How U.S. Tariffs Impact China's Domestic Sourcing: Evidence from Firm-to-firm Transactions*

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Abstract

This paper investigates how tariff shocks influence the domestic performance of Chinese firms, leveraging quarterly data on both international and domestic transactions from 2017 to 2018. Our analysis uncovers several key findings: (i) a one percent increase in export tariffs leads to a 0.235 percent increase in sales to domestic buyers, suggesting that higher export costs drive suppliers to prioritize domestic markets, primarily affecting the extensive margin; (ii) a similar increase in countervailing import tariffs results in a 0.995 percent decrease in domestic purchases, underscoring a complementary relationship between China's imported intermediates and domestic products; (iii) larger firms exhibit smaller magnitudes of domestic sales and are more likely to reduce their domestic intermediate inputs in response to a negative external risk. These findings highlight that understanding the complementary relationship between imports and domestic inputs is crucial for developing strategies to mitigate the adverse effects of tariff policies on domestic production.

Keywords: trade war; tariff shock; firm behavior

JEL Classification: F02, F13, F51, F60, R11

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I Introduction

The onset of the trade conflict between China and the United States in 2018 and 2019 marked a significant shift in international economics. In March and May of 2018, the Trump Administration levied tariffs on a range of Chinese imports to the U.S., with rates spanning from 10% to 50%. In a reciprocal move, China imposed retaliatory tariffs of 15% or 25% on 128 U.S. goods, totaling $3 billion, and later expanded tariffs on $50 billion of U.S. exports over July and August. Given the pivotal roles of China and the United States in the global economy, comprehending the ramifications of this trade skirmish is of paramount importance. While existing literature delineates the substantial adverse effects of the trade war on both nations–manifesting in altered prices, trade volumes, and overall welfare (Amiti et al., 2019; Fajgelbaum et al., 2020; Ye et al., 2022; Chen et al., 2023)–it predominantly concentrates on the implications for international sourcing and commerce. The dynamics within domestic sourcing, a critical component for a country's ability to withstand external economic disturbances, remain underexplored. This paper presents a new perspective by investigating the impact of tariff changes on China's domestic intermediates market and the performance of Chinese firms.

Our analysis is conducted in two steps. Firstly, we develop a theoretical model to generate key predictions about how domestic sourcing will react to U.S. tariff hikes. This model scrutinizes the interplay between tariff policies and corporate performance in a straightforward general equilibrium context. It predicts that when domestic and international inputs are substitutes, rising tariffs will increase the use of domestic inputs. Conversely, if these inputs are complementary, rising tariffs will decrease the use of domestic inputs. This theoretical framework provides a foundation for understanding the mechanisms through which tariff alterations sway firm behavior and input-sourcing decisions.

Secondly, guided by the theory, we match quarterly firm-to-firm transaction data with product-level tariff data from 2017 to 2018 to construct novel measures of export and import tariffs faced by each firm. By analyzing the variations in export and import tariffs during the 2018-2019 trade war, we can empirically identify the impacts of these tariffs on firm performance. This rich dataset allows us to observe how firms adjust their sourcing strategies in response to changing tariff rates, providing empirical evidence to support or refute our theoretical predictions.

A key strength of our analysis lies in the utilization of highly confidential domestic firm-to-firm transaction data, which provides unparalleled insights into firm-level operations. This dataset allows us to track detailed information on the products purchased by each firm and the suppliers of these products. Such granularity enables us to precisely measure the exposure of

firms to tariff changes and to observe their sourcing behavior in response to these shifts. By leveraging this confidential data, we can capture the intricate dynamics of trade relationships and supply chains, offering a robust and comprehensive understanding of how firms adjust their input sourcing strategies under varying tariff regimes. This level of detail is rarely accessible, making our study uniquely positioned to contribute valuable empirical evidence to the broader conversation regarding the repercussions of trade policies.

The regression results indicate that rising export tariffs significantly increase trade values between suppliers and domestic buyers while decreasing trade values between buyers and domestic suppliers. This shift occurs because exporters, facing higher export tariffs, are compelled to prioritize domestic sales over exports. However, the increase in domestic sales does not fully offset the loss from decreased exports, leading to a decline in total production and a reduction in the demand for domestic production inputs. Our results provide new evidence on the micro-level adjustments that firms make in response to tariff hikes, delving deeper into the specific reconfiguration of domestic supply chains. We show that tariffs shift the balance of trade between suppliers and buyers within the country, demonstrating how these policy changes affect internal market dynamics.

Additionally, under the strain of increasing tariff shocks, our analysis reveals that smaller firms perform better in the domestic market compared to larger firms. This outcome contrasts with the findings of Benguria et al. (2022), who focused on the effects of trade policy uncertainty and found that smaller firms experienced more pronounced increases in uncertainty and reduced performance. In our study, however, smaller firms—typically more domestically oriented—demonstrate a greater capacity for agility in adapting to the evolving trade landscape, thereby preserving their operational efficacy. In contrast, larger firms, with their extensive market networks and greater reliance on international trade, are more adversely affected by tariff increases. This suggests that firm size and market orientation are crucial factors in determining the impact of trade policy changes.

We also investigate the impact of import tariffs on the domestic performance of buyers. The empirical findings suggest that an increase in import tariffs leads to a significant decrease in domestic trade among buyers, implying that imported intermediate goods are complementary to domestic products. When import tariffs rise, firms that rely on imported intermediates from the U.S. face higher costs, which discourages them from purchasing complementary local products. This phenomenon creates a bottleneck effect, severely constraining their production processes and reducing overall efficiency. The adverse impact on domestic trade is particularly pronounced among larger firms, which are often more capital-intensive and thus

more dependent on a steady supply of intermediate goods. These firms, when faced with higher import tariffs, struggle to maintain their production levels and are forced to reduce their demand for domestic inputs. Overall, this evidence confirms the profound influence that changes in tariff policies significantly disrupt domestic sourcing patterns and firm performance, highlighting the critical nexus between international trade policies and domestic economic resilience.

Our work builds on and extends several strands of literature. First, it contributes to the growing body of research examining the consequences of the U.S.-China trade war on economic activities. Most existing studies have focused on the impact within the United States, analyzing aspects such as tariff pass-through, income, employment, and election outcomes (Amiti et al., 2019, 2020; Fajgelbaum et al., 2020; Fajgelbaum and Khandelwal, 2022; Autor et al., 2024; Blanchard et al., 2024). While the literature on the impact of the trade war on Chinese exporters is more closely related to this paper, discussions about the effects on China have been limited due to data constraints. To address this issue, some studies have utilized product-level trade data (Ma et al., 2021; Jiang et al., 2023), while others have focused on particular subsets of firms, such as listed companies (Benguria et al., 2022; Huang et al., 2023), or particular regions within China (Jiao et al., 2022). Unlike previous studies, our paper examines the impact of the trade war on domestic sourcing capability by applying firm-identified transaction data. This method allows us to explore the issue from a highly general perspective, shedding new light on how the trade war has reshaped domestic sourcing strategies in China.

In addition, this paper relates to a body of literature that investigates the impact of exports on firms' behavior. Existing studies have primarily concentrated on the benefits of exporting for firms' labor productivity. For instance, Park et al. (2010) and Trefler (2004) report that trade liberalization tend to enhance labor productivity. These studies frequently adopt a "learning by doing" perspective, suggesting that firms can acquire advanced technology through exporting activities. Consequently, growth in exports can boost firms' productivity(Park et al., 2010; Berman et al., 2015) and improve product quality(Atkin et al., 2014). However, to the best of our knowledge, no extant literature has empirically examined the impact of export shocks on firms' performance along the supply chain within the domestic market. While previous research has explored the impact of external shocks on the resilience of supply chains(Haakonsson and Nielsen, 2014; Davis et al., 2021; Zheng et al., 2024), these studies have primarily focused on specific industries. This leaves a gap in the comprehensive investigation of broader supply chain dynamics. Given the current trend of rising

anti-globalization sentiments, this paper makes a timely contribution to the literature by examining how export shocks affect domestic supply chains, thereby offering new insights on the interplay between international trade policies and domestic market performance.

Our work also connects to a strand of literature that studies the linkage between export and domestic sales. While neo-new trade theory assumes that firms' international trade decisions are independent of their domestic trade decisions(Melitz, 2003), it has been argued that there are connections between domestic and overseas markets, implying interdependence in firms' production costs across these different markets (Soderbery, 2014; Liu, 2018). Theoretically, incorporating capacity constraints into trade models explains that exports and domestic sales are substitutable, as firms' budgets could be constrained in the factor or financial markets. In other words, strong internal linkages across destinations allow any distortionary behavior to propagate to all markets. Empirical results show a negative relationship between export and domestic sales(Vannoorenberghe, 2012; Ahn and McQuoid, 2012; Blum et al., 2013). Consequently, trade can amplify distortions, as capacity-constrained firms strive to meet growing demand, leading to increased production across markets. In this paper, we yield similar findings, thereby offering fresh empirical support for existing studies.

