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The US-China Trade War and India's Exports

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Abstract

Between 2018-19, the US and China engaged in a trade war that targeted roughly $450 billion in bilateral trade, abruptly changing market conditions for thousands of internationally traded products. Was India able to capitalize in this new global environment by increasing its exports? The short answer is: not really. The trade war did not statistically impact India's overall exports. So, the prediction that India could benefit from the trade war did not materialize. These results hopefully contribute to ongoing policy discussions for how India can leverage export opportunities in an era of increased trade tensions.

JEL Classification: F0
Keywords: US-China Trade war, India

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1. Introduction

In 2018-19, the US and China engaged in a trade war that targeted $450 billion in bilateral trade. The war ran counter to a multi-decades long endeavor that lowered trade and non-tariff barriers across the globe, and the share of US GDP targeted by tariffs was more substantial than the Smoot-Hawley tariffs (Fajgelbaum and Khandelwal 2022). Market conditions for thousands of internationally traded products were upended, and analysts made predictions for how the trade war, and rising trade tensions more generally, would affect global trade. A common presumption among many businesses and policymakers was that "bystander" countries would benefit from the trade war as US and China reduced exports into each other's markets. The early reaction in the press suggested that India would benefit from an indirect improvement in access to the two largest markets in the world (see, e.g., Financial Times 2019; Economic Times 2019; CNBC 2019).

This paper provides an answer to the question: Did the trade war increase India's exports? Although it is natural to think that bystander countries would benefit from the tariffs, the extent to which a country like India could capitalize depends on several demand and supply forces. On the demand side: Do American and Chinese consumers perceive India's exports as substitutes with Chinese and American exports, respectively? If so, India's exports to these two markets would increase. But, if India exports goods that are complements to US and Chinese goods, the trade war would reduce its exports to these markets. On the supply-side: Did the tariff increases coincide with India's existing comparative advantage products? If not, taking advantage of the tariffs, at least initially, would be difficult. On the other hand, perhaps an improvement in market access would India's more marginal products. In either case, the response hinges on the extent to which India could reallocate factors of production into the targeted products. Moreover, Indian companies would need to overcome existing non-tariff barriers—regulatory hurdles, trade financing, rules of origin requirements, quality standards—that did not change during the trade war. Even if reallocation into US and China was seamless, would it come at the expense of exports to the rest of the world? If so, India's global export growth would be unchanged. Additionally, the trade war triggered a large cloud of uncertainty around economic growth and the future of globalization. The uncertainty could have blunted Indian companies' investment plans, and/or affected foreign MNCs decisions to invest in India. On the other hand, at least in the summer of 2018, analysts had blamed India's currency devaluation on the trade war tensions, and this devaluation could have benefited exports (Financial Times 2018). Finally, other bystanders faced the same forces and tradeoffs, and so even if India could take advantage of the trade war, the response by other countries, like Vietnam, Malaysia or Mexico, could crowd out India's gains.

A formal framework developed by Fajgelbaum et al. (2021) clarifies how these demand and supply-side factors shape a bystander's response to the trade war. If a bystander country like India exports products that are substitutes for Chinese exports, then the tariffs induce a positive demand shock and India's exports to the US would rise. On the other hand, if India exports goods that complement China, then India's exports to the US would fall. India's global export response, however, hinges on its ability to reallocate into the targeted goods. For example, if India's exports to the US increase, and if its supply curves slope upwards, exports to the rest of the world would fall and exports globally may not change. On the other hand, if its supply curves slope

downward, potentially due to economies of scale, then the export increase to the US would lower marginal costs and drive an export increase globally. The framework can therefore rationalize any impact of the tariffs on India's export responses to the US, China and the rest of the world (RW) according to underlying primitives of demand and supply parameters. Conveniently, the framework yields transparent and straightforward estimating equations that are easily taken to the data.

This paper examines India's response to the trade war from 2018-19. I analyze India's product-level trade data that cover the universe of its non-service exports.[1] During that period, the US raised tariffs on Chinese exports in 4,413 six-digit HS products by an average of 23.1%, and China raised tariffs on US exports in 4,422 products by an average of 29.4%. Collectively, these two sets of tariffs covered 98.5% of India's (pre-war) exports. The two countries also changed tariff rates on bystander countries. The US raised tariffs on India's steel and aluminum products and removed India from the Generalized System of Preferences (GSP) in May 2019. On the other hand, China reduced its most-favored-nation (MFN) tariff rates on bystander countries, so India faced lower tariffs on its exports to China. Together, these four sets of tariff changes constitute the "trade war," and I examine how they affected India's export response to the US, China, and RW. Through the lens of the model, the results offer insights into the underlying demand- and supply-side forces that drive India's trade. Moreover, the product-level responses can be aggregated to the overall country response to provide a summary of how India's exports responded to the trade war.[2]

The main takeaway of the analysis is that India's aggregate export response to the trade war was quite noisy. While there are particular tariffs that affect particular destinations more sharply, after accounting for full set of tariffs, I estimate that the trade war increased India's exports to the world by 1.7% with a large standard error of 3.6%. Thus, I conclude that the trade war did not statistically change India's global exports. Disaggregating the response by destination, the trade war decreased exports to the US by 7.7% (se 6.0%). This decline is surprising, since the underlying coefficients suggest that India exports products that are substitutes for China's. However, there is a large negative impact of the direct tariffs that the US imposed on India, and it appears that US demand for Indian intermediates fell. India's exports to China in response to the tariffs are essentially flat, increasing by only 0.3% but with a very large standard error of 12.1%. There is evidence that India's exports to RW increase, although the impacts are again noisy: exports increased by 4.2% (se 4.4%). Setting aside the noise, through the lens of the model this pattern suggests that India operates along textbook upward-sloping supply curves. So, any change in exports to US and China would be offset by export changes to RW. In short, there is no evidence that the trade war changed India's global exports on a statistical basis. Excluding the direct impacts of the US tariff on India and China's MFN reductions to focus exclusively on the

[1] The trade war changed tariffs for only non-service products, and due to data limitations, I am unable to examine whether or not there are spillovers to India's service exports. I do not include exports from 2020-22 because the pandemic is likely to have confounded the impact of the trade war.

[2] An important caveat to this aggregation exercise is that it controls for general equilibrium forces that operate at a higher level than what is controlled for by the econometrics specifications; for example, the trade war's impact on the Rupee which may affect exports across all products. However, this exercise can account for general-equilibrium forces within sectors, and so the aggregation exercise is meaningful and sidesteps the need for a fully-specified model.

impacts of the US-China tariffs does not qualitatively change this message.[3]

To put these numbers in perspective, Fajgelbaum et al. (2021) estimate that the trade war increased global exports for Indonesia (10.2%, se 5.6%), Malaysia (7.7%, se 5.4%), Mexico (11.3%, se 4.0%), Thailand (8.1%, se 5.1%), Turkey (13.9%, se 4.8%), and Vietnam (13.9%, se 5.0%). In aggregate, the trade war increased bystanders' global exports by 5.4% (se 0.7%).

Given the large standard errors, it is natural to conjecture that there is large heterogeneity in the responses to the tariffs by sectors or product characteristics. Heterogeneity can exist along many possible dimensions, and I discipline the analysis by considering dimensions that are policy relevant. But, across nine broad sectors, I continue to find a noisy response to the tariffs. The two exceptions are the apparel and transport sectors, where there are large increases in global exports of 19.2% (se 9.1%) and 60.8% (se 30.6%). But, overall, the impact on exports remains noisy once allowing for sector-specific tariff responses. Next, I consider heterogenous responses in products at the right tail of product size, comparative advantage, technology, and capital intensity. I also consider various measures of products' position in supply chains based on various measures proposed in earlier work. Along both sets of heterogeneity, I do not find sharp impacts of the tariffs. The lack of clear findings in the latter case is consistent with the claim that India, at least relative to its neighbors in East Asia, has difficulty integrating into manufacturing global value chains. Finally, I use customs data that track firm-level exports during the trade war. While there are caveats to these data, they similarly confirm the noisy response of India's exports to the tariffs. But, one point of optimism is that there is some evidence that the tariffs triggered entry of firms into product lines, particularly for firms' exports to RW.

The overall disappointing lack of response should contribute to ongoing discussions regarding India's export strategy. What is distinct about the US-China trade war is that market conditions changed suddenly for India's exports *without* India's consent. Thus, the normal considerations that weigh into bilateral or regional trade agreements—tariffs and non-tariff barriers, national security, and political factors—do not apply here. To be sure, India has recently been active in pursuing trade agreements outside the World Trade Organization; Krishna (2020b) discusses the 17 bilateral or regional agreements that India signed between 2007 and 2017. More recently, after a heated policy debate, India chose to not join the Regional Comprehensive Economic Partnership (RCEP) Agreement in 2020, but is currently negotiating bilateral agreements with the UK, EU, Australia, and Canada. Panagariya (2008), Panagariya (2019), and Krishna (2020a) are comprehensive sources that analyze India's past and recent external policies.

However, how India responded to the trade war should be of interest to policymakers given rising tension around the globe: Brexit, the US-China trade war, the Covid-19 global pandemic, Russia-Ukraine conflict, and rising tensions in the South China Sea. Can India benefit when market access deteriorates between other countries? The question here is somewhat related to one posed recently by Chatterjee

[3] In a concurrent and very related paper, Sanyal (2021) finds that India's exports to the US respond positively to the US tariff and negatively to the direct tariff increases, as I find here. He, too, finds relatively noisy responses of the other tariffs on exports to China and the RW. That paper does not provide an aggregation over the different tariff responses making it difficult to compare with the aggregate responses reported here.

and Subramanian (2020), who asked if India had taken advantage of export opportunities *indirectly* created by China's growth and development as it exited low-skilled exports. They conclude "no" because of India's deteriorated export competitiveness after the financial crisis and its underperformance in low-skilled intensive sectors. The trade war poses a similar question: did India take advantage of an *indirect* improvement in export market access? The results also suggest that India's response was quite mixed.

The lackluster results suggest that domestic policies may be important to address if India's non-service exports can capitalize on tensions between other countries. Atkin and Khandelwal (2020) and Atkin and Donaldson (2021) review the recent work in trade and development and demonstrates how distortions in low-income countries—weak rule of law, credit constraints, informality, size-dependent distortions, and political connections, and so forth—affect trade in low-income settings. The message on the importance of reforming domestic distortions for international trade outcomes echoes the pioneering work by Bhagwati (1971), Bhagwati and Srinivasan (1975), and Krueger (1984). This paper does not explore the precise domestic reforms necessary to change the trajectory of India's trade outcomes, but serves as a reminder that more work is necessary.

