China's Exports in a Protectionist World
(Revised)

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Abstract

Tariffs, currency wars, and protectionism pose risks for Chinese firms. In theory tariffs and exchange rates exert equivalent effects on export volumes. This paper estimates tariff and exchange rate elasticities for China's exports. The results indicate that, while exchange rates matter, tariffs deter exports almost three times as much as equivalent exchange rate changes do. The results also indicate that China's flagship industries such as electronics and machinery are exposed to tariffs and to exchange rate appreciations. The paper then considers how China can promote freer trade to mitigate risks and reduce uncertainty.

Key words: Chinese exports, exchange rate elasticities, tariffs
JEL codes: F10, F14, F13

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1. Introduction

Protectionism is exploding. The U.S. raised tariffs on Chinese products and labeled China a currency manipulator. Other countries are also pursuing beggar-thy-neighbor policies. How do tariffs, exchange rates, and other factors affect China's exports?

In theory, tariffs and exchange rates exert identical effects on export volumes. Fontagné et al. (2018) demonstrated this equivalence in a model with constant elasticity of substitution (CES) preferences. Krugman (1979) and Eaton and Kortum (2002) also showed this correspondence employing standard models. Because of this relationship, House et al. (2019) used exchange rate elasticities to calculate the effect of Chinese tariffs on the U.S. economy.

Tariffs on Chinese exports may deter trade more, however, than exchange rate appreciations. Benassy-Queré et al. (2021) investigated bilateral trade flows between 110 countries at the Harmonized System (HS) six-digit level. They reported that a 10 percent tariff reduces exports by 14 percent and that a 10 percent exchange rate appreciation reduces exports by 5 percent. Fontagné et al. (2018) examined exports from 8,500 French firms over the 1996-2010 period. They found that a 10 percent tariff reduces exports by 19 percent and that a 10 percent exchange rate appreciation reduces exports by 6 percent. Fitzgerald and Haller (2014) have reported this effect for Ireland. It is called the international elasticity puzzle. It could arise because tariffs, as policy instruments, are more persistent than exchange rate changes and affect exporters' pricing decisions more directly than exchange rate fluctuations do (Benassy-Queré et al., 2021). The finding that tariffs deter exports more than exchange rate appreciations implies that the impact of exchange rates on exports provides a lower bound for the impact of tariffs on exports.

Exchange rate changes are a thorny issue for China and its trading partners. The People's Bank of China only allows the renminbi to fluctuate within a certain band around the U.S. dollar each day. Although the U.S. at one point labeled China a currency manipulator, the International Monetary Fund (IMF) rejected this assessment.

This paper estimates tariff and exchange rate elasticities across a wide cross section of Chinese exports. These findings shed light on how factors such as tariffs and exchange rates that influence tradable prices will affect exports. Results from panel data estimation reveal that, while exchange rate elasticities are close to unity, tariffs reduce aggregate exports almost three times more. This is the first paper that confirms the existence of the international elasticity puzzle for China. The results also indicate that several sectors within the electronics, metals, and machinery industries are exposed to tariffs. Protectionism thus risks disrupting many of China's flagship industries.

Figure 1 shows how the trade war has reduced China's exports to the U.S. The figure only extends to 2019 to avoid the effects of the Covid-19 pandemic on exports. It shows that China's exports to the U.S. fell by almost $90 billion in 2019, after trending upwards before that.

The next section reviews the literature. Section 3 discusses our data and methodology. Section 4 presents the results. Section 5 considers how China can mitigate the risks caused by protectionism.

2. Literature review

Xu et al. (2020) employed multiproduct heterogeneous firm theory to analyze how tariffs affect China's exports over the 2002-2012 period. Using a gravity model specification and China's exports to 30 countries, they reported that a 10 percent increase in the log of one plus the bilateral tariff reduced exports by 24 percent. This response was driven by changes in the

extensive margin. For the top 500 Chinese exporters to the United States they found a tariff elasticity for high-technology products of 2.1 and for medium-low technology products of 2.2.

