The Impacts of the U.S. Trade War on Chinese Exporters*

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Abstract

This paper studies the impacts of the 2018 U.S. tariff surges on export prices and adjustments of sales across different markets of Chinese exporters. The finding that U.S. tariffs did not affect the free-on-board price of Chinese exports is robust to controlling for firm-related fixed effects. While firms' exports to the U.S. dropped significantly, exports to the E.U. increased moderately and domestic sales or exports to other foreign markets were barely affected. Finally, by surveying managers of exporting firms, we shed light on potential impediments to firms' adjustments of export prices and sales.

Key words: trade war, tariff incidence, within-firm adjustments, trade barriers

JEL Codes: F14, F13.

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1 Introduction

The Trump administration's aggressive approach towards the United States' trading partners marked a return to protectionism that reversed the several decades' long trend of global trade liberalization. In 2018, the U.S. government launched trade wars with many countries (c.f. Table 1 of Fajgelbaum et al., 2020), among which China was a major target. The three rounds of tariffs that were enacted increased tariff rates by 25 percentage points (pp.) on $50 billion worth of commodities and by 10 pp. on $200 billion worth of commodities imported from China. Studying the responses of Chinese exporters to the U.S. tariff hikes is vital for understanding the consequence of the trade war between the two largest economies in the world and making informed policy decisions going forward. This paper uses firm-product-level export and firm-level domestic sales data to investigate the responses of export prices and sales to tariff shocks among different markets of Chinese exporters.

We use proprietary data that cover all firms that exported to foreign countries in a Chinese prefecture-level city from January 2013 to April 2019. As shown in Figure A1 in the Online Appendix, the exports of our sample city evolved at a similar pace as that of the whole country. For the majority of our analysis, we restrict our sample to January 2017 - April 2019 to study the impacts of the 2018 trade war. In particular, we obtain two datasets from the local government: (1) daily transaction-level export data for each harmonized system (HS) 10-digit commodity exported by each firm to each country/region, and (2) monthly firm-level domestic sales data. The two datasets are merged using a unique anonymized firm identifier. This provides us with a unique advantage to study how firms adjusted sales in both domestic and various foreign markets in response to the U.S. tariff shocks.

We begin by using transaction-level export data to study the impacts of tariff rates on the value, volume, and free-on-board (f.o.b.) price of exports and find that Chinese exports to the U.S. fell gradually yet significantly after the U.S. tariff surges. This reduction was entirely driven by the adjustments of export volume. The f.o.b. export price, however, barely changed, which is consistent with the findings of a complete passthrough of tariff rates on U.S. consumers during the 2018

trade war as documented by Fajgelbaum et al. (2020), Amiti et al. (2019), Cavallo et al. (2021). With the benefit of firm-transaction-level export data, we show that the complete passthrough result is robust to controlling for firm-related factors. This implies that even after accounting for the possible entry and exit of exports at various levels (i.e. firm, firm-commodity, firm-country, and firm-commodity-country levels), the f.o.b. export price is unaffected by the tariff rate.

Because firms are the ultimate decision-makers regarding who responds to tariff surges, studying the adjustments at the firm level is crucial for understanding the impact of tariffs. Using export sales and monthly total domestic sales information matched at the firm level, we analyze the adjustments of firm-level sales across different markets. We find that the firm-level tariff increases induced by the surges in U.S. tariffs significantly reduced exports to the U.S., mildly increased exports to non-U.S. countries as a whole, and had little impact on firms' domestic sales. As a result, the impacts on firms' total exports and total sales were driven by reduced exports to the U.S. We estimate that as the firm-level tariff-inclusive price increased by one percent, exports to the U.S. on average decreased by 4.16%, exports to non-U.S. countries as a whole increased mildly by 0.97%, total exports decreased by 0.83%, domestic sales barely changed, and total sales decreased by 0.63%. By dividing foreign markets into several groups, we find that exports to the European Union market increased moderately.

To better understand what factors may have underlain firms' adjustments of sales and export prices, we complement our regression results with a survey of managers from 600 exporting firms in our sample city. Among those factors that are potential impediments to reducing export prices, an exporting firm's low profit margin is widely recognized as the dominant one. Among the factors that may prevent firms from adjusting sales across different markets in response to the U.S. tariff surge, a lack of sales channels and sales network is regarded as the dominant one. However, other factors, such as different product standards, lack of brand awareness, concern about a low collection rate, or an insufficient market scale are also recognized as important impediments to firms' adjustments of sales across different markets.

Contributions to the literature. First, this paper contributes to a burgeoning literature that studies the impact of trade wars initiated by the Trump administration. While previous papers have mainly focused on the impacts on the U.S.,[1] we analyze the consequences for China, which would help provide a more complete study of the costs of the trade war.[2] Among the few papers that study the impacts on China, Benguria et al. (2020) examine the impacts on Chinese listed firms' investments, R&D, and profits. Huang et al. (2018) study the impacts on the stock price of listed firms in both China and the U.S. By contrast, we study the impacts on export prices and adjustments of sales across different markets for Chinese exporters.

Second, this paper contributes to the literature that studies the tariff incidence.[3] We find that Chinese export prices did not change in response to U.S. tariff surges during the 2018 trade war,

[1]Fajgelbaum et al. (2020) find that, following U.S. tariff increases, imports declined significantly and the tariff burden fell completely on U.S. domestic consumers. Similarly, Amiti et al. (2019) and Cavallo et al. (2021) show that the U.S. tariffs were almost entirely borne by U.S. importers. Amiti et al. (2020) study the impact of the trade war on U.S. investment. In addition to a direct impact, Handley et al. (2020) find that U.S. exporters who relied on Chinese inputs suffered a loss in their exports through a supply chain channel. Waugh (2019) emphasizes the impact of China's retaliatory tariffs on U.S. consumption and provides evidence that U.S. counties in the upper quartile of the retaliatory-tariff distribution exhibited a 3.8 percentage point decline in consumption growth. Blanchard et al. (2019) study the political consequence of China's retaliation and argue that the U.S.-China trade war resulted in Republicans losing 5 seats in the House of Representatives.

[2]Relatedly, Jeanne and Son (2020) study the effects of the trade war on exchange rates and the extent to which tariffs are offset by the renminbi depreciation against the U.S. dollar.

[3]See Huber (1971), Feenstra (1989), Winkelmann and Winkelmann (1998), Bernhofen and Brown (2004), Trefler (2004), Broda et al. (2008), Marchand (2012), Han et al. (2016), Ludema and Yu (2016), Bai and Stumpner (2019), Irwin (2019), Jaravel and Sager (2019), Flaaen et al. (2020) for a literature on the incidence of tariffs.

which is consistent with the complete passthrough results documented by Fajgelbaum et al. (2020), Amiti et al. (2019), and Cavallo et al. (2021). We further confirm that this result is robust to controlling for firm-related factors. In addition, we complement our empirical findings with a survey of firm managers to understand the potential factors that may underlie firms' adjustments of export prices. Relatedly, Fajgelbaum and Khandelwal (2022) summarize estimates from the tariff-passthrough literature and discuss several possible explanations for the complete passthrough findings during the U.S.-China trade war period.

Third, this paper contributes to a growing literature on firms' adjustments of production and sales across different markets in response to various shocks.[4] Almunia et al. (2021) find that Spanish firms increased exports to foreign markets in response to domestic negative demand shocks. Berman et al. (2015) examine how exporters' domestic sales respond to foreign sales changes. By contrast, we study the impacts of tariff shocks in a foreign market (the U.S.) on firms' sales in both domestic and other foreign markets. Flaaen et al. (2020) examine the impact of U.S. trade policy shocks on imports of a particular product (i.e. washing machine) and argue that multinationals respond by changing production locations across countries. Instead, we study the impacts of tariff shocks on all exporting products of firms and study the sales adjustments of firms across different markets. We also use survey results to help understand potential factors that may underlie firms' adjustments of sales across countries.

The remaining sections of this paper are organized as follows. Section 2 introduces the data and institutional background. Section 3 studies the impacts of tariff rates on exports (price and quantity) and firms' adjustments of sales across different markets. Section 4 provides the survey results to help understand what may underlie firms' responses. Section 5 concludes.

[4]See Horstmann and Markusen (1992), Brainard (1997), Blonigen (2002), Helpman et al. (2004) for a literature on responses of multinational firms to tariff changes.

2 Data and Institutional Background

2.1 Institutional Background

In 2018, the U.S. government launched trade wars with many countries, among which China was a major target. In response, China also raised retaliatory tariffs against imports from the U.S., though on a much smaller scale in terms of trade values, given the large bilateral trade imbalance between the two countries.

The U.S. tariff hikes on Chinese exports during January 2017 - April 2019 consisted of three rounds. The first round, announced on June 15, 2018 and enforced on July 6, 2018, covered approximately $34 billion worth of commodities imported from China with tariff rates increasing by 25 percentage points. The second round, announced on August 7, 2018 and enforced on August 23, 2018, covered approximately $16 billion worth of commodities with tariff rates increasing by 25 pp. The third round, announced on July 10, 2018 and enforced on September 18, 2018, covered approximately $200 billion worth of commodities with tariff rates increasing by 10 pp. The time between the announcement and enforcement dates was quite short, leaving firms inadequate time to make sufficient adjustments to exports, for which we show evidence in our analysis.

2.2 Data on Trade and Sales of Firms

Our proprietary data cover all Chinese firms (around 20,000 firms, the number is rounded for disclosure avoidance) that export to foreign countries in a prefecture-level city from January 2013 to April 2019. Our sample city is a coastal city located in the eastern region of mainland China (this broad region includes Shanghai, Jiangsu, Zhejiang, Anhui, Jiangxi, Fujian, and Shandong), with a population falling in the range of 5-10 million. For the majority of our analysis, we restrict our sample to January 2017 - April 2019 to study the impact of the 2018 trade war.

We obtain two major datasets from the local government: (1) daily transaction-level export data for each harmonized system (HS) 10-digit (the finest product level) commodity exported by each firm to each country, which are recorded in the customs declaration for export, and (2) firm-level

domestic sales data, which are reported monthly as part of the corporate VAT (value-added tax) taxpayer's return. Note that all firms (including exporters) that are legally registered are required by the law to file the VAT forms. The two datasets are merged using a unique anonymized firm identifier. This combined dataset provides us with a unique opportunity to study the responses of firms' exports and domestic sales to the U.S. tariff shocks. This is in contrast to recent papers (e.g. Fajgelbaum et al., 2020; Amiti et al., 2019) which use product-level aggregate export data that lack firm information to study the impacts of the trade war. For each export transaction, we know its value (in current U.S. dollar), its quantity (in units), the HS 10-digit code for the exporting commodity, the exporting destination (country level), the exporting date, and a unique identifier for the firm that exports the commodity. At the firm level, we also have information on a firm's profit margin (ratio of net profit to total sales), which are reported quarterly as part of the corporate income tax return. But we do not have data on firms' employment or investment. Therefore, our analysis mainly focuses on firms' responses in export price and sales.