The paper is structured as follows. Section 2 provides a background of the trade war and the data. Section 3 provides an overview of the framework developed by Fajgelbaum et al. (2021). Section 4 presents the results, and Section 5 concludes.

2. Trade War Background and Data

2.1 Background

The opening rounds of the US-China trade war began in February 2018 when the US imposed tariffs on solar panels and washing machines. In March 2018, the US further targeted iron, steel and aluminum products. These initial tariffs waves were not focused on China; instead, they targeted virtually all countries that exported specific products. However, over the next year and a half, the US successively imposed tariffs on imports from China in five waves: July 2018, August 2018, September 2018, June 2019, and September 2019. At each stage, China retaliated by raising tariffs on US imports. By the time a truce was announced in January 2020, both countries had collectively targeted $450 billion in cross-border trade flows.[4] Across all trade partners, the US had imposed tariffs on 17.6% of its 2017 imports, or roughly 2.6% of its GDP, with average tariffs increasing from 3.7% to 25.8%. Trade partners imposed retaliations of 8.7% of US exports, corresponding to about 1% of its GDP with average tariffs increasing from 7.7% to 20.8%. Fajgelbaum and Khandelwal (2022) indicate that the 3.6% of US GDP targeted exceeds the 1929 Smoot-Hawley legislation that targeted 1.4% of GDP. From China's perspective, tariffs affected an even larger share—5.5%—of its GDP.

Although the trade war was fought between the US and China, other countries, including India, were targeted during some tariff waves. India was hit with tariff increases on its metal products in March 2018. Justified by the Trump Administration

[4] Readers interested in details of each tariff wave and the US-China Phase I trade agreement are encouraged to consult the excellent piece by Bown (2021).

over national security concerns, Bown (2019) writes that India was hit with 25% tariffs on $761 million of steel and 10% tariffs on $382 million of aluminum products, which together accounted for roughly 2.3% of India's exports to the US in 2017. India filed a formal dispute within the World Trade Organization in May 2018 and threatened to retaliate on $1.4 billion of US imports (the threat did not materialize). The second tariff wave against India came in June 2019 when the Trump Administration notified India of its removal from the GSP program. The GSP program is the US largest and oldest trade preference program, established in 1974. It was designed to give low-income countries preferential access to the US markets by eliminating tariff rates on their imports of eligible products. India's removal meant that it would now face the MFN tariff rate in these products to the US.

On the other hand, while the US was raising tariffs on selected products from its (non-China) trade partners, Bown et al. (2019) found that China was reducing its MFN tariff rates on its (non-US) trade partners. Thus, access to China's market improved for bystander countries vis-à-vis the US.

2.2 Data

I analyze India's exports using the UN Comtrade database which records India's trade flows at the HS6 product level. These data track annual bilateral flows for India's exports across countries in 5,203 potential HS6 products. To focus on long-run impacts and to smooth out annual fluctuations, I aggregate the data to biennial (24-month) intervals, 2014/15, 2016/17, and 2018/19. The notation 2018/19 means the sum of 2018 and 2019 exports.[5] The analysis focuses on export growth between 2016/17 to 2018/19, with 2014/15 used to assess pre-existing trends.

I consider India's exports to three destinations: US, China, and a collective RW destination that aggregates over India's trade partners. HS6 products are classified into nine sectors: agriculture, apparel, chemicals, materials, machinery, metals, minerals, transport, and miscellaneous. Table 1 provides examples of products within sectors, and reports the share of India's worldwide 2016/17 exports across sectors. The US and China accounted for 19.2% and 5.6% of India's 2016/17 exports, respectively, with the rest of world accounting for the remaining 75.2%. India's nominal export growth in 2018/19 was 13.8% whereas the inflation rate over this period ranged from 3.7% and 4.9% (World Development Indicators). Figure A.1 reports product-level growth rates to the three destinations across sectors. The growth rates within sectors are quite heterogenous, making it difficult to discern if subset of sectors particularly grew faster during this period. Below, I examine the impact of the tariffs by sector.

[5] I work with the HS2012 classification. I capture India's exports by HS6 through the mirror statistics of the imports of that HS6 code from India because Fisman and Wei (2004) suggest that import records may be of higher quality because importing countries have an incentive to collect tariff revenue.

TABLE 1. Summary statistics of India's exports

Industry	*Examples*	*Value*	*Share (%)*	*# HS6*
Agriculture	Soybeans, wine, coffee, beef	27	10.6	831
Apparel	Footwear, t-shirts, handbags	38	15.2	907
Chemicals	Medications, cosmetics, vaccines	38	15.2	778
Machinery	Engines, computers, cell phones	23	9.3	771
Materials	Plastics, lumber, stones, glass	56	22.0	632
Metals	Copper, steel, iron, aluminum	22	8.9	560
Minerals	Oil, coal, salt, electricity	27	10.9	146
Miscellaneous	Medical devices, furniture, art	6	2.3	353
Transport	Vehicles, airplanes, parts	14	5.6	126
All Sectors		252	100.0	5,104

Notes: Table reports India's average 2016 and 2017 exports to the world, by sector. Sectors are defined by two-digit HS chapters: Agriculture (1-24), Minerals (24-26); Chemicals (28-38); Materials (39-40, 68-71); Apparel (41-67); Metals (72-83); Machinery (84-85); Transport (86-89); Miscellaneous (90-97). Values in USD billions.

I supplement the analysis with firm-level customs records purchased from Descartes Datamyne for 2017 and 2019. These data record exporter identifiers, shipment values and product codes, and thus permit an analysis of the firm-level intensive and extensive margins.[6] There a few caveats with these data which is why I do not use them for the main analysis. First, these data do not capture the universe of India's exports. In 2017 and 2019, aggregate exports in these data were $212 billion and $283 billion, respectively, while aggregate exports in Comtrade total $294 billion and $323 billion. Table A.1 reports the aggregate statistics from each data source by year and destination, and the coverage of Datamyne in 2017 is lower than 2019. Notably, Datamyne data exclude exports from Free Trade Zones. Second, since exporter identifiers were missing for 45% of records in 2018, I did not purchase this year. Thus, in contrast to the main analysis which examines two-year growth rates, which tend to be smoother than annual rates, the analysis with Datamyne data covers growth between 2017 and 2019. Figure A.2 is consistent with this conjecture, which compares the product-level growth rates in Comtrade versus Datamyne data. The growth rates are positively correlated, but notice the x-axis range is substantially larger with growth rates from Datamyne data. Given these caveats, I use Datamyne data to assess the firm extensive margin during the trade war, but derive the main results from (publicly-available) Comtrade.

[6] According to the data provider, the export data is collected after Indian customs agents clears the shipment for export. The exporter identifier is taking from the customs declaration, but there are instances where the same company name reports different export identifiers. This could be because the company is shipping the item from different addresses or the company may have several subsidiaries within India. Determining the ultimate owner of each shipment is, in general, a major challenge with customs data. For the purposes of this project, I use a conservative approach that uses the exporter name as the identifier, after removing and standardizing the names to remove like "Limited," "Private," "ImpEx," and "Industries." This reduces the total number of exporters in 2017 and 2019 from 183,354 in the raw data to 152,086 after the trimming.

2.3 Trade War Tariffs

Since I work with biennial export changes, I scale the tariff changes in proportion to their duration within a 24-month interval such that, for example, a 20% tariff that is implemented for 12 months would be assigned a tariff rate of 10% = (20%*12/24). This scaling generates variation in tariff changes across products due to both variation in the magnitude of the rate changes as well as variation in the timing of when the tariff changes were implemented.

The trade war constitutes the four sets of tariffs:

1. Tariff increases by the US on China (the "US tariffs," $\Delta T_{CH,\omega}^{US}$ where ω denotes an HS6 product code).[7] These tariffs affected 4,413 products with average tariffs increasing by 23.1% (or 9.3% in scaled changes). These tariffs covered 88.9% of India's (pre-war) exports.
2. Tariff increases by China on the US (the "China tariffs", $\Delta T_{US,\omega}^{CH}$). These tariffs affected 4,422 products with average tariffs increasing by 29.4% (or 11.3% in scaled changes). These tariffs covered 94.0% of India's (pre-war) exports.
3. Tariff increases by the US on India, $\Delta T_{IN,\omega}^{US}$, which include targeted products in steel and aluminum and the removal from GSP.[8] These tariffs affected 582 products with average tariffs increasing by 10.0% (or 2.9% in scaled changes). These tariffs covered 16.5% of India's (pre-war) exports.
4. Tariff decreases by China on all countries other than the US. Since I focus on India, I'll denote these tariffs as $\Delta T_{IN,\omega}^{CH}$. These tariffs affected 2,178 products with average tariffs decreasing by 4.5% (or 2.8% in scaled changes). These tariffs covered 49.3% of India's (pre-war) exports.

These tariff changes are taken from Fajgelbaum et al. (2021).

Figure 1 shows the variation in the four tariffs across sectors. The US and China raised tariffs on each other across most sectors, but the US tariff increases on India were concentrated in the machinery and metals sectors. The removal from GSP affected products in other sectors, but given the relatively low MFN rate, the magnitude of these tariff increases were not large. The bottom panel shows China's tariff reductions on non-US trade partners across sectors.

The bilateral US-China bilateral tariffs alone covered 98.5% of India's global exports. Thus, the trade war effectively changed market conditions for virtually all of India's 5104 products that it exported prior to the trade war. There is a positive correlation between India's (pre-war) export shares and these US-China tariff hikes. The binscatter plot in Figure A.3 reports a positive correlation between 2017 product-level export shares and the average $\Delta T_{CH,\omega}^{US}$and $\Delta T_{US,\omega}^{CH}$ tariff increases. Thus, at the beginning of the war, it seems reasonable to conclude simply from India's pattern of specialization that the trade war would be favorable for India. However, as discussed in the next section, a simple model of international trade that incorporates flexible preferences and supply responses reveals that a straightforward prediction of how India would benefit from the US-China trade war is difficult to make.