Li et al. (2020) used a Computational General Equilibrium (CGE) model to investigate the impact of the U.S. – China trade war. Their GTAPinGAMS model divided the world into regions, with CES preferences and technologies in each region. They assumed perfect competition and market clearing characterized by a complete set of relative prices. They also modeled China and the United States as large countries that can affect global prices and treated goods from different countries as imperfect substitutes. Their model implied that the trade war would produce welfare losses of 1.7% in China and 0.2% in the U.S.

Lv et al. (2019) investigated the impact of the trade war using China and U.S. tariff levels at the HS 6-digit level. They obtained trade data from the COMTRADE database and tariff data from the TRAINS database. The authors simulated trade reductions, trade diversion, and welfare effects from the announced tariffs. They found that tariffs reduced China's exports more than America's exports. They reported that trade diversion effects will cause the U.S. to import more from Mexico, Japan and Germany and China to import more from Brazil, Germany and Japan. They also reported that China's welfare losses would be 2.6 times greater than the U.S.'s losses. They recommended strategic adjustments to China's trade policy to address the situation.

Li et al. (2018) employed a multi-country global general equilibrium model with an endogenous trade imbalance structure to investigate the impact of the China–U.S. trade war. They used actual data from 2013. They reported that China will lose more than the U.S. in terms of GDP, welfare and manufacturing employment. These effects were magnified when they included non-tariff barriers in the analysis. The also found that the trade war reduces world GDP and manufacturing employment.

Benguria et al. (2020) investigated how the trade war affected the trade policy uncertainty (TPU) of Chinese firms. The authors constructed a TPU index that varied across firms and time by using information from the companies' annual reports listed in the Shanghai and Shenzhen Stock Exchanges. They investigated the impact of tariffs on firm-level TPU indexes by estimating difference-in-difference regressions. They found that the trade war significantly increased Chinese firms' TPU indexes and that this effect was pronounced for smaller and less capital-intensive firms. They also reported that the impact was smaller for more diversified firms that export to more countries. In addition, the authors found a negative relationship between increases in TPU and firm performance. A one standard deviation increase in TPU reduced firm level investment by 1.4%, R&D expenditures by 2.7% and profits by 8.9%.

Xing (2018) investigated how renminbi appreciations and rising wages affect China's comparative advantage in labor-intensive assembly operations. He noted that the growth of processed exports, goods produced using imported parts and components, reflects China's strength in this area. Examining China's exports to more than 100 countries over the 1993-2013 period, he reported that a 10 percent appreciation of the nominal U.S. dollar/renminbi exchange rate would reduce the share of processed exports relative to total exports by 3 percent and that a 10 percent increase in manufacturing wages would reduce this share by 0.8 percent. Xing concluded that stronger exchange rates and higher wages forced many Chinese firms to stop exporting.

Cheung et al. (2012) used DOLS to investigate China's exports to the world over the 1994Q3-2010Q4 period. They employed the IMF's CPI-deflated real effective exchange rate and deflated exports using the Hong Kong to U.S. re-export unit value index. They found that a 10 percent appreciation of the renminbi would reduce total exports by between 9 and 16 percent,

processed exports by between 9 and 12 percent, and ordinary exports by between 13 and 19 percent. They also reported larger elasticities for manufacturing goods than for primary products and for private firms than for state-owned enterprises.

Baiardi et al. (2015) investigated China's clothing exports disaggregated at the Standard Industrial Trade Classification (SITC) 4-digit level over the 1992-2011 period.   They sought to explain exports using world real GDP and relative prices. They calculated relative prices as the ratio of China's export unit value for each 4-digit clothing category at time t to the average export unit value of all economies for the same good at time t.   They found that a 10 percent increase in relative prices would reduce China's clothing exports by 8 percent.

Fatum et al. (2018) examined firm-level exports and imports between China and the U.S. disaggregated at the HS 8-digit level. They investigated the 2000-2011 period. They reported results from many ordinary least squares regressions and found that a depreciation of the CPI-deflated U.S. dollar/renminbi exchange rate led to an increase in China's exports and an increase in its trade surplus.