Table 1 provides summary statistics of industry, ownership, and firm type of all firms in our data. Firms are classified as direct exporters or trade intermediaries when they are registered. Among all firms in our sample, 49.15% are direct exporters and 50.85% are trade intermediaries.[5] Firms are mainly concentrated in two industries: manufacturing (49.51%) and wholesale & retail (48.92%). Direct exporters are concentrated (98%) in the manufacturing industry and trade intermediaries are concentrated (96%) in the wholesale & retail industry. In terms of ownership structure, 87.43% of firms are established as domestic private firms, 12.19% as foreign-invested firms, and the proportion of sole-proprietorships and state-owned firms is negligible. The negligible fraction of SOEs in our sample is consistent with the fact that private businesses are more prosperous in East China, as opposed to other regions in China. Table 2 reports exports and sales of firms in our data in 2017. The table shows exports to the U.S., exports to non-U.S. destinations,

[5]Direct exporters refer to firms that mainly export products produced by themselves, while trade intermediaries (or indirect exporters) refer to firms that mainly export products produced by other firms. Ahn et al. (2011) provide a comprehensive analysis of trade intermediaries in China.

total exports (exports to the U.S. plus exports to non-U.S.), domestic sales, and total sales (total exports plus domestic sales), all in current millions of U.S. dollars. As evidenced by the standard deviations of these variables, there are large variations in exports and sales among firms. Because these values typically follow log-normal distributions, we use log values in our analyses.

Data representativeness. While our data are from a prefecture-level city, its exports are nonetheless a reasonable representation of the exports of the whole country. Figure A1 in the Online Appendix shows that the log of total exports and the log of exports to the U.S. of our sample city evolve at a similar pace over time with those of the entire country.[6] Figure A2 in the Online Appendix compares the log export values to the U.S. of our sample city with those of the whole country at the HS 4-digit level. The figure again demonstrates that exports to the U.S. of our sample city are in line with those of the whole country.[7]

2.3 Tariff Data

We obtain tariff data from the World Integrated Trade System (WITS) at the country-product (HS 6-digit) level. The annual average import MFN (most favored nation status) tariff rates at the HS 6-digit level during 2013-2018 are assigned to the Chinese 10-digit commodities. For 2019 tariff rates in non-U.S. countries, we carry forward the 2018 values for each country-commodity cell.[8]

[6]Figure A3 in the Online Appendix compares the log export values to the U.S. of our sample city with those of the whole country for different groups of exported products. We divide all exported products into two groups based on whether they were included in the Chinese product lists that were subject to the three rounds of U.S. tariff hikes. We show that for each group of exported products, the exports of our sample city evolve at a similar pace with those of China's aggregate exports.

[7]While we use 2016 data to conduct this cross-sectional analysis, our results are robust to using other years.

[8]While the WITS has not updated tariff data for 2019, the WTO Tariff Database has done so. We obtain very similar estimates using the tariff rates obtained in the WTO Tariff Database. We

The commodity-level U.S. tariff rates are adjusted using the Chinese product lists that were subject to the 3 rounds of U.S. tariff hikes. In particular, the tariff rates before the trade war (July 2018) are assigned using the WITS HS 6-digit level MFN tariff rates.[9] For months after the trade war, the commodity-level tariff rates are calculated as the pre-trade war tariff rates plus the increase in tariff rates caused by each round of U.S. tariff hikes.[10]

Figure 1 compares the evolution of tariff rates imposed on Chinese exports by the U.S. with those by other countries. The time series shows the average tariff rates, with weights corresponding to the export value of each commodity in the current month in our sample. As illustrated in the figure, there is a distinct jump in average tariff rates caused by the trade war. The U.S. average tariff rates on all Chinese commodities were around 3 pp. before the trade war and were around 10 pp. after the trade war. This differs from the steady average tariff rates of non-U.S. countries, which only slightly decreased from 7 pp. to 6 pp. from 2013 to April 2019.

3 The Impacts of Tariff Rates

3.1 Impacts on Exports: Commodity-Country-Level Analysis

An event-study analysis. We begin with an event-study analysis to examine the impacts of the trade war on exports at the commodity-country level. We aggregate exports of each commodity from all firms to each country (more precisely, each exporting destination) over each month. The

obtain very similar estimates because there were no significant tariff changes among China's major trading partners during our study period other than the U.S. Because the WITS dataset offers much more comprehensive coverage of tariff rates for countries and commodities, we use it as our source for tariff rates across countries.

[9]The 2018 tariff rates are carried forward using the 2017 tariff rates because the tariff surges occurred amid 2018.

[10]In this process, we compile a list of Chinese HS 10-digit products corresponding to the three rounds of U.S. tariff hikes.

treatment group consists of commodities exported to the U.S. that were included in the list from the three rounds of tariffs. The control group consists of the rest. The event-study analysis is based on the following specification:

$$ln(y_{gct}) = \sum \beta_m EventTime_m \times Treat_{ct} + \gamma_{ct} + \gamma_{gc} + \gamma_{gt} + \varepsilon_{gct}, \quad (1)$$

where y_{gct} is a measure of exports of commodity g to country c in month t. In different regressions, y_{gct} can be the value, quantity (in units) or price (per unit) of exports.[11] $Treat_{ct}$ is a dummy variable equal to one if c is the U.S. and g is a commodity included in the three rounds of U.S. tariff hikes. The event month is marked by the month when a specific commodity experiences a tariff increase due to the three rounds of U.S. tariff hikes. The event time m is the month relative to the event month.

Country-month FE γ_{ct} controls for time-varying demand factors of a destination country that are common to all Chinese commodities. Commodity-country FE γ_{gc} controls for the lasting preference of a destination country for each Chinese commodity. Commodity-month FE γ_{gt} controls for commodity-varying and time-varying factors that are common to all exporting destinations.

Figure 2 presents the event-study results. Panel (a) shows that before the tariff changes, the treatment group and the control group shared parallel trends, while after the tariff increases, exports of the treatment group gradually decreased compared to those of the control group. We estimate that six months after the tariff surges, exports on average decreased by 13%.

We then examine the impact of tariff rates on export prices. Papers studying the recent U.S. trade war (Amiti et al., 2019; Fajgelbaum et al., 2020; Cavallo et al., 2021) have all found that the tariff increases were completely passed onto U.S. domestic consumers and had no impact on the free-on-board export prices. The results shown in Panel (b) of Figure 2 are consistent with this complete passthrough result as it shows that the export price per unit remained almost unchanged

[11] Since units are mostly uniform within the 10-digit commodity level, examining the impacts on the export quantity and the price per unit is meaningful.

aside from the month when the tariff surged. Together, these results suggest that changes in the value of exports were mostly driven by changes in the quantity of export, and we confirm this in Panel (c). From Panel (c), there seems to be no clear evidence that firms increased exports prior to the increases in tariff rates. This is probably because the enforcement of the tariff increases happened soon after the announcement, leaving firms little time to make sufficient adjustments.

Impacts of tariff rates. In the event-study analysis, we did not distinguish among the potentially different impacts of the three rounds of tariff adjustments. However, since the increase in tariff rates for the $16 billion and the $34 billion rounds was 25 pp. while that for the $200 billion round was only 10 pp., they may have had different impacts. To see how tariff rates affect exports, we use the following regression specification:

$$ln(y_{gct}) = \beta ln(1+\tau_{gct}) + \gamma_{ct} + \gamma_{gc} + \gamma_{gt} + \varepsilon_{gct}, \tag{2}$$

where τ_{gct} is the tariff rate for exported product g imposed by country c at time t.

Column 1 of Table 3 shows that the elasticity of the export value with respect to the tariff-inclusive price is -0.46. Column 2 shows that the export price was entirely unresponsive to the tariff rate, which again confirms the complete passthrough result. Column 3 shows that the elasticity of the export quantity with respect to the tariff-inclusive price is -0.47. Based on the dynamic impacts on exports as shown in Figure 2, for the initial months after the trade war, the impact is close to zero, which implies a short-run elasticity around zero. Six months after the trade war, exports on average decreased by 13%. Since Figure 1 shows that the average tariff rates increased from around 3 pp. before the trade war to around 10 pp. after the trade war, we obtain the implied longer-run (six months after the tariff) elasticity of -1.98 ($=\frac{-0.13}{ln(1.1)-ln(1.03)}$). Consistent with our event-study evidence, we find that the response of exports was entirely driven by the adjustments in the export quantity and not the export price.[12]

[12]In Online Appendix A, we compare our estimates with those in Fajgelbaum et al. (2020), who also document a complete passthrough result. However, we obtain different point estimates of

In Online Appendix D, we redo the main analysis using Chinese national aggregate HS8 level export data and extend our analysis to the end of 2019, which accounts for the May 2019 and the September 2019 wave tariff adjustments. Table A6 shows the regression results of the tariff effects on exports. Restricting the sample period to Jan 2017 - April 2019, columns 1-3 show results quite similar to Table 3, suggesting that our data are quite representative of the national response. Expanding the study period to December 2019, columns 4-6 show larger elasticities, suggesting that longer-run responses are larger than short-run responses. Importantly, the complete passthrough result still holds for the extended data period.

Overall, our evidence is consistent with the complete passthrough results documented in recent papers that have also studied the impact of the recent trade wars initiated by the U.S. Like prior work, our analysis thus far has been conducted at the commodity-country level. However, it is possible that after controlling for potential entry and exit effects at the firm level, we can observe export prices being adjusted. For example, in response to higher tariffs, for firms that export the same commodity, those with low markup ratios may stop exporting, while those with higher markup ratios will continue exporting but reduce export prices. In this case, despite observing a complete passthrough result at the commodity-country level, we could still observe price adjustments after accounting for potential entry and exit effects. In the following section, we account for firm-related factors to re-examine the impacts of tariff rates.

3.2 Impacts on Exports: Accounting for Firm-Related Factors

We conduct a firm-commodity-country-level analysis by estimating the following regression specification:

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the impact on exports, which is likely caused by our sample difference and different comparison groups. In particular, while their estimates reflect the average response of all countries exporting to the U.S., our estimates reflect the average response of exports to all foreign countries from our Chinese sample city.

$$ln(y_{fgct}) = \beta ln(1+\tau_{gct}) + \gamma_{ct} + \gamma_{gc} + \gamma_{gt} + Firm - related\,FEs + \varepsilon_{fgct}, \quad (3)$$

where y_{fgct} can be export value, price, or quantity of commodity g by firm f to country c at time t. To control for additional firm-related confounding factors, in different specifications we further include firm FE, firm-commodity FE, firm-country FE, and firm-commodity-country FE. They are used to control for potential entry and exit at the firm, firm-commodity, firm-country, and firm-commodity-country levels. Standard errors are clustered at the HS-8 commodity level.