Finally, this paper contributes to the rapidly growing literature on the impact of import shocks. Building on the seminal concept of the "China Syndrome" (Autor et al., 2013), several studies have investigated the effects of import competition on labor markets of developed countries (Pierce and Schott, 2016; Acemoglu et al., 2016). However, it is equally vital to investigate the effects of import shocks on domestic products and firm behavior from perspectives beyond the labor market. Previous studies addressing this issue suggest that increased import penetration fosters competition among domestic firms, thereby reducing their cost markups and monopolistic power (Konings et al., 2005; Altomonte and Barattieri, 2015; De Loecker et al., 2016). Most of these studies highlight the substitution relationship between imported goods and domestic products, particularly in the context of protectionism (Kreuter and Riccaboni, 2023). In contrast to these studies, our paper explores the potential consequences of a complementary relationship between imported and domestic goods. While the existing literature predominantly concentrates on how import shocks intensify competition and reduce the pricing power of domestic firms, our analysis reveals a different dynamic. We present empirical evidence suggesting that, under certain conditions, imported goods and domestic products may act as complements rather than substitutes. This complementary relationship implies that an increase in import tariffs, which raises the cost of imported intermediates, can also adversely affect the demand for domestically produced in-

puts. Our results highlight the necessity of accounting for both substitution and complementarity in understanding the full spectrum of effects that import shocks can have on domestic markets. Understanding this complexity is crucial for policymakers and businesses as they navigate the challenges posed by changes in trade policy and global market conditions.

The rest of the paper is organized as follows: Section II introduces the background of the US-China trade tension; Section III describes the data sources and presents summary statistics of variables that would be used in the empirical analysis; Section IV builds a theoretical model framework to illustrate the casual relationship between tariffs and firms' behavior; Section V empirically examines the impact of export tariff and import tariff on firms' performance in the domestic market; Section VI concludes.

II Background: US-China Trade Tension

During Donald Trump's presidency (2016-2020), the U.S. government imposed numerous tariffs on trade partners, particularly targeting China. The first significant tariffs under Section 201 were announced in January 2018, aimed at large residential washers and solar panels. However, as these did not specifically target China and did not elicit a retaliatory response, they are excluded from our analysis. The escalation began in March 2018, when the U.S. imposed tariffs on steel and aluminum products under Section 232, citing national security concerns. These tariffs, set at 25% for steel and 10% for aluminum, prompted China to retaliate on March 23, 2018, by imposing tariffs on U.S. goods such as pork, fresh fruit, and recycled aluminum. This marked the initiation of what we term *Round 1* tariffs.

Subsequently, on April 3, 2018, the U.S. Trade Representative announced a list of Chinese products that would face an additional 25% tariff under Section 301, based on investigation findings. China responded swiftly, leading to a tit-for-tat escalation between the two nations. Here, we summarize the key rounds of Chinese retaliatory tariffs, while details of U.S. tariffs can be found in sources such as Benguria et al. (2022) and Ma et al. (2021).[1]

Round 1 (April 2, 2018): China imposed tariffs on 128 U.S. products worth approximately $3 billion, with 25% tariffs on pork and recycled aluminum and 15% tariffs on fresh fruit, wine, and other goods.

Round 2 (July 6, 2018): In retaliation to U.S. Section 301 tariffs, China levied an additional 25% tariff on 545 U.S. products valued at about $34 billion, targeting soybeans and

[1]For a comprehensive timeline of the U.S.-China trade war, see Bown and Kolb's detailed guide at https://www.piie.com/blogs/trade-investment-policy-watch/trump-trade-war-china-date-guide.

vehicles.

Round 3 (August 23, 2018): Responding to the second tranche of U.S. Section 301 tariffs, China imposed tariffs on 114 U.S. products worth $16 billion, including chemicals, consumer goods, and medical equipment.

Round 4 (September 24, 2018): Following the U.S. threat to impose tariffs on $200 billion of Chinese goods, China announced tariffs of 5-25% on $60 billion worth of U.S. products, divided into four sub-lists with varying rates.

Round 5 (June 1, 2019): After further U.S. tariff hikes, China increased tariffs on products already targeted in Round 4, applying additional rates of 15%, 10%, and 5% on various sub-lists.

Round 6 (September 1, 2019): In response to U.S. tariffs on nearly all remaining Chinese imports, China imposed tariffs on $75 billion of U.S. exports, with additional duties of 5% or 10%, initially effective from September 1, 2019, with further adjustments following the Phase One trade agreement.

Our empirical analysis primarily focuses on the period from January 2017 to May 2019, encompassing the first four rounds of tariff retaliation. We exclude Rounds 5 and 6 from the main analysis due to product overlaps with earlier rounds and their minimal additional coverage. The analysis is confined to the pre-2020 period to avoid disruptions caused by the COVID-19 pandemic.

Table II.1 details the timeline and scope of China's retaliatory tariffs against the U.S. The initial announcement dates for the additional tariffs are shown in row (1), while row (2) indicates the dates when these tariffs were implemented. The product lists have undergone multiple revisions since the initial announcements. Row (3) lists the number of HS-8 products affected by each round of tariffs, and row (4) provides the total import value of the targeted U.S. products. The total value of ordinary imports subject to these tariffs is shown in row (5), with all values in rows (4) and (5) based on 2017 import data from the U.S. It is important to highlight that the retaliatory tariffs excluded processing imports, so our primary analysis focuses on ordinary imports. Row (6) presents the statutory retaliatory tariff rates for each round. Due to significant overlaps between Round 5 and Round 6 with earlier rounds, the total import value in row (4) exceeds China's total imports from the U.S. Ultimately, only 12.8% of ordinary imports from the U.S. remained untargeted after all six rounds of tariffs.

Table II.1: Timeline and Coverage of China's Retaliatory Tariffs Against US Products

Variable \ Round of tariffs	Round 1	Round 2	Round 3	Round 4	Round 5	Round 6	Untargeted
(1) Announcement date	Mar.3, 2018	Apr.4,2018	Apr.4,2018	Aug.3,2018	May.13,2019	Aug.23,2019	
(2) Implementation date	Apr.2,2018	Jul.6,2018	Aug.23,2018	Sep. 24,2018	June.1,2019	Sep. 1,2019	
(3) # Targeted HS-8	128	545	333	5,207	4,545	1,717	1,917
(4) Total import value (bn $)	2.97	33.82	14.65	57.96	40.03	28.48	43.57
(5) Ordinary import value (bn $)	2.23	29.63	11.22	39.66	26.21	23.56	12.28
(6) Retaliatory tariff rates	15%;25%	25%	25%	5%;10%	5%;10%;15%	5%;10%	

Notes: The product list of Wave 2 had been revised on June 16th 2018, and the product list of Wave 3 had been revised twice, on June 16th and August 8th 2018, respectively. Wave 5 targeted almost the same products as Wave 4. In Wave 6, 1,181 out of the 1,917 HS-8 products have been charged additional tariffs in previous waves. Therefore, the total value of imports in row (4) exceeds China's total imports from the US. For detailed information see Ma et al. (2021).

III Data and Variable Description

This paper investigates the impacts of tariff shocks on firms' behavior in the domestic market amidst the U.S.-China trade war, using a comprehensive dataset. The empirical analysis primarily utilizes three data sources: (i) quarterly domestic firm-to-firm transaction data from 2017Q1 to 2018Q4, which includes trade amounts between individual firms and other domestic firms for various products each quarter, detailing transaction values, the number of firms involved, and product varieties differentiated by the 9-digit tax code within specific industries for each supplier and buyer; (ii) China customs data from 2014 to 2016, providing detailed information on firms' imports and exports, including amounts, product varieties, trade destinations, and other relevant details;[2] and (iii) product-level tariff rates between China and the United States during the sample period, which are crucial for understanding the tariff environment faced by firms. These data sources enable us to calculate the firm-level weighted-average export and import tariffs for each quarter, thereby quantifying the tariff shocks and facilitating a detailed analysis of their effects on domestic firm behavior.