Thorbecke (2015) used Johansen maximum likelihood estimation to investigate China's exports to the U.S. over the 1993Q3-2013Q3 period. He employed the CPI-deflated bilateral real exchange rate and deflated exports using the Bureau of Labor Statistics export price index for exports from China. He investigated exports in the SITC 7, 8, and 6 categories. SITC 7 goods comprised 51 percent of China's exports to the U.S. in 2013, SITC 8 goods comprised 32%, and SITC 6 goods comprised 11%. SITC 7 exports are primarily phones, computers, and white goods; SITC 8 exports are mainly labor-intensive products such as clothing, footwear, and toys; and SITC 6 exports are metals, metal products, textiles, and rubber. He reported that a 10

percent renminbi appreciation against the dollar would reduce SITC 7 exports by 16 percent, SITC 8 exports by 8 percent, and SITC 6 exports by 13 percent.

Thorbecke (2015) also found that China's exports to the US were four times larger than US exports to China and that the US trade deficit with China at the end of 2014 exceeded the US trade deficit with all other countries combined. He used the workhorse gravity model to investigate whether China's exports to the US were disproportionate. The results indicated that China's exports to the U.S. have been more than $100 billion greater than predicted year after year. This gap could be due to global value chains, since China imports intermediate goods from East Asia and exports finished products to the rest of the world. To investigate this, Thorbecke estimated a gravity model with China's processed and ordinary exports included separately. Processed exports contain parts and components from abroad while ordinary exports contain primarily domestic value-added. China's processed and ordinary exports to the U.S. were both major outliers, exceeding predicted values by more than $100 billion. Parts and components from the two leading suppliers to China (South Korea and Taiwan) were major outliers relative to South Korea and Taiwan's exports to other countries. In addition, China, South Korea, and Taiwan's exports to Asia were much less than predicted. These results suggest that East Asia's export structure is disproportionately focused on the U.S.

The works cited above focused on the impacts of tariffs and exchange rates separately. We add to this literature by comparing tariff and exchange rate elasticities for China's exports. The works above also deal primarily with aggregate exports. We examine China's exports to the world disaggregated at the four-digit International Standard Industrial Classification (ISIC) level. Researchers since Orcutt (1950) have highlighted the advantage of using disaggregated data to estimate trade elasticities. If elasticities differ by sector, aggregate estimates can be biased

downwards (see also Bahmani-Oskooee and Ardalani, 2006). In addition, investigating China's exports to the world rather than China's exports to a single country makes it possible to avoid misspecification issues that arise when examining bilateral trade (see, e.g., Ahmet, 2009).

3. Data and methodology

To investigate how tariffs and exchange rates affect China's exports we employ data from 2003 to 2017. China joined the WTO at the end of 2001, and by 2003 its exports had exploded. We thus focus on the 2003-2017 period when China was a major exporter.

We estimate standard export functions, with China's exports of product p to country j (X_{jpt}) depending on price competitiveness and demand in importing country j at time t. We measure price competitiveness using the natural logarithm of one plus the bilateral tariff rate on product p ($\ln(1+\tau_{jpt})$) and the bilateral real exchange rate between China and the importing country (rmb_{jt}). We measure foreign demand using GDP in the importing country (y^*_{jt}):

$$X_{jpt} = \alpha_1 + \alpha_2\log(1+\tau_{jpt}) + \alpha_3 rmb_{jt} + \alpha_4 y^*_{jt} \ , \tag{1}$$

We focus on data on China's exports to the 82 leading importers.[1] While the renminbi was pegged to the U.S. dollar for part of the sample period, it varied substantially relative to the other 81 currencies. These exchange rate fluctuations, as Chinn (2004, 2005) noted, are often disconnected from macroeconomic fundamentals and exhibit a life of their own (see also Obstfeld and Rogoff, 2000, and Devereux and Engel, 2002). This independent variation across countries and over time should help to identify in an econometric sense how exchange rate

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[1] Investigating China's exports for three different years, we found that 95 to 98 percent of China's exports flowed to these 82 countries.

changes affect China's exports. We thus follow Chinn in treating (1) as a semi-reduced form equation and interpreting the parameters as structural.