The regression results are presented in Table 4 and the corresponding elasticities are also reported. Focusing on panel A which studies the impact on export values, the regression in column 1 only includes γ_{ct}, γ_{gc}, γ_{gt} and does not include any firm-related factors.[13] In column 2, we further include firm FE, which controls for potential entry and exit effects at the firm level. In column 3, we control for potential entry and exit at the firm-commodity and at the firm-country levels. In column 4, we control for potential entry and exit at the firm-commodity-country level. Column 5 controls for the most stringent possible set of fixed effects, i.e. firm-commodity-country level, firm-country-time level, and firm-commodity-time level. Our estimates are quite robust to controlling for these firm-related confounding factors, which suggests that potential entry and exit at these levels are not driving our estimates.

Importantly, the complete passthrough result remains robust to controlling for these firm-related factors, implying that even after accounting for the possible entry and exit of exports at various levels, free-on-board export prices are unaffected by tariff rates.

[13]The quantitative estimates of responses in exports at the firm-commodity-country-level are smaller than those at the commodity-country-level. This is because the firm-commodity-country-level analysis only reflects the average responses of exports to tariff changes within firm-commodity-country-level cells, while the commodity-country-level analysis also reflects the extensive margin responses to tariff changes at the firm-commodity-country-level.

3.3 Impacts on Firm-Level Sales in Different Markets

Because firms are the decision units underlying the responses to tariff surges, studying the adjustments at the firm level is crucial for understanding the impacts of tariffs. We therefore use firm-level data to examine whether Chinese firms increased exports to other countries or sales in their domestic market in response to U.S. tariff surges.

Specification. The purpose of this analysis is to examine how the U.S. tariff surges, by affecting firm-level average tariff rates, resulted in firms' adjustments of sales in different markets. We consider the following regression specification:

$$ln(y_{ft}) = \beta ln(1+\widehat{\tau_{ft}}) + \gamma_t + \gamma_f + \varepsilon_{ft}, \tag{4}$$

where y_{ft} for different regressions take on the value of exports to the U.S., exports to non-U.S. countries as a whole, total exports, domestic sales, and total sales of firm f at time t.[14] $\widehat{\tau_{ft}} \equiv \sum_{g,c} \tau_{gct} w_{fgc0}$. w_{fgc0} is firm f's export value of product g to country c as a share of firm f's total export value at the initial time. By construction, $\sum_{g,c} w_{fgc0} = 1$ for any firm f. τ_{gct} is the tariff rate for product g imposed by country c at time t. The idea is to exploit the exogenous changes of tariff rates imposed by foreign countries while maintaining a stable composition of exports for each firm over time. We use 2014-2016 as the initial time period to avoid having too many missing observations as would occur when restricting it to a shorter time (e.g. only use 2016). But using other choices of initial time periods generates similar results. The parameter of interest β measures the elasticity of y_{ft} with respect to the firm-level average tariff-inclusive price. γ_t is time FE and γ_f is firm FE.

Impacts on exports and sales. Table 5 shows the results. Column 1 shows that tariff shocks significantly reduced firms' exports to the U.S. As the firm-level tariff-inclusive price increased

[14] In the firm-level regressions, we follow the literature to use the inverse of the hyperbolic sine transformation (i.e. $ln[x+(x^2+1)^{0.5}]$) to deal with potential zero values for y_{ft}.

by one percent, exports to the U.S. on average decreased by 4.16%. While Almunia et al. (2021) found evidence that a negative shock on domestic demand drove Spanish firms to export more, Table 5 shows that exports to non-U.S. countries as a whole increased mildly (and noisily) by 0.97% (column 2) and there is little evidence that Chinese firms increased their domestic sales as a response to U.S. tariff surges (column 4). This suggests a weak substitution between different markets for firms in our sample. One potential reason for this discrepancy is the different extents of frictions (e.g. market barriers) faced by firms when they tried to adjust sales across different markets. While the Spanish firms studied in Almunia et al. (2021) operated under an integrated European market and therefore, faced small barriers to adjusting sales between domestic and foreign markets in the E.U., Chinese firms might have faced larger barriers to adjusting sales across countries. For example, some products are produced to satisfy certain standards within specific markets (e.g. for medical masks, there are the U.S. standard N95, the Chinese standard KN95, and the European standard FFP2), which can result in an imperfect substitution between different markets. In addition, because our analysis focuses on a relatively short period after the trade shock, firms may not have been flexible enough to adjust their production of commodities to conform with standards across different markets.

As a result, export sales (exports to the U.S. plus exports to non-U.S. markets) and total sales (export sales plus domestic sales) dropped significantly.[15] In particular, as the firm-level tariff-inclusive price increased by one percent, firms' total exports on average decreased by 0.83% (column 3 of Table 5) and total sales decreased by 0.63% (column 5 Table 5).[16]

[15]While Fajgelbaum et al. (2021) also find a modest and noisy increase in exports to the rest of the world due to the trade war, they find China's global exports remained statistically unchanged. This difference may be driven by the difference in the sample, horizon, identification strategy, and specifications.

[16]As shown in Table A2, trade intermediaries and direct exporters experienced similar decreases in exports to the U.S. Domestic sales of both types of firms did not change. One important difference is in their responses of exports to non-U.S. markets. While trade intermediaries showed

In Online Appendix B, we conduct an event-study analysis to illustrate the impact of the trade war on firm-level sales and exports. Firms are divided into treatment and control groups based on whether they experienced exogenous tariff increases during the trade war period. Overall, while the event study is unable to account for the within-group variation of tariff rate changes, it shows a broadly consistent picture with the impacts of tariff rates on exports and sales of firms.

Impact on profitability. Using the profit margin (ratio of net profit to total sales) as the dependent variable in equation 4, we study the impact of tariffs on firms' profitability. We winsorize the top and bottom 1% values to avoid estimates driven by extreme values. Column 6 of Table 5 shows that on average, as the firm-level tariff-inclusive price increased by one percent, firms' profit margin would be reduced by 0.35 pp. Given that the average profit margin of all firms was -0.06 (i.e. -6 pp.) throughout our sample period, the U.S. tariff surges further deteriorated the business environment for those already struggling Chinese exporting firms.

The fact that prices barely responded to tariffs does not contradict with the drop in the profit margin. There are at least two possible explanations for this. First, when there exist nontrivial fixed costs and a fixed marginal cost, shrinking sales with unchanged prices immediately imply a drop in the profit margin.[17] Second, if the markup for exports to the U.S. is higher than that to other destinations, the compositional shift of sales from the U.S. market to other markets could also help explain the drop in the profit margin.[18]

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little tendency to adjust exports to non-U.S. markets, direct exporters exhibited some tendency to increase exports to non-U.S. markets. This export-diversion effect partially offsets the negative effect on exports to the U.S. As a result, direct exporters experienced smaller declines in export sales, total sales, and profit margin compared to trade intermediaries.

[17]Denote price by P, sales quantity by Q, marginal cost of production by c, fixed cost by FC. Then net profit=PQ-cQ-FC and total sales revenue=PQ. Then profit margin= net profit/total sales revenue=(P-c)/P-FC/(PQ). Suppose the marginal cost is also fixed. Then our finding that increased tariffs leave P unchanged and Q decreased immediately implies a decreased profit margin.

[18]Unfortunately, our data do not enable us to test whether the markup for exports to the U.S. is

Adjustments of sales in finer-divided markets. We explore potential heterogeneity among the responses of sales in finer-divided markets by estimating the following specification:

$$ln(y_{fct}) = \sum \beta_d \cdot I_d \cdot ln(1+\widehat{\tau_{ft}}) + \gamma_{fc} + \gamma_{ct} + \varepsilon_{fct}. \quad (5)$$

where y_{fct} is the value of sales in country c (which includes exports to each foreign country and domestic sales) by firm f in month t. I_d is an indicator variable denoting whether c belongs to a destination group d. The parameter of interest is β_d, which reflects the response of sales in destination d driven by the firm-level exogenous tariff shock $\widehat{\tau_{ft}}$. The standard errors are clustered at the firm-country level.

We consider a set of major exporting destinations for mainland China: (0) the United States (US), (1) the Association of Southeast Asian Nations (ASEAN, which includes Singapore, Brunei, Malaysia, Thailand, Phillippines, Indonesia, Vietnam, Laos, Myanmar, and Cambodia), (2) the European Union (EU, which includes the UK because our study period is before Brexit), (3) Japan and Korea (JK), (4) Hong Kong, Taiwan, and Macau (HTM), and (5) the rest of the world (ROW). These major trading partners of mainland China are divided into groups with similar levels of tariff rates and geographical locations within each group (except for the ROW). Table A4 reports the share of export value of firms in our sample city to these destinations during our study period (January 2017-April 2019). The shares of exports to US, ASEAN, EU, JK, HTM, ROW are 23.31%, 7.54%, 27.51%, 6.69%, 2.66%, and 32.29%, respectively.

Recall that in Table 5, we observed evidence that exports to non-U.S. countries as a whole increased mildly in response to the U.S. tariff shock. By decomposing exporting destinations into different groups, our regression results in Table 6 show that exports to the European Union increased moderately (and statistically significantly), which partially offsets the negative impact

higher than that to other markets. In particular, we only have information on the total cost of a firm, which does not allow us to differentiate the cost in different markets. Moreover, for domestic sales, we only know the total sales revenue but do not have separate quantity and price information.

on exports to the U.S. for Chinese exporters. By contrast, there is no evidence that Chinese exports to other destinations changed.[19]

Why did Chinese exports to the E.U. increase while exports to other markets barely changed? One possibility is that due to substantial adjustment costs of diverting exports from one market (the U.S.) to another, firms may tend to increase exports to a large enough market with similar demands for imported goods. We find some evidence to support this conjecture. First, the E.U. market is large enough to absorb a large fraction of exports that would have been sent to the U.S. Table A4 shows that the E.U. is the only major foreign market (ignoring the highly heterogeneous "rest of the world" group) with a size comparable to that of the U.S. Second, we test whether the similarity of goods exported to the U.S. and to the E.U. is a potential driver of our empirical results by constructing an overlapping ratio $OR_{d,US} = \frac{\#(\{g_d\} \cap \{g_{US}\})}{\#(\{g_d\} \cup \{g_{US}\})}$. $\{g_d\}$ denotes the set of commodities exported by Chinese firms to a destination group $d \in \{ASEAN, EU, JK, HTM, ROW\}$. $\#(\{g_d\} \cap \{g_{US}\})$ denotes the number of commodities (e.g. at the HS 10-digit level) exported by Chinese firms both to destination g and to the U.S. $\#(\{g_d\} \cup \{g_{US}\})$ denotes the number of commodities (at various HS levels) exported by Chinese firms to destination g or to the U.S. Our overlapping ratio $OR_{d,US}$ then measures the extent to which goods exported from China to the U.S. and to destination d are common. We calculate $OR_{d,US}$ using the export data of our sample city at the initial time (2014-2016). Table A5 shows that $OR_{d,US}$ is larger for the E.U. than for any other destination group, which is true for commodities at the HS 10-digit, 8-digit, and 6-digit levels. This finding suggests that the E.U. shares the most similar demand for Chinese commodities with the U.S.