We construct firm-specific exposure to U.S.-China trade tariffs using the Bartik approach, as specified in the following equation:

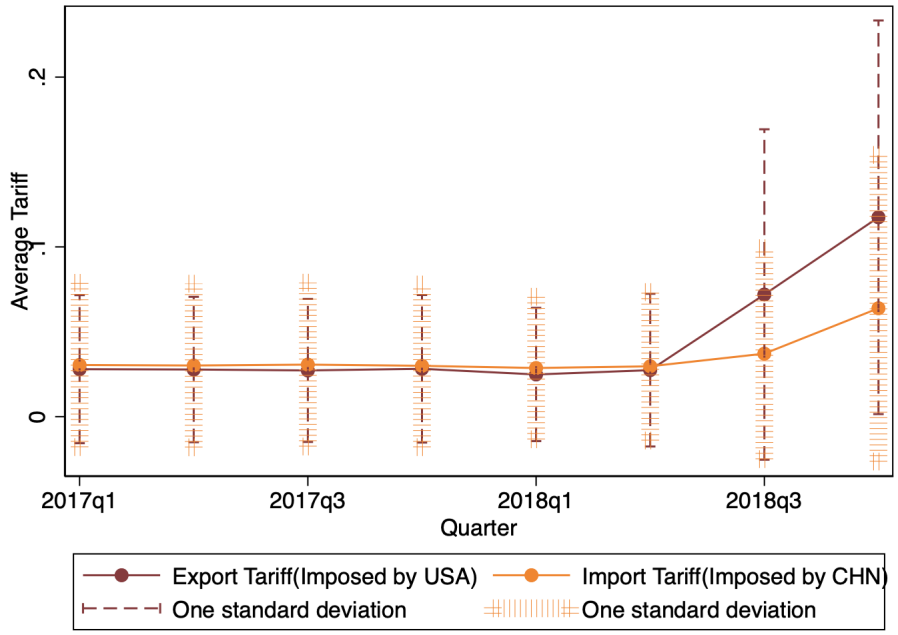
$$\text{tariff}_{ft}^{EXP} = \sum_j \frac{X_{fj}^{EXP}}{X_f^{EXP}} \times \text{tariff}_{jt}^{US}, \quad \text{tariff}_{ft}^{IMP} = \sum_j \frac{X_{fj}^{IMP}}{X_f^{IMP}} \times \text{tariff}_{jt}^{CHN} \tag{1}$$

where tariff_{ft}^{EXP} represents the export tariff faced by firm f in quarter t, and tariff_{ft}^{IMP} represents

[2]The tax code in transaction data contains information about the location of the sellers and buyers. We define each "city-firm" as an independent firm, matching the transaction data with the customs data based on the name of each firm and the city where it is located. We extract over 100 thousand exporting firms from the transaction data as our sample firms. The geographical distribution of the number of enterprises is shown in Appendix Figure B.1.

the import tariff faced by firm f in quarter t. tariff_{jt}^{US} denotes the export tariff of industry j imposed by the U.S. on China in quarter t, and X_{fj}^{EXP}/X_{f}^{EXP} represents the share of firm f's exports in industry j relative to its total exports. tariff_{jt}^{CHN} denotes the import tariff of industry j imposed by China on the U.S. in quarter t, and X_{fj}^{IMP}/X_{f}^{IMP} represents firm f's total imports in industry j as a share of its total imports.

Figure III.1 illustrates the average export and import tariffs of China in each quarter. Prior to the second quarter of 2018, both the export tariffs imposed on China by the U.S. and the import tariffs levied by China remained stable at relatively low levels, close to zero. However, beginning in the second quarter of 2018, there is a rapid increase in U.S. export tariffs on China. In response, China implemented retaliatory tariffs, which increased sharply in the third quarter of 2018, albeit with a slight lag. This trend aligns with the key events of the U.S.-China trade war: the United States initiated punitive tariffs against various trading partners, including China, in the second quarter of 2018, and China retaliated by imposing tariffs on the United States starting in the third quarter of 2018.



Notes: The figure presents the weighted average tariff rates against exports to the US and the weighted average tariff rates against imports from the US from the first quarter of 2017 to the fourth quarter of 2018. Weights are the annual export shares of each industry for each Chinese firm in 2017. Tariff data are collected from China's Ministry of Commerce. Trade data are sourced from China Customs.

Figure III.1: Trends in average export and import tariffs (2017-2018)

In our analysis, we differentiate between firms acting as suppliers and those acting as buyers in each domestic trade transaction recorded in data. Table III.1 presents summary statistics for the variables used in the empirical analysis. The data, covering the period from 2017 to 2018, indicates that suppliers operate on a smaller scale than buyers in terms of total trade volume, number of trade partners, and product varieties. Specifically, suppliers engaged in over 0.5 million domestic trade transactions during the two-year period, with each supplier trading with an average of approximately 20 partners and offering 13 different product varieties. In contrast, buyers conducted over 0.6 million transactions, with each buyer interacting with more than 22 trade partners and dealing in over 36 product varieties. Despite having fewer transactions, suppliers had a higher total trade value compared to buyers. Suppliers' average trade value exceeded 34 million yuan, while buyers' average total trade value was about 20 million yuan. This suggests that although suppliers had fewer transactions overall, their average trade value per transaction was significantly higher. The comprehensive coverage of the data allows us to capture a detailed snapshot of the domestic trade behavior of firms, providing valuable insights into the dynamics between suppliers and buyers in the Chinese market. This analysis highlights the importance of considering both the number of transactions and the trade value to understand the full impact of trade activities on firm performance.

Table III.1: Summary Statistics

Variables	Description	Observations	Mean	Std. Dev.	Min	Max
Firm as supplier/seller						
tariff_{ft}^{EXP}	Export Tariff	505,838	0.044	0.072	0	1.089
tariff_{ft}^{IMP}	Import Tariff	505,838	0.036	0.059	0	0.900
va	Value (million yuan)	512,593	34.195	694.842	0.000	185791.5
nfirm	Number of Firms	512,593	19.972	280.000	1	145293
npdt	Number of Varieties	512,593	13.340	1809.241	1	1291974
Firm as purchaser/buyer						
tariff_{ft}^{EXP}	Export Tariff	646,675	0.046	0.072	0	1.089
tariff_{ft}^{IMP}	Import Tariff	646,675	0.034	0.057	0	0.900
va	Value (million yuan)	674,143	20.582	445.201	0.000	100427
nfirm	Number of Firms	674,143	22.681	57.739	1	7991
npdt	Number of Varieties	674,143	36.646	158.028	1	44813

IV Theoretical Framework

We develop a straightforward general equilibrium model to theoretically illustrate how tariff shocks affect firm performance, which guides our empirical analysis. The model suggests that firms shift from overseas markets to domestic markets in response to negative export shocks, consistent with previous studies (Vannoorenberghe, 2012; Ahn and McQuoid, 2012; Blum et al., 2013). This shift underscores the reallocation of trade activities towards the domestic market when faced with higher export barriers. Furthermore, the model indicates that rising import tariffs would lead firms into a dilemma, where firms struggle due to the complementary nature of imported intermediate goods and domestic goods. The higher costs of imported inputs constrain production processes, reducing overall efficiency and competitiveness in the domestic market. By providing a theoretical framework, our model helps to structure the empirical investigation, enabling us to test these predictions and uncover the nuanced impacts of tariff shocks on firm behavior and performance.

Our model depicts an economy characterized by two symmetric countries: the domestic country, denoted as country H, and a foreign country, denoted as country F.[3] To simplify the analysis, tariffs are assumed to be the primary determinant of trade costs, neglecting the trade loss from international transport, resulting in zero iceberg costs. Each country has two sectors: the intermediate goods sector and the final goods sector. Intermediate goods are tradable, while final goods are non-tradable. We assume a substantial migration cost between the two countries, rendering workers immobile. Therefore, the only movable commodities across countries are the intermediate goods. Our theoretical framework aims to elucidate the behavioral adjustments exhibited by these sectors in response to tariff shocks.

Household There are L_i homogeneous households in country i. Each household has one consumer in both countries. Trade models typically assume that consumers have preferences for both domestically produced and imported goods, leading to international trade due to consumers' love for variety (Armington, 1969; Krugman et al., 1980; Melitz, 2003). While the primary objective of our study is to scrutinize firm behavior in the context of the trade relationship between the two countries, it's important to note that this trade pertains exclusively to the intermediate goods market. Consequently, to maintain analytical focus and simplicity, our model does not incorporate a 'love for variety' in consumer preferences. Instead, we posit that households exhibit linear preferences when it comes to the consumption of domes-

[3]This is a simplified version. The theoretical framework could be extended to a multi-country version without altering the conclusions.

tically produced final goods. This assumption allows us to concentrate on the core dynamics of firms' responses to trade policy without the added complexity of varied consumer tastes in the model.

Accordingly, the utility maximization problem for households in country i is given by:

$$\max y_i \tag{2}$$

Consumers face the following budget constraint when choosing the optimal consumption of final goods:

$$P_i y_i \leq w_i \tag{3}$$

where w_i is the wage for employment in the intermediate goods sector in the country i. It can be readily inferred that the demand for final goods among consumers in the country i depends on their income (W_i) and the prices of the products (P_i) they intend to consume. The demand curve is given by $Y_i = w_i L_i / P_i$, where $i = H, F$. Since the two countries are symmetric in economy, we simplify the notation by omitting the index, i.e., $L_H = L_F = L$.