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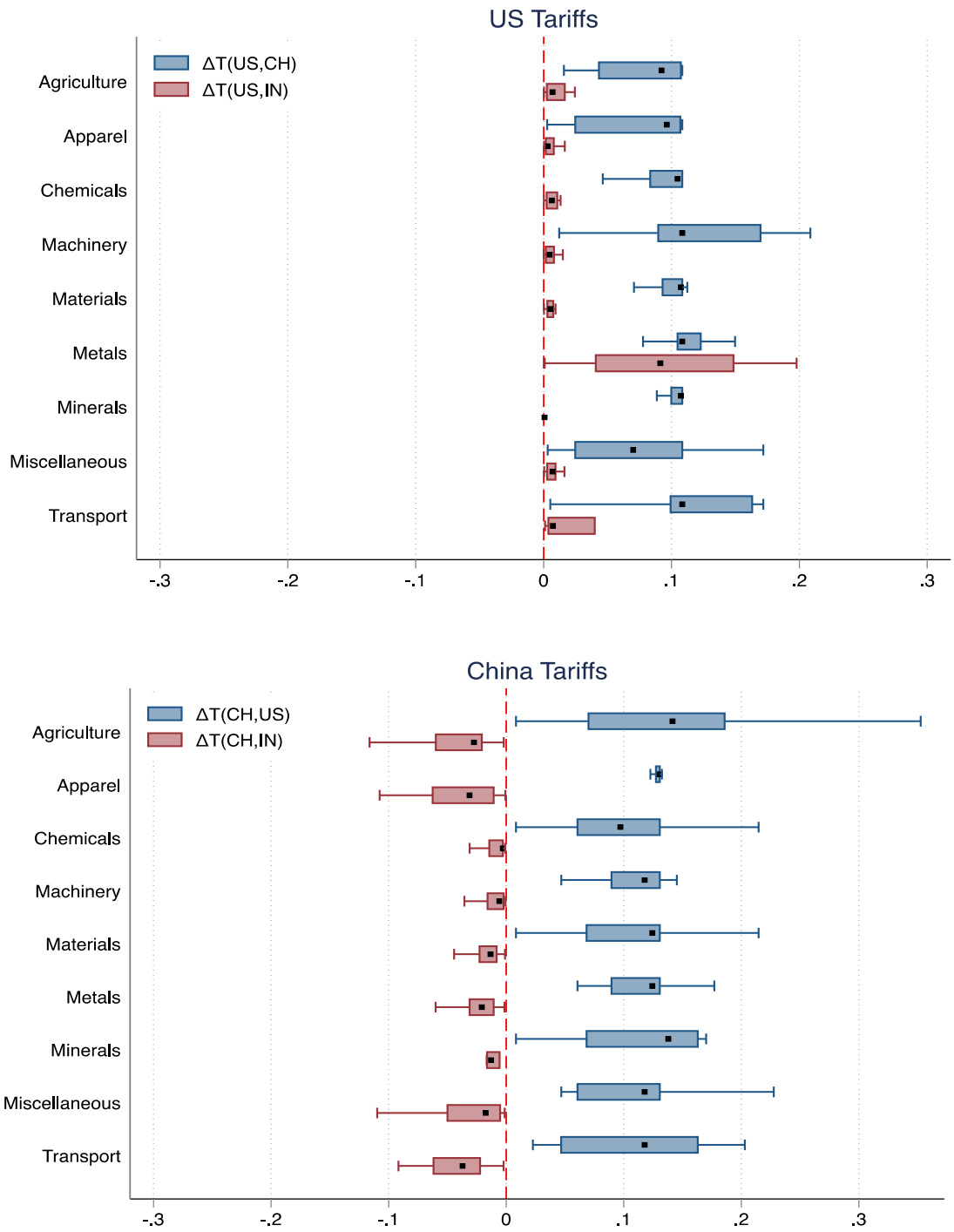
[7] Throughout the paper, I define $T \equiv 1 + t$ where t is the statutory ad valorem tariff rate.

[8] The source of product codes removed from GSP come from the official notification published on June 5, 2019, by Federal Register (2019).

FIGURE 1. Tariff changes



Source: Fajgelbaum, Goldberg, Kennedy, Khandelwal, and Taglioni (2021).

Notes: This figure is adapted from Fajgelbaum et al. (2021). It reports the set of tariff changes imposed by the US (Panel A) and China (Panel B), by sector. The tariff changes are scaled by total time in effect over the two-year window. For example, if the US raised tariffs on a product from China in September 2018 by 10%, the scaled tariff change over the two-year window would be 6.66% = (16/24) 10%. If the tariff of a product went up 25% in September 2019, the scaled tariff change would be 4.16% (= (4/24) 25%). The black dots indicate the median tariff increase, the boxes denote the 25th and 75th percentiles, and whiskers show the 10th and 90th percentiles.

3. Framework

This section outlines the framework developed in Fajgelbaum et al. (2021) to analyze the impacts of tariffs on bystander countries. The emphasis here is to provide the intuition for how tariffs between two countries may impact the economy of a third country, like India, and readers interested in the details of the model are encouraged to consult that paper.

The model is designed to interpret a country's response to the trade war tariffs across three destinations: US, China, and RW. The key insight is that the tariff changes will simultaneously affect a country's exports of product ω across all three destinations. The responses to each destination will depend on key parameters governing consumer preferences and production. On the production side, the framework assumes supply curves that could be positively sloped (the textbook case) or negatively sloped; the latter could occur if there are economies of scale in production, as analyzed recently by Costinot et al. (2019). On the demand side, the framework assumes that consumers have translog preferences. The use of this preference structure allows for dimensions of flexibility where consumers may value India's products relative to US or China differently than, say, Cambodia's products relative to US or China. Additionally, it allows for the possibility that India's products may complement Chinese exports, whereas Cambodia's products may substitute for China's. More formally, the semi-elasticities of India vis-à-vis the US and China will be different than other countries' semi-elasticities, and these semi-elasticities could either be negative (i.e., India's exports complement China) or positive (i.e., India's exports substitute China). A global trade equilibrium is characterized by a set of world prices that clear international markets. From that equilibrium, the model can then explore how a change in a tariff will affect a bystander's export allocation across destinations.

Consider how India's exports of product ω would change if the US imposes a tariff on China, $\Delta \ln T_{CH}^{US} > 0$. The tariff reduces China's exports to the US, a prediction confirmed by several analyses of the trade war (e.g., see Fajgelbaum et al. 2020). Consider India's export change of that product to the US, $\Delta \ln X_{\omega}^{US}$. If exports increase, this reveals that US consumers perceive India's varieties as substitutes for China's. So, if India is a substitute for China, the tariff change acts as a positive demand shock for India's exports in the US. What would happen to India's exports in this product to the rest of the world? If India's supply curve slopes upward, as standard textbook models typically assume, the increased exports to the US would accompany a simultaneous reduction of exports to the RW. Thus, when the US tariff increases on China, a response of $\Delta \ln X_{\omega}^{US} > 0$ and $\Delta \ln X_{\omega}^{RW} < 0$ would reveal that India is a substitute for China and operates along an upward sloping supply curve. On the other hand, suppose India's production supply for that product slopes downward. In this case, the positive demand shock in the US will simultaneously induce more exports to RW, $\Delta \ln X_{\omega}^{RW} > 0$. In this case, global exports of the product would increase because of two forces: the product is a substitute for China and there are upward-sloping supplies.

The model shows that any combination of increases or decreases in exports to the US and RW are possible, depending on the sign and strength of demand preferences and supply responses. Likewise, the same would be true when considering India's response to China's tariffs on the US.

More formally, the model yields the following set of estimating equations to examine India's response to the trade-war tariffs across destinations $n = US, CH, RW$:

$$\Delta \ln X_{\omega}^{n} = \alpha_{j}^{n} + \beta_{1}^{n} \Delta \ln T_{CH,\omega}^{US} + \beta_{2}^{n} \Delta \ln T_{US,\omega}^{CH} + \beta_{3}^{n} \Delta \ln T_{IN,\omega}^{US} + \beta_{4}^{n} \Delta \ln T_{IN,\omega}^{CH} + \varepsilon_{\omega}^{n} \qquad (1)$$

where $\Delta \ln X_{\omega}^{n}$ is India's change in exports of product ω to destination n and α_{j}^{n} is a sector j fixed effect that controls for sector-level supply and demand shifters generated by the model. The coefficient β_{1}^{n} is the elasticity of India's exports to destination n to the US tariff on China. The coefficient β_{2}^{n} is the elasticity of India's exports to China's tariff on the US. The third term captures the impact of the US tariff changes on India. For n = *US*, this would be the direct elasticity of India's exports to the tariff change. For n = *CH*, *US*, it captures the indirect impacts of India's exports to those two destinations when the US raised tariffs on India. The fourth term β_{4}^{n} is the analogous elasticity that captures India's response to China's tariffs on India during the trade war period.[9] Fajgelbaum et al. (2021) show that these four tariff elasticities to each destination n depend on the underlying supply and demand parameters that are specific to each exporting country.

The specifications in (1) call for running three separate regressions of India's exports to each destination on the four tariffs, with the HS6 products as the unit of observation. Identification of the coefficients comes from tariff variation across products within sectors.

Consider the interpretation of $\{\beta_{1}^{US}, \beta_{1}^{CH}, \beta_{1}^{RW}\}$, the coefficients on the US tariff across the ($\beta_{1}^{US} > 0$) or complement for China ($\beta_{1}^{US} < 0$). As also discussed above, the sign of β_{1}^{RW} reveals if India operates along upward ($\beta_{1}^{RW} < 0$) or downward ($\beta_{1}^{RW} > 0$) sloping supplies, on average across products. The coefficient on the US tariff in regression that examines exports to China, β_{1}^{CH}, captures two potential interpretations. First, analogous to the rest-of-world response, an increase or decrease of India's exports to China depends on the shape of India's supply of that product. A second interpretation concerns input-output linkages: if China's exports to the US decline because of the tariff and if India's exports of that product are used intensively by China as inputs, India's exports to China may also decline with the US tariff.

Consider next the interpretation of $\{\beta_{2}^{US}, \beta_{2}^{CH}, \beta_{2}^{RW}\}$, the coefficients on the China tariff across the three regressions. The sign of β_{2}^{CH} reveals India's substitutability or complementarity with US exports based on whether or not India's exports to China increase or decrease, respectively, with the China tariff. The coefficient β_{2}^{RW} reveals whether the tariff reallocated exports out of RW or exports production. The coefficient on β_{2}^{US} how the China tariff affects India's exports to the US, with the analogous two possible interpretations discussed in the previous paragraph. For example, exports to the US could fall with the China tariff if the US uses Indian products intensively as inputs.