We follow the approach of Bénassy-Quéré et al. (2021) in investigating the relationship between exports, tariffs and exchange rates. They represented the exports of country i to country j of product p in year t, X_{ijpt} with a series of fixed effects terms:

$$lnX_{ijpt} = \lambda_{ipt} + \mu_{jpt} + \nu_{ij} + \epsilon_{ijpt} \qquad (2),$$

where λ_{ipt}, μ_{jpt} and ν_{ij} are exporter,product,time; importer,product,time; and importer,exporter fixed effects, respectively. The variable ϵ_{ijpt} is a random error term. Benassy-Queré et al. added the log of one plus the bilateral tariff rate on product p, $(\log(1+\tau_{jpt}))$ and the bilateral real exchange rate between country i and country j, $BRER_{ijt}$, yielding the equation:

$$lnX_{ijpt} = \beta_0 + \beta_1 ln(1 + \tau_{ijpt}) + \beta_2 lnBRER_{ijt} + \lambda_{ipt} + \mu_{jpt} + \nu_{ij} + \epsilon_{ijpt} \qquad (3).$$

Since China is the only exporting country that we are examining we can only estimate equation (3) with fixed effects along three dimensions (j, p, t) instead of four dimensions(i, j, p, t). We also include importing country real GDP (Y_{jt}), giving the export equation:

$$lnX_{jpt} = \beta_0 + \beta_1 ln(1 + \tau_{ijpt}) + \beta_2 lnBRER_{ijt} + \beta_3 lnY_{jt} + \lambda_j + \nu_p + \mu_t + \epsilon_{jpt} \qquad (4).$$

We follow Benassy-Queré et al. (2021) in measuring (X_{jpt}) as the value of exports. We investigate China's exports in the 19 leading International Standard Industrial Classification (ISIC) four-digit categories to the 82 leading importers. We also investigate 1) exports in these 19 categories to 182 countries and 2) China's exports of 1241 HS four-digit categories to 82 leading importers. We obtain bilateral FOB export data between 2003 and 2017 for the ISIC categories from the World Integrated Trade Solution (WITS) database and for the HS categories

from the Atlas of Economic Complexity.[2] The Atlas in turn collected these data from the UN

Comtrade database.

We obtain bilateral tariff data from the WITS database. We obtain data on the bilateral

real exchange rate between the PRC and each importing countries from the CEPII-CHELEM

database. The exchange rate is defined so that an increase represents an appreciation of the

Chinese renminbi. We obtain data on real GDP in the importing countries from the CEPII gravity

database.[3]

4. Results

Table 1 presents trade elasticities for China's exports. Column (2) presents results for

China's exports in its 19 leading four-digit ISIC categories to its 82 leading importers. These 19

categories comprise more than 50 percent of the value of China's exports and the 82 leading

importers purchase 95 percent of China's exports. Column (4) presents results for China's

exports in its 19 leading four-digit categories to 182 importers. Column (6) presents results for

China's exports in 1241 four-digit categories to its 82 leading exporters.

The tariff elasticities are all statistically significant and equal -2.5 in column (2), -1.7 in

column (4), and -1.8 in column (6). The exchange rate elasticities are also all statistically

significant and equal -0.94 in column (2), -0.87 in column (4), and -0.87 in column (6). Finally,

the coefficients on real GDP are all statistically significant and equal 1.33 in column (2), 1.10 in

column (4), and 0.94 in column (6). In column (2), tariffs are 2.7 times more powerful than

exchange rate changes and in columns (4) and (6) tariffs are 2.0 times more powerful.

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[2] The website for WITS is: https://wits.worldbank.org/ and the website for the Atlas is:
https://growthlab.cid.harvard.edu/atlas-economic-complexity
[3] The website for the gravity database is http://www.cepii.fr/CEPII/en/bdd_modele/presentation.asp?id=8.

The results in column (2) are more informative concerning how tariffs and exchange rates affect China's exports than the results in columns (4) and (6). Moving from column (2) to column (4), we add 100 countries but less than 5 percent of China's exports. On average less than 0.05% of China's exports flow to each of these 100 additional countries. Thus the effects of tariffs and exchange rates in these countries are not important for China's overall exports. Going from column (2) to column (6) adds 1222 product categories but less than half of China's exports. On average only 0.04 percent of China's exports are from the additional product categories. Thus the mass of China's exports is concentrated in the 19 product categories and 82 countries investigated in column (2) rather than the additional 100 countries investigated in column (4) or the additional 1222 product categories investigated in column (6).

