The Return to Protectionism*

Pablo D. Fajgelbaum*, Pinelopi K. Goldberg†, Patrick J. Kennedy‡, and Amit K. Khandelwal§

*UCLA and NBER
†Yale (on leave), NBER (on leave) and World Bank Group
‡UC Berkeley
§Columbia GSB and NBER

First Draft: September 28, 2018
This Draft: March 5, 2019

Abstract

We analyze the impacts of the 2018 trade war on the U.S. economy. We estimate import demand and export supply elasticities using changes in U.S. and retaliatory tariffs over time. Imports from targeted countries decline 31.5% within products, while targeted U.S. exports fall 11.0%. We find complete pass-through of U.S. tariffs to variety-level import prices. We compute the aggregate and regional impacts in a general equilibrium framework that matches these elasticities. Annual consumer and producer losses from higher costs of imports are $68.8 billion (0.37% of GDP). After accounting for higher tariff revenue and gains to domestic producers from higher prices, the aggregate welfare effect is a $7.8 billion loss (0.04% of GDP). U.S. tariffs favored sectors located in politically competitive counties, but retaliatory tariffs offset the benefits to these counties. We compute that tradeable-sector workers in heavily Republican counties are the most negatively affected by the trade war.

Keywords: International Trade, Trade Wars, Tariffs, Prices, Wages
JEL Codes: F1

*We acknowledge funding from the National Science Foundation (NSF Grant 1529095). Huifeng Chang, Jett Pettus, and Brian Pustilnik provided excellent research assistance. We thank Bob Staiger, Jonah Rockoff, and seminar participants at the 2018 NBER ITI Winter meetings, CMU, Georgia, Harvard, and MIT for helpful suggestions. All errors are our own. E-mail: pfajgelbaum@econ.ucla.edu, penny.goldberg@yale.edu, patrick.kennedy@berkeley.edu, ak2796@columbia.edu. Kennedy acknowledges financial support from the National Science Foundation Graduate Research Fellowship Program. Goldberg is currently Chief Economist of the World Bank Group. Any opinions and conclusions expressed herein are those of the authors and do not necessarily represent the views of the World Bank Group.

1 Introduction

After more than a half-century of leading efforts to lower international trade barriers, in 2018 the United States enacted several waves of tariff increases on specific products, sectors, and countries. Import tariffs increased from 2.6% to 17% on 12,007 products (67% of imported products) covering $303 billion (12.6%) of 2017 annual U.S. imports. These measures represent the most comprehensive protectionist trade policies implemented by the U.S. since the 1930 Smoot-Hawley Act, when the U.S. raised tariffs from 40% to 46% on a third of annual imports (Irwin, 1998).[1] In response, several large U.S. trade partners imposed retaliatory tariffs on U.S. exports. These counter-measures increased tariffs from 6.6% to 23% on 2,931 export products (34% of exported products) covering $96 billion (6.2%) of 2017 annual U.S. exports.

This return to protection is unprecedented in the post-war era due to the sizes of the countries involved, the magnitudes of the tariff increases, and the breadth of tariffs across sectors. What were the impacts of the trade war on the U.S. economy? Classical arguments in trade theory dictate that the impacts depend on the incidence of tariffs. Consumers and firms who buy foreign products lose from higher tariffs. In addition, the net reallocations into (or away from) domestic products induced by the U.S. and retaliatory tariffs may lead to terms-of-trade effects (changes in U.S. export prices relative to import prices) and generate tariff revenue. The trade war may have also had distributional consequences across sectors, and therefore across regions with different patterns of comparative advantages.

In this paper we estimate the impact of the trade war on several margins of the U.S. economy and quantify welfare impacts. As a first step, using solely the variation in U.S. and retaliatory tariffs observed during the trade war, we estimate structural demand and supply elasticities that (partly) determine the incidence of tariffs across countries. We estimate the impacts of tariffs on U.S. exports, imports, and import prices. Then, we combine these elasticities with a supply-side model of the U.S. economy to gauge the aggregate and regional impacts of U.S. and retaliatory tariffs in general equilibrium. Our regional analysis focuses on the relationship between tariff protection, political preferences, and welfare effects of manufacturing and agricultural workers across counties.

To implement the first step, we estimate a constant elasticity of substitution (CES) three-tier nested demand system. The system accommodates several margins for reallocation in response to the trade war: across varieties, across imported products, and between imports and domestic goods within a sector.[2] To allow for terms-of-trade effects, we combine this system with upward sloping foreign export supply for each variety. In estimating these elasticities, we make progress on a key methodological issue. Existing papers that use variation in tariffs to estimate structural elasticities have focused on estimating the import demand curve, typically relying on cross-sectional variation. However, measuring the incidence of tariffs also requires estimating the slope of the export supply

[1] The more recent "Nixon shock" in 1971 imposed a 10% surcharge on roughly half of U.S. imports for four months (Irwin, 2013).

[2] We define *sectors* as 4-digit NAICS industry codes, *products* as 10-digit Harmonized System (HS) classification codes, and *varieties* as country-product pairs.

curve. In this paper, we leverage the insight that if changes in tariffs are uncorrelated with simultaneous demand and supply shocks—an assumption we devote significant effort to validating—a single tariff can be used to simultaneously instrument *both* the import demand and foreign export supply curves. This idea was recently introduced by Zoutman et al. (2018) in a public-finance setting, and we apply it here in the context of international trade.[3] We implement this approach at the variety level exploiting panel variation, and aggregate tariffs to construct instruments that identify demand elasticities at the product and sector levels.

An event-study framework validates using tariffs as a source of identification, by showing that targeted import and export varieties had not been on different trends compared to untargeted varieties prior to the trade war. Additionally, the event-study reveals immediate and large impacts of tariffs on U.S. import and export volumes but not changes in before-tariff prices.

We estimate that imports of varieties targeted by U.S. tariffs fall on average 31.5% (s.d. 15.5%) within products; imports of products targeted by tariffs fall 3.8% (s.d. 4.3%) within imports in each sector; and imports within targeted sectors decline 0.5% (s.d. 1.2%). Additionally, we estimate complete pass-through of tariffs to tariff-inclusive variety-level import prices faced by U.S. consumers and producers. Hence, we cannot reject horizontal foreign export variety supply curves, implying no evidence of market power gains for the U.S. over its imported varieties.[4] On the export side, we find that retaliatory tariffs resulted in a 11.0% (s.d. 3.8%) decline in U.S. exports within products. We estimate a fairly inelastic foreign demand for U.S. varieties, which implies high pass-through of retaliatory tariffs to foreign consumers. We demonstrate that these elasticities are not confounded by pre-existing trends in import and export outcomes, and do not reflect anticipation of the tariff changes by importers.

The aggregate impacts in the U.S. depend on the direct impact of tariffs on prices, on price changes induced by reallocations, and on tariff revenue.[5] The reallocations, in turn, depend on demand and supply elasticities in both the U.S. and its trade partners. Our empirical strategy provides estimates of some of these elasticities. In particular, it estimates the variety-level supply and demand elasticities of foreign countries, as well as the product, sector, and variety-level demand elasticities of the U.S. economy. To compute aggregate effects, we obtain the supply-side elasticities of the U.S. economy from a standard production structure calibrated to match fairly detailed cross-sectional data. This supply side includes input-output linkages across sectors, heterogeneity

[3] The identification relies on the fact that tariffs create a wedge between what the importer pays for a variety and what the exporter receives. A tariff decreases importers' willingness to pay, shifting down the demand curve for any given price received by the exporter, thereby tracing the slope of the supply curve. Because the importer pays a price that is inclusive of the tariff, there is only one demand slope that can rationalize the new price she pays.

[4] A prominent view about the role of trade agreements is that they serve to deal with terms-of-trade externalities (Bagwell and Staiger, 1999). While we estimate complete pass-through at the variety level, there could be reductions of import prices through country-level wage changes in foreign countries, leading to less than complete pass-through. Our estimation strategy absorbs these effects, and therefore does not measure this margin. Additionally, our results capture short-run effects.

[5] Formally, in a model satisfying the assumptions of neoclassical trade theory, the aggregate equivalent variation from tariff changes Δt is approximated by $-m\left(\Delta t+\Delta p^{*}\right)+\Delta R$, where m is a vector of imports before tariffs change (so $-m$ are exports), Δp^{*} are changes in international prices, and ΔR is tariff revenue. See Dixit and Norman (1980).

in specialization patterns across U.S. counties, and sector-specific factors.[6] Our computations abstract from aggregate effects within other countries, as we do not observe their internal production structure at the level of detail we do for the U.S. economy.[7]

We find that the producer and consumer losses from higher tariff-inclusive prices are $68.8 billion, or 0.37% of GDP. This number comes from our estimation of a complete pass-through at the variety level. In general equilibrium, we compute additional terms-of-trade gains of $21.6 billion, or 0.12% of GDP, due to reallocations towards domestic producers that lead to higher prices and producer gains.[8] Overall, when tariff revenue is further weighed in, we find that the trade war lowered aggregate U.S. welfare in the short-run by $7.8 billion, or 0.04% of GDP. If trade partners had not retaliated, the terms-of-trade gains would have been larger, and the aggregate effect would have been negligible at about one third of the actual negative impact. Hence, we find substantial redistribution from buyers of foreign goods to U.S. producers and the government, but a small net effect for the U.S economy as a whole.[9]

The small aggregate effects of the trade war also mask heterogeneous impacts across regions. If workers are regionally immobile—a reasonable assumption over this short time horizon—sectoral heterogeneity in U.S. and foreign tariffs generates unequal impacts for workers in different regions. We find a standard deviation of real wages in the tradeable sectors across counties of 0.4%, relative to an average real wage decrease of 0.7%.

We probe the hypothesis that the structure of protection was driven by electoral incentives.[10] We document that U.S. import tariffs were biased toward sectors concentrated in electorally competitive (less polarized) counties, as measured by their 2016 Presidential vote share, suggesting a potential *ex ante* electoral rationale for the U.S. tariffs increases during the trade war. Our counterfactuals suggest that these U.S. import tariffs favored workers in tradeable sectors living in electorally competitive counties. We compute that the majority of counties experienced reductions in tradeable wages due to retaliations. However, workers in very Republican counties bore the brunt of the costs of the trade war, in part because retaliations disproportionately targeted agricultural

[6] Caliendo et al. (2017) study the regional diffusion of shocks in a model of the U.S. with input-output linkages across sectors. Our parametrization strategy for the IO linkages and the regional production structure is similar to theirs, although at more detailed levels of sectoral and geographic disaggregation.

[7] Importantly, our computations *do* incorporate the estimated foreign import demand substitution away from U.S. products due to retaliatory tariffs, as well as the estimated export supply response of foreign varieties to U.S. tariffs. These reallocations happen along own-price demand and supply curves. Further incorporating aggregate effects in foreign countries would be straightforward assuming a simple internal production structure in these countries, to match the international cross-section of trade and wages following the steps described by Costinot and Rodriguez-Clare (2014). Baqaee and Farhi (2019) develop formulas for the impacts of tariffs in economies with production networks and implement them using existing estimates of the elasticities.

[8] The increases in producer prices generated by the model are consistent with evidence we document that the tariffs have lead to increases in the Producer Price Index (PPI).

[9] This small effect is a feature of the class of static trade models we consider. Aggregate impacts could be larger due to impacts from uncertainty that affects investment (Handley and Limão, 2017). See also Freund et al. (2018).

[10] A strand of endogenous trade policy theory emphasizes electoral competition. Mayer (1984) first studied tariff determination in a factor endowments model with majority voting. Grossman and Helpman (2005) characterize the trade policy that emerges when elected legislators represent geographic regions hosting different industries. More recently, Ma and McLaren (2018) study electoral competition with electoral-college votes, and show evidence that the tariff changes in the years leading up to NAFTA were biased towards industries located in swing states.

sectors.

A large literature studies the impacts of changes in trade costs or foreign shocks through empirical and quantitative methods (e.g., Eaton and Kortum (2002), Arkolakis et al. (2012) and Autor et al. (2013)). We focus instead on trade policy, and on tariffs in particular, since tariffs are a key policy instrument for governments and the main policy instrument of the 2018 trade war. One of our contributions is to measure the aggregate impacts of tariffs using estimated trade elasticities from actual tariff variation, as opposed to hypothetical changes in trade costs. The estimation approach that we adopt could be readily used in other contexts, e.g. to measure elasticities in the long run or in other trade liberalization episodes.

One approach to studying the impacts of trade policy uses *ex post* variation in tariffs across sectors to assess impacts on sectors (e.g., Attanasio et al., 2004), regions (e.g., Topalova (2010) and Kovak (2013) and Dix-Carneiro and Kovak (2017)), firms (e.g., Amiti and Konings (2007) and Goldberg et al., 2010) or workers (e.g., McCaig and Pavcnik, 2018). A key challenge in this literature is to address the potential endogeneity of tariff changes. These papers offer substantial empirical support for using tariffs as source of identifying variation, as we do in our setting through a battery of tests for pre-existing trends. These papers study trade liberalization episodes in developing countries, while we study a return to protectionism in the U.S. Moreover, their research designs do not attempt to quantify the aggregate implications of the trade reforms on an economy by uncovering structural elasticities needed for the computation.

A complementary approach uses quantitative models to simulate aggregate impacts of changes in tariffs, such as the Nash equilibrium of a global trade war (Ossa, 2014) or tariff cuts in the context of regional and multilateral trade liberalizations (such as Caliendo and Parro (2015) and Caliendo et al., 2015).[11] A key aspect of our approach is the parametrization of how trade volumes change with actual trade policy. We use variation in *changes* in trade caused by *changes* in tariffs to estimate both demand and supply elasticities. As a result, when we aggregate the impacts of tariffs through the model, the effects of tariffs on variety-level prices and on sector, product, and variety-level trade flows are estimated rather than imposed. Only a very small set of papers, including Spearot (2013) and Spearot (2016), uses actual tariff variation over time to estimate the demand elasticity. Most research efforts have relied on alternative sources of variation to estimate trade elasticities.[12]

Finally, our finding of complete pass-through deserves some discussion. A large literature in trade and international macroeconomics has estimated incomplete pass-through.[13] Typically, these papers have examined pass-through of exchange rate shocks. An exception is Feenstra (1989) who

[11] Goldberg and Pavcnik (2016) and Ossa (2016) survey the recent empirical and quantitative literature studying the impacts of trade policy.

[12] Head and Mayer (2014) review these alternative strategies. Caliendo and Parro (2015) use cross-sectional tariff variation prior to tariff changes that occurred through NAFTA. Prominent approaches include: gravity estimates of the cross-sectional relationship between trade and proxies of exporters marginal costs (e.g., Eaton and Kortum (2002), Costinot et al. (2012) and Donaldson (2018)); GMM identification via heteroskedasticity of supply and demand shocks (e.g., Feenstra (1994) and Broda and Weinstein (2006)); and price gaps (e.g., Simonovska and Waugh (2014) and Atkin and Donaldson (2015)).

[13] Amiti et al. (2019) corroborate our finding of complete pass-through at the variety level.

finds symmetry in the pass-through between tariffs and exchange-rate movements in the vehicle sector. Our estimates therefore appear at odds with this literature. One explanation is that the nature of this shock—tariff increases—may yield different pass-through estimates, as well as the short-run time horizon we consider. This finding is surprising, in particular if tariff changes are deemed to be temporary and suppliers are willing to absorb the tariff increases to keep the duty-inclusive price stable. In contrast, exchange rate shocks have been shown to be highly persistent. At any rate, we consider the difference between exchange rate and tariff pass-through to be an interesting result that deserves further exploration in future research.