[19]Here we focus on the impacts on sales values across different markets. In Online Appendix C, we show that the impacts of U.S. tariffs on export prices to non-U.S. destinations are close to zero. One exception is that export prices to the E.U. market decreased significantly (statistically though not economically).

4 Understanding Firms' Responses Based on a Survey

In this section, we complement our regression results with a survey of managers from 600 exporting firms in our sample city to better understand the factors that may have affected firms' adjustments of sales and export prices. The survey was conducted via government communication (WeChat) groups with exporting firms in the sample city. Firms in different regions of the sample city are grouped within each communication group. The government then randomly chooses several groups and asks all exporting firms within these groups to complete the survey form that we helped design. Since the choice of regions is randomized, from an ex ante perspective, the survey is representative of the sample city. Since the survey asks what range firms' annual total sales revenues fall into, we can compare our administrative data with survey data on firms' revenues. Table A7 compares the distribution of firms' revenues between the administrative data and the survey data. It shows that survey firms are largely comparable to firms in the administrative data except that small firms are slightly underrepresented in the survey. The goal of this survey is to seek direct explanations from relevant decision-makers on what factors prevent firms from adjusting sales across different markets and export prices after the U.S. tariff hikes. The options for each question are proposed based on preliminary interviews and pilot surveys with selective firm managers.

Impediments to the adjustments of export prices. We show that the complete tariff passthrough result, which has been consistently documented in the recent literature using aggregate-level data (Amiti et al., 2019; Fajgelbaum et al., 2020; Cavallo et al., 2021), is robust to controlling for firm-related fixed effects. However, what remains unclear is why firms do not adjust their export prices.

Panel (A) of Table 7 reveals that most firms (72.2%) do not adjust export prices because the profit margin is too low to allow for further price cuts, which is consistent with the average profit margin of all firms in our data being -0.06 throughout the entire sample period.[20] The survey

[20]Table A8 shows some evidence that firms with negative profits in last quarter face more pressure to adjust prices for different markets facing the U.S. tariff shocks, which is largely consistent

also reveals that 21.1% of firms do not have the flexibility to adjust prices due to contractual agreements. Another 3.8% of firms are unwilling to lower prices in fear of anti-dumping sanctions by U.S. customs. Finally, 2.8% of firms do not find it necessary to reduce prices in response to U.S. tariff surges because they control the pricing power in their market. These considerations taken together lead the exporting firms to not adjust export prices.

Impediments to the adjustments of sales across different markets. Panel (B) of Table 7 shows the impediments firms face to expanding alternative foreign markets in response to U.S. tariff surges. Since respondents can choose more than one option for these two questions, the sum of fractions of all options may exceed 100%. The survey reveals that a lack of sales channels and sales network, which is selected by 59.3% of firms, is regarded as the dominant impediment. Selling in a market requires a proper sales channel and building these channels involves attending exhibitions, placing advertisements, and building and maintaining networks, which takes time and lots of resources. As a result of this time-consuming and costly process, adjustments tend to be gradual and may be small within a short time after the tariff shock.

The other four impediments are almost equally important to each other. 22.9% of firms choose "different product specifications and standards" as a major impediment. Firms need to design and prepare machines to produce products that are compliant with standards in different markets, and adjusting production materials for this takes time and resources. 25.3% of firms regard "lack of brand awareness" as a major impediment, which is reasonable because a famous brand in one market may not be well known in a different market. 25% of firms are concerned about a low collection rate. In practice, firms often sell commodities to their retailers or customers without receiving full payments immediately, which can lead to cash flow risk. 25.3% of firms worry that the market size is not large enough. When economies of scale exist for the adjustments of sales across markets, significant adjustments are more likely to occur when the alternative markets are

with our survey findings.

large enough.

Panel (C) shows the impediments to diverting sales to the domestic market. A lack of sales channels and sales network, selected by 46.6% of firms, is still ranked as the most important impediment. The remaining four options are also selected by over 20% of firms. However, more firms choose "different product specifications and standards" (28.3%), "concern about a low collection rate" (28.9%), and "market size is not big enough" (27.2%) as a major impediment, while slightly fewer firms choose "lack of brand awareness" (23.2%). This result is largely consistent with our intuition. For example, product standards are likely to be a more important concern for diverting sales to the domestic market because of the vast difference in standards between China and the U.S.

5 Conclusion

In this paper, we examine the behavior of export prices and sales across different markets of Chinese exporters in response to the recent U.S. tariff surges. Using firm-product-level export data, we show that the complete tariff passthrough result, which has been consistently documented in the recent literature using aggregate-level data, is robust to controlling for firm-related fixed effects. This robust result suggests that it is unaffected by potential survival biases that may arise from firms' entry and exit decisions. In response to the U.S. tariff shocks, Chinese exporters reduced their exports to the U.S. significantly, which was partly offset by their increased exports to European Union countries. Their exports to the rest of the world and sales in the Chinese domestic market, however, remained unchanged.

Using results from a survey of firm managers, we shed additional light on impediments that firms face when adjusting their sales and export prices. Among all possible factors mentioned in the survey, the low profit margin of exporting firms is perceived as the dominant impediment to reducing export prices. Among the factors that may prevent firms from adjusting sales in different

markets in response to the U.S. tariff surges, a lack of sales channels and sales network is regarded as the dominant impediment. Other factors, such as different product standards, lack of brand awareness, the concern about a low collection rate, or an insufficient market scale, are also regarded as important impediments to firms' adjustments of sales across different markets.

We conclude with some important caveats. First, due to data limitations, we do not examine how Chinese exporters adjust their investments, employment, or financing. Second, we do not consider the role of trade policy uncertainty, as has been explored in Handley and Limao (2017), Benguria et al. (2020), in driving our empirical results. Third, we do not conduct a structural analysis to explore the counterfactual impact of tariff rates or a welfare analysis of the trade war on Chinese exporters. Subsequent research that incorporates these additional dimensions would provide further insights to help us understand the impacts of tariff shocks on firms.

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Table 1: Characteristics of Firms

Firm type	Percent
Direct exporters	49.15
Trade intermediaries	50.85
Total	100
Industry	**Percent**
Manufacturing	49.51
Wholesale & retail	48.92
Others	1.57
Total	100
Ownership	**Percent**
Domestic private firms	87.43
Foreign-invested firms	12.19
Others (Sole proprietorship or state-owned firms)	0.38
Total	100

Notes: Our proprietary data cover all Chinese firms (around 20,000 firms, the number is rounded for disclosure avoidance) that export to foreign countries in a prefecture-level city from January 2013 to April 2019. In our data, for trade intermediaries, on average, exports account for 91% of total sales, while for direct exporters, exports account for 54% of total sales. The direct exporters are mostly (98%) in the manufacturing industry and the trade intermediaries are mostly (96%) in the wholesale & retail industry. Industries other than manufacturing and wholesales & retail include scientific research and technology service industry, rental and business service industry, transportation, warehousing, and post industry, information and software service industry, construction industry, resident service industry, real estate industry, culture, sports, and entertainment industry, farming, forestry, animal husbandry, and fishery industry, power, heat, gas, water production and supply industry, and finance industry. The classification of the industry of each firm is determined when it is registered.

Table 2: Export and Sales of Firms in 2017

	Mean	Sd	Min	Max	P25	Median	P75
Exports to the U.S.	1.08	6.07	0.00	282.35	0.00	0.01	0.30
Exports to non-U.S.	3.74	20.02	0.00	1001.83	0.11	0.59	2.32
Total exports	4.82	24.27	0.00	1284.18	0.19	0.85	3.13
Domestic sales	6.67	81.25	0.00	5011.16	0.00	0.10	1.14
Total sales	11.49	90.05	0.00	5128.64	0.37	1.57	5.26

Notes: All values are in current million U.S. dollars. Total exports equal exports to the U.S. plus exports to non-U.S. Total sales equal total exports plus domestic sales.

Table 3: Impacts of Tariff Rates on Exports: Commodity-Country-Level Regressions

	[1]	[2]	[3]
DV: log of	exports value	export price	export quantity
ln(1+tariff rate)	-0.46***	0.003	-0.47**
	(0.16)	(0.11)	(0.19)
Commodity-Country FE	√	√	√
Commodity-Time FE	√	√	√
Country-Time FE	√	√	√
Observations	1,568,864	1,568,864	1,568,864
Adjusted R-squared	0.70	0.85	0.77

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at HS-8 commodity level are reported in parentheses. To do the commodity-country-level analysis, we aggregate exports of each commodity from all firms to each country in each month.

Table 4: Impacts of Tariff Rates on Exports: Firm-Commodity-Country-Level Regressions

Panel A: Impact on log (exports value)	[1]	[2]	[3]	[4]	[5]
ln(1+tariff rate)	-0.14	-0.20**	-0.13*	-0.16**	-0.16
	(0.09)	(0.08)	(0.07)	(0.07)	(0.15)
Adjusted R-squared	0.33	0.42	0.66	0.73	0.73
Panel B: Impact on log (export price)	[6]	[7]	[8]	[9]	[10]
ln(1+tariff rate)	-0.03	-0.01	-0.01	0.01	0.06
	(0.05)	(0.04)	(0.03)	(0.03)	(0.08)
Adjusted R-squared	0.70	0.76	0.89	0.93	0.90
Panel C: Impact on log (export quantity)	[11]	[12]	[13]	[14]	[15]
ln(1+tariff rate)	-0.11	-0.19**	-0.12*	-0.17**	-0.22
	(0.10)	(0.09)	(0.07)	(0.07)	(0.17)
Adjusted R-squared	0.47	0.57	0.76	0.82	0.79
Commodity-Country FE	√	√	√		
Commodity-Time FE	√	√	√	√	
Country-Time FE	√	√	√	√	
Firm FE		√			
Firm-Country FE			√		
Firm-Commodity FE			√		
Firm-Commodity-Country FE				√	√
Firm-Country-Time FE					√
Firm-Commodity-Time FE					√
Observations	4,864,318	4,863,753	4,693,147	4,372,774	2,016,350

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at HS-8 commodity level are reported in parentheses.