The results in column (2) indicate that tariffs deter trade. A 10 percent tariff increase reduces exports by more than 25 percent. The aggregate tariff elasticities are close to the elasticities of 2.4 that Xu et al. (2020) reported. Since trade wars can cause tariffs to increase by 10 or 25 percent, they can decimate exports. The exchange rate elasticities of close to unity in column (2) are similar to those reported by Cheung et al. (2012) and others. They indicate that exchange rates matter for exports, but less than tariffs do. Thus the international elasticity puzzle holds for China.

To shed light on the findings in Table 1, Table 2 presents results for the 19 leading categories of China's exports disaggregated at the four-digit ISIC level. The products are ordered from the one comprising the largest share of China's total exports in 2017 to the one making up the smallest share. Column (2) of the table indicates that four of the five categories with the largest shares are in the electronics industry. The first two rows of results in Table 2 present results for phones and computers. Computers are much more exposed to both tariff

increases and exchange rate appreciations than phones. This could be because computers have become more commoditized than cellphones. Thorbecke (2017) presented evidence indicating that smartphones contain more technologically advanced features such as accelerometers or gyroscopes than computers do. In addition, U.S. Bureau of Labor Statistics (BLS) import price indices for computers and phones largely reflect export prices for these goods in China and other East Asian countries. Over our sample period, BLS import prices fell 74 percent for computers and 36 percent for phones. This suggests that, compared with cellphone manufacturers, computer manufacturers have less pricing power. This lack of pricing power can explain why computers are more exposed to tariffs and exchange rate appreciations than phones are.

Tariffs do not affect China's electronic parts and components (ep&c) exports. Much of this trade takes place within East Asian value chains. Tariffs on electronic goods within these networks are low, so it is not surprising that there is no evidence that tariffs affect ep&c trade. Exchange rate elasticities are large, reflecting the competitive nature of this market and that fact that Chinese ep&c are technologically behind ep&c exported from frontier countries such as South Korea.

In contrast to ep&c, tariffs exert a major effect on television exports. The tariff elasticity equals -3.9, indicating that a 10 percentage point increase in tariffs reduces exports by 39 percent. Shortly before the beginning of our sample period, TV manufacturers transitioned from analogue to digital technology (see, e.g., Ward, 2003). As Chang (2008) noted, under analogue production the technological advantage of the frontier producer can be unsurmountable. On the other hand, under digital production any producer can purchase modules and assemble them to construct a television. Chang noted that televisions have thus become a commodity like

computers. Tariffs that raise prices thus have a powerful impact on exports. The exchange rate also matters, with a 10 percent appreciations reducing television exports by 8.4 percent.

The category manufactured iron and steel is also exposed to tariffs and exchange rates. A 10 percentage point rise in the tariff would reduce exports by 32 percent and a 10 percent appreciation would reduce exports by 16 percent.[4] The high elasticities for steel stem from the fact that steel is manufactured in more than 90 countries, so there are many options to substitute domestically supplied steel for imported material when tariffs rise. In addition, excess capacity makes it difficult to maintain significant price differentials on steel produced in different areas. Supply flows can shift rapidly in response to relative price changes arising from tariffs and other factors. Thus steel exports are especially sensitive to tariffs and exchange rate changes.

Three other sectors that are highly exposed to tariffs and also exposed to appreciations are electric motors and generators (em&g), general purpose machinery (gpm), and parts for motor vehicles (pmv). A 10 percentage point increase in tariffs would reduce em&g exports by 38.5 percent, gpm exports by 20.3 percent, and pmv exports by 16.6 percent. A 10 percent appreciation would reduce em&g exports by 15.1 percent, gpm exports by 9.7 percent, and pmv exports by 6.4 percent. These are medium-level technology sectors, and tariffs and appreciations damage the price competitiveness of exporters in these sectors.