The remainder of the paper is structured as follows. Section 2 summarizes the data used for the analysis. Section 3 outlines the demand-side framework that guides the estimation of the elasticities and discusses the identification strategy in detail. Section 4 presents the elasticity estimates. Section 5 then introduces the full general equilibrium structure necessary to compute the aggregate and distributional effects. Section 6 concludes.

2 Data and Timeline

This section describes the public data sources used throughout the analysis and provides a timeline of key events of the trade war.

2.1 Data

We build a monthly panel dataset of U.S. statutory import tariff rates using publicly available tariff schedules from the U.S. International Trade Commission (USITC). In years prior to 2018, USITC released an annual baseline tariff schedule in January and a revised schedule in July; changes in the tariff schedule typically reflected expected and long-standing treaty commitments. In 2018, by contrast, USITC issued 14 schedule revisions, reflecting a rapid series of tariff increases. Tariff increases were almost always set at the 8-digit Harmonized System (HS) level.[14] The new ad-valorem tariffs went into effect quickly, always within 1-3 weeks following a press release by the Office of the U.S. Trade Representative.

We obtain retaliatory tariffs on U.S. exports enacted by trade partners from official documents released by the Ministry of Finance of China, the Department of Finance of Canada, the Office of the President of Mexico, and the World Trade Organization (covering the EU, Russia, and Turkey). These tariffs were also entirely ad-valorem and went into effect shortly after the announcement

[14] A total of 18 Chinese varieties received tariff exemptions at the 10-digit level. These varieties have a 2017 annual value of $1 million. Since our trade-flow analysis is performed at the HS10-country level, we are able to account for these narrowly tailored exemptions. For a very small fraction of products, ad-valorem tariffs apply only after surpassing a quota threshold. For example, the US made a quota allowance of 50,000 annually imported for imports of varieties with the HS-8 stub 84509020 (household laundry machines). As another example, four countries (Australia, Argentina, South Korea, and Brazil) were exempt from steel tariffs unless they surpass a quota threshold of 500,000 kg of imports in a 3-month period. In all, quotas affect only $16 million of targeted imports. Our compilation of tariff line changes match those collected by Bown and Zhang (2019). We find 99.8% overlap in the value of targeted import products between their compilation and our independent compilation.

dates. To construct a country- and product-specific monthly panel of retaliatory statutory tariffs on U.S. exports, we use the annual WTO database of Most Favored Nation (MFN) tariff rates, and compute the retaliatory tariff rate for each country-product as the sum of the MFN rate and the announced tariff rate change. We measure export tariffs at the HS-6 level, since HS-8 codes are not directly comparable across countries.

We use monthly administrative U.S. import and export data from the U.S. Census Bureau that record values and quantities of trade flows at the 10-digit Harmonized System Tariff (HS) level. The time span covers through November 2018. For imports, the data also include the value of duties collected. We construct applied (ad-valorem) tariff rates directly from the import data as the ratio of duties collected to the CIF import value. Duty-inclusive unit values are constructed as (value + duties)/quantity. Since we do not observe the duties collected by foreign governments on U.S. exports, we cannot compute the applied rate for exports. We define duty-inclusive unit value for exports as the unit value multiplied by the ad valorem retaliatory statutory rate.

At different stages of the analysis we also require sector-level data on prices, employment, wages, output, and input linkages. The BLS PPI measures the prices received by producers for their output at the sector level, and covers virtually all tradeable domestic output. We use the BLS Current Employment Statistics database for information on sectoral employment and wages, and the Federal Reserve G17 Industrial Production Index as a measure of domestic sector output.[15] All data are collected at monthly frequency, and we define sectors at the level of 4-digit NAICS industry codes. None of these monthly industry measures include the farm sector, which either is not covered by these datasets or is only available at coarse frequencies. We classify NAICS sectors as tradeable if they match to an HS code using the concordance of Pierce and Schott (2012). To construct input-output linkages we use the 2016 Bureau of Economic Analysis (BEA) annual "use" tables from input-output (I-O) accounts.

For the analysis of regional exposure to the trade war we use the Census County Business Patterns (CBP) database, which provides annual industry employment and wage data at the county-level for non-farm sectors. For the farm sector, we use the BEA Local Area Personal Income and Employment database. From each data source, we use the most recently available data from 2016 to compute the industry employment share of each county. We obtain county-level demographic statistics from the Census American Community Survey and county-level voting data from the U.S. Federal Election Commission.

2.2 Timeline

Table 1 provides a timeline of events. Panel A reports the total affected imports, and shows that import tariffs have targeted 12,007 products and a total of 25,066 varieties. In 2017, these imports were valued at $303 million, or 12.6% of imports. The average statutory tariff rate increased from

[15] The G17 Industrial Production Index is a monthly database covering the manufacturing, mining, and electricity and gas sectors. It tracks real output and index values are computed as a Fisher index, with weighted constructed from yearly estimated of value added.

2.6% to 17.0%.[16] A key feature of the tariffs is that they were discriminatory across countries, which allows us to exploit variation in tariff changes across varieties within products.

The first wave of tariff increases began in February 2018 when the U.S. increased tariffs on $8 billion of solar panel and washing machine imports. The U.S. implemented a second wave in March 2018 on iron, aluminum, and steel products. The largest tranches of import tariffs targeted approximately $247 billion worth of imports from China. In March 2018 the U.S. implemented tariffs on approximately $50 billion of Chinese imports, and the scope and value of targeted products on China expanded with subsequent tariffs waves implemented in July and September. Rows 5-7 indicate that tariffs on China have targeted 11,173 imported products worth $247 billion, and increased tariffs, on average, from 3.1% to 15.9%. A total of 48.8% of 2017 imports from China were targeted with tariffs.

Panel B of Table 1 reports the retaliatory tariffs imposed on U.S. exports by trade partners. Canada, China, Mexico, Russia, Turkey, and the European Union enacted retaliatory tariffs against the US. Collectively, these retaliations cover $96 billion (6.2%) of annual U.S. exports across 2,931 products. The average statutory tariff rate on these exports increased from 6.5% to 23.3%.

Figure 1 plots the tariff changes over time.[17] Panel A shows the unweighted average statutory tariff rate on targeted varieties for each tariff wave over time, and Panel B plots the average applied tariffs. The applied tariff rates sometimes increase at a lag relative to the statutory rates because the monthly data aggregate shipments arriving before the tariffs are enacted with those arriving after. Applied rates may also be measured with error (discussed in detail below). Panel C shows the retaliatory statutory tariffs on U.S. exports over time. Appendix Figure A.1 shows the monthly changes in import duties collected by the U.S. over time.

2.3 Structure of Protection

Table 2 reports summary statistics for targeted import and export varieties across three-digit NAICS industry codes. For imports, we report the number of HS10 products and varieties targeted, and the mean and standard deviation across HS10 products within NAICS-3 codes of the increase in statutory import tariffs due to the trade war. In sectors where only China was targeted, the number of targeted products equals the number of varieties. The table also reports the corresponding statistics for the retaliatory tariffs on U.S. exports.

The table conveys three important facts. First, the sectors that receive the most protection are primary metals, machinery, computer products, and electrical equipment and appliances. These sectors contain a large share of intermediate inputs, comprise a large share of targeted varieties and products, and saw steep tariff increases relative to most other sectors. We match HS10 prod-

[16] The U.S. authorized the tariffs through Section 201 of the Trade Act of 1974, Section 301 of the Trade Act of 1974, and Section 232 of the Trade Expansion Act of 1962. These laws permit the president to apply protectionist measures under different justifications, including "serious injury" to domestic industries, threats to national security, or retaliations for allegations of unfair trade practices.

[17] Tariffs are often enacted in the middle of the month, but we only observe trade flow data at a monthly frequency. Figure 1 shows the tariff increase in the initial month that it is implemented.

ucts to BLS Consumer Price Index product codes to approximate the share of final goods versus intermediate goods within targeted products, and estimate that 87% of targeted products within these sectors are intermediate goods (in USD terms), compared to 72% of targeted products in all other sectors. Second, it is not the case that U.S. trading partners simply retaliated on the same set of products and sectors targeted by the U.S; the sector-level correlation is 0.47. In particular, foreign governments applied large tariff increases on U.S. agriculture exports, even though the U.S. did not significantly raise tariffs on agriculture imports. Third, import and export protection rates of targeted varieties are similar across sectors, and the standard deviation of tariff changes within sectors is low (and most often, zero).

The synchronous variation in tariff changes is informative about the economic rationale for the tariffs, or its lack thereof. Since Johnson (1953), work on optimal tariffs shows that governments can maximize national income by setting higher tariffs on sectors with more inelastic foreign export supply, and Broda et al. (2008a) offer empirical support. However, the tariff changes are extremely similar across sectors. Appendix Figure A.2 illustrates this point further by plotting the distribution of tariff changes for targeted varieties. The left panel shows that, during the trade war, the U.S. applied only five tariff rate changes to targeted varieties: 10%, 20%, 25%, 30%, and 50%. In fact, virtually all varieties (99.8%) were hit with either 10% or 25% tariff changes. The right panel shows that, although trading partners have retaliated with a slightly more diverse range of tariff hikes, most of the rate increases were also concentrated at those two values. These patterns are suggestive that neither the U.S. nor retaliatory tariffs were primarily driven by a terms-of-trade rationale, as in that case we would expect tariff changes to vary substantially across sectors instead of bunching at few round numbers.[18]

This variation across sectors is also suggestive that the tariff changes are unlikely to have been driven by special interests. Explanations in this tradition argue that sectors make political campaign contributions and engage in costly lobbying activities in order to secure import protection from policymakers.[19] However, these explanations also rely on variation in protection across sectors. Hence, a "protection for sale" hypothesis is unlikely to explain the undifferentiated pattern of protection observed in the data. We explore this idea further by tabulating financial campaign contributions made to candidates for the U.S. House of Representatives in the 2016 election cycle, using data from the Center for Responsible Politics. Appendix Figure A.3 plots financial contributions against tariff changes at the sector-level, and shows that there is no systematic relationship. These results suggest it is unlikely that campaign contributions were the main determinant of the U.S. tariff structure.

[18] When we plot the sectors' 2018 tariff level against the foreign export supply elasticities estimated by Broda et al. (2008b), we find a flat correlation. Results available upon request.

[19] Early theoretical studies in this tradition include the tariff-formation function approach Findlay and Wellisz (1982), the political-support function of Hillman (1982), and the political-competition model of Magee et al. (1989). Grossman and Helpman (1994) develop a model in which special interests make financial contributions in exchange for favorable trade policies, and Goldberg and Maggi (1999) and Gawande and Bandyopadhyay (2000) find support for this model. In a model of supply chains it is not obvious *a priori* whether businesses should prefer high or low tariffs. Blanchard et al. (2016) and Mayda et al. (2018) study endogenous tariff protection with supply chains.

3 Trade Framework and Identification

We now describe the trade framework used for the estimation of key elasticities. We present the equations for aggregate import demand in the U.S., and for export supply and import demand in its trade partners. We defer the supply-side and general-equilibrium assumptions in the U.S. to Section 5. Those supply side assumptions will be consistent with the aggregation properties of the demand side we introduce here, but are not needed for the estimation.

3.1 U.S. Import Demand

There are S traded sectors corresponding to 4-digit NAICS industry codes (collected in the set $\mathcal{S}$ and indexed by s). Within each traded sector, aggregate demand (from producers and consumers) is structured according to a 3-tier CES demand system. In the upper nest there is differentiation between domestic and imported goods. Within each of these two nests of sector s there are G_s products (collected in the set $\mathcal{G}_s$ and indexed by product g) corresponding to an HS10 level of aggregation. Within the nest of imported products, there is differentiation by country of origin. The U.S. trades with I countries (collected in the set $\mathcal{I}$ and indexed by country i). Varieties are product-origin pairs.

The CES utility functions and price indexes are presented in Appendix A. This structure readily gives U.S. import demand in each tier as function of prices. The value of imports in sector s is:

$$P_{Ms}M_s = E_s A_{Ms} \left(\frac{P_{Ms}}{P_s}\right)^{1-\kappa}, \tag{1}$$

where E_s are aggregate U.S. expenditures in sector s from both final consumers and firms, A_{Ms} is an import demand shock, P_{Ms} is the import price index defined in equation (A.7) in Appendix A, and P_s is the sector price index defined in equation (A.5).

The value of imports for product g in sector s is

$$p_{Mg}m_g = P_{Ms}M_s a_{Mg} \left(\frac{p_{Mg}}{P_{Ms}}\right)^{1-\eta}, \tag{2}$$

where a_{Mg} is an import demand shock and p_{Mg} is the import price index of product g defined in equation (A.8).

Finally, the quantity imported of product g's variety from country i is:

$$m_{ig} = m_g a_{ig} \left(\frac{p_{ig}}{p_{Mg}}\right)^{-\sigma}. \tag{3}$$

where a_{ig} is a demand shock and p_{ig} is the domestic price of the variety ig. The U.S. imposes ad-valorem tariffs τ_{ig} on the CIF price p^*_{ig}, so that the domestic price is:

$$p_{ig} = (1 + \tau_{ig})\, p^*_{ig}. \tag{4}$$

The previous demand equations depend on three elasticities: across imported varieties within product (σ), across products (η), and between imports and domestic products within a sector (κ).[20]

[20]This three-tier demand system is motivated by what we observe in monthly public data: variety- and product-level imports and exports, and sector-level domestic production data. With this nesting structure, it is sufficient

3.2 Foreign Export Supply and Import Demand

Trade partners are represented with export-supply and import-demand curves at the variety level. We allow for terms-of-trade effects of U.S. trade policy through potentially upward sloping foreign export supply. Each foreign country i supplies the quantity m_{ig} that solves the following profit maximization problem:

$$\max p_{ig}^* m_{ig} - \frac{1}{\omega^* + 1} \frac{(\delta_{ig} m_{ig})^{\omega^*+1}}{Z_{ig}^*}, \tag{5}$$

In this expression, δ_{ig} is a bilateral iceberg trade cost specific to product g (so that $\delta_{ig} m_{ig}$ units must be produced for m_{ig} to arrive) and Z_{ig}^* is a foreign marginal cost shifter. The foreign export supply curve is:

$$m_{ig} = \left(z_{ig}^* p_{ig}^* \right)^{\frac{1}{\omega^*}} \tag{6}$$

where $z_{ig}^* \equiv \delta_{ig}^{\omega^*+1} / Z_{ig}^*$ summarizes the impact of trade frictions and productivity.

The parameter ω^* is the *inverse* of the foreign export supply elasticity. It is a key determinant of the welfare effects of U.S. trade policy as it drives the magnitude of the reduction in foreign prices when U.S. tariffs are imposed. (Before-tariff) import prices fall more sharply the larger is ω^*. If $\omega^* \approx 0$, tariffs are fully passed to U.S. consumers.

Each foreign country demands a quantity x_{ig} of US exports of good g. Foreign import demand for U.S. varieties is similar to (3) on the U.S. side, but with a potentially different demand shifter and demand elasticity:

$$x_{ig} = a_{ig}^* \left(\left(1 + \tau_{ig}^* \right) p_{ig}^X \right)^{-\sigma^*}, \tag{7}$$

where x_{ig} is the U.S. exports of product g to country i, p_{ig}^X is export price faced by exporters, τ_{ig}^* is the ad-valorem tariff set by country i on U.S. exports of good g, and a_{ig}^* is a foreign demand shock.