The coefficients $\beta_{3}^{US}, \beta_{3}^{CH}, \beta_{3}^{RW}$ capture the response to the direct US tariffs on India. The sign of β_{3}^{US} is straightforward. It captures the direct impact of the tariff increases on Indian exports to the US. The other two coefficients, β_{3}^{CH} and β_{3}^{RW}, reflect potential

[9] Fajgelbaum et al. (2021) show that the full model motivates two additional terms that capture India's response to the tariff changes of other countries. But since the magnitude of US and China tariff changes across bystanders were similar (in the case of China, the tariff changes were identical because China lowered MFN rates), there is not enough separate variation to identify these two additional terms.

expansion (or diversion) from China and the RW. An analogous interpretation lies with $\beta_4^{US}, \beta_4^{CH}, \beta_4^{RW}$: China's tariff reductions on India's exports will affect its exports to China, $\Delta \ln X_\omega^{CH}$, and there will be simultaneous reallocation from US and RW.

It is important to note that (1) captures India's response along the intensive margin, i.e., exports in continuing products. I also analyze the extensive margin since the trade war tariff changes could have led to entry or exit of products, or entry/exit of firms within products. A second important note is the inclusion of the sector fixed effects, α^n. In the model, these fixed effects control for supply and demand shifters at the sector level. In a fully-specified general equilibrium, these shifters themselves would respond to tariff changes. The analysis below controls for these changes and does formally account for how they may adjust. Thus, the interpretation of how the tariffs affect India's exports must be made with this important caveat in mind.

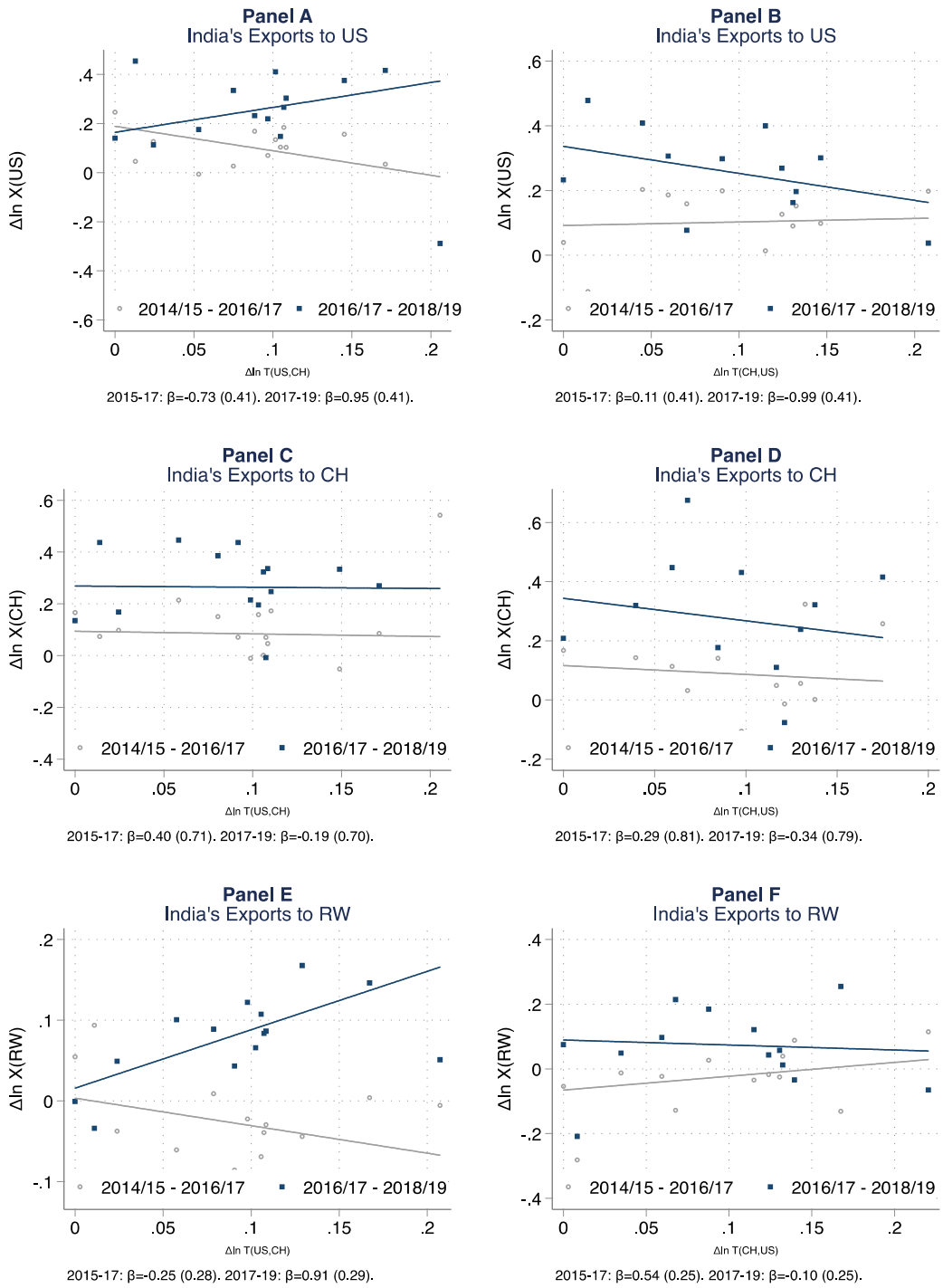
4. Results

I begin by assessing its pre-existing export trend growth to the US, CH and RW. I then present the results from estimating (1), and end with a discussion of heterogeneous responses.

4.1 Visualizing India's Export Results

It is instructive to examine visually India's export response to four tariffs and to the three destinations. Figure 2 shows a series of binscatter plots, where the y-axes show changes in India's product-level log exports and the x-axes show the US and China tariff changes. Each plot contains data points and linear trend lines from two periods: export growth prior to the trade war (2014/15 to 2016/17), and growth during the trade war (2016/17 to 2018/19). The former series helps assess potential pre-existing trends in India's exports that may have coincided with the tariff changes; the latter shows the export responses during the trade war.

FIGURE 2. Trade war tariffs and India's export growth



Notes: The panels show binscatter plots of India's export growth (on the y-axes) against changes in tariffs due to the trade war (on the x-axes; the left panel plots $\Delta \ln T_{CH,\omega}^{US}$ and the right panel plots $\Delta \ln T_{US,\omega}^{CH}$). Panels A and B show India's exports to US. Panels C and D show India's exports to CH. Panels E and F show India's exports to RW.

Panel A plots India's exports to the US against the US tariffs. India's exports to the US increased sharply with the tariffs during the trade war, suggesting that the country

took advantage of China's loss in market access along this tariff. Interestingly, India's export growth prior to the war happened to be slightly negatively correlated with the tariff. Panel B examines the same export response to the US but against the China tariff. Here, the picture looks different: India's exports to the US decline with the China tariff. So, on net, it is not immediately obvious how the trade war would have affected India's exports to the US, something examined more formally below.

Panels C and D plot India's exports to China against the US and China tariffs, respectively. The panel reveals that India's export growth to China are flat or slightly negative during the trade war along both tariffs. This suggests that the trade war did not translate to export gains in China for India.

Panels E and F report India's exports to the rest of world against the US tariff and China tariff, respectively. There is a sharp rise in exports to RW with the US tariff, and differentially so relative to the pre-trade war period. This is suggestive evidence that India benefited from the US tariffs not only by increasing exports to the US (Panel A), but also by increase exports globally (Panel E). Panel F, however, reveals no differential export growth against the China tariff to the rest of world. Together, the visual patterns suggest that India's exports to RW may have increased, and in the next subsection, I analyze this formally through the regressions specifications.

4.2 Main Results

I now examine the main specifications in (1) and report the results in Table 2.[10]

TABLE 2. Export responses to tariffs, main specifications

	(1)	*(2)*	*(3)*
	$\Delta\ln X_{\omega}^{US}$	$\Delta\ln X_{\omega}^{CH}$	$\Delta\ln X_{\omega}^{RW}$
$\Delta T_{CH,\omega}^{US}$ (β_1)	0.73	0.17	0.40
	(0.46)	(0.79)	(0.31)
$\Delta T_{US,\omega}^{CH}$ (β_2)	-0.72	-0.05	0.16
	(0.40)	(0.79)	(0.25)
$\Delta T_{IN,\omega}^{US}$ ($\beta 3$)	-4.20***	-4.88*	1.02
	(1.05)	(1.82)	(0.82)
$\Delta T_{IN,\omega}^{CH}$ (β_4)	1.52	0.07	0.58
	(0.93)	(1.73)	(0.68)
Pre-Existing Trend Control	Yes	Yes	Yes
Sector FE	Yes	Yes	Yes
R^2	0.06	0.07	0.11
N	3,578	2,806	5,050

***Notes*:** Table reports the coefficients from specification (1). Columns 1, 2, and 3 examines India's exports to US, China, and RW, respectively. The specifications include sector fixed effects and pre-existing trend control variable, $\Delta\ln X_{\omega,t-1}^{n}$. Significance: * 10%, ** 5%, *** 1%.

[10] Table A.2 examines pre-existing trends formally by regressing pre-war tariff changes $\Delta\ln X_{\omega,t-1}^{n}$ tariff changes and sector fixed effects. These results suggest that pre-existing trends are not a major concern, but the main regressions in (1) will nevertheless include a pre-existing trend control in all specifications.

Column 1 reports India's export response to the US against the four tariffs. The coefficient β_1^{US} reveals that India's exports to the US increased with the US tariffs on China at an elasticity of 0.73 (se 0.46). This indicates that Indian varieties are substitutes for Chinese varieties in the US. The coefficient on the China tariffs, β_2^{US}, is negative, indicating that India's exports to the US declined with China's tariffs on the US. This finding could capture a value chain mechanism. The China tariff reduced US exports to China. If those exports use Indian products as inputs, then India's exports to the US would decline as the US lost market access in China. Both point estimates, however, are somewhat noisy. The direct impact of the US tariff increase on India is captured by β_3^{US}. There is a large and negative elasticity of -4.20 (se 1.05) indicating that India's exports are quite negatively responsive to these direct tariffs. The last coefficient β_4^{US} captures India's export response to the US against the tariff reductions it received in China. This coefficient is positive, although not statistically significant, perhaps revealing reallocation out of the US along this tariff (recall that $\Delta \ln T_{IN}^{CH} < 0$). In sum, the pattern of India's tariff elasticities to the US are nuanced: the US tariff raised Indian exports but the other three tariffs reduce its exports.