It might seem surprising that there is no evidence that textile and apparel exports are exposed to tariffs. History has not performed the right experiment to shed light on how tariffs affect these categories. Until January 2005, the Agreement on Textiles and Clothing imposed quotas on textile and apparel exports. Then, with the removal of quota restrictions, China's exports surged. Nations tried to react to this by raising tariffs. For instance, China's knitted

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[4] We are indebted to Dr. Anthony de Carvalho for the discussion in this paragraph. Any errors are our responsibility.

fabrics exports to the U.S. increased logarithmically by 117 percent and China's knitted fabrics exports to the U.S. increased logarithmically by 83 percent between 2003 and 2007 even as the U.S. raised tariffs on these goods. This helps explain why the tariff elasticities on textile and apparel exports are positive. The exchange rate elasticities indicate that appreciations cause a large decrease in these exports. A 10 percent appreciation would reduce knitted fiber exports by 14.4 percent, wearing apparel exports by 10.8 percent, and prepared textile fiber exports by 9.1 percent.

Chemical exports are not exposed to either tariffs or exchange rates. The OECD classifies chemical exports as medium high-technology goods (see Hatzichronoglou, 1997). Thorbecke and Salike (2020) also reported low elasticities for chemical exports from leading exporting countries.

5. Conclusion

Appreciations deter exports by raising prices in importing countries. Tariffs work in a similar way. This paper reports that tariffs reduce China's exports almost three times more than equivalent exchange rate changes do.

The disruption to trade caused by tariffs is multiplied by the uncertainty that accompanies trade wars and protectionism. Bloom (2009) reported that uncertainty hinders investment. Investing in physical capital and in research and development is crucial for the electronics industry, given its short product cycles and volatile consumer demand. By reducing investment, uncertainty jeopardizes the ability of Chinese firms to remain competitive in the electronics industry and in other key sectors.

China could offset these risks and uncertainties by signing free trade agreements (FTAs) with countries other than the U.S. These could strengthen economic cooperation, deepen market-driven integration, and lessen nationalistic pressures unleashed by the COVID-19 pandemic. FTAs could also rechannel China's exports to countries other than the U.S. This would reduce protectionist demands from the U.S.

China has concluded bilateral agreements with Chile, Georgia, New Zealand, Pakistan, Peru, Singapore, Switzerland and others countries. It has also almost completed negotiating the Regional Comprehensive Economic Partnership (RCEP) with multiple Asian partners. These partners include the ten Association of Southeast Asian Nations (ASEAN), China, Japan, South Korea, Australia, and New Zealand.[5] RCEP is important because it is the largest Asian trade deal under consideration and because many of these countries are linked through regional value chains.   While the negotiations focus on establishing a region-wide free trade zone, the discussions also address investment, trade in service, technological cooperation and intellectual property (IP) rights.

Ratifying the RCEP could be a boon for China. It would grant Chinese firms access to large markets in the region. It would also reduce prices of imported food, footwear, and medicine. Finally, it would rebalance trade by redirecting final goods to Asian consumers.

In addition to the RCEP, the Comprehensive and Progressive TPP (CPTPP) could benefit Chinese companies. The CPTPP sets high standards for labor and environmental rules, competition policy, state-owned enterprise behavior, and IP protection. China would need to prepare diligently to join the CPTPP. However, as Chinese firms continue technological upgrading, high quality agreements with strong IP protection would be in their interest.

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[5] India, an original negotiating partner, opted out in November 2019.

The Belt and Road Initiative (BRI) offers benefits analogous to a trade agreement. The BRI promotes connectivity by improving infrastructure in the countries involved. This not only increases the scope of potential markets but also reduces transportation costs. Transportation costs are at the heart of trade theory. A simulation exercise found substantial welfare gains for both China and participating countries. For example, a 25 percent reduction in transportation costs caused by BRI would increase the welfare of a representative consumer in China by 1.18 percent, the EU by 0.55 percent, the Middle East & North Africa by 0.15 percent and Sub-Saharan Africa by 0.13 percent. Furthermore, the simulation indicated that the welfare gains could multiply if the countries also negotiated an FTA (Jackson and Shepotylo, 2018). Given the possible gains available through the BRI, contracting nations should work together to realize this potential.