3.3 Identification

Our goal is to estimate the elasticities $\{\sigma, \eta, \kappa, \sigma^*, \omega^*\}$ that characterize U.S. import demand and foreign export and import curves. Import tariffs are used to identify U.S. import demand elasticities $\{\sigma, \eta, \kappa\}$ and the foreign export supply elasticity $\{\omega^*\}$, and the retaliatory tariffs are used to identify the foreign import demand elasticity $\{\sigma^*\}$. This section discusses the identification strategy and its potential threats.

to observe the import shares of expenditures within each sector s to estimate the elasticities. We do not require information on import shares within each product g, or about the differential import share of consumers relative to producers within each sector, which are not observed in publicly available data but would be required under alternative nesting assumptions. A potential shortcoming of this structure is that the imports m_g of any particular product g in sector s impact the domestic expenditures of that same product only through the sector-level shifter $P_{Ms} M_s$. The three-tier demand system is also the same as in Broda et al. (2008b).

3.3.1 U.S. Import and Foreign Export Variety Elasticities (σ, ω^*)

We use variation in U.S. import tariffs to estimate the variety import demand and export supply elasticities simultaneously. The idea of identifying two elasticities with one instrument was recently introduced by Zoutman et al. (2018) in the context of applications to public finance.

Identification of both elasticities using a single tariff follows from the fact that tariffs introduce a wedge between the price the importer pays and the price the exporter receives. Consider the equilibrium of the system of import demand and export supply equations of varieties imported by the U.S., equations (3) and (6). The import demand equation (3) can be written as a function $m_{ig}^M(\cdot)$ of the duty-inclusive price p_{ig},

$$m_{ig} = m_{ig}^M\left(\left(1+\tau_{ig}\right)p_{ig}^*\right) = m_{ig}^M\left(p_{ig}\right), \tag{8}$$

whereas the export supply equation (6) can be written as function $m_{ig}^X(\cdot)$ of the price before duties,

$$m_{ig} = m_{ig}^X\left(p_{ig}^*\right) = m^X\left(\frac{p_{ig}}{1+\tau_{ig}}\right). \tag{9}$$

Consider first equation (8). Conditioning on the export price p_{ig}^*, an increase in τ_{ig} acts as a (negative) demand shifter. This shift traces the supply curve. Now consider equation (9). Conditioning on the tariff-inclusive price p_{ig}, an increase in τ_{ig} acts as a (negative) supply shifter in (9). This shift traces the demand curve.[21]

Adding a time subscript and log-differencing over time, the structural equations (3) and (6) can be written as:[22]

$$\Delta \ln m_{igt} = \alpha_{gt}^M + \alpha_{it}^M + \alpha_{is}^M - \sigma \Delta \ln p_{igt} + \varepsilon_{igt}^M \tag{10}$$

$$\Delta \ln m_{igt} = \alpha_{gt}^X + \alpha_{it}^X + \alpha_{is}^X + \frac{1}{\omega^*}\Delta \ln p_{igt}^* + \varepsilon_{igt}^X, \tag{11}$$

where the α_{gt} are product-time fixed effects, α_{it} are country-time fixed effects, and α_{is} are country-sector fixed effects (s is the sector of product g). The error term of the import demand equation is structurally interpreted as the change in the residual demand shock, $\varepsilon_{igt}^M \equiv \Delta \ln\left(a_{igt}\right)$. For now, suppose that tariffs are uncorrelated with unobserved import demand and export supply shocks, an issue we return to below at the end of this section. Then, import demand σ is identified by instrumenting the (change in) tariff-inclusive price with the (change in) tariff. The export supply ω^* is identified by instrumenting the (change in) before-tariff price with the (change in) tariff. The first stage F-statistic of the instrument is informative of whether or not the incidence of the tariff is shared by both parties (Zoutman et al., 2018). Specifically, if the first-stage F-statistic for the

[21] This intuition can also be seen in a standard textbook model of supply and demand curves, expressed in log-units. Point A in Appendix Figure A.4 illustrates the initial equilibrium price and quantity. If an exogenous tariff is imposed, the consumer's willingness to pay will shift down by the amount of the tariff. The equilibrium quantity and price that the exporter receives moves to point B. The movement from A to B traces the slope of the supply curve. However, since importers pay the tariff (which goes to the government, not the exporter), the tariff-inclusive price $\ln p^* + \ln\left(1+\tau\right)$ is point C. There is only one slope of the demand curve that can rationalize point C. Hence, the wedge generated by the tariff simultaneously pins down the slopes of both curves.

[22] The log changes in import demand shifter are $\Delta \ln\left(m_{gt} p_{gMt}^{\sigma}\right) \equiv \alpha_{gt}^M + \alpha_{it}^M + \alpha_{is}^M$ and $\varepsilon_{igt}^M \equiv \Delta \ln\left(a_{igt}\right)$. The log changes in export supply shifters are $-\Delta \ln\left(z_{ig}^{*1/\omega^*}\right) \equiv \alpha_{gt}^X + \alpha_{it}^X + \alpha_{is}^X + \varepsilon_{igt}^X$.

supply curve is low, this is indicative of full pass-through to the importer.

Equilibrium in the market of variety i of product g requires equalization of (3) and (6). As shown in Appendix equation (A.2), the structural equations can also be written in reduced-form as:

$$y_{ig} = \alpha_{gt}^{M} + \alpha_{it}^{M} + \alpha_{is}^{M} - \beta^{y} \Delta \ln (1 + \tau_{igt}) + \varepsilon_{igt}^{y} \tag{12}$$

for $y = \{p^*, m\}$. The structural elasticities can then be recovered from the reduced-form parameters: $\omega^* \equiv \frac{\beta^{p^*}}{\beta^m}$ and $\sigma \equiv -\frac{\beta^m}{1+\beta^{p^*}}$.

3.3.2 Product Elasticity (η)

The elasticity η across products is identified by aggregating the variety-specific tariffs to the product level. From (2), adding a time subscript and log-differencing over time, we have

$$\Delta \ln (s_{Mgt}) = \psi_{st} + (1 - \eta) \Delta \ln (p_{Mgt}) + \varepsilon_{Mgt}, \tag{13}$$

where $s_{Mgt} \equiv \frac{p_{Mgt} m_{gt}}{P_{Mst} M_{st}}$ is the share of product g in total imports of its sector s. The parameter $\psi_{st} \equiv -(1 - \eta) \Delta \ln (P_{Mst})$ is a sector-time pair fixed effect that controls for the overall sector import price index, and $\varepsilon_{Mgt} = \Delta \ln (a_{Mgt})$ is a residual that captures the demand shock. The expression reveals that the elasticity η can be estimated from a regression of changes in import expenditure shares of product g on sector-time fixed effects and changes in the import price index p_{Mgt} of product g.

Estimating (13) requires the price index of product g. We leverage the structure of the demand system to build this index exactly from the variety-level data. When doing so, we also account for the entry and exit of varieties by applying the variety correction from Feenstra (1994). Combining (A.8) and (3) we obtain the following exact expression for the change in the product price index:

$$\Delta \ln p_{Mgt} = \frac{1}{1 - \sigma} \ln \left(\sum_{i \in \mathcal{C}_{gt}} s_{igt} e^{(1-\sigma) \Delta \ln \left(p_{igt}^{*} (1 + \tau_{igt}) \right) + \Delta \ln a_{igt}} \right) - \frac{1}{1 - \sigma} \ln \left(\frac{S_{g,t+1} (\mathcal{C}_{gt})}{S_{g,t} (\mathcal{C}_{gt})} \right), \tag{14}$$

where s_{igt} is the share of continuing variety i in all continuing varieties, $\mathcal{C}_{gt}$ be the set of continuing varieties in product g between t and $t + 1$, and $S_{g,t} (\mathcal{C})$ is the share of the varieties in the set $\mathcal{C}$ in the total imports of product g at time t.[23] Notice that the price index includes two pieces from the estimation in the previous step: the estimated σ and the residuals, which reflect mean-zero demand shocks $\Delta \ln (a_{igt})$.[24]

According to our model the change in the product price index p_{Mgt} is correlated with the unobserved demand shock ε_{Mgt}. Using the same logic applied at the previous stage that tariffs are uncorrelated with demand shocks, we can instrument $\Delta \ln p_{Mgt}$ using the tariffs. We construct an

[23] I.e., $s_{igt} \equiv \frac{p_{igt} m_{igt}}{\sum_{i' \in \mathcal{C}_{gt}} p_{i'gt} m_{i'gt}}$ and $S_{g,t} (\mathcal{C}) \equiv \frac{\sum_{i' \in \mathcal{C}} p_{i'gt} m_{i'gt}}{\sum_{i' \in \mathcal{I}} p_{i'gt} m_{i'gt}}$.

[24] This step to construct a product level price index from aggregation residuals in the lower tier is the same as in Costinot et al. (2016), who estimate a nested CES demand over agricultural products and varieties.

instrument that is a simple average of changes in tariffs across the continuing varieties:[25]

$$\Delta \ln Z_{Mgt} = \ln \left(\frac{1}{N_{gt}^{\mathcal{C}}} \sum_{i \in \mathcal{C}_{gt}} e^{\Delta \ln(1+\tau_{igt})} \right), \tag{15}$$

where $N_{gt}^{\mathcal{C}}$ is the number of continuing varieties in product g between t and $t+1$.

3.3.3 Import Elasticity (κ)

We further aggregate to the top tier within a sector to estimate the elasticity κ between domestic and imported products within sectors. The import expenditures $P_{Mst}M_{st}$ defined in (1), relative to the expenditures in domestically produced goods $P_{Dst}D_{st}$, are a function of the import price index P_{Mst} relative to the price index of domestically produced goods P_{Dst}, defined in equations (A.7) and (A.6):

$$\Delta \ln \left(\frac{P_{Mst}M_{st}}{P_{Dst}D_{st}} \right) = \psi_s + (1-\kappa) \Delta \ln \left(\frac{P_{Mst}}{P_{Dst}} \right) + \varepsilon_{st}. \tag{16}$$

The fixed effect and residual components capture demand shocks. We proceed analogously to the previous step to construct the sector import price index, P_{Mst}, and to instrument for it using variety-level tariffs. The import price index of sector s changes according to:

$$\Delta \ln P_{Mst} = \frac{1}{1-\eta} \ln \left(\sum_{g \in \mathcal{C}_t^s} s_{gt} e^{(1-\eta)\Delta \ln p_{gMt} + \Delta \ln\left(a_{gMt}\right)} \right) - \frac{1}{1-\eta} \ln \left(\frac{S_{t+1}^s\left(\mathcal{C}_t^s\right)}{S_t^s\left(\mathcal{C}_t^s\right)} \right), \tag{17}$$

where s_{gt} is the import share of continuing product g in continuing products imported in sector s, $S_t^s(\mathcal{C})$ is the share of the products in the set $\mathcal{C}$ in imports of sector s at time t, and $\mathcal{C}_t^s$ is the set of continuing products in sector s between t and $t+1$. Notice again that (17) relies on the the estimated η and the residuals at this step which reflect mean-zero demand shocks.

We construct $\Delta \ln P_{Mst}$ using the residuals $\varepsilon_{Mgt} = \Delta \ln(a_{gMt})$ estimated from (13), and we instrument for the relative price of imports, $\Delta \ln(P_{Mst}/P_{Dst})$, using

$$\Delta \ln Z_{Mst} \equiv \ln \left(\frac{1}{N_{st}^{\mathcal{C}}} \sum_{g \in \mathcal{C}_t^s} e^{\Delta \ln Z_{gMt}} \right), \tag{18}$$

where Z_{Mst} is the instrument defined in (15) at the product level and $N_{st}^{\mathcal{C}}$ is the number of continuing varieties in product g between t and $t+1$.

3.3.4 Foreign Import Variety Elasticity (σ^*)

The foreign import demand is estimated using an equation similar to (10). We consider how U.S. exports respond to retaliatory tariffs. From (7), decomposing the log-change of the foreign demand shifter $\Delta \ln\left(a_{igt}^*\right)$ into a product-time effect α_{gt}^X, country-time effect α_{it}^X, country-sector effect α_{is}^X, and a residual ε_{igt}^X, we obtain:

$$\Delta \ln x_{igt} = \alpha_{gt}^X + \alpha_{it}^X + \alpha_{is}^X - \sigma^* \Delta \ln \left(\left(1+\tau_{igt}^*\right) p_{igt}^X \right) + \varepsilon_{igt}^X, \tag{19}$$

[25] We use a simple average in constructing the instrument since using value weights may induce mechanical correlations with the left-hand side of equation (13).

where p_{igt}^X is the before-tariff price observed in the U.S. If the retaliatory tariffs τ_{igt}^* are uncorrelated with foreign import demand shocks, ε_{igt}^X, we can identify σ^* by instrumenting the change in the tariff-inclusive price with the change in retaliatory tariffs.

3.3.5 Threats to Identification

There are three main threats of identification to using tariffs to identify the elasticities. First, the simultaneous identification of $\{\sigma, \omega^*\}$ requires that the tariff affects importers' willingness to pay. If importers can evade the tariff or do not base their demand on tariff-inclusive prices, the tariffs will not cause inward shifts of the import demand curve. In our setting, we do not believe either concern is of first order. While sales taxes may not be salient to consumers because retail prices are quoted in before-tax prices (e.g., Chetty et al. 2009), tariffs are paid at the border and consumers always observe the after-tariff prices. Moreover, tariff evasion is a larger concern in developing countries (e.g., Sequeira 2016).

Second, as previously mentioned, we require that the tariff changes are uncorrelated with unobserved import demand and export supply shocks. The system of equations are all run in first differences and control flexibly for potential demand and supply shocks at each step, which mitigates these concerns. In the next section, we additionally implement several checks of pre-trends that support this key identification assumption.[26]

Third, importers may have anticipated looming tariffs in the months before implementation. If so, they may have shifted forward their imports which could bias the elasticities because of a mismatch in timing of imports and tariff changes. The next section also checks this concern by implementing dynamic specifications that allow lags and leads of tariffs to affect outcomes.[27]

4 Elasticities

This section presents the estimates for the elasticities. We begin by addressing the threats to identification raised above, and then present the elasticity estimates.

4.1 Pre-existing Trends

A key assumption to identify the elasticities is that the tariff changes are uncorrelated with import demand and export supply shocks. We provide three pieces of evidence that support this assumption.

[26] The identification strategy is not threatened if the tariff changes reflect the differences between the preferences for redistribution towards specific sectors of the policymakers that were elected in 2016 and the previous policymakers. Rather, it only requires those preference changes over sectors to be uncorrelated with unobserved shocks to changes in demand and supply over the time period in which the tariff changes take place.

[27] Coglianese et al. (2017) made this point in the context of estimating the demand for gasoline. A final caveat applies to the fact that the analysis assumes export supply curves derived under perfect competition. Conditional on a particular parametric family of demand and a log-linear marginal cost function, the approach readily extends to monopolistic, Cournot, or Bertrand competition.

First, we correlate import and export outcomes before the 2018 trade war—values, quantities, unit values, and duty-inclusive unit values—with the future tariff changes. We compute these outcomes as the monthly average change between January 2016 and December 2017, and regress them against the 2017-18 change in statutory tariff rates (τ):

$$\Delta_{2016-17} \ln \bar{y}_{ig} = \alpha_g + \alpha_{is} + \beta \Delta_{2017-18} \ln(1 + \tau_{ig}) + \epsilon_{igt} \tag{20}$$

The regression controls for HS10 product (α_g) and country-sector (α_{is}) fixed effects. This specification is informed by the estimating equations derived in Section (3.3.1). These equations rely on variation in log of one plus tariffs, controlling for these fixed effects, to identify the import demand and foreign export supply elasticities. Standard errors are clustered by country and HS8 (for imports) or HS6 (for exports).