Final Goods Sector Firms in the final goods sector operate in a perfectly competitive market. Unlike the assumption that consumers exclusively consume local products, our model posits that firms rely on intermediates sourced from both countries for production, thereby facilitating international trade. Moreover, intermediate goods are complementary. For simplicity, the production function of the final goods sector in country i is modeled in a typical Leontief form:

$$y_i = \min\{x_{ii}, x_{ji}\} \tag{4}$$

where y_i denotes the output of final goods, and x_{ii} and x_{ji} represent the inputs of intermediate goods from country i and country j ($j = H, F; j \neq i$), respectively. Based on this production function, the final goods sector determines the optimal quantity of intermediate goods input to maximize its profit:

$$\max P_i y_i - p_{ii} x_{ii} - p_{ji} x_{ji} \tag{5}$$

where P_i is the price of final goods in country i, and p_{ii} and p_{ji} are the prices of intermediate goods from country i and country j, respectively. The optimal production strategy implies $y_i = x_{ii} = x_{ji}$ and $P_i = p_{ii} + p_{ji}$.

Intermediate Goods Sector The intermediate goods sector uses labor as the sole input for production and operates under perfect competition. Neo-new trade theory posits that firms have fixed marginal costs, rendering exports and domestic sales orthogonal (Melitz, 2003). However, as discussed earlier, there may be a correlation between export and domestic sales if firms are capacity-constrained (Soderbery, 2014; Liu, 2018). Consequently, an exogenous trade shock would affect firms' domestic performance. In line with previous findings, we assume the production function in the intermediate goods sector in country i ($i = H, F$) as follows:

$$l_i = x_i^2, \quad x_i = x_{ii} + x_{ij} \tag{6}$$

where x_i is the output of each firm in the intermediate sector of country i, and l_i is the quantity of labor. The total sales of intermediates, x_i, consist of domestic sales, x_{ii}, and export sales, x_{ij}. The quadratic form captures the non-linear correlation between labor inputs and outputs. We employ this form to model the capacity constraints faced by firms, indicating that firms' trade decisions are independent across overseas and domestic markets.

As firms engage in trade with both domestic and foreign markets, they must determine distinct sets of prices and quantities for each market to maximize their profits:

$$\max \pi_i = \frac{1}{n_i} p_{ii} x_{ii} + \frac{1}{n_i}(1 - t_{ij}) p_{ij} x_{ij} - w_i l_i + s_i, \; s_i = \frac{1}{n_i} t_{ji} p_{ji} X_{ji} \tag{7}$$

where p_{ii} represents the price of intermediates in country i, n_i is the number of firms in the intermediate sector of country i, t_{ij} is the tariff imposed by country j on country i, X_{ii} and X_{ji} are the total demand for intermediate goods in country i and country j, respectively, and s_i is the import tariff subsidy from country j transferred to each firm in country i. We can solve for the price relationship as follows: $p_{ii} = (1 - t_{ij}) p_{ij} = 2w_i(x_{ii} + x_{ij})$. The above equation reveals a substitutable relationship between exports and domestic sales within the intermediate goods sector, constrained by production costs. This implies that an increase in exports leads to a corresponding decrease in domestic sales, while a decrease in exports results in an increase in domestic sales.

Market Clearing Condition In equilibrium, the goods markets are clear. Firstly, under perfect competition, the intermediate goods sector satisfies the zero-profit condition, where

revenue equals cost, $\pi_i = 0$:

$$\frac{1}{n_i} p_{ii} X_{ii} + \frac{1}{n_i}(1 - t_{ij}) p_{ij} X_{ij} - \frac{1}{n_i^2} w_i (X_{ii} + X_{ij})^2 - w_i f + s_i = 0 \tag{8}$$

The zero-profit condition also applies to the final goods sector in equilibrium, given by $P_i Y_i = p_{ii} X_{ii} - p_{ji} X_{ji}$, where Y_i is the total supply of final goods in the country i. Combining this with the demand function, we derive the following equilibrium equation:

$$(p_{ii} + p_{ji}) X_{ii} = w_i L \tag{9}$$

In addition to the goods market, the labor market must also be clear, meaning that labor supply equals labor demand. Due to the immobility of labor, individuals work exclusively within their own country. Consequently, the total labor demand is constrained by the total number of potential workers, denoted as L. This restriction ensures that the available workforce in each country matches the labor requirements of both the intermediate and final goods sectors, maintaining equilibrium in the labor market:

$$L = n_i (l_i + f) \tag{10}$$

Finally, in equilibrium, there must be a balance of trade, represented by the equation $(1 - t_{ij}) p_{ij} X_{ij} = (1 - t_{ji}) p_{ji} X_{ji}$. This condition ensures that the value of exports from country i to country j equals the value of imports from country j to country i, adjusted for tariffs. Using the market clearing conditions, we can derive the domestic revenue r_{HH} from the sale of intermediate goods by firms in country H as follows:

$$r_{HH} = p_{HH} x_{HH} = \frac{2 t_{HF}(1 - t_{FH})}{t_{HF} + t_{FH}} \cdot f \tag{11}$$

Therefore, we can derive the following proposition:[4]

Proposition 1 *Domestic sales in the intermediate goods sector will increase when the export tariff t_{HF} rises. Conversely, an increase in the import tariff t_{FH} will lead to a decrease in the domestic revenue of intermediates, and vice versa.*

In other words, when confronted with a negative export shock, the intermediate goods sector, constrained by high export costs and capacity limitations, has incentives to shift from

[4]Details of solving the model are provided in the Appendix.

overseas markets to domestic markets to maximize profits. Proposition 1 highlights that in response to a negative export shock, there is a notable increase in domestic sales attributable to the substitutable relationship between exports and domestic sales. The complementarity between domestic and imported inputs plays a crucial role in shaping firms' domestic sourcing decisions in response to U.S. tariff spikes. When imported intermediates become more expensive, firms cannot easily substitute these inputs with domestic alternatives due to their complementary nature. This interdependence highlights the vulnerability of firms to international trade policies and underscores the significant impact that rising tariffs can have on domestic production strategies.

V Empirical Analysis

The preceding section provides an analytical framework for understanding the mechanisms by which tariff shocks influence firm behavior. Traditional trade theory often emphasizes the role of comparative advantage and the substitutability of inputs. However, our theoretical model highlights the critical role of the complementarity between domestic and imported inputs in shaping firms' responses to tariff changes. When U.S. tariffs spike, the interdependence between these inputs becomes crucial, as firms cannot easily replace imported intermediates with domestic ones without impacting their production processes. In the empirical section, we will test the propositions derived from the theoretical model, specifically focusing on how this complementarity affects firms' domestic sourcing decisions. Furthermore, we will conduct various heterogeneity analyses to incorporate additional dimensions into our investigation, providing a more nuanced understanding of firm behavior under different trade conditions.

V.1 Baseline Regressions

To empirically test the propositions derived from our theoretical model, we employ a baseline regression specification designed to capture the impact of tariff shocks on firm behavior. This specification allows us to quantify the effects of changes in export and import tariffs on various firm-level outcomes, including domestic sales and production decisions. By incorporating controls for firm-specific characteristics and external economic factors, our model aims to isolate the causal relationship between tariff changes and firm responses.

The baseline specification is as follows:

$$\ln \text{va}_{fcjt} = \beta_1 \ln \text{tariff}_{ft}^{EXP} + \beta_2 \ln \text{tariff}_{ft}^{IMP} + \lambda_f + \lambda_{ct} + \lambda_{jt} + \varepsilon_{fcjt} \tag{12}$$

where $\ln \text{va}fcjt$ is the logged domestic trade value in industry j by firm f in city c during quarter t, $\ln \text{tariff}ft^{EXP}$ is the logged average tariff on exports to the U.S. faced by firm f in quarter t, and $\ln \text{tariff}_{ft}^{IMP}$ is the logged average tariff on imports from the U.S. faced by firm f in quarter t. Standard errors of all regressions are clustered at the industry level.[5] The coefficients of interest are β_1 and β_2, which reflect the impact of export tariffs and import tariffs on firms' domestic trade values, respectively.