Liberalization would thus benefit China and its trading partners. Global liberalization would generate even greater gains by producing a more efficient allocation of resources based on comparative advantage, as compared to the case of FTAs between a limited number of countries. The world is in danger, however, of breaking up into trading blocs. A likely outcome is one bloc centered on China and a second centered on the U.S. (see Jacks and Novy, 2019).

Bifurcated trading blocs and trade wars foment uncertainty, misallocate resources, and sever value chains. China and the U.S. should assiduously pursue breakthrough agreements for their mutual benefit and as an example to other countries in the 21st century. Each should offer concessions to the other in order to achieve this. China should also hedge against the risk of a failure in these negotiations by signing free trade agreements with as many countries as it can. China should also consider moving out of industries such as steel that are exposed to tariffs and exchange rate appreciations into industries such as chemicals and pharmaceuticals that provide

firms with greater pricing power. Finally, it should recognize the damage that tariffs and trade

wars do to its industries. Rather than pursuing a strategy of maximizing exports, China should

consider allowing consumption and investment to supplant exports in generating growth.

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Table 1. Trade Elasticities for China's Exports over the 2003–2017 Period

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	China's Exports of 19 Leading Products to 82 Leading Importers		China's Exports of 19 Leading Products to 182 Leading Importers		China's Exports of 1241 Products to 82 Leading Importers	
Independent Variable	Coefficient	S.E.	Coefficient	S.E.	Coefficient	S.E.
Log of One Plus the Bilateral Tariff Rate	-2.502***	0.631	-1.730***	0.499	-1.749***	0.410
Log of the Bilateral Real Exchange Rate	-0.939***	0.166	-0.869***	0.145	-0.869***	0.159
Log of Real GDP in Importing Countries	1.331***	0.244	1.101***	0.247	0.936***	0.232
Adjusted R-squared	0.8379		0.8604		0.6718	
Within R-squared	0.0591		0.0286		0.0162	
Number of Observations	21,502		40,063		1,306,389	

Notes: The table reports trade elasticities for China's exports over the 2003-2017 period. Products are disaggregated at the 4-digit International Standard Industrial Classification (columns (2) and (4)) and 4-digit Harmonized System (column (6)) levels. Country, product, and time fixed effects are included in the regressions. An increase in the bilateral real exchange rate implies an appreciation of the renminbi relative to the importing country.
*** denotes significance at the 1% level

Table 2. Trade Elasticities for China's 19 Leading Export Categories to 82 Countries over the 2003–2017 Period.

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Product Category (ISIC Code)	Share of China's Total Exports in 2017 (percent)	China's Exports in this Category in 2017 relative to World Exports in this Category (percent)	Tariff Elasticity	Stan-dard Error	Exchange Rate Elasticity	Stan-dard Error	GDP Elasticity	Stan-dard Error
Phones (3220)	11.8%	51.5%	-0.891	0.898	-0.485**	0.197	1.346***	0.284
Computers (3000)	9.4%	44.7%	-7.476***	1.357	-1.503***	0.136	0.663***	0.196
Wearing Apparel (1810)	5.0%	36.6%	0.311	0.386	-1.080***	0.128	2.202***	0.182
Electronic Parts & Components (3210)	3.9%	13.7%	-0.630	1.335	-0.909***	0.212	1.716***	0.302
Televisions (3230)	3.6%	39.5%	-3.937***	0.657	-0.837***	0.118	2.304***	0.167
Manufactured Iron & Steel (2710)	2.6%	13.7%	-3.187**	0.919	-1.585***	0.166	1.084***	0.239
Plastic Products (2520)	2.5%	20.1%	-0.581*	0.307	-0.742***	0.071	1.684***	0.104
Chemicals (2411)	2.4%	13.2%	-0.359	0.617	0.064	0.087	0.730***	0.128
Fabricated Metal Products (2899)	2.4%	24.5%	-0.763**	0.379	-0.837***	0.072	1.820***	0.105
Footwear (1920)	2.3%	37.0%	0.054	0.341	-0.608***	0.113	1.753***	0.162
Furniture (3610)	2.2%	30.9%	-0.128	0.354	-1.330***	0.107	1.602***	0.154
Domestic Appliances (2930)	2.1%	37.7%	0.320	0.376	-0.966***	0.087	1.466***	0.127
Electric Motors & Generators (3110)	2.0%	27.1%	-3.853***	0.787	-1.511***	0.127	0.707***	0.181
Knitted Fabrics (1730)	2.0%	36.2%	0.597	0.511	-1.435***	0.148	1.811***	0.214
Games & Toys	2.0%	61.5%	-1.470***	0.413	-0.495***	0.105	1.739***	0.149