We plot the residualized outcomes and tariffs after controlling for the fixed effects to visualize the relationship, and report the regression output at the top of each panel.[28] Panels A and B of Figure 2 plot the regression relationship using the 2017 statutory and applied tariff levels as the left-hand side variable in (20). We observe no correlation between pre-war import tariffs levels and war tariff changes. This implies that imports with lower pre-war tariffs were not more likely to be targeted by higher tariffs during the war. The subsequent panels plot the relationship for changes in import outcomes. Here, too, we observe no statistically significant relationship, suggesting that targeted import varieties were not on differential trends prior to the war. We document the same flat relationship for U.S. export outcomes in Figure 3: pre-war tariff levels and export outcomes trends do not correlate with retaliatory war tariff changes. These findings suggest that trade partners did not target U.S. varieties on the basis of pre-war tariff levels or export trends.[29]

Second, we further rule out confounding pre-trends through an event-study framework that demonstrates similar trends in key outcomes for targeted relative to untargeted varieties prior to the war. The event study illuminates whether or not changes in trade outcomes coincide with the timing of the tariff changes, as our (static) model predicts. We compare the trends of targeted varieties (those directly hit by a tariff increase) to varieties not targeted in the following specification:

$$\ln y_{igt} = \alpha_{ig} + \alpha_{gt} + \alpha_{it} + \sum_{j=-6}^{3} \beta_{0j} I\left(event_{ig} = j\right) + \sum_{j=-6}^{3} \beta_{1j} I\left(event_{ig} = j\right) \times target_{ig} + \epsilon_{igt}. \tag{21}$$

This specification includes variety (α_{ig}), country-time (α_{it}) and product-month (α_{gt}) fixed effects. Varieties targeted by tariffs are captured with the $target_{ig}$ dummy. The inclusion of α_{gt} fixed effects implies that the β_{1j} coefficients are identified using variation between targeted and non-targeted varieties within product-time. The event time coefficients are captured by the indicator variables. We assign the event date of targeted varieties to be the nearest full month to the actual event date, using the 15th of the month as the cutoff date.[30] Non-targeted varieties within the same HS10

[28] Because these plots show residualized tariffs, they do not display the bunching from Figure (A.2).

[29] The correlation between the pre-trend outcomes and subsequent changes is also zero for all outcomes when considering a longer time horizon.

[30] The event date varies by both product and country, since some varieties within the same product code are targeted before others. For example, the U.S. imposed steel tariffs on Canada, Mexico, and the EU three months after imposing steel tariffs on other countries.

product code as a targeted variety are assigned the earliest event date within that product code. For all other non-targeted varieties, we assign the event date to be the earliest month of a targeted variety within the same NAICS-4 sector. If a non-targeted variety does not share the same NAICS-4 sector as any targeted varieties, we sequentially use NAICS-3 and NAICS-2 codes, and otherwise assign the event month to be the earliest month of the trade war (February 2018 for imports, and April 2018 for exports). We bin event times≥3 together and exclude event time≤-7. Standard errors are clustered by country and HS8 (for import outcomes) and HS6 (for export outcomes), as these are the levels of product aggregation at which import and export tariffs are respectively set. We plot the the β_{1j} dummies that capture the relative trends of targeted varieties.

Figure 4 illustrates the sharp increase in import and export tariff rates as a result of the trade war. Prior to the date of implementation, we do not observe divergent trends between targeted and exempt varieties. We observe increases in $\ln(1+\tau)$ of approximately 14% in the import statutory rate and 18% in the retaliatory rate. For the reasons discussed above, the applied rates increase more gradually relative to the statutory tariff changes.

Figure 5 shows the event study results for the import outcomes. The top two panels trace the impact of tariffs on import values and quantities, and the bottom panels show the effects on unit values, both exclusive and inclusive of duties. Upon impact, we detect large and virtually immediate declines in trade flows. Import values decline on average by 20% and quantities decline by 23%. In the bottom-left panel, unit values exclusive of duties do not change. However, duty-inclusive unit values increase sharply for targeted varieties by 9%, on average. These two panels are initial evidence of complete pass-through of the tariffs to import prices.

The event study also directly addresses the third identification threat mentioned in Section 3.3.5: tariff anticipation. The figures suggest some anticipatory effects occurring two months before the tariff changes, but they are quantitatively small (the coefficient on import values at event time of -2 is 5%). Hence, the concern that importers shifted forward their purchases in order to avoid paying tariffs is mild. Below, we further assess this potential threat through dynamic specifications in Section 4.6.

Figure 6 repeats the event study exercise using the export data and the retaliatory tariffs faced by U.S. exporters. Although the magnitudes are smaller, the patterns are similar to what we observe for imports. We find that, at implementation, export values decline on average by 21% and quantities fall by 25%. Again, we observe no change in the unit values before tariff duties. Inclusive of duties, unit values increase by 19%. These two panels are initial evidence of complete pass-through of the retaliatory tariffs to foreign import prices. We observe no clear pattern of anticipation of U.S. exports.

The third check examines domestic sectoral-level outcomes. While the analysis shows that targeted import/export varieties were not on differential trends prior to the war, it could be that recent trends in domestic sectoral outcomes triggered the U.S. to raise tariffs on imports. We assess this concern by analyzing the time path of key U.S. sector variables–PPI, production index,

employment, and nominal wages–through the following event-study framework:

$$\ln y_{st} = \alpha_s + \alpha_{mt} + \sum_{j=-6}^{3} \beta_{0j} I\left(event_s = j\right) + \sum_{j=-6}^{3} \beta_{1j} I\left(event_s = j\right) \times target_s + \epsilon_{st}, \tag{22}$$

where s denotes a (NAICS4) sector and m denotes a two-digit NAICS code. The α_{mt} fixed effects control for monthly trends that may be different for broader sectors of the economy, such as manufacturing and agriculture. To define the event time for sector-level outcomes, we must confront that sectors may experience multiple tariff changes throughout the year. Additionally, retaliatory tariffs are often enacted after import tariffs in the same sector. We define the event time by assigning the month in which the sector experiences the largest (percentage point) increase in import tariffs. Our sample includes all sectors for which we observe at least one of the four outcomes, but we do not observe all outcomes for all sectors.[31]

Figure 7 presents the sector-level event study plots. Prior to the increase in protection, we observe no trends in sectoral outcomes. This is reassuring as it suggests that, like the trade outcomes, the tariffs did not respond to short-run trends in domestic employment, producer prices or production.

4.2 U.S. Import and Foreign Export Variety Elasticities (σ, ω^*)

This subsection estimates the variety level import demand and foreign export supply elasticities following the approach described in Section 3.3.1.

We face a choice between using either the applied import tariff or the statutory tariff as the policy variable. The applied tariff is appealing because it is based on the actual duties paid by the importers. However, there are reasons to be concerned about using applied rates as the source of identifying variation. As noted above, applied rates are constructed as the ratio between actual duties collected and import values, both of which could be measured with error. While classical measurement errors would attenuate the elasticities, the larger concern is non-classical measurement error. For instance, measurement error in import values induces a mechanical correlation between the applied rates and unit values. We present the elasticities with respect to the applied rates, but we also address these measurement error concerns by instrumenting the applied duties with the statutory tariff. This approach has the advantage of exclusively relying on the tariff variation generated by the trade war.[32]

Table 3 reports the elasticities using the applied rate, and Table 4 instruments the applied rates with the statutory rates. Columns 1-4 of Table 3 report the reduced-form specifications in (12) for the four outcomes: values (p^*m), quantities (m), unit values (p^*), and duty-inclusive unit values $(p^*(1+\tau))$. Each specification is run in first-differences and includes fixed effects for product-time, country-time and country-sector. Standard errors are two-way clustered by country and HS8, and

[31] The results are similar when we use a subsample of 266 sectors for which we observe all four outcomes.

[32] We ignore changes in statutory rates that are part of pre-existing commitments made by the U.S. through regional trade agreements. These changes occur in January and July of 2018. Therefore we only use tariff changes that occur during the trade war as identifying variation.

use data from January 2017 to November 2018.[33] Column 1 shows that import values drop sharply with tariff increases. The point estimate is a statistically significant -2.45 (s.e.=0.08). Column 2 shows that this import value decline is closely matched by changes in quantities. Column 3 indicates a positive impact of the tariff increases on the unit values, which is puzzling but disappears below once we instrument with statutory tariff changes.[34] This is verified in column 4, which indicates that for a one percent increase in the applied tariff, duty-inclusive unit values increase by 1.09%. Based on these reduced-form regressions, the data suggest essentially complete pass-through of the tariffs to import prices.

We recover the elasticities $\{\sigma, \omega^*\}$ from the structural IV estimates using (10) and (11) in columns 5-6. Column 5 reports the supply curve elasticity, $1/\hat{\omega^*}$. (Recall that the first stage for this specification is column 3). The coefficient is large and negative, which is consistent with more-than-complete pass-through from the corresponding first-stage regression (column 3), and implies $\hat{\omega}^*$=-0.03 (s.e.=0.01). Moreover, as discussed in Section 3.3.1, the low first-stage F-statistic is useful for determining who bears the incidence of the tariffs. The first-stage F-statistic is low (6.2), indicating that we cannot reject a horizontal supply curve. Therefore, we do not find strong evidence that U.S. tariffs have caused foreign exporters to reduce their before-tariff prices in the short-run. Column 6 reports the estimate of import demand elasticity. The first-stage F-statistic, from the first-stage regression in column 4, is large. The estimate implies $\hat{\sigma}$=2.32 (s.e.=0.07).

To address the potential concerns with measurement error in the applied rates discussed above, we now exploit the statutory tariff variation as an instrument in Table 4.[35] The first column reports the first-stage regression of the change in the applied tariffs on the change in statutory tariffs. The coefficient is tightly estimated, as expected, but is less than a perfect correlation (consistent with measurement error). Columns 2-5 report the impacts of the instrumented applied rate on import outcomes. We continue to detect no relationship between before-tariff unit values and the statutory tariffs (column 4).

Columns 8 and 9 report the structural IV regressions for the supply and demand curves using the statutory tariff to instrument the before-tariff and tariff-inclusive unit values. The corresponding first-stage regressions are in columns 6 and 7. These specifications yield $\hat{\omega}^*$=-0.02 (s.e.=0.05). As before, the F-statistic for the supply curve is low. This is again consistent with a horizontal foreign export supply curve in the short run. The import demand elasticity remains precisely estimated $\hat{\sigma}$=2.47 (s.e.=0.26), and is our preferred estimate since it relies on the statutory tariff variation.

Using the estimated elasticities $\hat{\sigma}$=2.47 and $\hat{\omega^*} = 0$ and the average change in statutory tariffs,

[33] We have also run the specifications in levels with variety fixed effects and found very similar elasticities. We choose to work in first differences, as it is consistent with the model and reduces computational burden, particularly when we allow for variety-specific trends. We choose January 2017 as starting point of the analysis because it is one year before the Trade War began and it is the first month that the U.S. administration implementing the tariffs took office.

[34] The number of observations in columns 2-4 differ from column 1 because of missing quantities.

[35] Since the statutory tariffs change during the middle of the month, we scale the tariff changes by the number of days in the month that they are in effect. We adopt this scaling because the monthly import data includes transactions that arrive before the tariff went into affect.

we compute the average change in import values of targeted varieties:

$$\overline{\Delta \ln \left(p^*_{igt} m_{igt}\right)} = -\underbrace{\sigma \frac{1+\omega^*}{1+\omega^*\sigma}}_{2.47} \underbrace{\overline{\Delta \ln\left(1+\tau_{igt}\right)}}_{12.75\%} = 31.5\%,$$

with standard deviation of 15.5% across targeted varieties.

4.3 Product Elasticity (η)

Table 5 presents estimates of the product elasticity (η) from equation (13) following the steps described in Section 3.3.2. The regressions are run in first differences, control for sector-time pair fixed effects, and cluster standard errors at the sector level. We construct the price index from equation (14) using $\hat{\sigma}$ and the residuals from the import variety demand equation. We first construct this index using the estimates from column 6 of Table 3, and build the instrument $\Delta \ln Z_{gMt}$ using (15). Columns 1-3 report results using applied tariffs to build the instrument and columns 4-6 report results that instrument with statutory tariffs.

Column 1 regresses the change in product shares, $\Delta \ln (s_{Mgt})$, directly on the instrument (i.e., the reduced form). Higher (product-level) tariffs result in lower relative product-level expenditures. Column 2 reports the first-stage where we regress the tariff-inclusive price index on the instrument. The sign is consistent with what we should expect: higher tariffs raise the product price index. Column 3 reports the IV estimate which regresses the change in product shares on the change in the instrumented price index. The estimate implies $\hat{\eta}$ =3.25 (s.e.=0.71).

Columns 4-6 report the results that instrument using the estimates from the statutory tariffs (column 9 of Table 4). The results are consistent with the previous columns but now the elasticities are lower because there is less variation over time in the statutory rates (which change only during the trade war) compared to the applied rates. The coefficient in column 6 implies $\hat{\eta}$ =1.81 (s.e.=0.48). As before, this is our preferred estimate because it is estimated using the statutory tariff variation.

Using this elasticity and the average change in product-level statutory import tariffs, these estimates imply that import values for targeted products within imported sectors have fallen 3.8% (s.d. 4.3%) across targeted products.[36]

4.4 Import Elasticity (κ)

Table 6 reports estimates of the sector elasticity (κ) following the steps described in Section 3.3.3. The regressions control for sector fixed effects and cluster standard errors at the sector level. Since the analysis is run in first differences, the fixed effects control quite flexibly for sector-specific trends. As shown in (16), estimating this elasticity requires data on changes imports and domestic expenditures at the sectoral level.

[36] This number is the average change in import values for targeted products obtained from $\Delta \ln p_{Mgt} m_{gt} = -(\eta - 1) \Delta \ln Z^{stat}_{gMt}$ where we set $\{\hat{\omega}^* = 0, \hat{\sigma} = 2.47, \hat{\eta} = 1.81\}$.

The monthly changes on U.S. expenditures in domestically produced goods, $\Delta \ln (P_{Dst} D_{st})$, is not directly observed. We measure it as the difference between the changes in sectoral production and exports. Estimating this elasticity also requires data on the price index of domestically produced goods, $\Delta \ln (P_{Dst})$. The production structure we assume below implies that the change in the price index of domestically produced goods equals the change in PPI, $\Delta \ln p_{st}$, plus a mean-zero shock: $\Delta \ln P_{Dst} = \Delta \ln p_{st} + \Delta \ln \varepsilon^P_{st}$.[37] This allows us to implement equation (16) with the PPI instead of the consumer price index of domestically produced goods. Hence, our specification uses $\Delta \ln (P_{Mst}/p_{st})$ instead of $\Delta \ln (P_{Mst}/P_{Dst})$ in (16).

The change in the price index, $\Delta \ln P_{Mst}$, is constructed from (17) using the estimated $\hat{\sigma}$ and $\hat{\eta}$ from the previous two steps, and the corresponding residuals from these regressions. As before, we can construct the price index from either the applied tariffs (which uses estimates from column 6 of Table 3 and column 3 of Table 5) or statutory tariffs (which uses estimates from column 9 of Table 4 and column 6 of Table 5).

Column 1-3 use the applied tariffs as the source of variation. Column 1 is the reduced form specification that projects relative imports on the instrument, column 2 is the first stage and column 3 is the IV estimate. Columns 4-6 repeat the analysis using the statutory tariff as the identifying variation. Column 5 regresses the relative import price index directly on the statutory tariff instrument (i.e., the first stage). The coefficient is negative, suggesting that price propagation of the tariff through input-output linkages is strong and causes the domestic PPI to increase, but is noisy. Column 6 reports the IV estimate. The coefficient is not statistically significant from zero but recall that the structural interpretation of the coefficient is $1 - \kappa$. This implies a statistically significant $\hat{\kappa}$ =2.12 (s.e.=0.84).