Column 2 reports India's export response to China. The point estimates are noisier. In particular, we do not see a sharp response with China's tariffs on the US; if anything, β_2^{CH} is negative (and quite noisy) indicating complements with US varieties. Curiously, we also see that India's exports to China decline with ΔT_{IN}^{US}; this indicates that India was not able to reallocate their exports out of the US and into China in these products. Surprisingly, the coefficient β_4^{US} $\beta_{4^{US}}$ is essentially zero and quite noisy, suggesting that the MFN tariff declines did raise India's exports to China, on average. But, it is difficult to conclude much given the large standard errors.

Column 3 reports India's export response to RW. The first two rows suggest that India's exports to RW increased with the US-China tariffs, but again the results are noisy. The positive coefficient in the third row suggests that India's exports to RW increased with the direct tariffs the US imposed on India, which is consistent with an upward-sloping reallocation channel. But, as before, the standard errors on the tariffs responses are high, making it difficult to form sharp conclusions about India's exports to RW.

While examining the marginal response of exports to each of the four tariff changes is instructive, it masks the overall impacts of tariff changes on exports. As noted above, the US and China changed tariff rates on overlapping products, so to better understand India's export response to the trade war, I perform an exercise that aggregates exports to each destination across the tariff impacts. As discussed above, the procedure does not incorporate the impacts of the tariffs on destination-sector fixed effects α_j^n in (1). Thus, the aggregation procedure does not incorporate general equilibrium impacts of the tariffs that operate above the sector level. For example, if the tariffs affected exchange rates or wages at the national level, the aggregate response would not reflect this. See Fajgelbaum et al. (2021) for an extended discussion of this aggregation point.

To perform the aggregation, I first generate the predicted impacts of the tariffs at the product level using the coefficients from Table 2:

$$\Delta \widehat{\ln X_\omega^n} = \widehat{\beta_1^n} \Delta \ln T_{CH,\omega}^{US} + \widehat{\beta_2^n} \Delta \ln T_{US,\omega}^{CH} + \widehat{\beta_3^n} \Delta \ln T_{IN,\omega}^{US} + \widehat{\beta_4^n} \Delta \ln T_{IN,\omega}^{CH} \qquad (2)$$

Next, aggregate these product-level exports to the destination by weighing each product by the (pre-war) export share to each destination:

$$\Delta\widehat{\ln X^n} = \lambda_\omega^n \sum_\omega \Delta\widehat{\ln X_\omega^n} \qquad (3)$$

where λ_ω^n is product ω's share of India's exports to each destination.

Finally, further aggregate the export responses to the world by taking a weighted average of the (pre-war) export responses across the three destinations

$$\Delta \ln \widehat{X^{WD}} = \sum_{n=US,CH,RW} \Lambda^n \, \Delta \widehat{\ln X^n} \quad (4)$$

where Λ^n is destination n's share of India's exports to the world.

TABLE 3. India's aggregate response to trade war

Panel A: All Tariffs			
US	*CH*	*RW*	*World*
-7.7	0.3	4.2	1.7
(6.0)	(12.1)	(4.4)	(3.6)
Panel B: US-China Tariffs Only			
US	*CH*	*RW*	*World*
-3.1	0.6	4.8	3.0
(5.5)	(12.1)	(4.2)	(3.4)

***Notes*:** Table reports the coefficients from specification (1) and aggregated using the procedure described in (2)-(4). Panel A reports the response to all tariffs, and Panel B reports the response to the US-China bilateral tariffs only (i.e., setting $\beta_3^n = \beta_4^n = 0$ in (1)). Bootstrapped standard errors reported in parentheses.

The aggregation results are reported in Panel A of Table (3). Below the estimates are bootstrapped standard errors that are computed through the following procedure: 1) draw a sample, with replacement, of products within sectors; 2) estimate the specifications in (1); 3) construct the aggregate predicted exports to each destination using (2) and (3); 4) repeat 100 times to compute the standard errors of the aggregate responses.

The results show that India's aggregate response to the US decreased 7.7%, but with a standard error of 6.0% around this estimate. Although the India's exports to the US increase with the US tariff, its exports decline along the three other tariffs, as shown in Table 2. In aggregate, the tariffs have a negative impact on India's exports to the US, although there is considerable variance around that estimate.

India's aggregate response to China is muted and noisy. Exports increased by 0.3% with a standard error of 12.1%. The flat response is due to the relatively attenuated coefficients in column 2 of Table 2.

Finally, aggregate exports to RW increased by 4.2% (se 4.4%). It is a sizable

response, but again is noisy. Through the lens of the model, this pattern of decreased exports to the US, flat response to China, and increased exports to RW suggests that India operates under textbook upward-sloping supply curves.

Aggregating across the response to the three destinations using (4), the results indicate that the trade war increased India's global exports by 1.7% with a standard error of 3.6%. This leads to one main takeaway from the analysis: the trade war did little to stimulate aggregate exports for India. The bottom panel of Table 3 considers the impact of just the US-China bilateral tariffs on each other. The reason to focus on these two tariffs is to think about a counterfactual scenario where international market conditions just change indirectly for India, rather than also including the direct tariff changes on India. To do so, I construct the predicted responses by setting $\beta_3^n = \beta_4^n = 0$ in (2), re-perform the aggregation, and present the aggregate impacts in Panel B of Table 2. In the absence of negative impacts of the direct US tariff hikes on India, its exports the US would have been less negative. But, across destinations and on net to the world, focusing on the bilateral US-China tariffs do not qualitatively change the message: exports to the world are predicted to increase by 3.0% (se 3.4%).

4.3 Heterogeneous Responses

In the framework, India's export response differs to each destination depending on demand and supply-side parameters. However, it imposes common elasticities across products to each destination. In this section, I relax this assumption by allowing the coefficients to vary by destination and sector/product characteristics.

4.3.1. By Sector

I re-estimate (1) separately by destination and sector. With the products classified into the 9 sectors reported in Table 1, this yields 27 regressions (9 sectors to 3 destinations) with each regression estimating the four tariffs coefficients. Given the large number of results to interpret, I report the aggregate responses (full results are available upon request). Specifically, I estimate (1) by destination-sector, and then perform the aggregation steps in (2)-(4) to obtain the aggregate responses by sector. The results are reported across nine panels in Table 4. As before, the top row reports the impact of all four tariffs and the bottom reports the impact of just the US-China tariffs. The final panel, Panel J, aggregates the responses across all sectors using pre-war sectoral weights to obtain the overall impact of the tariffs on India's exports.

The main message of the table is that the responses by sector are quite noisy. The two exceptions are the apparel and transport sectors, which account for 10.6% of India's exports in 899 products and 5.6% of India's exports in 130 products, respectively. In apparel, there is a strong response to China, and this drives an overall export expansion of apparel to the world. For transport, there are a particularly large response to US and RW and to the world. However, when aggregating across sector responses (Panel J), allowing for sectoral heterogeneity in the tariff responses does not qualitatively change the message from the baseline results: the trade war increased India's global exports by 6.0% (se 5.7%). Nor does the message change when the analysis only considers the US-China tariffs (the lower sub-panel in J: 6.5% with standard error of 5.6%).

TABLE 4. Aggregate response, heterogeneity

Panel A: Agriculture				*Panel F: Metals*			
US	*CH*	*RW*	*World*	*US*	*CH*	*RW*	*World*
-16.8	-9.1	11.9	6.8	11.3	-52.4	-11.9	-13.1
(11.4)	(46.3)	(9.5)	(7.9)	(18.8)	(40.6)	(13.9)	(12.1)
-12.2	-7.2	11.2	7.1	33.2	-51.2	-16.9	-14.4
(11.3)	(46.1)	(9.6)	(8.0)	(20.6)	(40.9)	(15.1)	(13.0)
Panel B: Apparel				*Panel G: Minerals*			
US	CH	RW	World	*US*	*CH*	*RW*	*World*
13.5	48.1	18.8	19.2	-123.2	72.8	44.3	30.7
(23.4)	(26.3)	(11.4)	(9.1)	(92.6)	(56.5)	(48.2)	(40.5)
-4.8	38.4	8.0	6.7	-126.1	72.1	46.8	32.3
(14.1)	(25.4)	(7.3)	(5.8)	(96.7)	(56.2)	(54.6)	(45.8)
Panel C: Chemicals				*Panel H: Miscellaneous*			
US	*CH*	*RW*	*World*	*US*	*CH*	*RW*	*World*
-6.4	-18.5	-4.3	-5.6	2.9	-13.6	-18.7	-12.6
(7.8)	(30.8)	(10.4)	(7.8)	(17.3)	(46.2)	(14.2)	(10.5)
0.2	-18.2	0.7	-0.3	6.0	-11.7	-12.1	-7.1
(4.3)	(30.6)	(9.3)	(6.6)	(17.4)	(46.4)	(14.7)	(10.9)
Panel D: Machinery				*Panel I: Transport*			
US	*CH*	*RW*	*World*	*US*	*CH*	*RW*	*World*
-25.6	37.7	-4.5	-5.9	119.8	39.5	53.7	60.8
(19.2)	(26.2)	(13.1)	(11.0)	(76.3)	(88.9)	(33.1)	(30.6)
-26.3	35.8	-2.7	-4.6	111.8	53.5	61.2	66.6
(19.2)	(26.3)	(12.9)	(10.8)	(67.1)	(71.8)	(28.3)	(26.2)
Panel E: Materials				*Panel J: All Sectors*			
US	*CH*	*RW*	*World*	*US*	*CH*	*RW*	*World*
2.2	-13.9	-9.5	-7.1	-8.3	9.1	7.3	6.0
(24.2)	(32.5)	(13.8)	(11.8)	(13.7)	(13.1)	(6.2)	(5.7)
8.9	-12.7	-5.5	-2.6	-6.9	8.9	7.8	6.5
(21.7)	(33.2)	(12.2)	(10.6)	(13.0)	(12.8)	(6.2)	(5.6)

Notes: Table reports the aggregate responses of India's exports for different sets of products. Within each panel, the top rows report the response to all tariffs and the bottom rows report the response to the US-China bilateral tariffs only (i.e., setting $\beta_3^n = \beta_4^n = 0$ in (1). Panel B estimates (1) on Agriculture, covering 10.6% of India's exports in 899 products. Panel B estimates (1) on Apparel, covering 15.2% of India's exports in 912 products. Panel C estimates (1) on Chemicals, covering 15.2% of India's exports in 787 products. Panel D estimates (1) on Machinery, covering 9.3% of India's exports in 771 products. Panel E estimates (1) on Materials, covering 22.0% of India's exports in 639 products. Panel F estimates (1) on Metals, covering 8.9% of India's exports in 563 products. Panel G estimates (1) on Minerals, covering 10.9% of India's exports in 148 products. Panel H estimates (1) on Miscellaneous, covering 2.3% of India's exports in 354 products. Panel I estimates (1) on Transport, covering 5.6% of India's exports in 130 products. Panel J estimates (1) aggregates across sectors. Bootstrapped standard errors reported in parentheses.