(3694)								
Prepared Textile Fibers (1711)	1.8%	39.3%	1.593***	0.551	-0.949***	0.125	1.049**	0.184
General Purpose Machinery (2919)	1.8%	18.7%	-2.031***	0.551	-0.965***	0.095	1.606***	0.138
Electric Lamps & Lighting (3150)	1.7%	57.2%	-0.556	0.387	-0.751***	0.082	1.391***	0.118
Parts for Motor Vehicles (3430)	1.5%	7.7%	-1.664***	0.598	-0.636***	0.127	0.728***	0.182

Notes: The table reports elasticities for China's exports in the ISIC categories listed in column (1) to 82 countries over the 2003-2017 period. Country and time fixed effects are included in the regressions. An increase in the bilateral real exchange rate implies an appreciation of the renminbi relative to the importing country.
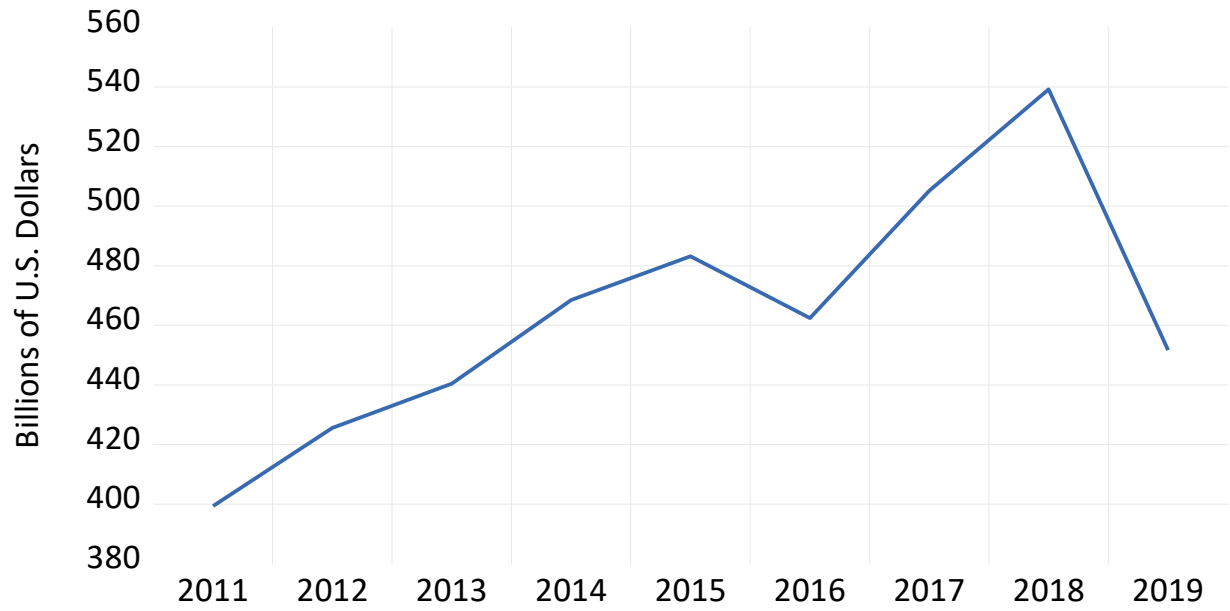*** (**) [*] denotes significance at the 1% (5%) [10%] level

Figure 1. China's Total Exports to the U.S. over the 2011–2017 Period.
Source: U.S. Census Bureau.