Using this elasticity and the average change in sector-level statutory import tariffs, these estimates imply that import values for targeted sectors fell 0.5% (s.d. 1.2%) across targeted sectors.[38]

4.5 Foreign Import Variety Elasticity (σ^*)

This subsection estimates the foreign import demand elasticity σ^* using equation (19). The regressions include product-time, destination-time and destination-sector fixed effects, and cluster standard errors by destination country and HS6. For completeness, we first report regressions of the four export outcomes on the retaliatory tariffs in columns 1-4 of Table 7. We observe a statistically significant decline in export values and quantities. We also observe evidence in column 3 that the retaliatory tariffs caused U.S. exporters to lower (before tariff) product level unit values, but the coefficient is not statistically significant.[39]

Column 5 reports the IV estimate of equation (19) to estimate σ^*. (The first-stage is column 4). We estimate $\hat{\sigma}^*$=.83 (s.e.=.33). Using the estimated elasticity and the average change in retaliatory

[37] See Section 5 for more details, and in particular footnote 43.

[38] This number is the average change in import values for targeted sectors obtained from $\Delta \ln \left(\frac{P_{Mst} M_{st}}{P_{Dst} D_{st}} \right) = (1 - \kappa) \Delta \ln Z^{stat}_{Mst}$ where we set $\{\hat{\omega}^* = 0, \hat{\sigma} = 2.47, \hat{\eta} = 1.81, \hat{\kappa} = 2.12\}$.

[39] This finding is consistent with the supply side for the U.S. economy in Section 5. In particular see footnote 44.

tariffs, these estimates imply that U.S. export values for varieties targeted by trade partners fell 11.0% (s.d. 3.8%).[40]

4.6 Trends and Dynamic Specifications

We demonstrated in Section 4.1 that pre-existing trends and tariff anticipation are unlikely to be concerns. Now, we estimate the elasticities using specifications that check the sensitivity to pre-existing trends and lagged impacts.

The first robustness check controls for trends through panel fixed effects. We re-estimate the variety-level specifications to include variety fixed effects and report the analog to Table 3 in Appendix Table A.1. The results are essentially unchanged. Table A.2 adds variety trends to the specifications that instrument using the statutory rates, and again the results are hardly effected. For the product elasticity, Appendix Table A.3 repeats the analysis with product fixed effects which is equivalent to controlling for product-specific trends. Again, the results hardly change. These findings are consistent with the evidence provided in Section 4.1 that pre-existing trends are unlikely to be confounders.

The second concern is that importers may have anticipated the changes in tariffs and shifted their purchasing decisions forward to avoid the duties. This concern means that, even though there is a real impact of tariffs on trade, in a contemporaneous regression of changes in imports on changes in tariffs the estimated elasticities may be biased. We check for anticipatory and lagged effects by allowing for leads and lags in the variety-level reduced-form in equation (12):

$$\Delta \ln y_{igt} = \alpha_{gt} + \alpha_{it} + \alpha_{is} + \sum_{m=-6}^{m=3} \beta_m^y \left[\ln\left(1+\tau_{ig,t-m}\right) - \ln\left(1+\tau_{ig,t-1-m}\right)\right] + \epsilon_{igt}, \tag{23}$$

where we allow for leads up to six months before the tariff change and up to three months after the tariff changes.

Figure 8 plots the estimated β_m coefficients for import values, quantities, unit values, and tariff-inclusive unit values at the variety level. There is evidence of anticipation, but consistent with the event study figures, the effects are quantitaively small. Additionally, the coefficient at time zero is quantitatively very similar to the reduced form estimate from the static regression. This reassures us that the elasticities are not biased due to anticipation effects. Figure 9 replicates the analysis for exported varieties, and further suggests no anticipation of exports to the retaliatory tariffs.

5 Aggregate and Regional Impacts

Our goal now is to compute the aggregate and regional impacts of the tariff war. We combine the previous demand structure with a supply-side framework of the U.S. economy. The mechanics of how tariffs impact the economy in general equilibrium depend on the elasticities we have estimated from tariff variation, and on the parametrization of the production side that we now introduce.

[40] This number is the average change in export values for targeted varieties obtained from $\Delta \ln\left(p_{igt}^X x_{igt}\right) = -\sigma^* \Delta \ln\left(1+\tau_{igt}^*\right)$ where we set $\hat{\sigma}^* = .83$.

This supply-side combines various margins of economic activity that are standard in quantitative trade models. We model input-output linkages across tradeable sectors assuming production functions with constant expenditure shares as in Caliendo and Parro (2015). Linkages have a spatial dimension because regions vary in their specialization patterns as in Caliendo et al. (2017). We incorporate a flexible international demand and supply structure, involving the 3-tier demand system within each sector as well as the foreign import demand and export supply elasticities we have estimated at the variety level. To capture distributional effects of the tariffs we assume specific factors and imperfect labor mobility across regions.

5.1 General Equilibrium Structure

The U.S. is divided into R counties (collected in the set $\mathcal{R}$ and indexed by r). In addition to the traded sectors there is one non-traded sector. In each region r there are L_r workers. Workers are immobile across regions, and may be either perfectly mobile or immobile across sectors. Within traded sectors, final goods are freely traded within the U.S. but face trade costs internationally.

Consumption in county r results from maximizing aggregate utility,

$$\beta_{NT} \ln C_{NT,r} + \sum_{s \in \mathcal{S}} \beta_s \ln \left(\prod_{s \in \mathcal{S}} C_{sr} \right), \tag{24}$$

where $C_{NT,r}$ is consumption of a homogeneous non-traded good, C_{sr} is consumption of tradeable sector s, and $\beta_{NT} + \sum_{s \in \mathcal{S}} \beta_s = 1$. The price of the non-traded good is $P_{NT,r}$. Assuming no trade costs within the U.S., the price index P_s of sector s is the same in every region. Letting X_r be final consumer expenditures in region r, defined in (33) below, expenditures in the non-traded sector are $P_{NT,r} C_{NT,r} = \beta_{NT} X_r$, and in each traded sector they are $P_s C_{sr} = \beta_s X_r$.

Production of tradeable goods uses workers, intermediate inputs, and the sector-specific capital. The domestic production of tradeable sector s in region r is

$$Q_{sr} = Z_{sr} \left(\frac{I_{sr}}{\alpha_{I,s}} \right)^{\alpha_{I,s}} \left(\frac{L_{sr}}{\alpha_{L,s}} \right)^{\alpha_{L,s}}, \tag{25}$$

where Z_{sr} is local productivity, I_{sr} are intermediate inputs and L_{sr} is the number of workers. The factor shares add up to less than 1, and we let $\alpha_{K,s} \equiv 1 - \alpha_{I,s} - \alpha_{L,s}$ be the production share of the fixed factor. Intermediate inputs in sector s are first aggregated to the national level using a Cobb-Douglas technology and then freely allocated across regions. We let $\alpha_s^{s'}$ be the share of input s' in total sales of sector s. As a result, the cost of the bundle of intermediates used by sector s is:[41]

$$\phi_s \propto \prod_{s' \in \mathcal{S}} P_{s'}^{\alpha_s^{s'} / \alpha_{I,s}}. \tag{26}$$

The owners of fixed factors choose the quantities I_{sr} and L_{sr} to maximize profits Π_{sr}. Assuming

[41] Formally, the technology that aggregates intermediates supplied to sector s to the national level before allocating them regionally has share $\alpha_s^{s'} / \alpha_{I,s}$ on inputs from sector s', where $\sum_{s'=1}^{S} \alpha_s^{s'} = \alpha_{I,s}$. The condition that total supply of intermediates used by sector s equals demand therefore is $\prod_{s' \in \mathcal{S}} \left(I_s^{s'} \right)^{\alpha_s^{s'} / \alpha_{I,s}} = \sum_{r \in \mathcal{R}} I_{sr}$ where $I_s^{s'}$ are the intermediate goods from sector s' used by sector s at the national level.

away trade costs within the U.S., the producer price in tradeable sector s is p_s. We let w_{sr} be the wage per person in sector s and region r. The returns to the fixed factors of sector s in region r are:

$$\Pi_{sr} = \max_{Q_{sr}} p_s Q_{sr} - (1 - \alpha_{K,s}) \left(\frac{\phi_s^{\alpha_{I,s}} w_{sr}^{\alpha_{L,s}}}{Z_{sr}} Q_{sr} \right)^{\frac{1}{1-\alpha_{K,s}}}, \tag{27}$$

giving the the supply curve $Q_{sr} = \frac{\partial \Pi_{sr}}{\partial p_s}$ and the national supply in sector s, $Q_s = \sum_{r \in \mathcal{R}} Q_{sr}$.[42]

Non-traded output in region r uses only labor:

$$Q_{NT,r} = Z_{NT,r} L_{NT,r}, \tag{28}$$

where $L_{NT,r}$ is the employment in the non-traded sector in region r. The wage per person in the non-traded sector is $w_{NT,r} = P_{NT,r} Z_{NT,r}$. Market clearing in the non-traded sector implies $Q_{NT,r} = C_{NT,r}$.

Labor is immobile across regions, and we perform the benchmark analysis under the assumption that workers are immobile across sectors. In the first case case, wages are given by the expressions in Appendix B.1. We also consider the implications of perfect mobility. In that case, $w_{sr} = w_{NT,r}$ for all sectors and the level of wages adjusts such that the local labor market clears, $\sum_{s \in \mathcal{S}} L_{sr} + L_{NT,r} = L_r$.

Production by sector and region, defined above in (25), is allocated across products according to a constant marginal rate of transformation. Letting q_g be output of good g in sector s, the feasibility constraint for products in sector s is:

$$\sum_{g \in \mathcal{G}_s} \frac{q_g}{z_g} = Q_s, \tag{29}$$

where z_g is a product-level productivity shock. We assume this linear production structure because we only observe employment by region at the sector level (4-digit NAICS in our data) and not at the product level (HS10 codes in our data). This approach allows us to calibrate the production functions at the sector level using information from input-output tables. It also allows us to quantify the impact of tariffs using information on trade shares at the variety level (i.e., for each HS10 product-origin) and on the labor allocation at the sector-county level.

Assuming perfect competition, the price of the domestically produced variety of good g is $p_{Dg} = \frac{p_s}{z_g}$.[43] Given iceberg costs δ_{ig}, the price faced by importer i of product g is $p_{ig}^X = \delta_{ig} p_{Dg}$.[44]

[42] Having defined the decisions of consumers and producers of tradeable goods, we now have an explicit expression for the aggregate demand shifters E_s entering previously in the import demand defined in (1): $E_s = \sum_{r \in \mathcal{R}} \beta_s X_r + \sum_{r \in \mathcal{R}} \sum_{s' \in \mathcal{S}} \alpha_{s'}^s p_{s'} Q_{s'r}$.The first component adds up the regional expenditures of final consumers, and the second term adds up the regional expenditures of producers in each sector.

[43] This production structure also implies that the price index of domestically produced goods defined in (A.6) equals producer prices times a function of demand and supply shocks at the product level: $P_{Ds} = p_s \varepsilon_s^P$, where $\varepsilon_s^P \equiv \left(\sum_{g \in G_s} \frac{a_{Dg}}{z_g^{1-\eta}} \right)^{\frac{1}{1-\eta}}$. We relied on this property to measure the price index of domestically produced goods in the estimation of κ in Section 3.3.3.

[44] Our assumptions on the supply of products are broadly consistent with the evidence in Section 4.5. In that section we found that the coefficient for the impact of retaliatory tariffs on U.S. export prices at the product level was not statistically significant. In the model, the export price of product g is $p_{ig}^X = \frac{\delta_{ig}}{z_g} p_s$. Hence, the export price at the product level p_{ig}^X is only affected by retaliatory tariffs at the variety level through the sector-level component p_s. In turn, the sector level component depends on the total demand and supply at the sector lever, rather than at

Hence, market clearing in the U.S. variety of product g implies

$$q_g = d_g + \sum_{i \in \mathcal{I}} \delta_{ig} x_{ig}, \tag{30}$$

where d_g is the U.S. demand of product g and x_{ig} is the foreign import demand defined in (7). From the CES structure described in Appendix A, domestic demand for the U.S. variety of good g is:

$$d_g = (a_{Dg} D_s) \left(\frac{p_{Dg}}{P_{Ds}} \right)^{-\eta}, \tag{31}$$

where a_{Dg} is a demand shock, D_s is the aggregate U.S. consumption of domestic goods in sector s defined in (A.2), p_{Dg} is the domestic price of the domestic variety, and P_{Ds} is the price index of domestically produced goods defined in (A.6).

To close the model, we assume that labor income and profits are spent where they are generated. Total tariff revenue, defined as

$$R = \sum_{s \in \mathcal{S}} \sum_{g \in \mathcal{G}_s} \sum_{i \in \mathcal{I}} \tau_{ig} p^*_{ig} m_{ig}, \tag{32}$$

is distributed to each region in proportion b_r equal to its national population share. We allow the model to match the aggregate trade imbalance. For that, we allow for aggregate income D derived from ownership of foreign factors, owned by region r also in proportion to its population. By aggregate accounting, D equals the trade deficit.[45] Final consumer expenditures in region r therefore are

$$X_r = w_{NT,r} L_{NT,r} + \sum_{s \in \mathcal{S}} w_{sr} L_{sr} + \sum_{s \in \mathcal{S}} \Pi_{sr} + b_r \left(D + R \right). \tag{33}$$

A general equilibrium given tariffs consists of import prices p^*_{ig}, U.S. prices p_{Dg}, traded wages w_{sr}, non-traded wages $w_{NT,r}$, and price indexes (P_s, P_{Ds}, P_{Ms}, p_{Mg}, ϕ_s) such that: i) given these prices, final consumers, producers, and workers optimize; ii) local labor markets clear for every sector and region, international markets clear for imports and exports of every variety, and domestic markets for final goods and intermediates clear; and iii) the government budget constraint is satisfied.[46]

5.2 Parametrization

To simulate the impact of the tariff we derive a system of first-order approximations to the impact of tariff shocks around the pre-war equilibrium.[47] The system is fully characterized by

the product level. Section B.4 discusses the determinants of p_s in the general equilibrium model.

[45] Given our previous assumption of frictionless trade in the traded sector, the assumptions about how value added, tariff revenue and foreign imbalances are owned by different regions only matter to determine prices in the non-traded sector of each region. Since preferences are homothetic, we do not need to take a stand on how government revenue or foreign factor ownership is distributed across factors within a region.

[46] This equilibrium definition takes as given the foreign demand and supply shifters z^*_{ig} and a^*_{ig} in (6) and (7). I.e., we solve for the full general equilibrium within the U.S. allowing import and export prices to adjust for international market clearing along these foreign demand and supplies.

[47] A potential concern is that U.S. tariffs increased in varieties with initially zero tariffs. Therefore we use a second-order approximation to the change in tariff revenue.

(A.15)-(A.31) in Appendix B.2. In response to a simulated shock to U.S. and foreign tariffs, the system gives the impact on every outcome as a function of the demand and supply elasticities estimated from tariff variation in Section 4: $\{\hat{\sigma} = 2.47, \hat{\eta} = 1.81, \hat{\kappa} = 2.12, \hat{\omega}^* = 0, \hat{\sigma}^* = .83\}$.