Table 5: Impacts on Exports and Sales of Firms

	[1]	[2]	[3]	[4]	[5]	[6]
DV:	ln(exports to US)	ln(exports to non-US)	ln(export sales)	ln(domestic sales)	ln(total sales)	profit margin
ln(1+Firm-level tariff rate)	-4.16***	0.97*	-0.83***	-0.40	-0.63***	-0.35***
	(0.51)	(0.56)	(0.16)	(0.50)	(0.14)	(0.05)
Firm FE	√	√	√	√	√	√
Time FE	√	√	√	√	√	√
Time Frequency	Monthly	Monthly	Monthly	Monthly	Monthly	Quarterly
Observations	330,602	330,602	330,602	330,602	330,602	116,398
Mean of DV	4.98	11.26	12.31	7.10	12.91	-0.06
Std of DV	5.90	3.54	1.82	6.14	1.80	0.29

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at firm level are reported in parentheses. Export sales equal exports to the U.S. plus exports to non-U.S. countries. Total sales equal export sales plus domestic sales. For profit margin (ratio of net profits to total sales), we winsorize the top and bottom 1% values to address extreme values. All values are in current U.S. dollars. The firm-level tariff rate is $\widehat{\tau_{ft}} \equiv \sum_{g,c} \tau_{gct} w_{fgc0}$, where w_{fgc0} is the share of firm f's export value of product g to country c in firm f's total export value at the initial time (2014-2016) and τ_{gct} is the tariff rate for product g.

Table 6: Responses of Sales in Different Markets

	ln(sales)
ln(1+Firm-level tariff rate) × US	-1.65***
	(0.21)
ln(1+Firm-level tariff rate) × China	1.07
	(0.97)
ln(1+Firm-level tariff rate) × ASEAN	-0.09
	(0.45)
ln(1+Firm-level tariff rate) × EU	0.87***
	(0.21)
ln(1+Firm-level tariff rate) × (Japan, Korea)	0.11
	(0.45)
ln(1+Firm-level tariff rate) × (HK, TW, Macau)	-0.33
	(0.67)
ln(1+Firm-level tariff rate) × ROW	0.11
	(0.19)
Firm-Country FE	√
Country-Time FE	√
Observations	1,642,475
Time Frequency	Monthly
Mean of DV	10.00
Std of DV	2.35

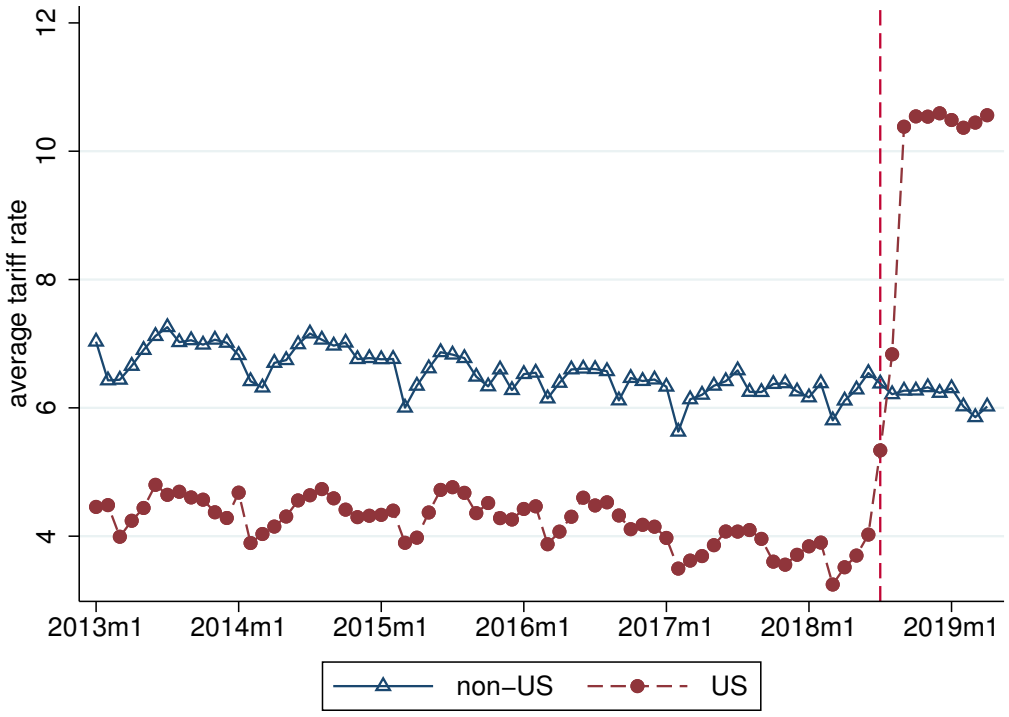
Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at firm-country level are reported in parentheses. All values are in current U.S. dollars.

Table 7: Survey Results: Impediments to Firms' Adjustments of Export Prices and Sales in Different Markets

	Fraction
Panel (A): Impediments to the Adjustments of Export Prices (choose only one option)	
Profit margin is too low to further reduce prices	72.2%
Lack of price adjustment flexibility due to contractual agreements	21.1%
If prices fall, worry about anti-dumping investigations	3.8%
Control the pricing power, thus no need to reduce prices	2.8%
Panel (B): Impediments to Expanding Alternative Foreign Markets (can choose more than one option)	
Different product specifications and standards	22.9%
Lack of sales channels and sales network	59.3%
Lack of brand awareness	25.3%
Concern of a low collection rate	25.0%
Market size is not big enough	25.3%
Panel (C): Impediments to Diverting Sales to the Domestic Market (can choose more than one option)	
Different product specifications and standards	28.3%
Lack of sales channels and sales network	46.6%
Lack of brand awareness	23.2%
Concern about a low collection rate	28.9%
Market size is not big enough	27.2%

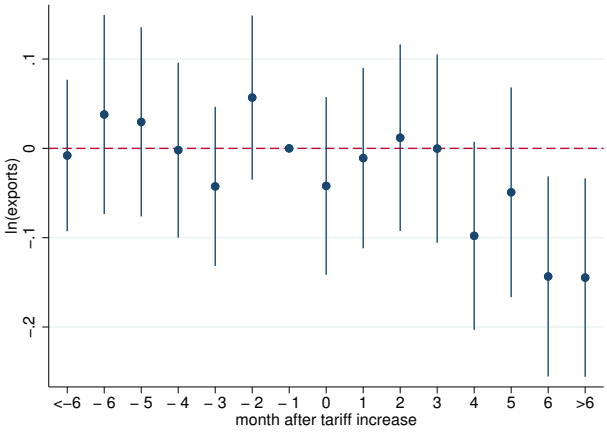
Notes: The table is based on a survey of managers of 600 exporting firms in our sample city.

Figure 1: Evolution of Tariff Rates

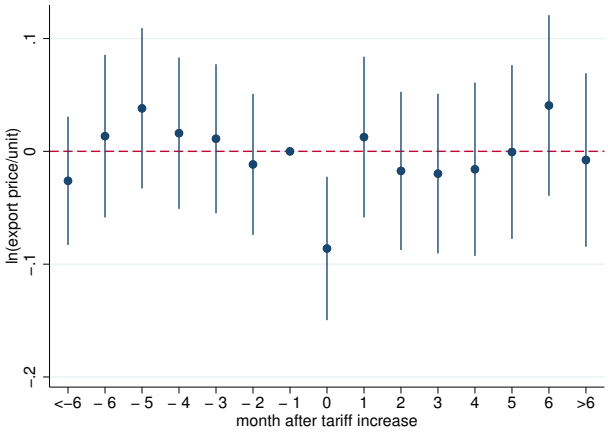


Notes: The average tariff rates are weighted by the export value of each commodity (HS 10-digit product) in our sample city in the current month. The vertical line denotes July 2018, which is the month when the first round of tariff surges was enforced.

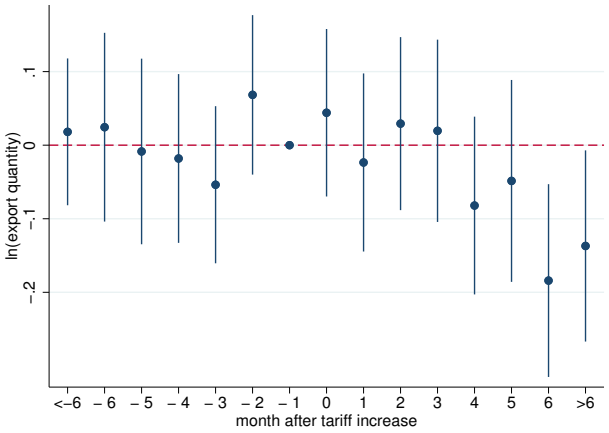
Figure 2: Dynamic Impacts on Exports: Commodity-Country Level Results



(a) Value of exports



(b) Export price per unit



(c) Export quantity

Notes: We restrict our sample to 2017m1-2019m4. The reference time is set as the month prior to the tariff change. The 95% confidence interval is shown in the figure. Standard errors are clustered at the HS-8 commodity level. The event month is the month when a specific commodity experiences tariff increases due to the three rounds of U.S. tariff lists.

Online Appendix

(Not For Publication)

A Comparison with Fajgelbaum et al. (2020)

In this section, we compare the estimates in Table 3 with Fajgelbaum et al. (2020) (Table IV). Like their paper, we also obtain the complete passthrough result. Thus, the response of values is fully driven by the response of quantities. To compare our estimate with them, we run the following regression

$$ln(y_{gct}) = \beta ln(1+\tau_{gct}) + \gamma_{ct} + \gamma_{gc} + \gamma_{gt} + \varepsilon_{gct}, \tag{6}$$

where τ is tariff rate in percent rather than in percentage point, same as Fajgelbaum et al. (2020). The dependent variable is the before-duty exports value, corresponding to column 1 of Table IV of Fajgelbaum et al. (2020). Column 1 of Table A1 shows that our estimate of β is -0.463, which is about one-third of their estimate (-1.52). Column 2 shows that focusing on exports to the U.S. does not change much the estimate. Since Fajgelbaum et al. (2020) use monthly first-differencing specification, we use the similar specification to better compare with them. Column 3 shows that the estimate of β in the first-differencing specification is -0.359, though not statistically significant. In column 4, we replace the commodity-country FE with sector-country FE, where the sector is measured using the HS4 code. The estimate is similar to column 3.

The use of different tariff rates is less likely to drive the difference. Both Fajgelbaum et al. (2020) (Table IV) and us use statutory tariff rates in main results. Table A3 of Fajgelbaum et al. (2020) shows that using the applied tariff rate would yield an even larger estimate. Thus, this should not drive the difference.

Overall, the difference between our estimate and that of Fajgelbaum et al. (2020) is probably due to the sample difference and different comparison groups. While their estimates reflect the

average response of all countries exporting to the U.S., our estimates reflect the average response of exports to all foreign countries of our Chinese sample city.