4.3.2. By Product Characteristics

While the previous specifications allow for different tariff responses across sectors, it is possible that export responses differ according to certain *product* characteristics. I consider heterogenous responses along four characteristics: product size, the strength of India's comparative advantage in the product, technological sophistication, and capital intensity. I also examine export responses based on measures that capture products' intensity in global value chains.

Panel A of Table 5 considers the aggregate response of the top 10th percentile products in terms of global exports. This panel covers 83.4% of India's exports in 521 products. As before, the message does not change. The tariffs increase global exports in these products, but the standard error is large.

An alternative dimension of heterogeneity is to examine India's exports of its highly comparative advantage products. Using pre-war flows, I construct products' revealed comparative advantage as

$$\frac{X_{\omega}^{WD} \Big/ \sum_{\omega} X_{\omega}^{WD}}{\sum_{i} X_{i\omega}^{WD} \Big/ \sum_{i} \sum_{\omega} X_{i\omega}^{WD}}$$

where X_{ω}^{WD} denotes India's exports to the world in product ω, and $X_{i\omega}^{WD}$ denotes all other countries' exports of ω to the world. Panel B considers the response of top 10th percentile RCA products, which cover 41.8% of India's exports. Here, we do observe a large increase in exports to RW, and to the world overall, but somewhat noisy. This suggests that the trade war may have reinforced India's existing pattern of comparative advantage, but the evidence is not sharp.

Next, I examine the differential response in HS6 codes classified by the US as advanced technology products (ATP). In 1989, the US Census Bureau introduced the ATP classification to track trade in high-technology products (Ferrantino et al. 2007). For the US, one of the stated geopolitical goals of the trade war was to reduce its imports and exports of sensitive technology products with China. This could create an opportunity for India to increase exports of these products to the US. Prior to the trade war, ATP goods accounted for 9.1% of India's pre-war exports in 235 products. As shown in Panel C of Table 5, aggregate exports of ATP goods decreased by 6.9% (se 5.6%). This suggests that there is little evidence that the trade war led, at least thus far, to meaningful shifts in India's exports of advanced technology products.

Panel D examines the response of products in the top 10th percentile of capital intensity, as measured by Ma et al. (2014) from Chinese production data. These products cover 10.2% of India's exports. There is no clear pattern of response among these products.

Examining the responses of intermediate products is natural in an era of global value chains. I rely on the UN's Broad Economic Category classification that assigns an end-use to sectors which are then mapped to HS6 codes. According to this

classification, intermediate goods accounted for 69.8% of India's 2017 exports in 3,822 products. Panel E reports the response of intermediate exports to the tariffs. As before, the estimates remain noisy.

An alternative way to understand exports within value chain is to consider the response of products that rely more heavily on contracts. Antràs and Chor (2022) argue that trade within global value chains is of products that are highly customizable and governed by contracts that are incomplete and difficult to enforce. Thus, if India is to integrate further into GVCs, it is instructive to examine its response in products that are contract intensive. Nunn (2007) develops a measure of contract intensity based on the extent to which a final product is produced through differentiated inputs. Panel F of Table 5 reports the response of products in the top 10th percentile of this contract intensity measure, covering 12.5% of India's pre-war exports. Again, there is no discernible impact of the tariffs on India's exports of these products.

A third way to analyze India's response within value chains is to look at products that are produced upstream. Antràs et al. (2012) provide a measure of a sector's position in the supply chain using standard input-output matrixes, which can then be mapped to the HS6 classification. Panel G reports products with an upstream measure in the top 10th percentile, covering 13.1% of India's 2017 exports. As before, the results are noisy.

Finally, Panel H examines the export response in differentiated products, as defined by Rauch (1999), covering 79.4% of India's 2017 exports in 4,011 products. The message remains the same.

To conclude, aside from the apparel and transport sectors, Table 5 indicates no clear heterogenous response of India's exports to the trade war along the dimensions considered.

TABLE 5. Aggregate response, product heterogeneity

Panel A: Top 10th Pctile, Size			
US	*CH*	*RW*	*World*
10.8	0.6	-5.7	-2.2
(13.2)	(26.4)	(6.6)	(5.6)
2.4	-1.9	-4.7	-3.5
(11.0)	(26.1)	(5.0)	(4.4)
Panel B: Top 10th Pctile, RCA			
US	*CH*	*RW*	*World*
6.3	15.3	14.0	12.7
(15.8)	(20.4)	(12.2)	(10.0)
-1.9	10.7	10.2	7.7
(13.4)	(19.7)	(10.2)	(8.1)
Panel C: ATP Products			
US	*CH*	*RW*	*World*
-4.1	8.1	-7.6	-6.9
(5.7)	(13.7)	(6.8)	(5.6)
-2.7	7.3	-1.8	-1.8
(4.4)	(12.5)	(3.7)	(2.9)
Panel D: Capital Intensive			
US	*CH*	*RW*	*World*
0.6	-21.2	8.5	5.1
(23.2)	(31.0)	(12.9)	(10.5)
6.0	-13.1	8.4	6.4
(22.3)	(31.3)	(11.0)	(9.5)

Panel E: Intermediate			
US	*CH*	*RW*	*World*
4.0	2.5	0.7	1.4
(9.3)	(13.8)	(6.3)	(5.5)
3.8	5.5	1.9	2.2
(7.4)	(13.4)	(5.4)	(4.6)
Panel F: Contract Intensive			
US	*CH*	*RW*	*World*
-15.3	23.9	-5.8	-6.6
(11.8)	(19.6)	(7.6)	(6.2)
-9.4	23.9	3.1	1.2
(10.3)	(19.9)	(6.2)	(5.1)
Panel G: Upstream			
US	*CH*	*RW*	*World*
-7.1	-5.7	-17.8	-15.0
(16.1)	(31.2)	(20.0)	(15.3)
-1.9	-1.1	-1.7	-1.8
(13.8)	(30.4)	(16.7)	(13.2)
Panel H: Differentiated			
US	*CH*	*RW*	*World*
-10.4	-5.4	5.3	1.8
(7.2)	(13.9)	(4.7)	(3.9)
-5.0	-4.9	6.5	3.7
(6.8)	(13.5)	(4.5)	(3.8)

***Notes*:** Table reports the aggregate responses of India's exports for different sets of products. Within each panel, the top row shows the baseline response and the bottom row shows the response to the US-China bilateral tariffs only (i.e., setting $\beta_3^n = \beta_4^n = 0$ in (1). Panel A estimates (1) on the top 10th percentile products with largest export values to the world; this panel covers 83.4% of India's pre-war exports in 521 products. Panel B estimates (1) on the top 10th percentile products with largest *RCA* values; this panel covers 41.8% of India's exports. Panel C estimates (1) on advanced technology products (ATP); this panel covers 9.1% of India's exports in 235 products. Panel D estimates (1) on products with top 10th percentile capital intensity; this panel covers 10.2% of India's exports. Panel E estimates (1) on intermediate products as according to the UN Broad Economic Categories classification; this panel covers 69.8% of India's exports in 3,822 products. Panel F estimates (1) on products in the top 10th percentile of contract intensity, as defined by Nunn (2007); this panel covers 12.5% of India's exports. Panel G estimates (1) on products in the top 10th percentile of the upstream measures developed by Antràs et al. (2012); this panel covers 13.1% of India's exports. Panel H estimates (1) on differentiated products, as defined by Rauch (1999); this panel covers 79.4% of India's exports in 4,011 products. Bootstrapped standard errors reported in parentheses.

4.4 Product Extensive Margin

The analysis has so far examined the trade war's impact along the product intensive margin, i.e., India's exports of continuing products. It is also possible that the trade war affected entry into and/or exit out of products. The product extensive margin response would not quantitatively affect aggregate impacts of the war since it accounts for 0.4% of India's export growth over this time period (with continuing products accounting for 99.6% of export growth). Of the 123 products that India could have entered in 2018/2019 (i.e., these are products India did not export in 2016/2017), the country entered 41 HS codes. Moreover, India exited only 25 products in 2018/19 (i.e., these are products that India exported in 2016/17 but did not export in 2019/19). Thus, there is a small net entry into new products during this period. But, while the product extensive margin may be important over long intervals, it would not have been an important contributor to India's aggregate exports during this period.

4.5 Firm Extensive Margin

Using Datamyne data, I can examine the firm-level response to the trade war tariffs. As discussed in Section 2.2, these results should be interpreted with some caution since they do not capture the universe of India's exports. Nevertheless, they can be used to understand the firm-level margins of adjustment to the tariffs.

To facilitate comparison with the product-level analysis, I perform a decomposition exercise that partitions export responses into the intensive and extensive margins. Consider the identity:

$$X_\omega \equiv \frac{X_\omega}{N_\omega} N_\omega \quad (5)$$

where X_ω is the total exports and N_ω is the number of exporters in product ω (at time t). Taking logs and first differencing over time, $\Delta \ln X_\omega \equiv \Delta \ln \frac{X_\omega}{N_\omega} + \Delta \ln N_\omega$. The term $\Delta \ln \frac{X_\omega}{N_\omega}$ reflects the growth in the average exports per firm, or the *intensive margin*. The term $\Delta \ln N_\omega$ captures growth in the number of exporters per product, or the *extensive margin*. I can re-run (1) using these three terms as the outcome responses to learn the overall response to the tariffs (as was done with the Comtrade data), but now can determine how that response exactly decomposes into the two margins of adjustment.