In addition, the system requires information on benchmark preference and technology parameters $\left\{\beta_{NT}, \beta_s, \alpha_{L,s}, \alpha_{I,s}, \alpha_s^{s'}\right\}$, and on observable shares of economic activity in the equilibrium before the war. To obtain these parameters, we use the input-output (IO) tables from 2016, which is the most recent year before the tariff war for which the IO information is available. We construct total sales ($p_s Q_s$ in the model), sales from sector s' to sector s ($P_{s'} I_s^{s'}$), consumption expenditures by sector ($P_s C_s$), exports by sector, import expenditures by sector ($P_{Ms} M_s$), total labor compensation ($w_s L_s$), and gross operating surplus ($\sum_r \Pi_{sr}$). The trade deficit D is defined as the difference between total imports and exports. The technology parameters $\alpha_{I,s}$ and $\alpha_s^{s'}$ are defined as intermediate input shares of sales, and $\alpha_{K,s}$ is the gross operating surplus share of sales. The average intermediate and capital shares across sectors are 0.39 and 0.17. The residual sales accrue to the labor share $\alpha_{L,s}$. The tradeable consumption shares β_s are defined as the sectoral shares in the domestic absorption columns of the IO tables. We set a non-traded share of expenditures of $\beta_{NT} = 0.6$, computed as the fraction of expenditures observed in the 2016 consumer expenditure survey (CEX) in the non sectors of our data.[48]

Implementing the system (A.15)-(A.31) also requires information on labor income and employment shares by counties. We allocate the total labor compensation from IO tables across US counties using the regional labor compensation shares from the 2016 County Business Patterns. Consistent with our assumption that the Cobb-Douglas function is constant across regions within a sector, county-level sales by sector are constructed by applying the (inverse) national labor share to the regional wage bill by sector. Finally, implementing the system requires information on import and export flows by variety. We apply the import and export shares within each 4-digit NAICS sector in the trade dataset for 2016 to the sector level import and export flows of the IO table. For this step we restrict the trade dataset to the largest trade partners (accounting for 99% of U.S. trade) and to the largest varieties (accounting for 99% of trade within each sector).

In sum, after these cleaning steps, we simulate the impact of the tariff war by matching the model to 2016 data on economic activity for 3067 US counties, 88 traded sectors (4-digit NAICS), 71 trade partners, 10242 imported HS10 products, 213,668 imported varieties (unique product-country origin), 3,688 exported products and 53,469 unique product-destination countries.

5.3 Aggregate Impacts

We use the model to quantify the aggregate impacts of the tariff war. For each primary factor (capital and labor) the equivalent variation is the change in income at initial prices (before the tariff war) that would have left that factor indifferent with the changes in tariffs that took place. Adding up the equivalent variations across factors we obtain the aggregate equivalent variation for

[48] The NAICS codes with the following stubs are included in the non-traded sector: 23, 42, 55, 115, 44, 45, 48, 49, 52, 53, 56, 62, 71, 72, 2131, 22, 3328, 51, 54, 61, 81.

the U.S. economy as a whole. The aggregate equivalent variation, EV, can be written as a function of initial trade flows, and price and revenue changes:

$$EV = \underbrace{-\mathbf{m}'\Delta\mathbf{p}^M}_{EV^M} + \underbrace{\mathbf{x}'\Delta\mathbf{p}^X}_{EV^X} + \Delta R \tag{34}$$

where $\mathbf{m}$ is a column vector with the imported quantities of each variety before the war, $\mathbf{x}$ is a column with all the quantities exported of each product to each destination, $\Delta\mathbf{p}^m$ are changes in tariff-inclusive import prices, and $\Delta\mathbf{p}^x$ are changes in export prices.[49]

The expression (34) highlights where the general-equilibrium structure is needed to assess the aggregate impact of the tariff war. The pre-tariff war levels of imports and exports, $\mathbf{m}$ and $\mathbf{x}$, are directly observed; while the estimated model gives the responses of import and export prices to the simultaneous change in U.S. and retaliatory tariffs. Details of the economy, such as its input-output structure, matter in the aggregate inasmuch as they affect prices and tariff revenue.

The top panel of Table 8 shows each of the components of EV in response to the trade war. EV^M and EV^X correspond to import and export price components of EV defined in equation (34). The first row of each panel reports the monetary equivalent on an annual basis at 2016 prices, the second row reports numbers relative to GDP, and the third row reports the number per capita using the 2016 US population. The first column, which reports EV^M, shows that U.S. consumers and producers lost in aggregate $68.8 billion (or 0.37% of GDP) because of higher tariff-inclusive prices, a loss of $213 per person. This number comes from our estimation of a complete pass-through at the variety level, which implies a perfectly elastic export supply elasticity ($\omega^* = 0$). The EV^M term is essentially the product of the import share of value added in the calibrated model (20%), the fraction of US imports targeted by tariff increases (13%), and the average import price increase among targeted varieties (14%).[50]

The second column shows the EV^X component. This term depends on the export price changes implied by the general equilibrium model. Export prices increase if the reallocation of domestic and foreign demand into U.S. goods is stronger than the reallocations away from these goods as a result of the war tariff changes. As discussed in Appendix B.4, the intensity of these reallocations depend on the estimated demand elasticities. We estimate an increase of EV^X of $21.6 billion (0.12% of GDP). This aggregate number equals a 1.15% increase in producer prices that we find in the model (weighted by each sector share in total exports) times a 10% observed share of exports in GDP. This simulated impact on prices is corroborated by the PPI data in the event study in Figure 7. Furthermore, a regression of the change in sectoral log PPI on the change in the sector-level tariff instrument ($\Delta \ln Z_{Mst}$), controlling for sector fixed effects and clustering by sector, yields a coefficient of 0.13 (s.e.=0.06), suggesting that the tariffs increased domestic producer prices, as the

[49] In terms of our notation: $\mathbf{m}'\Delta\mathbf{p}^M \equiv \sum_{s\in\mathcal{S}}\sum_{g\in\mathcal{G}_s}\sum_{i\in\mathcal{I}} m_{ig}\Delta p_{ig}$ and $\mathbf{x}'\Delta\mathbf{p}^X \equiv \sum_{s\in\mathcal{S}}\sum_{g\in\mathcal{G}_s}\sum_{i\in\mathcal{I}} x_{ig}\Delta p^X_{ig}$.

[50] The calibrated model implies a slightly higher share of imports in GDP than the raw data. The reason is that, in the initial equilibrium, and for internal consistency of all the general-equilibrium equations, the non-traded share of value added at the county level must be computed as an equilibrium outcome that is consistent with local goods market clearing. Local market clearing in turn depends on the model-implied county-level expenditures (33) and on the non-traded share of expenditures calibrated to match the aggregate data.

model predicts.

The final component of the decomposition is the increase in tariff revenue. Our general equilibrium model yields a 70% increase in tariff revenue, equivalent to $39.4 billion of annual revenue. This increase is larger than the increase in tariff revenue observed in the actual data. The difference arises because the model isolates the revenue increases from tariffs, both through the direct impact of tariffs and the indirect impacts through changes in import values. In reality, tariff revenues also changed due to shocks besides tariffs that affected import values.

These numbers imply large and divergent consequences of the war on consumers and producers. However, these effects approximately balance out, leading to a small aggregate effect for the U.S. as a whole. Column 4 sums the three components of EV to obtain the aggregate impacts of the war on the U.S. economy. We estimate an aggregate loss of $7.8 billion or 0.04% of GDP.[51]

The second panel reports the aggregate outcomes of a hypothetical scenario where foreign trade partners did not retaliate against the U.S. In this scenario, the aggregate losses would have been about one third lower than the actual impacts: a decline of 0.02% of GDP. The impact of the retaliation operates almost exclusively through export prices: by lowering demand for U.S. exports, our computations imply 20% larger producer gains without retaliation.

5.4 Regional Impacts

We now examine distributional effects of the tariff war across regions. The real wages we examine are implied by the model and elasticities we estimate. There are three reasons why we do not examine county-level wages directly. First, monthly earnings data are available only at the sector level (and only for a subset of sectors). Second, even if such data were available, the model would still be necessary to construct the impact of the tariffs on the level of wages. Appendix Section B illustrates that the wage effects are a complex function of shocks in general equilibrium. Third, the model allows us to compare wages under different counterfactual scenarios, such as shutting down foreign retaliations.

Figure 10 illustrates large variation in exposure to the trade war across counties in the U.S. The top panel shows county-level exposure to U.S. tariffs, and the bottom panel shows county-level exposure to retaliatory tariffs. We construct the county-level exposure of tradeable sectors by first computing the trade-weighted import and retaliatory tariff changes by NAICS sector and then mapping them to counties based on counties' employment structure.[52] The maps show a clear

[51] These impacts assume that workers are immobile across sectors, which is the appropriate assumption in the short-run. Table A.4 in the Appendix replicates Table 8 assuming perfect labor mobility. In that case the consumer losses are the same as when workers are immobile but the producer gains are larger, leading to an aggregate welfare loss of $6.1 billion.

[52] We compute the NAICS-level import and export tariff shock as the import and export-weighted averages of the variety level U.S. and retaliatory tariff changes using average 2013-2016 trade shares. We then construct the county-level import and export tariff shocks as the labor-compensation weighted average of the NAICS-level tariff shocks. In the notation of the model, the import tariff shock (due to US tariffs) is $\Delta\tau_r^j = \sum_{s\in\mathcal{S}} \left(\frac{w_{sr}L_{sr}}{w_r^T L_r^T}\right) \frac{\sum_{g\in\mathcal{G}_s}\sum_{i\in\mathcal{I}} p_{ig}^* m_{ig}\Delta\tau_{ig}}{\sum_{g'\in\mathcal{G}_s}\sum_{i'\in\mathcal{I}} p_{i'g'}^* m_{i'g'}}$ and the export tariff shock (due to retaliatory tariffs) is $\Delta\tau_s^* = \sum_{s\in\mathcal{S}} \left(\frac{w_{sr}L_{sr}}{w_r^T L_r^T}\right) \frac{\sum_{g\in G_s}\sum_{i\in\mathcal{I}} p_{ig}^X x_{ig}\Delta\tau_{ig}^*}{\sum_{g\in G_s}\sum_{i\in\mathcal{I}} p_{ig}^X x_{ig}}$, where $w_r^T L_r^T$

contrast between the regional structure of U.S. protection and retaliation. The Great Lakes region of the Midwest and the industrial areas of the Northeast received higher tariff protection, while rural regions of the Midwestern plains and Mountain West received higher tariff retaliation.

We construct the model-implied welfare effects on tradeable sectors across counties in response to the tariff war.[53] On average across counties, the nominal wages for workers in tradeable sectors increase by 0.6% (s.d. 0.4%). However, these income gains at initial prices are more than offset by a higher cost of living, as the CPI of tradeable goods increases by 1.5% on average across sectors, partly due to an average 2.0% increase in import prices. The full CPI, accounting for non-traded consumption, increases by 1.3% across counties. As a result, real wages in the tradeable sector fall by 0.7% (s.d. 0.4%), on average.[54]

Figure 11 shows the impacts of the trade war across counties. The first map shows the county-level reduction in real wages in tradeable sectors in a hypothetical scenario where U.S. trade partners did not retaliate, and the second map shows real wage losses from the full war. All but 30 counties experience a reduction in tradeable real income. Counties with smaller relative losses are concentrated in the Rust Belt region as well as the Southeast. These patterns map imperfectly with the direct protection received through import tariffs shown in Figure 10 because of input-output linkages across sectors. The counties hit hardest by the war are those concentrated in the Midwestern Plains, both due to input-output links and the the retaliatory tariffs.

5.5 Tariff Protection, GOP Voting Patterns, and Wage Effects

As discussed in Section 2.3, the pattern of tariff changes across sectors does not *a priori* support the view that protection was waged by contributions of special interests nor by incentives to maximize national income (and we uncover no evidence of aggregate real income gains in the short-run). We now probe a third major hypothesis from the political economy of trade protection literature, namely that policy-makers pursued an electoral rationale when setting tariffs by targeting regions according to their political leanings. We examine the relationship between the county-level tariff exposure shown in Figure 10 and the voting pattern in the 2016 presidential election. The logic of majority voting suggests that tariffs set by an electorally motivated incumbent government should be higher in sectors that are disproportionally located in regions where voters are likely to be pivotal in elections.[55] We then contrast the *ex ante* incentives of policy-makers suggested by the

are total tradeable sector wages in county r.

[53] The real tradeable wage change in region r is defined as $\hat{w_{T,r}} - \hat{P}_r$, where $\hat{w_{T,r}} = \frac{\sum_{s\in\mathcal{S}} w_{sr}L_{sr}\hat{w}_{sr}}{\sum_{s\in\mathcal{S}} w_{sr}L_{sr}}$ is the nominal wage increase in the tradeable sector, and where $\hat{P}_r = \beta_{NT}\hat{P}_{NT,r} + \sum_{s\in\mathcal{S}} \beta_s \hat{P}_s$ is the change in the local price index. Equations (A.15) gives the solution for the wage change as function of price changes. Equations (A.21) to (A.24) characterize the block of the model with the solution to the price changes as function tariffs and expenditure shifters.

[54] The returns to specific capital change in the same proportion to the returns to labor. The county-level distribution of losses is mitigated under the assumption of perfect labor mobility across sectors. In that case, the average increase in nominal income of all factors in tradeable sectors is 0.8% (instead of 0.5% without mobility) and the average real loss of 0.4% (instead of a loss of 0.7%).

[55] Helpman (1995) characterizes optimal tariffs under majority voting in a specific factors model, showing that tariffs are higher in sectors where the median voter has larger factor ownership

relationship between tariffs and voting with the distributional consequences of their policies.

Figure 12 presents a non-parametric plot of county-level import and retaliatory tariff changes against the Republican vote share, weighted by county population. Recall from footnote 52 that the county-level tariffs are constructed within tradeables, and therefore do not reflect differences in shares of tradeable activity across counties. The figure reveals two different patterns of protection for U.S. and retaliatory tariffs. For U.S. tariffs, we observe an inverted-U shape, implying that counties with a 40-60% Republican vote share received more protection than heavily Republican or Democratic counties. Hence, U.S. tariffs appear targeted towards sectors concentrated in politically competitive counties, where voters are not overwhelmingly Republican or Democrat. By contrast, trading partners retaliated by targeting exports in sectors concentrated in heavily Republican counties.

Appendix Table A.5 in Appendix D examines the robustness of these patterns by controlling for county characteristics. For U.S. tariffs, Panel A shows that the inverted-U pattern over county-level GOP vote share remains even after controlling for agriculture employment shares, several measures of county demographic characteristics, and pre-existing trends in county employment and income growth. For retaliations, the positive relationship with county GOP vote share is not robust once we control for agriculture share.

This evidence is consistent with electoral motivations for U.S. tariffs. However, assessing the differential impacts of the trade war across counties is complex. Tariffs help workers in protected sectors through reallocations of domestic expenditures. At the same time, tariffs increase the price of consumption as well as the costs of intermediate inputs, which are used more intensively by some regions than others. The ultimate regional impact of the tariff war also depends on the structure of the retaliatiory tariffs.

We use the general-equilibrium model to assess if the tradeable real wages of electorally competitive counties indeed experience the largest (relative) gains. Figure 13 plots tradeable real wages (defined in Footnote 53) against the county Republican vote share for two different scenarios. The black solid curve shows the actual impacts of the war. The dashed curve reflects the impact under a hypothetical scenario where U.S. trade partners did not retaliate.

The model suggests reductions in tradeable real wages. However, the curves illustrate differential losses across counties. In the scenario where foreigners do not retaliate, shown by the dashed curve, impacts are fairly even across electorally competitive counties. There is no sharp peak, and the relationship plateaus between a 35% and 50% vote share. Relative to a heavily Democratic county (a 5-15% vote share), the losses in a heavily Republican county (85-95% vote share) are 33% larger. The black curve reveals the impacts from the full war. The peak of the full war scenario shifts leftward and is more pronounced. The war relatively favors tradeable workers in Democrat-leaning counties that had a 2016 Presidential vote share of roughly 35%. Moreover, workers in Republican counties (85-95% vote share) bear the largest cost of the full war. The losses in these counties are 58% larger than in a heavily Democratic county (a 5-15% vote share).