B A Firm-Level Event-Study Analysis

To give a more transparent illustration of the impact of the trade war on firm-level sales and exports, we conduct an event-study analysis. The control group is defined as firms which do not experience exogenous increases in tariff rates, i.e. $\widehat{\tau_{f,post}} - \widehat{\tau_{f,pre}} \leq 0$, where $\widehat{\tau_{f,post}}$ is the average $\widehat{\tau_{ft}}$ for firm f in months after July 2018, and $\widehat{\tau_{f,pre}}$ is defined likewise. The treatment group is defined as firms which experience exogenous increases in tariff rates, i.e. $\widehat{\tau_{f,post}} - \widehat{\tau_{f,pre}} > 0$.[21] We define treatment vs control group based on $\widehat{\tau_{ft}}$ rather than τ_{ft} because $\widehat{\tau_{ft}}$ is defined on a stable weight over time and its variation is entirely driven by exogenous change of foreign tariff rates. About one third of firms are in the treatment group, about two thrids of firms are in the control group.

The event-study analysis is based on the following specification:

$$ln(y_{ft}) = \sum \beta_m EventTime_m \times Treat + \gamma_t + \gamma_f + \varepsilon_{ft}. \tag{7}$$

The event time m is defined as the month relative to July 2018. y_{ft} can take various measures of firm-month level exports and sales.

Figure A4 panel (a) shows results when y_{ft} is τ_{ft}, i.e. the actual firm-month level tariff rates. It shows clearly that before the trade war, the relative firm-level tariff rates between treatment and control groups experience no change. After the trade war, the treatment group experienced increases in tariff rates for three consecutive months, and then stay stable. This is consistent with the three rounds of tariff increases.

Panels (b)-(f) show results for various measures of exports and sales. While there is some noise, the event-study results show that these variables are largely stable between the treatment group and the control group during pre-periods. After the trade war initiates, exports to the U.S. experience a clear decreasing trend for firms experiencing tariff increases. Exports to non-U.S. show a mild decreasing trend after the trade war, though the diverging trend seems insignificant.

[21] Admittedly, defining the treatment group following the rule $\widehat{\tau_{f,post}} - \widehat{\tau_{f,pre}} > 0$ is somewhat arbitrary. But choosing other thresholds yields similar results.

Domestic sales remain largely unchanged after the trade war. As a result, export sales and total sales experience a clear decreasing trend for the treatment group after the trade war. Overall, while the event study is unable to account for within-group differences of tariff rate changes, which may make it less precise in revealing the responses to the tariff shock, it shows a broadly consistent picture with the quantitative analysis of the impact of tariff rates on exports and sales of firms.

C The Impacts of U.S. Tariff Rates on Prices of Chinese Exports to Different Markets

Two major findings of this paper are the complete passthrough result and the increased exports of Chinese firms to the E.U. in response to the U.S. tariff surges. The complete passthrough result shows the price impact of U.S. tariff rates on the prices of exports to the U.S. But what are the impacts of U.S. tariff rates on the prices of exports to other countries? If there is any impact, then it implies that studying the incidence of the U.S. tariff rate while ignoring its impact on exports to other countries would be incomplete.

To explore the impacts of U.S. tariff rates on the prices of exports to different countries, we use the following specification

$$ln(p_{gct}) = \sum \beta_d \cdot I_d \cdot ln(1+\tau_{g,US,t}) + \beta ln(1+\tau_{gct}) + \gamma_{ct} + \gamma_{gc} + \gamma_{gt} + \varepsilon_{gct}, \tag{8}$$

where p_{gct} denotes the export price per unit of commodity g exported to country c in month t. $d \in \{US, ASEAN, EU, JK, HTM, ROW\}$. $\tau_{g,US,t}$ denotes the tariff rate of commodity g imposed by the U.S. in month t. τ_{gct} denotes the tariff rate of commodity g imposed by the destination country c in month t.

Table A3 shows the regression results. Column 1 simply replicates column 2 of Table 3. In columns 2 and 3, we do not include commodity-month FE because it will absorb all variation in $\tau_{g,US,t}$. Column 2 shows that the U.S. tariff rates on average have a precisely estimated cloze to zero impact on exports to all destinations. Column 3 shows that by decomposing the exporting destinations into several groups, the impacts of U.S. tariffs on export prices to destinations other than the U.S. are all close to zero. One exception is that the impact on the export price in the E.U. is negative and statistically significant at the 1% significance level.

D An Extended Analysis Through December 2019 Using National Aggregate Data

Using Chinese aggregate HS8 level export data (publicly available at http://43.248.49.97/indexEn), we extend our analysis to the end of 2019, which accounts for the May 2019 wave tariff adjustments and the September 2019 wave tariff adjustments. Using this aggregate data, we generate results in correspondence to Figure 2 and Table 3, which are our main results that do not use the firm-level information.

Like in Figure 2, we use regression specification 1 to do event-study analyses. Figure A5 presents the event-study results using Chinese aggregate HS8 level export data. Panel (a) shows that the dynamic pattern and the magnitude are quite close to those obtained in the online "updates to Fajgelbaum et al. (2020) with 2019 tariff rates". In addition, the responses of exports value and exports quantity beyond six months after the tariff increases became larger, which implies a larger elasticity as time elapses. Panel (b) shows the complete passthrough result for the first six months after the tariff changes. For months beyond that, we see some evidence that the tariff increase resulted in a decrease in Chinese export prices in some months, yet the magnitude is small and returns to a nearly zero impact when the sample ends. Therefore, as Panel (c) shows, the impacts on export quantity largely closely track those on the export value. Overall, we obtain quite close estimates to those in the "updates to Fajgelbaum et al. (2020) with 2019 tariff rates", despite our difference in samples. In particular, while the estimates in Fajgelbaum et al. (2020) reflect the average response of all countries exporting to the U.S., our estimates here reflect the average response of Chinese exports to all foreign countries.

Like in Table 3, we use the regression specification 2 to study the impacts of tariff rates on exports. Table A6 reports the regression results using Chinese aggregate HS8 level export data. Restricting the sample period to Jan 2017 - April 2019, columns 1-3 show results quite similar to Table 3, suggesting that our data are quite representative of the national response. Expanding the study period to December 2019, columns 4-6 show larger elasticities, suggesting that longer-run

responses are larger than short-run responses. Importantly, the complete passthrough results still hold for the extended data period.

E Appendix Tables and Figures

Table A1: Comparison with Fajgelbaum et al. (2020)

	[1]	[2]	[3]	[4]
DV:	ln(exports)	ln(exports)	Δln(exports)	Δln(exports)
ln(1+tariff rate (percent))	-0.463***	-0.372***		
	(0.155)	(0.118)		
Δln(1+tariff rate)			-0.359	-0.285
			(0.371)	(0.382)
Country FE				
Time FE		√		
Commodity FE		√		
Commodity-Country FE	√		√	
Commodity-Time FE	√		√	√
Country-Time FE	√		√	√
Sector-Country FE				√
Sample	All	US exports	All	All
Observations	1,568,864	60,426	967,742	983,097
Adjusted R-squared	0.697	0.819	0.007	0.033

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at commodity level are reported in parentheses. The first-differencing specification is made to compare with Fajgelbaum et al. (2020). Since they control for sector-country FE rather than commodity-country FE, we replicate their specification using our sample. In Fajgelbaum et al. (2020), sector is measured using NAICS-4. We use HS4 as the measure of sector.

Table A2: Impacts on Exports and Sales of Firms: Trade Intermediaries vs. Direct Exporters

		[1]	[2]	[3]	[4]	[5]	[6]
		ln(exports to US)	ln(exports to non-US)	ln(export sales)	ln(domestic sales)	ln(total sales)	profit margin
Trade intermediaries	ln(1+Firm-level tariff rate)	-4.778***	0.366	-1.055***	-0.3	-0.908***	-0.618***
		(0.866)	(1.040)	(0.298)	(1.145)	(0.295)	(0.116)
Direct exporters	ln(1+Firm-level tariff rate)	-3.758***	1.487**	-0.605***	-0.276	-0.350**	-0.147***
		(0.633)	(0.671)	(0.191)	(0.522)	(0.145)	(0.055)
	Firm FE	√	√	√	√	√	√
	Time FE	√	√	√	√	√	√
	Time Frequency	Monthly	Monthly	Monthly	Monthly	Monthly	Quarterly

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at firm level are reported in parentheses. Export sales equal exports to U.S. plus exports to non-U.S. markets. Total sales equal export sales plus domestic sales. For profit margin (ratio of net profits to total sales), we winsorize the top and bottom 1% values to address extreme values. All values are in current U.S. dollars.

Table A3: The Impacts of U.S. Tariff Rates on Prices of Chinese Exports to Different Markets

	[1]	[2]	[3]
DV: log of	export price	export price	export price
ln(1+Tariff rate (exporting destination))	0.003	0.107	0.231
	(0.113)	(0.112)	(0.324)
ln(1+Tariff rate (US))		-0.0822**	
		(0.037)	
ln(1+Tariff rate (US)) × US			-0.229
			(0.339)
ln(1+Tariff rate (US)) × ASEAN			-0.1024
			(0.095)
ln(1+Tariff rate (US)) × EU			-0.1514***
			(0.056)
ln(1+Tariff rate (US)) × (Japan, Korea)			0.0101
			(0.118)
ln(1+Tariff rate (US)) × (HK, TW, Macau)			0.0418
			(0.174)
ln(1+Tariff rate (US)) × ROW			-0.0523
			(0.043)
Commodity-Country FE	√	√	√
Commodity-Time FE	√	√	√
Country-Time FE	√		
Observations	1,568,864	1,596,691	1,596,691
Adjusted R-squared	0.852	0.856	0.856

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at commodity level are reported in parentheses. Column 1 simply replicates column 2 of Table 3. In columns 2 and 3, we do not include commodity-month FE because it will absorb all variation in $\tau_{g,US,t}$. Column 2 shows that the U.S. tariff rates on average have a precisely estimated zero impact on exports to all destinations. Column 3 shows that by decomposing the exporting destinations into several groups, the impacts of U.S. tariffs on export prices to destinations other than the U.S. are all close to zero. One exception is that the impact on the export price in the E.U. is negative and statistically significant at the 1% significance level.

Table A4: Share of Export Value to Different Groups of Exporting Destinations

US	23.31%
ASEAN	7.54%
EU	27.51%
Japan, Korea	6.69%
Hong Kong, Taiwan, Macau	2.66%
Rest of the world	32.29%
Total	100.00%

Notes: The shares are calculated for firms in our sample city during 2017m1-2019m4.

Table A5: Overlapping Shares of Commodities Exported to the U.S. and to Other Destinations

HS commodity digit	10-digit	8-digit	6-digit
ASEAN	58.98%	66.15%	71.80%
EU	68.93%	73.01%	78.07%
Japan, Korea	61.44%	65.26%	70.13%
Hong Kong, Taiwan, Macau	53.79%	60.18%	65.20%
Rest of the world	62.23%	66.70%	72.64%

Notes: The shares are calculated for firms in our sample city at the initial time (2014-2016).