Table A.3 reports the results of those regressions. If Datamyne data aggregated perfectly to Comtrade data, the coefficients in Panel A would be identical to Table 2.[11] Column 1 reports the results for exports to the US. Compared to column 1 of Table 2, the coefficients are fairly similar, with the exception of the coefficient on China's tariff reductions, ΔT_{IN}^{CH}, which is negative here but positive in Table 2. There are more discrepancies between the results for China and RW between Datamyne and Comtrade data. One potential source of the difference lies with the discrepancy in the number of products exported to the two destinations; the Comtrade data report India exporting

[11] The point estimates would be identical leaving aside the control for pre-existing trends, which are not included in the decomposition regressions.

more products to China and RW than Datamyne data.[12] The second source of difference lies in potentially more measurement error in Datamyne data, also discussed in Section 2.2. Since product-level exports exactly decompose into the intensive and extensive margins according to (5), the coefficients on each tariff in Panel B (the intensive margin response) and Panel C (the extensive margin response) will sum exactly to the coefficients in Panel A. For example, product-level exports to the US respond to the US tariff, $\Delta T_{CH,\omega}^{US}$, with an elasticity of 1.57 (Panel A, column 1, row 1). This response decomposes exactly into an intensive margin response of 1.02 (Panel B, column 1, row 1) and extensive margin response of 0.56 (Panel C, column 1, row 1). Likewise, exports to the RW respond to the CH tariff, $\Delta T_{US,\omega}^{CH}$, with an elasticity of 0.41 (Panel A, column 3, row 2) which decomposes into an intensive margin response of 0.12 (Panel B, column 3, row 2) and 0.29 (Panel C, column 3, row 2).

As before, it is useful to aggregate the regressions using the procedure in (2)-(4) to assess overall impacts. The decomposition properties are preserved, so this procedure can decompose the aggregate response to the tariffs into both margins. The first row of Panel A of Table A.4 shows the overall response, which again, if Datamyne data perfectly matched the Comtrade data, would be identical to Panel A in Table 3. Although the numbers do not match, the impacts are noisy and the two tables do align within margins of error. Moreover, Datamyne data confirm the noisy aggregate response of Indian exports to the trade war. The second and third rows report how the overall export response decomposes into the two margins. The final row reports the contribution of the extensive margin as a percent of the overall response. As before, the bottom panel of this table reports the impact of just the bilateral US-China tariffs.

There are two messages from this table. First, the contribution of the extensive margin into US and China is roughly 40%. This means that for every five percentage points increase in growth to these two markets caused by the tariffs, two percentage points is driven by firms entering product lines that they had not previously exported. Second, the contribution of the extensive margin to the RW response is even larger; the tariffs lower exports along the intensive margin but causes entry into these product lines. The result is a sizable response of the extensive margin.

With the data caveats in mind, this table provides some optimism around India's overall lackluster export response. It suggests that the tariffs cause exporters to expand their export scope by entering new product lines.

5. Conclusion

The recent shocks to the world trade system—Brexit, the US-China trade war, the Covid-19 pandemic, Russia-Ukraine conflict, and increased nationalism in the West and China—have ushered in an era of heightened geopolitical tensions. Of course, these events directly affect trade and investment of the involved countries. But bystander countries are also affected and may stand to gain.

This paper offers an analysis of India's export response to the US-China trade war

[12] As noted in Section 2.2, I define India's exports through the countries' reported imports from India, but use India's exports in Datamyne data. This difference could also explain the discrepancy in the number of products exported to China between the two data sets. For example, Indian firms may use Hong Kong as a transshipment point and label the destination to Hong Kong, while Comtrade imports records may appropriately classify these such transactions as sales in China.

from 2018-19. I find that the trade war raised India's exports by 1.7% but with considerable error around this estimate. I conclude that the export response was not sharp, nor do I find sharp patterns across a range of sector and product characteristics. There is some evidence that the tariffs increased firm entry into products, particularly for exports to the rest of the world, which offers some optimism that the trade war has created an opportunity for India to broaden its export base over the long run.

The lackluster export response begs more questions than can be answered from these administrative data. The framework developed in Fajgelbaum et al. (2021) points to two broad determinants of the export response to the tariffs: How substitutable are firms' products relative to the targeted country? And, how strong are the reallocation frictions and scale for production? Tailored surveys that collect information on exporters' product quality, searching and matching frictions for overseas buyers, production structures, and constraints on factor markets can open the black box to reveal the binding constraints that Indian firms face in global markets.

As an example, an emergent literature has documented that a particular form of non-trade barriers—information frictions—can have consequential impacts on trade.[13] Were Indian firms aware of the magnitude of tariff changes in the precise product codes they export? Were they aware of how their competitor were responding? Could they find buyers in China or the US, and if so, through what platforms? Was trade financing difficult to secure? Did the products they export appeal to US and/or Chinese consumers? Given the challenges of contracting on specialized products, how easy is it for Indian businesses to build trust with buyers so that relational contracts emerge?[14]

The data used in this paper are not detailed enough to answer these questions. As such, a final contribution of this paper is to urge policymakers to create tailored surveys and launch targeted interventions to understand fully the challenges that Indian exporters face in global markets.

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[13] Atkin et al. (2017) conduct a randomized trial that lowers search and matching frictions for Egyptian rug producers to find overseas buyers, and document large impacts on profits, quality and productivity. For a review of the literature on information frictions and trade, see Atkin and Khandelwal (2020).

[14] Banerjee and Duflo (2007) provide an analysis of the importance of reputation and contracting for Indian software exports in the late 1990s. Macchiavello (2022) provides an excellent review of the importance of relational contracts in developing countries.

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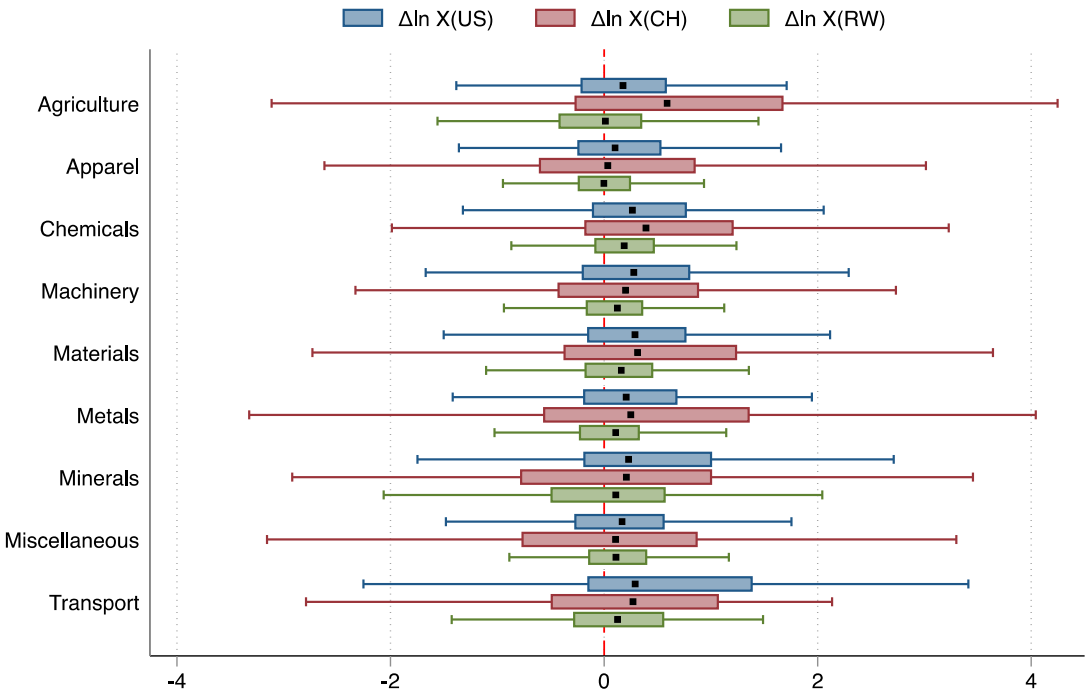
Appendix Tables and Figures

FIGURE A.1. Raw export changes



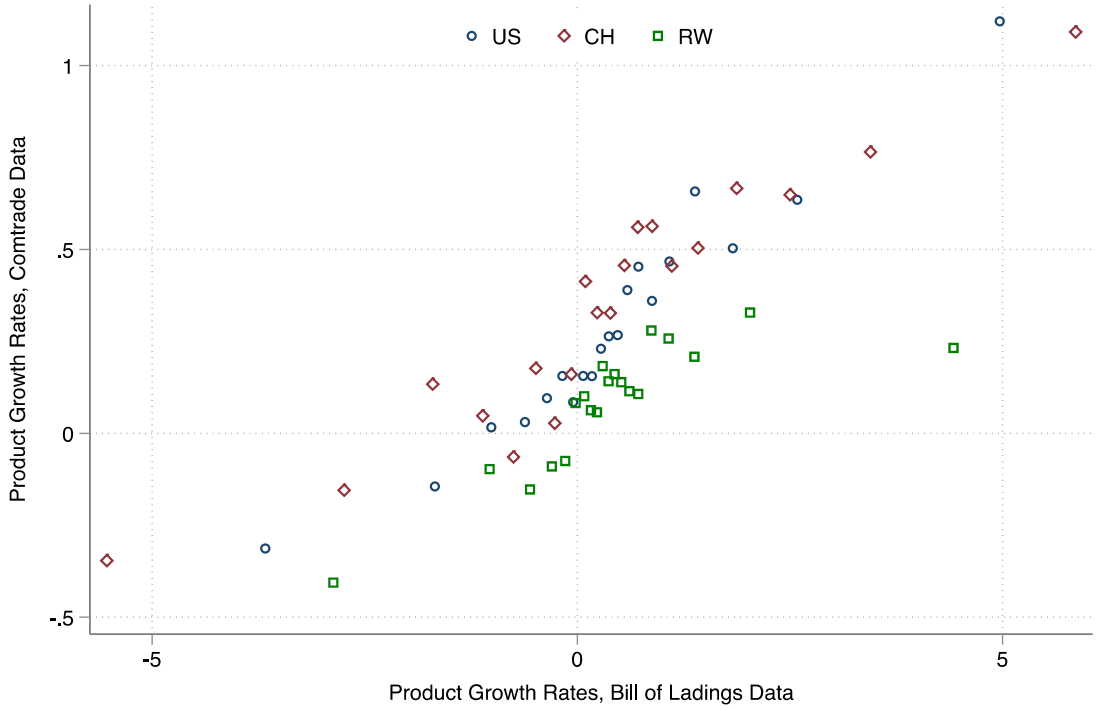
***Notes*:** This figure reports product-level growth rates by destination and sector. The black dots indicate the median tariff increase, the boxes denote the 25th and 75th percentiles, and whiskers show the 10th and 90th percentiles.