6 Conclusion

This paper analyzes the impacts of the 2018 trade war on the U.S. economy. Using tariff changes on U.S. imports and retaliations on U.S. exports, we estimate key elasticities of trade outcomes with respect to tariffs. The elasticities are precisely estimated and reveal large and immediate impacts of the war on imports and exports: imports from targeted countries decline 31.5% within products, while targeted U.S. exports fall 11.0%. The export supply of foreign varieties is horizontal, suggesting that U.S. consumers bear the incidence of the U.S. tariffs. Likewise, we estimate imperfectly inelastic foreign demand for U.S. exports, suggesting that foreign consumers bear the incidence of retaliatory tariffs.

We estimate an annual loss for the U.S. of $68.8 billion due to higher import prices. Using a general equilibrium framework and the estimated elasticities, we compute gains of $21.6 billion from higher prices received by US producers. The redistribution from buyers of foreign goods to U.S. producers and the government nets out to a negative effect of $7.8 billion on annual basis for the U.S. economy (0.04% of GDP). Our computations show that, in the absence of retaliations, the aggregate impact on the U.S. economy would have been negligible, at one third of that value.

We document that the pattern of U.S. tariffs protected sectors concentrated in electorally competitive counties, while foreign retaliations affected sectors concentrated in Republican counties. The spatial model allows us to explore the welfare implications of this heterogeneity. We compute that workers in tradeable sectors in heavily GOP counties experienced the largest losses.

Our study examines short-run effects. It does not consider long-run impacts, or margins such as investment that may respond to uncertainty. These remain important questions for future work.

References

Amiti, M. and J. Konings (2007): "Trade Liberalization, Intermediate Inputs, and Productivity: Evidence from Indonesia," *American Economic Review*, 97, 1611–1638.

Amiti, M., S. Redding, and D. Weinstein (2019): "The Impact of the 2018 Trade War on U.S. Prices and Welfare," CEPR Discussion Paper 13564.

Arkolakis, C., A. Costinot, and A. Rodriguez-Clare (2012): "New Trade Models, Same Old Gains?" *The American Economic Review*, 102, 94–130.

Atkin, D. and D. Donaldson (2015): "Who's Getting Globalized? The Size and Implications of Intra-national Trade Costs," Working Paper 21439, National Bureau of Economic Research.

Attanasio, O., P. K. Goldberg, and N. Pavcnik (2004): "Trade reforms and wage inequality in Colombia," *Journal of development Economics*, 74, 331–366.

Autor, D. H., D. Dorn, and G. H. Hanson (2013): "The China Syndrome: Local Labor Market Effects of Import Competition in the United States," *American Economic Review*, 103, 2121–68.

Bagwell, K. and R. W. Staiger (1999): "An economic theory of GATT," *American Economic Review*, 89, 215–248.

Baqaee, D. and E. Farhi (2019): "Trade Theory with Production Networks," *Manuscript, Harvard University and UCLA*.

Blanchard, E. J., C. P. Bown, and R. C. Johnson (2016): "Global Supply Chains and Trade Policy," Tech. rep., National Bureau of Economic Research.

Bown, C. and Y. Zhang (2019): "Measuring Trump's 2018 Trade Protection: Five Takeaways," Tech. rep., Peterson Institute for International Economics.

Broda, C., N. Limao, and D. E. Weinstein (2008a): "Optimal Tariffs and Market Power: The Evidence," *American Economic Review*, 98, 2032–65.

——— (2008b): "Optimal tariffs and market power: the evidence," *American Economic Review*, 98, 2032–65.

Broda, C. and D. E. Weinstein (2006): "Globalization and the Gains from Variety," *The Quarterly journal of economics*, 121, 541–585.

Caliendo, L., R. C. Feenstra, J. Romalis, and A. M. Taylor (2015): "Tariff reductions, entry, and welfare: Theory and evidence for the last two decades," Tech. rep., National Bureau of Economic Research.

Caliendo, L. and F. Parro (2015): "Estimates of the Trade and Welfare Effects of NAFTA," *The Review of Economic Studies*, 82, 1–44.

Caliendo, L., F. Parro, E. Rossi-Hansberg, and P.-D. Sarte (2017): "The impact of regional and sectoral productivity changes on the US economy," *The Review of economic studies*, 85, 2042–2096.

Chetty, R., A. Looney, and K. Kroft (2009): "Salience and Taxation: Theory and Evidence," *American Economic Review*, 99, 1145–77.

Coglianese, J., L. W. Davis, L. Kilian, and J. H. Stock (2017): "Anticipation, Tax Avoidance, and the Price Elasticity of Gasoline Demand," *Journal of Applied Econometrics*, 32, 1–15.

Costinot, A., D. Donaldson, and I. Komunjer (2012): "What goods do countries trade? A quantitative exploration of Ricardo's ideas," *The Review of Economic Studies*, 79, 581–608.

Costinot, A., D. Donaldson, and C. Smith (2016): "Evolving comparative advantage and the impact of climate change in agricultural markets: Evidence from 1.7 million fields around the world," *Journal of Political Economy*, 124, 205–248.

Costinot, A. and A. Rodriguez-Clare (2014): "Trade Theory with Numbers: Quantifying the Consequences of Globalization," in *Handbook of International Economics*, ed. by E. H. Gita Gopinath and K. Rogoff, Elsevier, vol. 4 of *Handbook of International Economics*, 197 – 261.

Dix-Carneiro, R. and B. K. Kovak (2017): "Trade liberalization and regional dynamics," *American Economic Review*, 107, 2908–46.

Dixit, A. and V. Norman (1980): *Theory of international trade: A dual, general equilibrium approach*, Cambridge University Press.

Donaldson, D. (2018): "Railroads of the Raj: Estimating the impact of transportation infrastructure," *American Economic Review*, 108, 899–934.

Eaton, J. and S. Kortum (2002): "Technology, geography, and trade," *Econometrica*, 70, 1741–1779.

Feenstra, R. C. (1989): "Symmetric pass-through of tariffs and exchange rates under imperfect competition: An empirical test," *Journal of International Economics*, 27, 25 – 45.

——— (1994): "New product varieties and the measurement of international prices," *The American Economic Review*, 157–177.

Findlay, R. and S. Wellisz (1982): "Endogenous tariffs, the political economy of trade restrictions, and welfare," in *Import competition and response*, University of Chicago Press, 223–244.

Freund, C., M. Ferrantino, M. Maliszewska, and M. Ruta (2018): "ChinaUS Trade War Scenarios: Impacts on Global Trade and Income," *World Bank Working Paper*.

Gawande, K. and U. Bandyopadhyay (2000): "Is protection for sale? Evidence on the Grossman-Helpman theory of endogenous protection," *Review of Economics and statistics*, 82, 139–152.

Goldberg, P. K., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010): "Imported intermediate inputs and domestic product growth: Evidence from India," *The Quarterly journal of economics*, 125, 1727–1767.

Goldberg, P. K. and G. Maggi (1999): "Protection for sale: An empirical investigation," *American Economic Review*, 89, 1135–1155.

Goldberg, P. K. and N. Pavcnik (2016): "The effects of trade policy," in *Handbook of commercial policy*, Elsevier, vol. 1, 161–206.

Grossman, G. M. and E. Helpman (1994): "Protection for Sale," *The American Economic Review*, 84, 833–850.

——— (2005): "A protectionist bias in majoritarian politics," *The Quarterly Journal of Economics*, 120, 1239–1282.

Handley, K. and N. Limão (2017): "Policy uncertainty, trade, and welfare: Theory and evidence for china and the united states," *American Economic Review*, 107, 2731–83.

Head, K. and T. Mayer (2014): "Gravity equations: Workhorse, toolkit, and cookbook," in *Handbook of international economics*, Elsevier, vol. 4, 131–195.

Helpman, E. (1995): "Politics and trade policy," Tech. rep., National Bureau of Economic Research.

Hillman, A. L. (1982): "Declining industries and political-support protectionist motives," *The American Economic Review*, 72, 1180–1187.

Irwin, D. A. (1998): "The Smoot-Hawley Tariff: A Quantitative Assessment," *The Review of Economics and Statistics*, 80, 326–334.

——— (2013): "The Nixon shock after forty years: the import surcharge revisited," *World Trade Review*, 12, 29–56.

Johnson, H. G. (1953): "Optimum Tariffs and Retaliation," *The Review of Economic Studies*, 21, 142–153.

Kovak, B. K. (2013): "Regional Effects of Trade Reform: What Is the Correct Measure of Liberalization?" *American Economic Review*, 103, 1960–76.

Ma, X. and J. McLaren (2018): "A swing-state theorem, with evidence," Tech. rep., National Bureau of Economic Research.

Magee, S. P., W. A. Brock, and L. Young (1989): *Black hole tariffs and endogenous policy theory: Political economy in general equilibrium*, Cambridge University Press.

Mayda, A. M., R. D. Ludema, M. Yu, and Z. Yu (2018): "The political economy of protection in GVCs: Evidence from Chinese micro data," Tech. rep., Georgetown University, Department of Economics.

Mayer, W. (1984): "Endogenous Tariff Formation," *American Economic Review*, 74, 970–85.

McCaig, B. and N. Pavcnik (2018): "Export Markets and Labor Allocation in a Low-Income Country," *American Economic Review*, 108, 1899–1941.

Ossa, R. (2014): "Trade wars and trade talks with data," *American Economic Review*, 104, 4104–46.

——— (2016): "Quantitative models of commercial policy," in *Handbook of commercial policy*, Elsevier, vol. 1, 207–259.

Pierce, J. R. and P. K. Schott (2012): "A Concordance Between Ten-Digit U.S. Harmonized System Codes and SIC/NAICS Product Classes and Industries," *Journal of Economic and Social Measurement*, 37, 61–96.

Sequeira, S. (2016): "Corruption, Trade Costs, and Gains from Tariff Liberalization: Evidence from Southern Africa," *American Economic Review*, 106, 3029–63.

Simonovska, I. and M. E. Waugh (2014): "The elasticity of trade: Estimates and evidence," *Journal of international Economics*, 92, 34–50.

Spearot, A. (2016): "Unpacking the long-run effects of tariff shocks: New structural implications from firm heterogeneity models," *American Economic Journal: Microeconomics*, 8, 128–67.

Spearot, A. C. (2013): "Variable demand elasticities and tariff liberalization," *Journal of International Economics*, 89, 26–41.

Topalova, P. (2010): "Factor immobility and regional impacts of trade liberalization: Evidence on poverty from India," *American Economic Journal: Applied Economics*, 2, 1–41.

Zoutman, F. T., E. Gavrilova, and A. O. Hopland (2018): "Estimating Both Supply and Demand Elasticities Using Variation in a Single Tax Rate," *Econometrica*, 86, 763–771.

A Appendix to Section 3 (Trade Framework and Identification)

A.1 Utility and Price Indexes

The demands of consumers and final producers are aggregated at the sector level. Each tradeable sector $s = 1, .., S$ is used for consumption C_s and as intermediate I_s. Sector-level aggregate demands are:

$$C_s + I_s = \left(A_{Ds}^{\frac{1}{\kappa}} D_s^{\frac{\kappa-1}{\kappa}} + A_{Ms}^{\frac{1}{\kappa}} M_s^{\frac{\kappa-1}{\kappa}} \right)^{\frac{\kappa}{\kappa-1}}, \tag{A.1}$$

where D_s and M_s are composite domestic and imported products,

$$D_s = \left(\sum_{g \in \mathcal{G}_s} a_{Dg}^{\frac{1}{\eta}} d_g^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, \tag{A.2}$$

$$M_s = \left(\sum_{g \in \mathcal{G}_s} a_{Mg}^{\frac{1}{\eta}} m_g^{\frac{\eta-1}{\eta}} \right)^{\frac{\eta}{\eta-1}}, \tag{A.3}$$

where d_g and m_g is U.S. consumption of the domestic variety and an aggregate of imported varieties of product g, respectively, and where $\mathcal{G}_s$ is the set of products in sector s. The imported products are further differentiated by origin. For $g \in \mathcal{G}_s$, the quantity imported is

$$m_g = \left(\sum_i a_{ig}^{\frac{1}{\sigma}} m_{ig}^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}, \tag{A.4}$$

where m_{ig} is the quantity of product g imported from country i. The terms A_{Ds}, A_{Ms}, a_{Dg}, and a_{ig} all denote aggregate demand shocks at the different tiers.

The sector level price index associated with (A.1) is

$$P_s = \left(A_{Ds} P_{Ds}^{1-\kappa} + A_{Ms} P_{Ms}^{1-\kappa} \right)^{\frac{1}{1-\kappa}}, \tag{A.5}$$

where P_{Ds} and P_{Ms} are the price indexes of domestic and imported goods in sector s associated with (A.2) and (A.3),

$$P_{Ds} = \left(\sum_{g \in \mathcal{G}_s} a_{Dg} p_{Dg} \right)^{\frac{1}{1-\eta}}, \tag{A.6}$$

$$P_{Ms} = \left(\sum_{g \in \mathcal{G}_s} a_{Mg} p_{Mg} \right)^{\frac{1}{1-\eta}}, \tag{A.7}$$

where p_{Dg} is the price of the domestic variety of good g and p_{Mg} is the price index of imported varieties associated with (A.4),

$$p_{Mg} = \left(\sum_i a_{ig} p_{ig}^{1-\sigma} \right)^{\frac{1}{1-\sigma}}, \tag{A.8}$$

where p_{ig} is the domestic price defined in (4).

A.2 Reduced Form System

Solving for imports m_{ig} and CIF prices p^*_{ig}, adding a time subscript and log-differencing over time, we obtain:

$$\Delta \ln p^*_{igt} = \Delta \ln A^{p^*}_{igt} + \beta^{p^*} \Delta \ln (1 + \tau_{igt}), \tag{A.9}$$

$$\Delta \ln m_{igt} = \Delta \ln A^{m}_{ig} + \beta^{m} \Delta \ln (1 + \tau_{igt}). \tag{A.10}$$

The intercepts in (A.9) and (A.10) correspond to log changes of the following functions of demand and supply shocks:

$$A^{p^*}_{ig} \equiv (m_g a_{ig} p_{Mg})^{\frac{\omega^*}{1+\omega^*\sigma}} \left(z^*_{ig}\right)^{\frac{1}{1+\omega^*\sigma}}, \tag{A.11}$$

$$A^{m}_{ig} \equiv (m_g a_{ig} p_{Mg})^{\frac{\omega^*}{1+\omega^*\sigma}} \left(z^*_{ig}\right)^{\frac{1}{1+\omega^*\sigma}}. \tag{A.12}$$

We assume that these intercepts can be decomposed into a product-time, country-time, country-sector fixed effects, and a residual component:

$$\Delta \ln A^{y}_{igt} = \alpha^{y}_{gt} + \alpha^{y}_{it} + \alpha^{y}_{is} + \varepsilon^{y}_{igt}$$

for $y = p^*, m$. As a result, (A.9) and (A.10) can be written as in (12).

B Appendix to Section 5 (Aggregate and Distributional Effects)

B.1 Wages

The labor demand curve resulting from profit maximization (27) yields

$$w_{sr} = \left(\frac{Z_{sr} p_s}{(L_{sr}/\alpha_{L,s})^{\alpha_{K,s}} \phi_s^{\alpha_{I,s}}} \right)^{\frac{1}{1-\alpha_{I,s}}}, \tag{A.13}$$

for $s = 1, .., S$, where L_{sr} is the number of workers by sector and region. We define the tradeable sector wage as

$$w_{T,r} = \frac{\sum_{s \in \mathcal{S}} w_{sr} L_{sr}}{\sum_{s \in \mathcal{S}} L_{sr}}$$

Using the non-traded wage $w_{NT,r} = P_{NT,r} Z_{NT,r}$ and market clearing in the non-traded sector gives the wage in that sector:.

$$w_{NT,r} = \beta_{NT} \frac{X_r}{L_{NT,r}}. \tag{A.14}$$

B.2 General-Equilibrium System in Changes

We derive the model solution in a counterfactual equilibrium as a system of first-order approximations around an initial equilibrium corresponding to the period before the tariff war. We use this system for all the numerical experiments in Section 5.