Tables V.1 and V.2 present the results of the baseline regressions for suppliers and buyers, respectively. The findings reveal that export tariffs significantly impact trade values, with a one percent increase in the U.S. export tariff rate imposed on China leading to a 0.235 percent increase in domestic sales for suppliers and a 0.409 percent decrease in domestic purchases for buyers. These results are consistent with our theoretical model's propositions and align with previous studies (Liu, 2018), highlighting the substitutable relationship between exports and domestic sales within the intermediate goods sector. The results indicate that firms adjust their domestic sales in response to increased production costs: higher export costs incentivize suppliers to shift focus from international markets to the domestic market, boosting domestic sales. However, this increase in domestic sales does not fully offset the decline in exports, leading to an overall contraction in firms' total output. This underscores the central theme of the paper: the interplay between domestic and international trade dynamics significantly influences firm behavior, particularly in the context of tariff-induced cost changes. The complementarity and substitutability of inputs play a crucial role in shaping these responses, demonstrating the complex adjustments firms must navigate in a shifting trade environment.

Furthermore, the results in Tables V.1 and V.2 indicate that import tariffs do not significantly affect the performance of suppliers in the domestic market. However, they do lead to a substantial decrease in the domestic trade value of buyers. Specifically, as shown in column (3) of Table V.2, a one percent increase in the import tariff results in a significant 0.995 percent decrease in the domestic purchases of buyers. These findings are consistent with our theoretical conclusions and suggest that some intermediate goods imported by China from the United States are complementary to local products. In other words, firms must

[5] Additionally, we also cluster the standard errors at the city level and report these results in Table B.1 of the Appendix. The results remain robust.

Table V.1: Baseline Results of Firms as Sellers in Domestic Market

Dep. Var.: $\ln va_{fcjt}$	(1)	(2)	(3)
$\ln tariff_{ft}^{EXP}$	0.241***		0.235***
	(0.084)		(0.084)
$\ln tariff_{ft}^{IMP}$		-0.137	-0.086
		(0.192)	(0.190)
Observations	495,492	495,492	495,492
R-square	0.808	0.808	0.808
Firm FE	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variable $\ln va_{fcjt}$ is the domestic sales of firms. The independent variables $\ln tariff_{ft}^{EXP}$ and $\ln tariff_{ft}^{IMP}$ are the average export tariff and import tariff, respectively. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Robust stand errors of all regressions are clustered at the industry level.

procure and invest in a certain number of intermediate products from the U.S. to ensure a smooth production flow. When the import tariff increases, the cost of these necessary inputs rises, discouraging firms from purchasing local products. This explanation aligns with previous studies. Feng et al. (2016) found that technology is embedded in the import inputs of Chinese firms, facilitating product upgrades and expanding exports to overseas markets. Similarly, Kasahara and Lapham (2013) combined a structural empirical model with firm-level data from Chile and found that trade policies discouraging the importation of foreign intermediate goods can significantly negatively impact exports. Although their focus was on the relationship between imports and exports, it also implies the technical impediments firms may face when import costs rise. Our findings contribute to this body of literature by highlighting the domestic repercussions of increased import tariffs, emphasizing the intricate relationship between imported intermediates and local production.

We also examine whether all firms are equally affected by tariff shocks by presenting regression results for subsamples in Tables B.2 to B.5 in the Appendix. Firms engaged in both purchasing and selling activities in the domestic market are defined as intermediate producers. These firms process raw materials and sell intermediates to upstream firms. The results in Tables B.2 and B.4 are consistent with the baseline results in Tables V.1 and V.2, indicating that the effects observed are primarily driven by intermediate producers. Firms engaged solely in selling activities are defined as raw material suppliers. Table B.2 shows that the domestic trade value of raw material suppliers decreases significantly when export tariffs

Table V.2: Baseline Results of Firms as Buyers in Domestic Market

Dep. Var.: $\ln va_{fcjt}$	(1)	(2)	(3)
$\ln tariff_{ft}^{EXP}$	-0.344***		-0.409***
	(0.084)		(0.084)
$\ln tariff_{ft}^{IMP}$		-0.915***	-0.995***
		(0.283)	(0.296)
Observations	669,492	669,492	669,492
R-square	0.724	0.724	0.724
Firm FE	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables $\ln va_{fcjt}$ are the domestic purchase value of firms. The independent variables $\ln tariff_{ft}^{EXP}$ and $\ln tariff_{ft}^{IMP}$ are the average export tariff and import tariff, respectively. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

increase, supporting our conjecture that firms reduce inputs in response to export losses. Finally, firms involved only in purchasing activities are classified as final goods producers, as they likely sell products directly to consumers rather than to other firms. The results in Table B.4 indicate that changes in export and import tariffs do not significantly affect final goods producers. Overall, the subsample results reinforce the conclusion that the baseline regression outcomes are primarily driven by intermediate goods suppliers.

V.2 Extensive and Intensive Margins of Domestic Sourcing

Furthermore, we investigate how tariff changes specifically affect firms' trading behavior, considering that trade theory suggests extensive and intensive margins of sales could react differently to tariff shocks. According to trade literature, the extensive margin refers to the number of distinct products or trade partners, while the intensive margin pertains to the trade value per product or partner (Melitz, 2003; Bernard et al., 2009). This decomposition is crucial as it helps to understand whether firms adjust their trade activities by altering the range of products and partners (extensive margin) or by changing the volume of existing trade relationships (intensive margin). To introduce this exercise, we decompose the trade value into its extensive and intensive margins and provide the corresponding estimates in Tables V.3 and V.4. This approach allows us to capture the nuanced effects of tariff shocks on firms' trade behavior and provides a detailed view of how firms navigate changes in trade policy.

In contrast to previous findings that external shocks primarily affect firms' export behavior through the intensive margin (Bernard et al., 2009), our results indicate that the surge in domestic sales following a negative export shock is primarily evidenced at the extensive margin. Specifically, a one percent increase in export tariffs leads to a 0.186 percent increase in the number of trade partners. This suggests that when export costs rise, firms tend to seek more buyers in the domestic market. However, the trade value per buyer does not increase significantly with higher export tariffs, implying that the products firms offer may not be sufficiently attractive to their existing domestic partners. Additionally, we find that a one percent increase in export tariffs results in a 0.669 percent increase in product varieties, while the average trade value per variety decreases by 0.434 percent. This suggests that firms respond to increased export costs by diversifying their product offerings to mitigate risk and appeal to a broader range of domestic buyers.

Table V.3: Extensive and Intensive Margins of Domestic Sourcing: Firms as Sellers in Domestic Market

Dep. Var.(logged):	(1) number of firms	(2) number of varieties	(3) avg. value per firm	(4) avg. value per variety
$\ln \text{tariff}_{ft}^{EXP}$	0.186***	0.669***	0.048	-0.434***
	(0.069)	(0.081)	(0.040)	(0.088)
Observations	495,492	495,492	495,492	495,492
R-square	0.854	0.736	0.781	0.774
Firm FE	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (4) are the number of firms(logged), the average domestic sales per firm(logged), the number of varieties(logged), and the average domestic sales value per variety(logged). The independent variable is the average export tariff(logged). We also control the average import tariff(logged) across all columns. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table V.4 illustrates how import tariffs affect buyers and yields similar findings. Column (1) of Table V.4 shows that the number of upstream partners declines by 0.365 percent with each one percent increase in the import tariff. Additionally, column (3) indicates that a one percent rise in import tariffs leads to a 0.630 percent decline in average trade values with domestic suppliers. Thus, firms reduce their domestic production inputs through both a decrease in the number of trade partners (extensive margin) and a reduction in average trade values (intensive margin). Furthermore, columns (2) and (4) reveal that the average

trade values per variety decrease significantly by 0.885 percent with a one percent increase in import tariffs, while the impact across varieties is not significant. This suggests that the rise in China-U.S. import tariffs prompted Chinese firms to cut down their production inputs, resulting in a direct adverse effect on their production levels.

Table V.4: Extensive and Intensive Margins of Domestic Sourcing: Firms as Buyers in Domestic Market

Dep. Var.(logged):	(1) number of firms	(2) number of varieties	(3) avg. value per firm	(4) avg. value per variety
ln tariff_{ft}^{IMP}	-0.365***	-0.110	-0.630***	-0.885***
	(0.130)	(0.115)	(0.180)	(0.207)
Observations	669,492	669,492	669,492	669,492
R-square	0.818	0.798	0.622	0.615
Firm FE	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (4) are the number of firms(logged), the average domestic purchase value per firm(logged), the number of varieties(logged), and the average domestic purchase value per variety(logged). The independent variable is the average import tariff(logged). We also control the average export tariff(logged) across all columns. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

V.3 Heterogeneity Analysis

Based on the baseline results, we conclude that changes in both export and import tariffs significantly impact firms' performance in the domestic market. The granular data allows us to distinguish the impact of tariff changes along various important dimensions. To further investigate, we conduct heterogeneous analyses to identify the specific industries and firms affected by these tariff changes. This approach deepens our understanding and provides a more nuanced perspective on the interplay between international trade and the domestic market. Additionally, it helps to validate and reinforce the interpretation of the baseline results discussed earlier.