Table A6: Impacts of Tariff Rates on Exports: Commodity-Country-Level Regressions Using Chinese Aggregate Data

	[1]	[2]	[3]	[4]	[5]	[6]
DV: log of	export value	export price	export quantity	export value	export price	export quantity
ln(1+tariff rate)	-0.5092***	-0.043	-0.4728***	-0.7164***	-0.0612	-0.6666***
	(0.091)	(0.060)	(0.095)	(0.080)	(0.049)	(0.083)
Commodity-Country FE	√	√	√	√	√	√
Commodity-Time FE	√	√	√	√	√	√
Country-Time FE	√	√	√	√	√	√
Sample period	2017.1-2019.4			2017.1-2019.12		
Observations	8,366,498	8,304,829	8,304,829	10,917,041	10,833,693	10,833,693
Adjusted R-squared	0.758	0.881	0.841	0.753	0.877	0.838

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at HS-8 commodity level are reported in parentheses. We use Chinese aggregate HS8 level export data 2017m1-2019m12 here.

Table A7: Comparison of the Distribution of Firms' Revenues between Administrative Data and Survey

Annual Revenue in 2018 (RMB)	Administrative Data	Survey
<=20000000	51.2%	38.4%
>20000000 & <=50000000	17.0%	21.6%
>50000000 & <=100000000	11.8%	18.6%
>100000000	20.1%	21.4%
Total	100.0%	100.0%

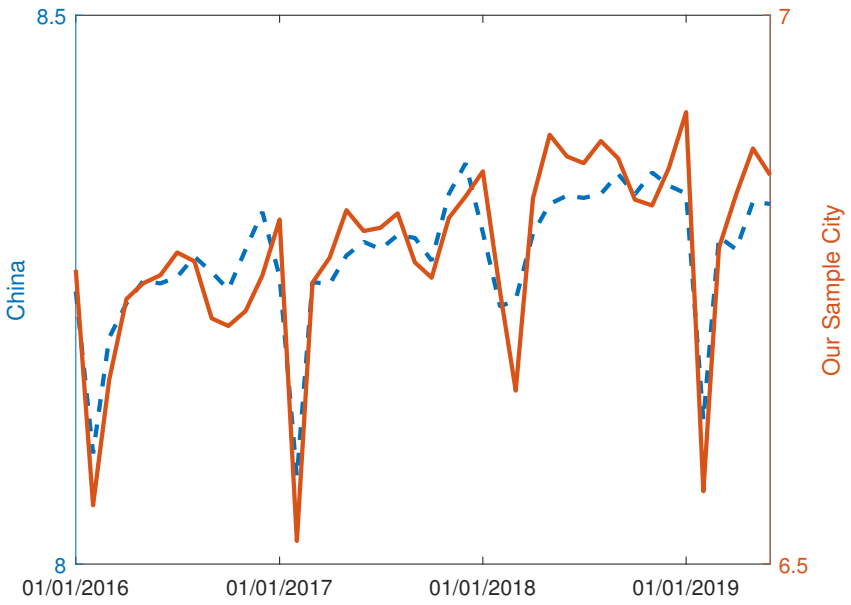
Notes: This table shows that survey firms are largely comparable to firms in the administrative data except that small firms are slightly underrepresented in the survey.

Table A8: Impacts of US Tariff Rates on Export Prices to Different Destination Groups for Firms with Different Profits

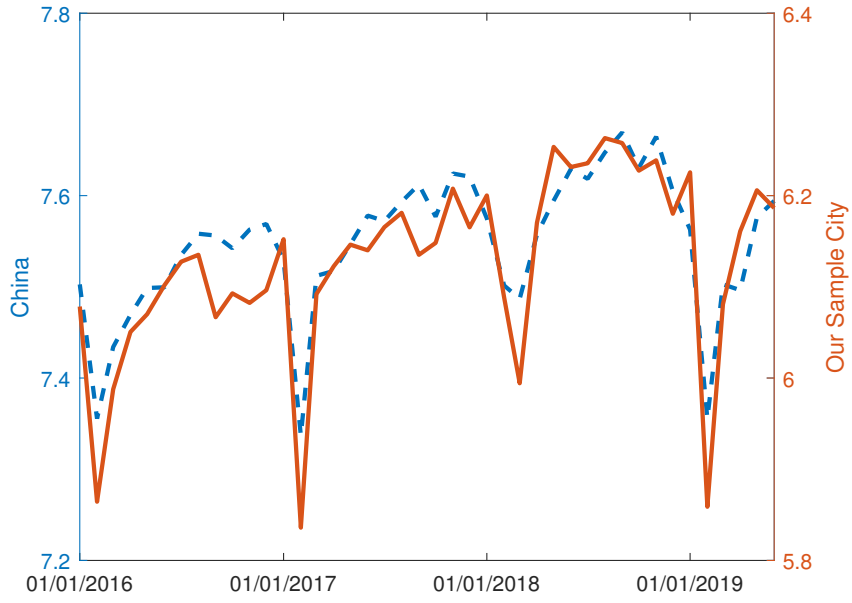
DV: log of	export price
Tariff rate (exporting destination)	0.0012
	(0.002)
Tariff rate (US) × US	-0.0025
	(0.002)
Tariff rate (US) × ASEAN	-0.0005
	(0.001)
Tariff rate (US) × EU	-0.0014***
	0.000
Tariff rate (US) × (Japan, Korea)	-0.0013*
	(0.001)
Tariff rate (US) × (HK, TW, Macau)	0.0003
	(0.001)
Tariff rate (US) × ROW	-0.0003
	0.000
Tariff rate (US) × US × Negative profit last quarter	0.0012*
	(0.001)
Tariff rate (US) × ASEAN × Negative profit last quarter	0.0008
	(0.001)
Tariff rate (US) × EU × Negative profit last quarter	0.0020***
	(0.001)
Tariff rate (US) × (Japan, Korea) × Negative profit last quarter	0.0012
	(0.001)
Tariff rate (US) × (HK, TW, Macau) × Negative profit last quarter	0.002
	(0.001)
Tariff rate (US) × ROW × Negative profit last quarter	-0.0002
	(0.001)
Commodity-Country FE	√
Commodity-Time FE	√
Country-Time FE	
Observations	5,295,669
Adjusted R-squared	0.703

Notes: *** p<0.01, ** p<0.05, * p<0.1. Standard errors clustered at commodity level are reported in parentheses. We do not include commodity-month FE because it will absorb all variation in the tariff rates. Overall, we do find some evidence that firms with negative profits in last quarter face more pressure in adjusting prices to different markets facing the US tariff shocks, which is largely consistent with our survey findings.

Figure A1: Data Representativeness



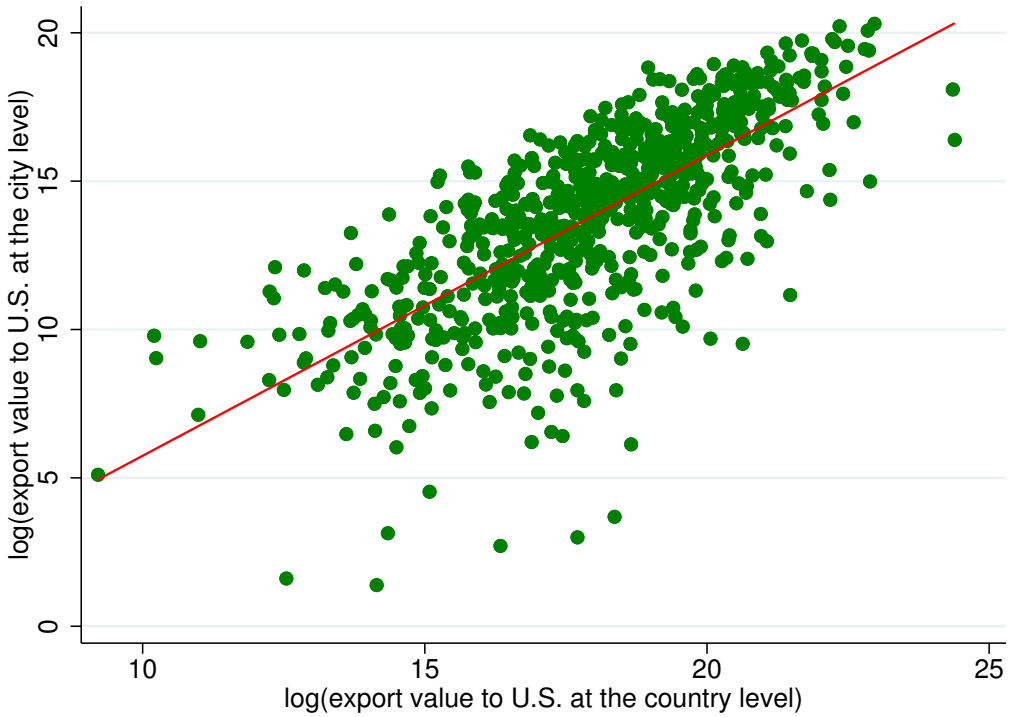
(a) Log of total export value



(b) Log of export value to the U.S.

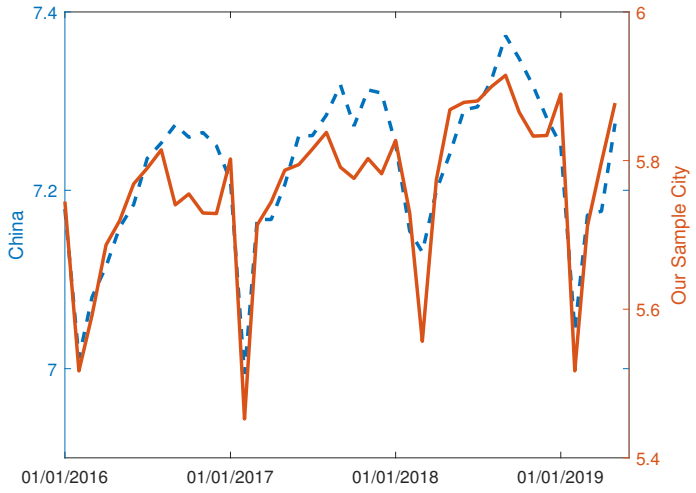
Notes: This figure shows that the log of total exports and the log of exports to the U.S. of our sample city evolve at a similar pace over time with those of the whole country. Panel (a) shows the log of total export value and panel (b) shows the log of export value to the U.S.

