. The initial post-tariff equilibrium is determined by the total supply curve *Supply* 2, and the demand curve, yielding a domestic price of P^{**}. As the domestic price rises relative to the pre-tariff level P^*, households in Groups B and C respond by demanding higher wages. This causes the supply curve to shift leftward from *Supply* 2. This resulting shift—represented by the blue dashed line—creates excess demand, which further increases the domestic price, reinforces wage demands, and induces additional leftward movements of the supply curve. Through this iterative process, the supply curve gradually converges to $Supply^{***}$, and the market reaches a final equilibrium E^{***}, characterized by a higher domestic price P^{***} and lower total output Q^{***}.

At this final equilibrium, total output declines relative to the initial post-tariff equilibrium. However, because wages in Group A remain constant throughout the adjustment process, exporters in this group benefit from the continued increase in the domestic price. As a result, their production is expected to rise compared to the short-run post-tariff outcome at P^{**}, partially offsetting their initial production losses. Conversely, since the overall quantity in the market falls while Group A's output rises, the initial gains realized by exporters in Groups B and C are partially reduced.

Figure 2: Initial Post-Tariff and Final Equilibria in the Domestic Market



C.2 Production Decisions in Group B and C

The steady-state output levels for Groups B and C can be written as:

$$F_B^* = (\theta_B^L)^{\frac{1-\alpha}{\alpha}}(r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \tag{40}$$

$$F_C^* = (\theta_C^L)^{\frac{1-\alpha}{\alpha}}(r + \delta - \theta_C^K(\theta_C^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \tag{41}$$

To evaluate the long-run effects of tariffs on production, consider the derivative of steady-state output in Group B with respect to the domestic price P^{Dom}, accounting for the positive relationship between wages W_B and the domestic price:

$$\frac{dF_B^*}{dP^{Dom}} = \underbrace{\frac{\partial F_B^*}{\partial P^{Dom}}}_{\text{Short-run effects}} + \underbrace{\frac{\partial F_B^*}{\partial W_B}\frac{\partial W_B}{\partial P^{Dom}}}_{\text{Long-run adjustments}} \tag{42}$$

where $\frac{\partial F_B^*}{\partial P^{Dom}}$ captures the short-run effects, while $\frac{\partial F_B^*}{\partial W_B}\frac{\partial W_B}{\partial P^{Dom}}$ represents the long-run adjustments, whose magnitude depends on the wage elasticity with respect to the domestic price. The short-run effects, evaluated at the pre-tariff equilibrium price P^{Dom^*}, are given by:

$$\left.\frac{\partial F_B^*}{\partial P^{Dom}}\right|_{P^{Dom}=P^{Dom^*}, W_B, P_B^I} = \frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(1-\alpha)(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\} \tag{43}$$

On the other hand, the partial derivative of steady-state output in Group B with respect to the wage W_B is given by:

$$\begin{aligned} &\frac{\partial F_B^*}{\partial W_B} \\ &= -\frac{1-\alpha}{\alpha}\frac{(1-\alpha)P^{Dom}}{W_B^2}(\theta_B^L)^{\frac{1-2\alpha}{\alpha}} \cdot (r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}} \\ &-(\theta_B^L)^{\frac{1-\alpha}{\alpha}} \cdot \frac{1}{2}(\theta_B^K \cdot \frac{1-\alpha}{\alpha}\frac{(1-\alpha)P^{Dom}}{W_B^2}(\theta_B^L)^{\frac{1-2\alpha}{\alpha}})(r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{3}{2}} \end{aligned} \tag{44}$$

where the return to labor is defined as $\theta_B^L = \frac{(1-\alpha)P^{Dom}}{W_B}$, with its derivative given by $\frac{\partial \theta_B^L}{\partial W_B} = -\frac{(1-\alpha)P^{Dom}}{W_B^2}$. Substituting the steady-state capital stock $K_B^* = (r + \delta - \theta_B^K(\theta_B^L)^{\frac{1-\alpha}{\alpha}})^{-\frac{1}{2}}$, and multiplying αP^{Dom}, the derivative simplifies to:

$$\frac{\partial F_B^*}{\partial W_B} = \frac{1}{\alpha \cdot P^{Dom}}\left\{K_B^*(\theta_B^L)^{\frac{1}{\alpha}} + \frac{(K_B^*)^3(\theta_B^L)^{\frac{2-\alpha}{\alpha}}\theta_B^K}{2}\right\} \tag{45}$$

By combining this derivative with the short-run effects of the tariffs, the long-run effects—evaluated at the pre-tariff equilibrium price P^{Dom^*}, and input prices W_B and P_B^I—are given by:

$$\begin{aligned} &\left.\frac{dF_B^*}{dP^{Dom}}\right|_{P^{Dom}=P^{Dom^*}, W_B, P_B^I} \\ &= \underbrace{\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(1-\alpha)(\theta_B^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}}_{\text{Short-run effects}} \\ &-\underbrace{\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_B^*(\theta_B^{L^*})^{\frac{1}{\alpha}} + \frac{(K_B^*)^3(\theta_B^{L^*})^{\frac{2-\alpha}{\alpha}}\theta_B^{K^*}}{2}\right\}\frac{\partial W_B}{\partial P^{Dom}}}_{\text{Long-run adjustments}} \end{aligned} \tag{46}$$

Similarly, the long-run effects for Group C, evaluated at the same pre-tariff price P^{Dom^*}, and given input prices W_C and P_C^I, are given by:

$$\left.\frac{dF_C^*}{dP^{Dom}}\right|_{P^{Dom}=P^{Dom^*},W_C,P_C^I}$$

$$= \underbrace{\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_C^*(1-\alpha)(\theta_C^{L^*})^{\frac{1-\alpha}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-2\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\}}_{\text{Short-run effects}}$$
$$\underbrace{-\frac{1}{\alpha \cdot P^{Dom^*}}\left\{K_C^*(\theta_C^{L^*})^{\frac{1}{\alpha}} + \frac{(K_C^*)^3(\theta_C^{L^*})^{\frac{2-\alpha}{\alpha}}\theta_C^{K^*}}{2}\right\}\frac{\partial W_C}{\partial P^{Dom}}}_{\text{Long-run adjustments}} \tag{47}$$

As in Group B, the wage elasticity with respect to the domestic price, $\frac{\partial W_C}{\partial P^{Dom}}$, determines the magnitude of the long-run adjustment.