Industry Characteristics We first distinguish the industries and repeat baseline specifications in subsamples. The results of suppliers and buyers are reported in Table V.5 and Table V.6, respectively. Firms sell goods downstream, and we primarily conduct group regressions

on goods-related industries, as shown in Table V.5. The results indicate that the trade values of mechanical equipment products have significantly increased. According to statistics from China Customs, the main products exported to the United States are machinery and equipment.[6] Therefore, the findings support the hypothesis that firms shift their focus from overseas markets to the domestic market.

Table V.5: Industry Heterogeneity Analysis of Sellers (Dependent Variable: ln va)

Category	$\ln \text{tariff}_{ft}^{EXP}$	S.E.
All goods	0.222**	(0.087)
Agriculture, Forestry, Livestock and Fisheries	-0.624	(1.010)
Minerals	0.128	(0.751)
Food, Beverage, Tobacco, Alcohol	-0.039	(0.240)
Textile, Clothing, Leather	1.785	(0.676)
Wood products, Furniture	-0.566	(1.067)
Literature, Education, Handicrafts	0.072	(0.336)
Petroleum, Chemical, Medicine	0.331	(0.231)
Metal, Non-metal	0.176	(0.318)
Machinery, Equipment	0.186**	(0.074)

Notes: The sample period starts from Q1 2017 to Q4 2018. All rows perform baseline regressions the same as column (3) of Table V.1, using sub-samples. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

The raw materials and intermediates acquired by downstream buyers encompass not only goods but also labor and other services. In Table V.6, we present group regressions that differentiate between several categories of inputs. The regression results show that firms reduce both goods inputs and expenditures on electricity, heat, and labor when export costs increase. Given that labor, electricity, and heat are all necessary inputs for product processing, this finding corroborates the reduction in firms' production.

Moreover, we find that the impacted inputs of downstream firms primarily include products such as chemicals, machinery, metal, non-metal, and food, as shown in Table V.6. This suggests that the raw materials imported from the U.S. and purchased by firms may be essential or complementary to the production and processing of these materials. Consequently, the increase in import tariffs on these goods would exacerbate the production costs for firms involved in producing chemicals, machinery, and similar products. While a long-term solution may be found through R&D or seeking new partners, there will still be a negative impact in the short run.

[6]See White Paper on Facts and China's Position on Economic and Trade Friction between China and the United States by the Information Office of China's State Council, https://www.gov.cn/zhengce/2018-09/24/content_5324957.htm.

Table V.6: Industry Heterogeneity Analysis of Buyers (Dependent Variable: ln va)

Category	ln tariff_{ft}^{EXP}	S.E.	ln tariff_{ft}^{IMP}	S.E.
All Goods	-0.429***	(0.084)	-1.049***	(0.319)
Agriculture, Forestry, Livestock, Fisheries	-0.754	(1.321)	0.824	(0.850)
Minerals	-0.759	(2.057)	-4.151	(3.544)
Food, Beverage, Tobacco, Alcohol	-1.521*	(0.523)	-0.748***	(0.154)
Textile, Clothing, Leather	0.536	(0.807)	0.343	(0.388)
Wood products, Furniture	0.099	(0.811)	-1.129	(1.039)
Literature, Education, Handicrafts	-0.139	(0.513)	-3.573*	(1.321)
Petroleum, Chemical, Medicine	-0.410	(0.223)	-1.445***	(0.319)
Metal, Non-metal	-0.459	(0.267)	-0.803**	(0.196)
Machinery, Equipment	-0.470***	(0.118)	-1.429**	(0.506)
Electricity, Heat, Water, Gas	-0.583**	(0.077)	0.768	(0.755)
Labor Service	-0.723***	(0.098)	-1.475	(0.699)
Sales Service	-0.221	(0.431)	0.476	(0.637)
Technical Services	-5.012	(4.794)	1.415	(6.627)

Notes: The sample period starts from Q1 2017 to Q4 2018. All rows perform baseline regressions the same as column (3) of Table V.2, using sub-samples. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Firm Characteristics Next, we conduct a heterogeneity analysis to explore whether trade patterns vary across firms of different scales. Although the transaction data does not provide direct information on firm scale (such as the number of employees and total assets), we use the domestic revenues of each firm in the benchmark year (2017) as a proxy for its scale. We include the firm scale interaction term in the baseline specification. The results for suppliers, presented in column (1) of Table V.7, indicate that larger firms exhibit smaller magnitudes of domestic sales. This could be attributed to the higher productivity levels of larger firms, potentially enabling them to engage with a greater number of trading partners (Melitz, 2003). Consequently, large firms may shift their exports from the U.S. market to other international markets (such as the European Union). In contrast, small firms have fewer options and may primarily switch to the domestic market. The results in Table B.6 in the Appendix validate our inference, showing that firms with larger export scales have fewer domestic sales.

Column (2) of Table V.7 presents the results for buyers. The findings indicate that larger-scale buyers are more likely to reduce their domestic intermediate inputs in response to a negative import shock, implying that they are more vulnerable to external risks. This observation aligns with previous studies suggesting that larger firms are more integrated into global supply chains and, therefore, more exposed to international trade shocks (Bernard et al., 2010; Altomonte et al., 2012). The theoretical framework proposed by Melitz (2003)

supports this, as larger firms typically have higher productivity and are more involved in export and import activities. Large firms often utilize costlier catalysts and computer numerical control (CNC) machines from abroad to produce higher-quality products. Consequently, the complementary relationship between domestic and foreign products exacerbates the impact of import shocks on large firms. This highlights the intricate link between firm size, production strategies, and vulnerability to external shocks.

Table V.7: Heterogeneity Analysis of Firm Scale

Dep. Var.: ln va	Sellers (1)	Buyers (2)
$\ln \text{tariff}_{ft}^{EXP}$	1.670***	
	(0.454)	
$\ln \text{tariff}_{ft}^{EXP} \times \text{scale}_f$	-0.089***	
	(0.028)	
$\ln \text{tariff}_{ft}^{IMP}$		6.589***
		(1.813)
$\ln \text{tariff}_{ft}^{IMP} \times \text{scale}_f$		-0.455***
		(0.122)
Observations	494,617	660,781
R-square	0.808	0.724
Firm FE	Yes	Yes
City-Quarter FE	Yes	Yes
Industry-Quarter FE	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. Both columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variable in column (1) is the domestic sales of firms(logged). The dependent variable in column (2) is the domestic purchase value of firms(logged). The independent variables in columns (1) and (2) are the interaction terms of average export tariff(logged) with firm scale, and the interaction terms of average import tariff(logged) with firm scale, respectively. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table V.8 presents the industry distribution of downstream buyers in the top 10 percent of the firm scale, confirming our earlier conjecture. Over three-quarters of these buyers are concentrated in capital- or skill-intensive sectors such as machinery and equipment (43.02%), petroleum, chemical, and pharmaceutical (23.23%), and metal and non-metal (14.57%). These sectors heavily rely on advanced technology and specialized inputs, which are often imported. Consequently, these firms are more susceptible to import shocks due to their dependency on high-quality foreign intermediates. This distribution underscores the vulnerability of larger firms in these industries to external trade shocks, supporting the findings discussed earlier.

Table V.8: Industry Distribution for Buyers in the Top 10% Scale

Industry	Proportion
Machinery and equipment	43.02%
Petroleum, chemical, and pharmaceutical	23.23%
Metal and non-metal	14.57%
Textile, clothing, and leather	7.20%
Food, beverage, tobacco, and alcohol	4.22%
Cultural, educational, and craft	4.06%
Agriculture, forestry, animal husbandry, and fishery	1.34%
Minerals	1.21%
Wood products and furniture	1.15%

V.4 Robustness Checks

Last but not least, unobserved factors may confound the impact of tariff shocks on firm performance, leading to potential endogeneity problems. To mitigate estimation bias, we adopt placebo tests to verify the robustness of our baseline results. If these placebo tests yield insignificant estimations, suggesting that "placebo" tariff shocks have no impact on firms' behavior, we can assert that our baseline specification is notably robust. We conduct three types of placebo tests in this section.

First, we address potential mismatches in firm IDs by re-sorting them. This involves randomly assigning the tariff rates faced by one firm to another within the same period (Q1 2017 to Q1 2018). We then regress these incorrectly assigned tariff rates against the respective firms' domestic trade values during the same period, following the baseline specifications. The results, presented in Panel A of Table V.9, show an anticipated lack of significant impact on firms' domestic trading behavior, confirming that the baseline results are not driven by firm ID mismatches.