Figure A2: Data Representativeness: Product-Level Exports

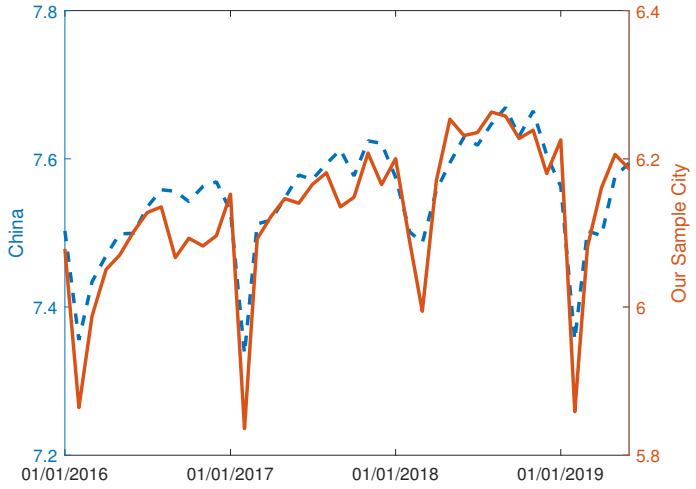


Notes: This figure compares the log export values to the U.S. of our sample city with those of the whole country at the HS 4-digit level. We use the 2016 data to produce this figure. But using other years would generate similar results. The red line shows the fitted linear relation between exports of our sample city and exports of the whole country. The fitted line has a slope of 1.01, which implies that if a product A is exported to the U.S. 1% more than another product B in the country as a whole, such relation also largely holds in our sample city.

Figure A3: Data Representativeness: Off-the-List Products and On-the-List Products



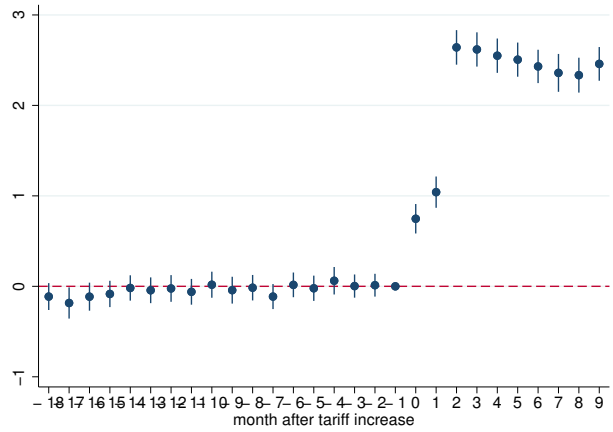
(a) Off-the-list products



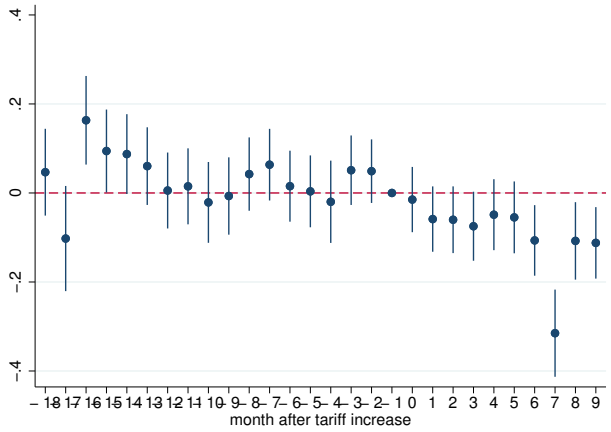
(b) On-the-list products

Notes: This figure shows the dynamics of the log export values to the U.S. of our sample city and that of the whole country for different groups of exported products. We divide all exported products into two groups. (1) Off-the-list group: those never show up in the Chinese product lists that are subject to the 3 rounds of U.S. tariff hikes. (2) On-the-list group: the rest. Since we do not have Chinese monthly export data at the HS 8-digit or 10-digit level, this division is done at the HS 6-digit level. The data of Chinese monthly exports to the U.S. at the HS 6-digit level are obtained from https://www.trademap.org/. Panel (a) examines the off-the-list group and panel (b) examines the on-the-list group.

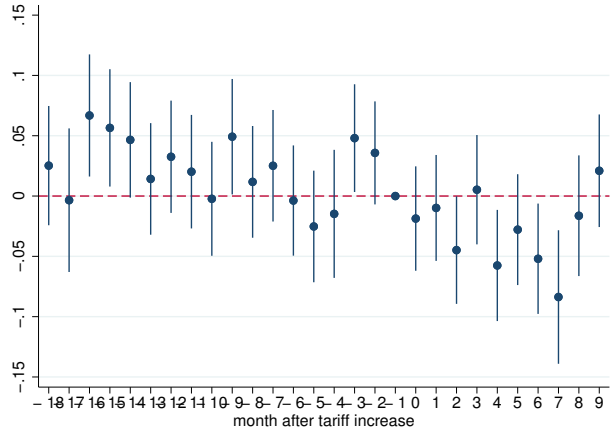
Figure A4: Dynamic Impacts on Exports and Sales: Firm-Level Results



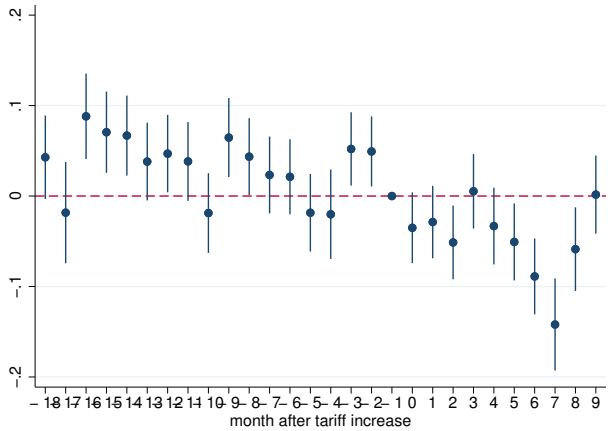
(a) Firm-level tariff rate



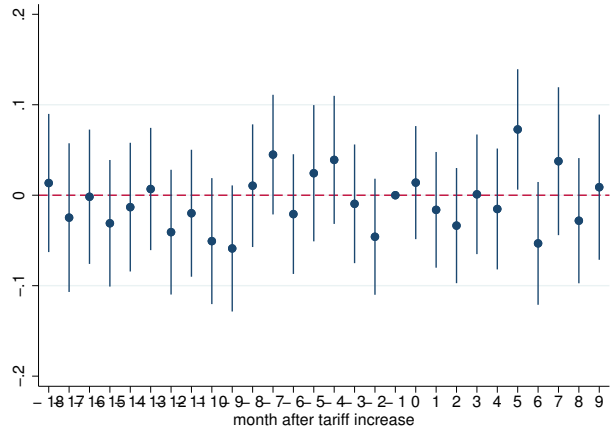
(b) ln(exports to US)



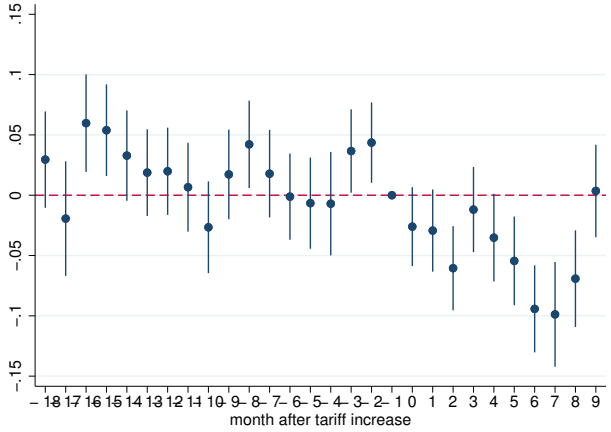
(c) ln(exports to non-US)



(d) ln(exports sales)



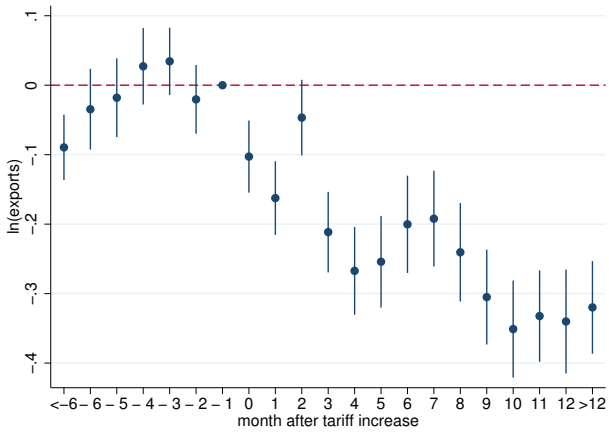
(e) ln(domestic sales)



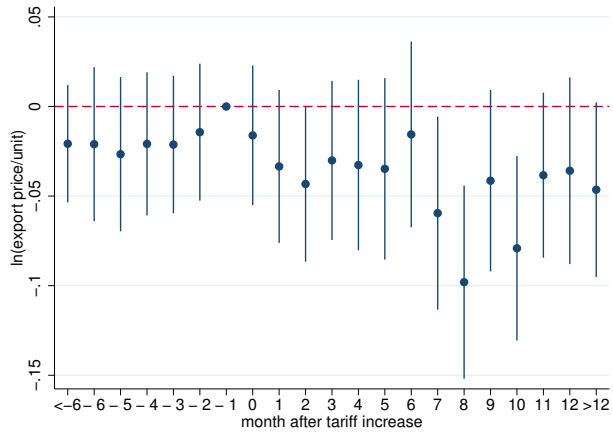
(f) ln(total sales)

Notes: We restrict our sample to 2017m1-2019m4 period. We set the reference time as the month prior to the initial tariff change month (July, 2018). 95% confidence interval is shown in the figure. Standard errors are clustered at firm level. The event time is defined as month relative to July, 2018.

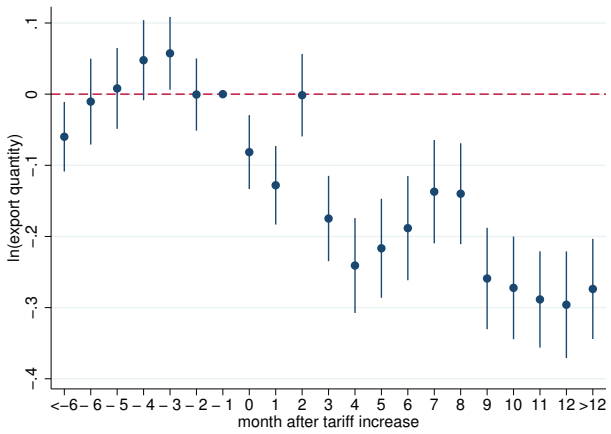
Figure A5: Dynamic Impacts on Exports: Commodity-Country Level Results Using Chinese Aggregate Data



(a) Value of exports



(b) Export price per unit



(c) Export quantity

Notes: We use Chinese aggregate HS8 level export data 2017m1-2019m12 here. The reference time is set as the month prior to the tariff change. The 95% confidence interval is shown in the figure. Standard errors are clustered at the HS-8 commodity level. The event month is the month when a specific commodity experiences tariff increases due to the three rounds of U.S. tariff lists.