TABLE A.1: Compare Comtrade with Datamyne

Panel A: Comtrade Data		
	2017	*2019*
Exports to US	46	54
Exports to CH	12	17
Exports to RW	236	252
Exports to World	294	323
Panel B: Datamyne Data		
	2017	*2019*
Exports to US	32	42
Exports to CH	9	15
Exports to RW	171	225
Exports to World	212	283

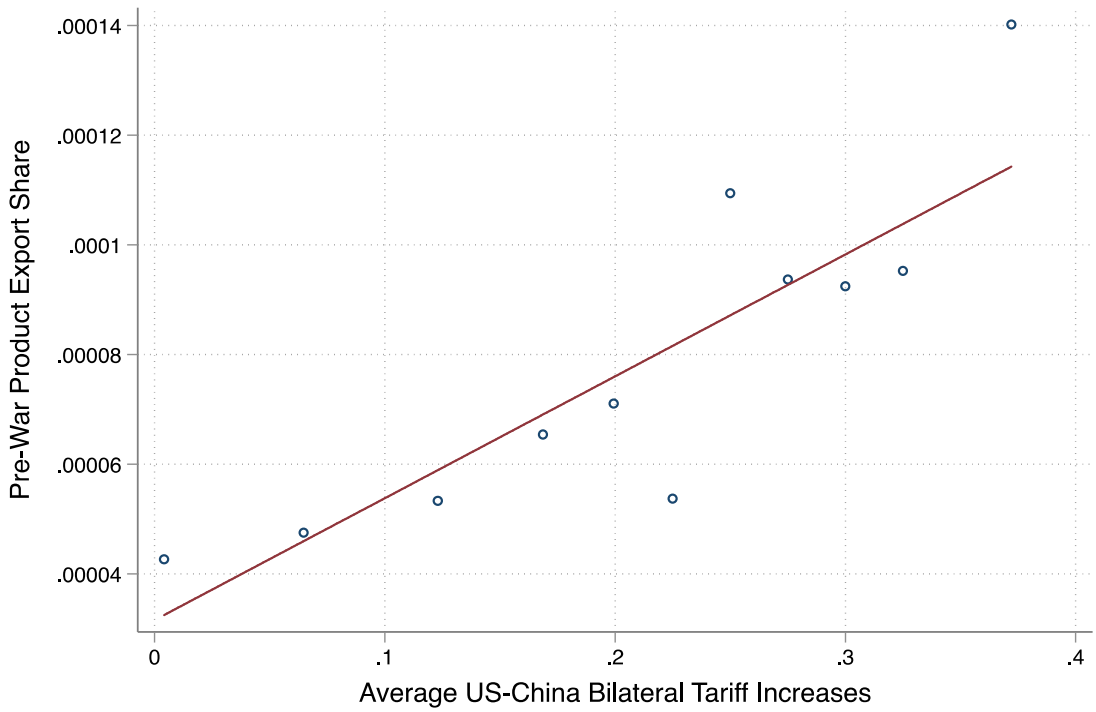
Notes: Table compares aggregate export values in Comtrade and Datamyne data for 2017 and 2019. All values in USD billions.

FIGURE A.2: Product-level growth rates in Comtrade vs Datamyne data



Notes: Figure reports a binscatter of product-level global export growth in Comtrade versus Datamyne data. The Comtrade growth rates are from 2016/17 to 2018/19, and Datamyne growth rates are computed from 2017 to 2019.

FIGURE A.3: Average US-China bilateral tariff changes and export shares



Notes: Figure reports a binscatter of India's product-level global export shares against the product-level average $\Delta T^{US}_{CH,\omega}$ and $\Delta T^{CH}_{US,\omega}$. The figure removes India's top 2% products before constructing the binscatter because those shares are significantly larger than the remaining 98% of products.

TABLE A.2: Checks for pre-existing trends

	(1)	*(2)*	*(3)*
	$\Delta X^{US}_{\omega,t-1}$	$\Delta X^{CH}_{\omega,t-1}$	$\Delta X^{RW}_{\omega,t-1}$
$\Delta T^{US}_{CH\,\omega}(\beta_1)$	-0.14	-0.22	-0.33
	(0.48)	(0.85)	(0.32)
$\Delta T^{CH}_{US,\omega}$ (β_2)	0.14	0.30	0.66**
	(0.42)	(0.83)	(0.26)
$\Delta T^{US}_{IN,\omega}$ (β_3)	-1.26	5.16**	-0.77
	(1.10)	(1.95)	(0.85)
$\Delta T^{CH}_{IN,\omega}$ (β_4)	-2.48*	-1.12	0.27
	(0.97)	(1.80)	(0.71)
Sector FE	Yes	Yes	Yes
R^2	.01	.009	.0023
N	3,530	2,714	5,054

Notes: Table reports the coefficients from specification (1), using $\Delta \ln X^{n}_{\omega,t-1}$ as the dependent variable. Columns 1, 2 and 3 examine India's exports to US, China, and RW, respectively. The specifications include sector fixed effects. Significance: * 10%, ** 5%, *** 1%.

TABLE A.3: Export responses to tariffs, decomposition

Panel A: Overall Response			
	$\Delta\ln X_{\omega}^{US}$	$\Delta\ln X_{\omega}^{CH}$	$\Delta\ln X_{\omega}^{RW}$
	(1)	(2)	(3)
$\Delta T_{CH,\omega}^{US}$ (β_1)	1.57*	1.22	-0.29
	(0.75)	(1.23)	(0.46)
$\Delta T_{US,\omega}^{CH}$ (β_2)	-0.63	0.93	0.41
	(0.65)	(1.17)	(0.38)
$\Delta T_{IN,\omega}^{US}$ (β_3)	-5.03**	-5.86	1.13
	(1.87)	(3.01)	(1.19)
$\Delta T_{IN,\omega}^{CH}$ (β_4)	-1.19	-4.94	2.33*
	(1.59)	(2.77)	(1.02)
Sector FE	Yes	Yes	Yes
R2	0.01	0.01	0.01
N	3,598	2,265	4,760
Panel B: Intensive Margin			
	$\Delta\ln(X/N)_{\omega}^{US}$	$\Delta\ln(X/N)_{\omega}^{CH}$	$\Delta\ln(X/N)_{\omega}^{RW}$
	(1)	(2)	(3)
$\Delta T_{CH,\omega}^{US}$ (β_1)	1.02	0.70	-0.60
	(0.70)	(1.13)	(0.42)
$\Delta T_{US,\omega}^{CH}$ (β_2)	-0.44	0.59	0.12
	(0.60)	(1.07)	(0.34)
$\Delta T_{IN,\omega}^{US}$ (β_3)	-5.22**	-4.67	1.25
	(1.73)	(2.76)	(1.09)
$\Delta T_{IN,\omega}^{CH}$ (β_4)	-1.25	-4.16	0.20
	(1.47)	(2.54)	(0.93)
Sector FE	Yes	Yes	Yes
R2	0.01	0.01	0.01
N	3,598	2,265	4,760
Panel C: Extensive Margin			
	$\Delta\ln N_{\omega}^{US}$	$\Delta\ln N_{\omega}^{CH}$	$\Delta\ln N_{\omega}^{RW}$
	(1)	(2)	(3)
$\Delta T_{CH,\omega}^{US}$ (β_1)	0.56**	0.52	0.31*
	(0.20)	(0.31)	(0.15)
$\Delta T_{US,\omega}^{CH}$ (β_2)	-0.19	0.34	0.29*
	(0.17)	(0.29)	(0.12)
$\Delta T_{IN,\omega}^{US}$ (β_3)	0.19	-1.19	-0.12
	(0.51)	(0.75)	(0.38)
$\Delta T_{IN,\omega}^{CH}$ (β_4)	0.06	-0.79	2.12***
	(0.43)	(0.69)	(0.32)
Sector FE	Yes	Yes	Yes
R^2	0.02	0.02	0.06
N	3,598	2,265	4,760

Notes: Table reports the coefficients from specification (1) on overall exports (Panel A), and the intensive (Panel B) and extensive margins (Panel C). Columns 1, 2 and 3 examine India's exports to US, China, and RW, respectively. The coefficients in Panel A exactly decompose into their corresponding coefficients in Panels B and C, as shown in (5). Significance: * 10%, ** 5%, *** 1%.
Source: Datamyne.

TABLE A.4: Aggregate responses, decomposition

Panel A: All Tariffs

US	*CH*	*RW*	*World*
	Overall		
5.7	22.7	-1.2	0.7
(9.6)	(17.3)	(6.5)	(5.7)
	Intensive Margin		
3.4	14.2	-3.2	-1.5
(8.5)	(15.6)	(6.1)	(5.3)
	Extensive Margin		
2.3	8.5	1.9	2.2
(2.7)	(4.3)	(2.1)	(1.8)
	Extensive Margin Contribution		
40.6%	37.5%	156.7%	319.3%

Panel B: US-China Tariffs Only

US	*CH*	*RW*	*World*
	Overall		
5.6	20.3	2.0	3.2
(8.6)	(16.9)	(5.8)	(5.1)
	Intensive Margin		
3.3	12.2	-3.4	-1.8
(7.6)	(15.2)	(5.6)	(4.8)
	Extensive Margin		
2.3	8.2	5.4	5.0
(2.4)	(4.2)	(1.9)	(1.6)
	Extensive Margin Contribution		
41.4%	40.1%	265.9%	157.4%

Notes: Table reports the coefficients from specification (1) and aggregated using the procedure described in (2)-(4) on Datamyne data. Panel A reports the response to all tariffs, and Panel B reports the response to the US-China bilateral tariffs only (i.e., setting $\beta_3^n = \beta_4^n = 0$ in (1)). Within each panel, the first subpanel reports the overall response, and the second and third subpanels report the contribution of the intensive and extensive margins, as defined in (5). The final row reports the contribution of the extensive margin. Bootstrapped standard errors reported in parentheses.
***Source*:** Datamyne.

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