Second, to address potential timeline inaccuracies, we randomly allocate the tariff rates faced by each firm during the tariff shock period (Q2 2018 to Q4 2019) to various quarters preceding the actual tariff shock. We estimate the effects of these misaligned tariff rates on domestic trade values from Q1 2017 to Q1 2018. As shown in Panel B of Table V.9, the results indicate no significant impact, reinforcing the robustness of our baseline results against timeline misalignments.

Third, we adopt a more random approach by completely shuffling tariff rates and randomly assigning them to each firm-quarter observation. We then regress these fake tariff rates against firms' performance before the actual tariff shock, adhering to the baseline spec-

ifications. Panel C of Table V.9 demonstrates that these fabricated tariff shocks have no significant impact on firms' trading behavior in the domestic market, further supporting the robustness of our baseline findings. These robustness checks, consistent with our baseline results, provide strong evidence that the observed effects of tariff shocks on firms' domestic performance are not driven by unobserved confounding factors.

VI Conclusion

This paper explores the ramifications of tariff shocks on firms' conduct within the domestic market in the context of the U.S.-China trade war. We construct a theoretical model to illustrate the effects of such shocks on firms' performance and the underlying mechanisms. The equilibrium suggests that, when export tariffs rise, the intermediate goods sector is inclined to shift from overseas to domestic markets. Moreover, our analysis reveals that a rise in import tariffs prompts firms to decrease their demand for local products, as imports and domestic intermediates serve as complementary inputs.

We then apply empirical analysis using unique quarterly firm-to-firm transaction data, allowing us to draw several key findings. Our results indicate that an increase in the export tariffs imposed by the United States on China corresponds to an increase in firms' domestic sales. This implies that as export costs rise, firms tend to pivot from foreign to domestic markets. Moreover, we find that China's retaliatory import tariffs against the United States inadvertently affect Chinese firms. Because U.S. imports are technologically intensive and complementary to domestically purchased products, increased import costs reduce firms' willingness to import, leading to a decrease in domestic purchases. Our empirical findings further reveal that an increase in retaliatory import tariffs leads to a decrease in domestic procurement by firms. These findings align with our theoretical model's predictions.

Our study makes several important contributions to the literature. First, this paper provides a novel perspective by being the first to systematically analyze how tariff shocks impact the domestic trade behavior of Chinese firms, particularly in the context of U.S.-China trade friction. Second, while previous studies have touched on the impact of external shocks on firms' performance, they have been limited by data constraints. Our research breaks new ground by introducing detailed domestic firm-to-firm transaction data, offering deeper insights into firm-level adjustments. The granular nature of this data allows us to capture nuanced firm behavior and provides a robust empirical foundation for understanding the broader implications of trade policies. Third, our findings add new evidence to the exist-

Table V.9: Placebo Test

Panel A		Sellers			Buyers	
Dep. Var.: ln va	(1)	(2)	(3)	(4)	(5)	(6)
ln $tariff_{ft}^{EXP}$	0.690		0.685	-1.299		-1.307
	(1.571)		(1.572)	(2.273)		(2.283)
ln $tariff_{ft}^{IMP}$		0.804	0.804		0.232	0.246
		(0.600)	(0.601)		(0.750)	(0.760)
Observations	354,243	354,243	354,243	464,311	464,311	464,311
R-square	0.843	0.843	0.843	0.770	0.770	0.770
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel B		Sellers			Buyers	
Dep. Var.: ln va	(1)	(2)	(3)	(4)	(5)	(6)
ln $tariff_{ft}^{EXP}$	0.085		0.101	0.313*		0.302
	(0.129)		(0.135)	(0.182)		(0.186)
ln $tariff_{ft}^{IMP}$		0.214	0.226		-0.202	-0.165
		(0.187)	(0.195)		(0.235)	(0.242)
Observations	354,243	354,243	354,243	464,311	464,311	464,311
R-square	0.843	0.843	0.843	0.770	0.770	0.770
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Panel C		Sellers			Buyers	
Dep. Var.: ln va	(1)	(2)	(3)	(4)	(5)	(6)
ln $tariff_{ft}^{EXP}$	0.019		0.019	-0.002		-0.002
	(0.027)		(0.027)	(0.023)		(0.023)
ln $tariff_{ft}^{IMP}$		0.036	0.036		-0.028	-0.028
		(0.036)	(0.036)		(0.037)	(0.037)
Observations	495,492	495,492	495,492	669,492	669,492	669,492
R-square	0.808	0.808	0.808	0.724	0.724	0.724
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. Columns across three panels all include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (3) across panel A to panel C are the domestic sales of firms(logged). The dependent variables in columns (4) to (6) across panel A to panel C are the domestic purchase value of firms(logged). The independent variables are the average export tariff(logged) and average import tariff(logged). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

ing literature. Not only do they support the conclusion that firms shift from exporting to domestic sales when faced with increased export tariffs, but they also reveal that increased retaliatory import tariffs lead to a reduction in the demand for local intermediates due to the complementary relationship between U.S. imports and domestic inputs. This specific insight has been scarcely discussed before.

Overall, our study contributes to both empirical evidence and theoretical studies by offering a comprehensive view of how firms navigate the complexities of international trade shocks and adjust their strategies in response to changing economic landscapes. The unique firm-to-firm transaction data utilized in our analysis provides a significant advantage, enabling us to deliver detailed and precise findings that enhance our understanding of the interplay between international trade and domestic market behavior.

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Appendix

A Theoretical Model

From the zero-profit condition of the intermediates sector, it can be derived that:

$$w_i(x_{ii} + x_{ij})^2 + s_i = w_i f \tag{13}$$

Based on the market clearing conditions, we can derive the following equilibrium system:

$$X_{HH} + X_{HF} = n_H \frac{p_{HH}}{2w_H}, X_{FH} + X_{FF} = n_F \frac{p_{FF}}{2w_F}$$

$$2w_H f - \frac{w_H L}{n_H} = \frac{t_{FH} p_{FH} X_{FH}}{n_H}, 2w_F f - \frac{w_F L}{n_F} = \frac{t_{HF} p_{HF} X_{HF}}{n_F}$$

$$p_{HH} = (1 - t_{HF}) p_{HF}, p_{FF} = (1 - t_{FH}) p_{FH}$$

$$L = n_H \left[(\frac{X_{HH} + X_{HF}}{n_H})^2 + f \right], L = n_F \left[(\frac{X_{FF} + X_{FH}}{n_F})^2 + f \right]$$

$$(p_{HH} + p_{FH}) X_{HH} = w_H L, (p_{FF} + p_{HF}) X_{FF} = w_F L$$

$$X_{HH} = X_{FH}, X_{HF} = X_{FF}$$

$$p_{HH} X_{HF} = p_{FF} X_{FH}$$

Within the system, the first two equations depict a cleared goods market within the intermediate goods sector. Following this, the middle six equations represent its zero-profit condition, the optimal prices of intermediates, and the corresponding cleared labor market. The following four equations elucidate a cleared goods market within the final goods sector and the relationship between intermediate goods across different countries. The last equation is the trade balance condition.

Specifically, define $n_H \triangleq n$, a simplified version of the above system can be derived as follows:

$$X_{HH} + X_{FF} = n_H \frac{p_{HH}}{2w_H}, \quad L = n_H \left[(\frac{X_{HH} + X_{FF}}{n_H})^2 + f \right]$$

$$2w_H f - \frac{w_H L}{n_H} = \frac{t_{FH} p_{FF} X_{HH}}{(1 - t_{FH}) n_H}, \; 2w_F f - \frac{w_F L}{n_F} = \frac{t_{HF} p_{HH} X_{FF}}{(1 - t_{HF}) n_F}$$

$$(p_{HH} + \frac{1}{1-t_{FH}} p_{FF}) X_{HH} = w_H L, \;\; (p_{FF} + \frac{1}{1-t_{HF}} p_{HH}) X_{FF} = w_F L$$

$$n_H = n_F, \;\; p_{HH} X_{FF} = p_{FF} X_{HH}$$

The number of firms in the intermediate goods sector in the country i is:

$$n_i = \frac{1}{2} \cdot \frac{t_{ij} + t_{ji}}{t_{ij} + t_{ji} - t_{ij} t_{ji}} \cdot \frac{L}{f} \tag{14}$$

Set the wage of country i as $t_{ij}(1 - t_{ji})$ as the numeraire. The domestic revenue of each firm in the home country i is thereby:

$$r_{ii} = \frac{1}{n_i} p_{ii} X_{ii} = \frac{2t_{ij}(1 - t_{ji})}{t_{ij} + t_{ji}} \cdot f \tag{15}$$

B Supplementary Figures and Tables

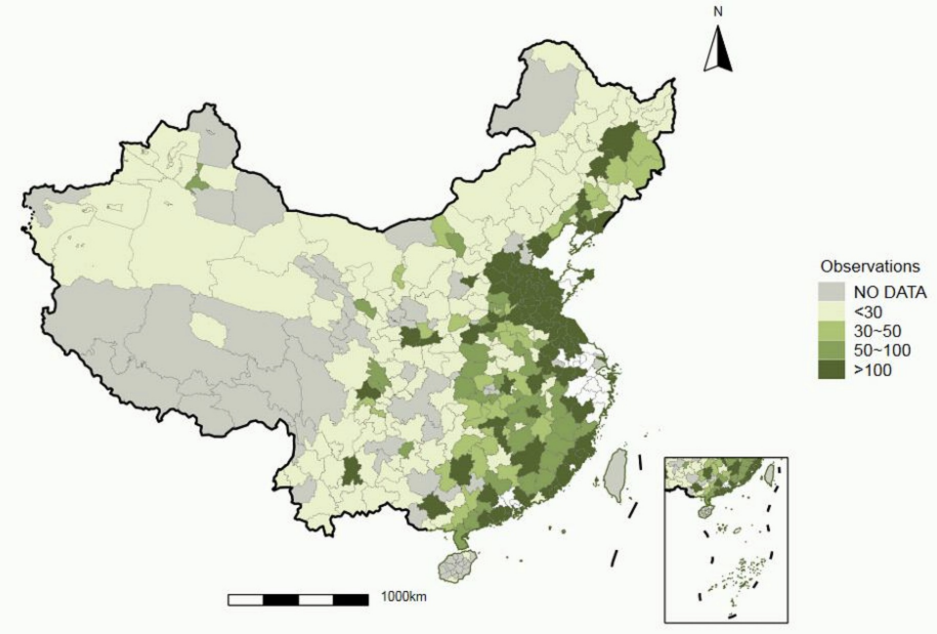

Figure B.1: The Distribution of Number of Firms across China

Table B.1: Baseline Regression Clustering at City Level

	Firms as Sellers			Firms as Buyers		
Dep. Var.: ln va	(1)	(2)	(3)	(4)	(5)	(6)
$\ln \text{tariff}_{ft}^{EXP}$	0.241***		0.235***	-0.344***		-0.409***
	(0.063)		(0.061)	(0.104)		(0.104)
$\ln \text{tariff}_{ft}^{IMP}$		-0.137	-0.086		-0.915***	-0.995***
		(0.151)	(0.149)		(0.155)	(0.152)
Observations	495,492	495,492	495,492	669,492	669,492	669,492
R-square	0.808	0.808	0.808	0.724	0.724	0.724
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables $\ln va_{fcjt}$ in columns (1) to (3) are the domestic sales of firms, and in columns (1) to (3) are the domestic purchase value of firms. The independent variables $\ln \text{tariff}_{ft}^{EXP}$ and $\ln \text{tariff}_{ft}^{IMP}$ are the average export tariff(logged) and the average import tariff(logged), respectively. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the city level.

Table B.2: Baseline Regression Results of Intermediates Suppliers

Dep. Var.(logged):	(1) total value	(2) number of firms	(3) number of varieties	(4) avg. value per firm	(5) avg. value per variety
$\ln \text{tariff}_{ft}^{EXP}$	0.229***	0.183***	0.047	0.663***	-0.434***
	(0.084)	(0.069)	(0.040)	(0.082)	(0.087)
$\ln \text{tariff}_{ft}^{IMP}$	-0.078	0.082	-0.160**	0.241	-0.319***
	(0.187)	(0.179)	(0.078)	(0.189)	(0.103)
Observations	493,106	493,106	493,106	493,106	493,106
R-square	0.807	0.854	0.780	0.736	0.773
Firm FE	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018 and the sample is limited to intermediates suppliers. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (5) are the domestic sales of firms(logged), the number of firms(logged), the average domestic sales per firm(logged), the number of varieties(logged), and the average domestic sales value per variety(logged). The independent variables across all columns are the average export tariff(logged) and average import tariff(logged). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table B.3: Baseline Regression Results of Raw Material Suppliers

Dep. Var.(logged):	(1) total value	(2) number of firms	(3) number of varieties	(4) avg. value per firm	(5) avg. value per variety
$\ln \text{tariff}_{ft}^{EXP}$	-3.964***	-2.241***	-1.723*	-2.272*	-1.692
	(1.062)	(0.639)	(1.024)	(1.250)	(1.345)
$\ln \text{tariff}_{ft}^{IMP}$	-1.965	-1.385	-0.581	-2.318	0.353
	(4.188)	(1.243)	(3.178)	(2.178)	(2.437)
Observations	2,000	2,000	2,000	2,000	2,000
R-square	0.866	0.830	0.880	0.787	0.869
Firm FE	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018 and the sample is limited to raw material suppliers. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (5) are the domestic sales of firms(logged), the number of firms(logged), the average domestic sales per firm(logged), the number of varieties(logged), and the average domestic sales value per variety(logged). The independent variables across all columns are the average export tariff(logged) and average import tariff(logged). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table B.4: Baseline Regression Results of Intermediates Buyers

Dep. Var.(logged):	(1) total value	(2) number of firms	(3) number of varieties	(4) avg. value per firm	(5) avg. value per variety
$\ln \text{tariff}_{ft}^{EXP}$	-0.412***	-0.145***	-0.266***	0.010	-0.421***
	(0.081)	(0.052)	(0.049)	(0.052)	(0.049)
$\ln \text{tariff}_{ft}^{IMP}$	-1.001***	-0.366***	-0.635***	-0.105	-0.896***
	(0.299)	(0.132)	(0.182)	(0.117)	(0.208)
Observations	664,883	664,883	664,883	664,883	664,883
R-square	0.724	0.819	0.621	0.798	0.614
Firm FE	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018 and the sample is limited to intermediates buyers. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (5) are the domestic purchase value of firms(logged), the number of firms(logged), the average domestic purchase value per firm(logged), the number of varieties(logged), and the average domestic purchase value per variety(logged). The independent variables across all columns are the average export tariff(logged) and average import tariff(logged). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table B.5: Baseline Regression Results of Final Goods Buyers

Dep. Var.(logged):	(1) total value	(2) number of firms	(3) number of varieties	(4) avg. value per firm	(5) avg. value per variety
$\ln \text{tariff}_{ft}^{EXP}$	0.392	0.271	0.121	0.071	0.321
	(0.562)	(0.438)	(0.622)	(0.436)	(0.649)
$\ln \text{tariff}_{ft}^{IMP}$	-0.644	-0.310	-0.334	-0.504	-0.140
	(1.857)	(0.595)	(1.969)	(0.570)	(1.765)
Observations	4,202	4,202	4,202	4,202	4,202
R-square	0.755	0.781	0.725	0.762	0.723
Firm FE	Yes	Yes	Yes	Yes	Yes
City-Quarter FE	Yes	Yes	Yes	Yes	Yes
Industry-Quarter FE	Yes	Yes	Yes	Yes	Yes

Notes: The sample period starts from Q1 2017 to Q4 2018 and the sample is limited to final goods buyers. All columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables in columns (1) to (5) are the domestic purchase value of firms(logged), the number of firms(logged), the average domestic purchase value per firm(logged), the number of varieties(logged), and the average domestic purchase value per variety(logged). The independent variables across all columns are the average export tariff(logged) and average import tariff(logged). *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.

Table B.6: Heterogeneity Analysis of Export Scale

Dep. Var.: ln va	Export value (1)	Avg. export value (2)
$\ln \text{tariff}_{ft}^{EXP}$	1.356***	2.309***
	(0.195)	(0.227)
$\ln \text{tariff}_{ft}^{IMP}$	0.305*	0.348*
	(0.183)	(0.183)
$\ln \text{tariff}_{ft}^{EXP} \times \ln \text{exp}_f$	-0.076***	
	(0.012)	
$\ln \text{tariff}_{ft}^{EXP} \times \ln \text{avgexp}_f$		-0.169***
		(0.017)
Observations	400,678	400,678
R-square	0.806	0.806
Firm FE	Yes	Yes
City-Quarter FE	Yes	Yes
Industry-Quarter FE	Yes	Yes

Notes: The export data is sourced from China Customs data for the year 2016. The sample period starts from Q1 2017 to Q4 2018. Both columns include firm fixed effects, city-quarter fixed effects, and industry-quarter fixed effects. The dependent variables are the domestic sales of firms(logged). The independent variables in columns (1) and (2) are the interaction terms of average export tariff(logged) with export value(logged), and the interaction terms of average export(logged) tariff with average export value(logged), respectively. *** indicates significance at the 1% level, ** at the 5% level, and * at the 10% level. Stand errors of all regressions are clustered at the industry level.