Letting $\hat{x} \equiv d \ln x$ be the infinitesimal log-change in variable x, the system gives the change in each endogenous variable given shocks to US and foreign tariffs, $\left\{ d\tau_{ig}, d\tau^*_{ig} \right\}$. Using market clearing conditions, the solution of the model can be expressed as a system for the changes in

wages per efficiency unit $\{\hat{w}_{sr}\}$, average wages in the traded sectors $\left\{\hat{w}_r^T\right\}$, wages in the non-traded sector $\left\{\hat{w}_r^{NT}\right\}$, producer prices by sector $\{\hat{p}_s\}$, intermediate input prices $\left\{\hat{\phi}_s\right\}$, employment in the tradeable sector $\left\{\hat{L}_r^T\right\}$, sector price indexes $\left\{\hat{P}_s\right\}$, import price indexes $\left\{\hat{P}_{Ms}\right\}$, product level price indexes $\{\hat{p}_{Mg}\}$, tariff-inclusive prices of imported varieties $\{\hat{p_{ig}}\}$, tariff revenue $\hat{R}$, sector level expenditures $\left\{\hat{E}_s\right\}$, national final consumer expenditures $\hat{X}$, national value added $\hat{Y}$, national intermediate expenditures by sector $\left\{\hat{P_s I_s}\right\}$, national sales by sector $\left\{\hat{p_s Q_s}\right\}$, and final consumer expenditures by region $\left\{\hat{X}_r\right\}$.

We now describe the full system of equations that characterizes the solution to these outcomes as function of elasticities, demand and production parameters, values of endogenous variables in the initial equilibrium, and shocks. To organize the presentation of the system, it is convenient to split it in 4 separate blocks

Wages, Producer Prices, Input Prices, and Tradable Employment

The first block characterizes $\left\{\hat{w_{sr}}, \hat{w_{T,r}}, \hat{w_{NT,r}}, \hat{p}_s, \hat{\phi}_s, \hat{L_r^T}\right\}$ given $\left\{\hat{X}_r, \hat{E}_s, \hat{P}_s, \hat{\tau_{ig}^*}\right\}$. We let χ^I be an indicator equal to 1 if labor is assumed to be immobile across sectors (otherwise, it is perfectly mobile). From (A.13) to (A.14):

$$\hat{w_{sr}} = \frac{\chi^I}{1-\alpha_{I,s}}\left(\hat{p}_s - \alpha_{I,s}\hat{\phi_s}\right) + \left(1-\chi^I\right)\hat{w_{T,r}}, \tag{A.15}$$

$$\hat{w_{T,r}} = \left(1-\chi^I\right)\frac{\sum_{s\in\mathcal{S}}\left(\frac{w_{sr}L_{sr}}{w_{T,r}L_r^T}\right)\frac{\hat{p}_s-\alpha_{I,s}\hat{\phi_s}}{\alpha_{K,s}} - \hat{L_r^T}}{\sum_{s\in\mathcal{S}}\left(\frac{w_{sr}L_{sr}}{w_{T,r}L_r^T}\right)\frac{1-\alpha_{I,s}}{\alpha_{K,s}}} + \chi^I\sum_{s\in\mathcal{S}}\left(\frac{w_{sr}L_{sr}}{w_{T,r}L_r^T}\right)\frac{\hat{p}_s-\alpha_{I,s}\hat{\phi_s}}{1-\alpha_{I,s}}, \tag{A.16}$$

$$\hat{w_{NT,r}} = \chi^I\hat{X}_r + \left(1-\chi^I\right)\hat{w_{T,r}}. \tag{A.17}$$

From equilibrium in the non-traded sector, the change in traded sector employment is

$$\hat{L_r^T} = \left(1-\chi^{\mathrm{I}}\right)\left(\hat{w_{T,r}} - \hat{X}_r\right)\frac{L_r^{NT}}{L_r^T}. \tag{A.18}$$

Finally, using the market clearing condition (30) for each variety, the sector supply (29) to aggregate to the sector level, and the domestic and foreign demands (31) and (7), the producer price in sector s changes according to:

$$\hat{p_s} = \frac{\frac{P_{Ds}D_s}{p_s^P Q_s}\left(\hat{E}_s + (\kappa-1)\hat{P}_s\right) + \frac{\alpha_{I,s}}{\alpha_{K,s}}\hat{\phi}_s + \sum_{r\in\mathcal{R}}\frac{p_sQ_{sr}}{p_sQ_s}\frac{\alpha_{L,s}}{\alpha_{K,s}}\hat{w_{sr}} - \sigma^*\sum_{g\in G_s}\sum_{i\in\mathcal{I}}\frac{p_{Dg}x_{ig}}{p_sQ_s}\frac{d\tau_{ig}^*}{1+\tau_{ig}^*}}{\frac{1-\alpha_{K,s}}{\alpha_{K,s}} + \frac{P_{Ds}D_s}{p_sQ_s}\kappa + \left(1-\frac{P_{Ds}D_s}{p_sQ_s}\right)\sigma^*}. \tag{A.19}$$

Both the wages per efficiency unit $\hat{w_{sr}}$ and the producer prices $\hat{p}_s$ depend on the price index of intermediates, which using (26) is:

$$\hat{\phi}_s = \sum_{s'\in\mathcal{S}}\frac{\alpha_s^{s'}}{\alpha_{I,s}}\hat{P}_{s'}. \tag{A.20}$$

Consumer and Import Prices

The second block characterizes $\left\{\hat{P}_s, \hat{P_{Ms}}, \hat{p}_{gM}, \hat{p_{gi}}, \hat{R}\right\}$ given $\left\{\hat{E}_s, d\tau_{ig}\right\}$. From (A.5), the sector price index changes according to a weighted average of producer prices and the import price index,

$$\hat{P}_s = \frac{P_{Ds}D_s}{E_s}\hat{p_s} + \left(1 - \frac{P_{Ds}D_s}{E_s}\right)\hat{P}_{Ms}. \tag{A.21}$$

From (1), (3), (6), (A.7), and (A.8), the import price index $\hat{P}_{Ms}$ in sector s changes according to

$$\hat{P_{Ms}} = \sum_{g\in\mathcal{G}_s}\left(\frac{p_{Mg}m_g}{P_{Ms}M_s}\right)\hat{p_{Mg}}, \tag{A.22}$$

where the product-level import price index changes according to

$$\hat{p}_{gM} = \sum_{i\in\mathcal{I}}\left(\frac{p_{ig}m_{ig}}{p_{Mg}m_g}\right)\hat{p}_{ig}, \tag{A.23}$$

and where the CIF price changes according to

$$\hat{p_{ig}} = \frac{\omega^*}{1+\omega^*\sigma}\left(\hat{E}_s + (\kappa-1)\hat{P}_s + (\eta-\kappa)\hat{P}_{Ms} + (\sigma-\eta)\hat{p}_{gM}\right) + \frac{1}{1+\omega^*\sigma}\frac{d\tau_{ig}}{1+\tau_{ig}}. \tag{A.24}$$

Sector and Region Demand Shifters

The third block characterizes the sector and region level expenditure shifters $\left\{\hat{E}_s, \hat{X}_r\right\}$ given $\left\{\hat{R}, \hat{p_s}, \hat{\phi}_s, \hat{w_{NT,r}}, \hat{w_{sr}}\right\}$. Sector-level expenditures are defined as $E_s = P_sC_s + P_sI_s$. Hence, they change according to:

$$\hat{E}_s \equiv \frac{P_sC_s}{E_s}\hat{X} + \left(1 - \frac{P_sC_s}{E_s}\right)\hat{P_sI_s}, \tag{A.25}$$

where national consumer consumer expenditures change as function of the change in net income $\hat{Y}$ and tariff revenue,

$$\hat{X} = \frac{Y}{X}\hat{Y} + \frac{R}{X}\hat{R}, \tag{A.26}$$

and where net national income changes according to

$$\hat{Y} = \sum_{r\in\mathcal{R}}\left(\frac{P_{NT,r}Q_{NT,r}}{Y}\right)\hat{X}_r + \sum_{s\in\mathcal{S}}(1-\alpha_{I,s})\left(\frac{p_sQ_s}{Y}\right)\sum_{r\in\mathcal{R}}\left(\frac{p_sQ_{sr}}{p_sQ_s}\right)\left(\hat{p_s} + \hat{Q_{sr}}\right). \tag{A.27}$$

Aggregate expenditures $\hat{P_sI_s}$ in intermediates from sector s are given by

$$\hat{P_sI_s} = \sum_{s'\in\mathcal{S}}\alpha^s_{s'}\sum_{r\in\mathcal{R}}\frac{p_{s'}Q_{s'r}}{P_sI_s}\left(\hat{p_{s'}} + \hat{Q_{s'r}}\right). \tag{A.28}$$

In turn, using (33), final expenditures in region r change according to

$$\hat{X}_r = \frac{\sum_{s\in\mathcal{S}}\frac{p_{sr}Q_{sr}}{X_r}(1-\alpha_{I,s})\left(\hat{p_s} + \hat{Q_{sr}}\right) + \frac{b_rR}{X_r}\hat{R}}{1 - \frac{P_{NT,r}Q_{NT,r}}{X_r}}. \tag{A.29}$$

Using local labor market clearing, we obtain the change in sales of sector s in region r, entering in the last three expressions:

$$\hat{p_s} + \hat{Q_{sr}} = \frac{1}{\alpha_{K,s}}\hat{p_s} - \frac{\alpha_{I,s}}{\alpha_{K,s}}\hat{\phi}_s - \frac{\alpha_{L,s}}{\alpha_{K,s}}\hat{w_{sr}}. \tag{A.30}$$

Tariff Revenue

The previous system determines all the model outcomes to a first order approximation given a change in tariff revenue, $\hat{R}$. We use a second-approximation to tariff revenue. From the definition of tariff revenue in (32) we obtain:

$$\hat{R} = \sum_s \sum_{g \in G_s} \sum_i \frac{p^*_{ig} m_{ig}}{R} \frac{d\tau_{ig}}{1+\tau_{ig}} + \sum_s \sum_{g \in G_s} \sum_i \left(\frac{p^*_{ig} \tau_{ig} m_{ig}}{R} \right) (\hat{p_{ig}} + \hat{m_{ig}})$$
$$+ \sum_s \sum_{g \in G_s} \sum_i \frac{p^*_{ig} m_{ig}}{R} (\hat{p_{ig}} + \hat{m_{ig}}) \frac{d\tau_{ig}}{1+\tau_{ig}} - \sum_s \sum_{g \in G_s} \sum_i \frac{p^*_{ig} m_{ig}}{R} \left(\frac{d\tau_{ig}}{1+\tau_{ig}} \right)^2,$$

where, from the equilibrium in the market for each variety that results from combining (3) and (6), using the solution for $\hat{p_{ig}} + \hat{m_{ig}}$ we obtain:

$$\hat{R} = \sum_s \sum_{g \in G_s} \sum_i \left(\tau_{ig} + \frac{d\tau_{ig}}{1+\tau_{ig}} \right) \frac{p^*_{ig} m_{ig}}{R} \frac{1+\omega^*}{1+\omega^*\sigma} \left(\hat{E}_s + (\kappa - 1) \hat{P}_s + (\eta - \kappa) \hat{P}_{Ms} + (\sigma - \eta) \hat{p}_{gM} \right)$$
$$+ \sum_s \sum_{g \in G_s} \sum_i \left(1 - \tau_{ig} \frac{\sigma - 1}{1+\omega^*\sigma} \right) \frac{p^*_{ig} m_{ig}}{R} \frac{d\tau_{ig}}{1+\tau_{ig}} - \sum_s \sum_{g \in G_s} \sum_i \frac{p^*_{ig} m_{ig}}{R} \sigma \frac{1+\omega^*}{1+\omega^*\sigma} \left(\frac{d\tau_{ig}}{1+\tau_{ig}} \right)^2. \tag{A.31}$$

B.3 Numerical Implementation

To implement the system (A.15)-(A.31) we first re-write it in reduced form as a system of the form $A\hat{x} - Bd\tau = 0$, where $\hat{x}$ is a column vector stacking all the endogenous variables, $d\tau$ stacks the U.S. and retaliatory tariff shocks, and the matrices A and B collect all the elasticities and shares. The reduced-form of the system, giving the solution for endogenous variables as function of shocks, takes the form $\hat{x} = (A^{-1}B)\, d\tau$. We check numerically that the matrix A has full rank and that therefore the equilibrium in changes is uniquely defined. The vector x includes $1,020,045$ endogenous variables, hence the matrix A has 10^{12} elements. We exploit that the matrix A is very sparse, making this inversion computationally feasible and quick. The reason why the matrix is very sparse is that, as noted above, the various blocks of the system interact only through a few variables. Specifically, of the approximately 1 million endogenous variables, about 700 thousand correspond to the variety prices $\hat{p_{ig}}$, which only enter in the rows of A corresponding to import prices and tariff revenue.

B.4 Producer Price Increases

When foreign export supply is perfectly elastic ($\omega = 0$), we can combine our previous solution for the increase in the producer price index from (A.19) with the price indexes (A.21) to (A.24) to obtain the following decomposition of the change in producer prices in response to a tariff shock:

$$\hat{p_s} = \frac{1}{\Phi_s} \left(DomExpenditure_s + TariffShock_s + CostShock_s \right) \tag{A.32}$$

where

$$
\begin{aligned}
DomExpenditure_s &\equiv \frac{P_{Ds}D_s}{p_sQ_s}\hat{E}_s, \\
TariffShock_s &\equiv \sum_{g\in\mathcal{G}_s}\sum_{i\in\mathcal{I}} \frac{P_{Ds}D_s}{p_sQ_s}\left(1-\frac{P_{Ds}D_s}{E_s}\right)(\kappa-1)\left(\frac{p_{ig}m_{ig}}{P_{Ms}M_s}\right)\frac{d\tau_{ig}}{1+\tau_{ig}} - \sigma^*\sum_{g\in\mathcal{G}_s}\sum_{i\in\mathcal{I}}\frac{p_{Dg}x_{ig}}{p_sQ_s}\frac{d\tau^*_{ig}}{1+\tau^*_{ig}}, \\
Cost_s &\equiv \frac{\alpha_{I,s}}{\alpha_{K,s}}\hat{\phi}_s + \sum_{r\in\mathcal{R}}\frac{p_sQ_{sr}}{p_sQ_s}\frac{\alpha_{L,s}}{\alpha_{K,s}}\hat{w_{sr}}, \\
\Phi_s &\equiv \frac{1-\alpha_{K,s}}{\alpha_{K,s}} + \frac{P_{Ds}D_s}{p_sQ_s}\frac{P_{Ds}D_s}{E_s} + \frac{P_{Ds}D_s}{p_sQ_s}\left(1-\frac{P_{Ds}D_s}{E_s}\right)\kappa + \left(1-\frac{P_{Ds}D_s}{p_sQ_s}\right)\sigma^*.
\end{aligned}
$$

This decomposition highlights the multiple general-equilibrium effects on domestic producer prices taken into account when US or foreign tariffs change. The first two components, domestic expenditures and tariffs, drive price changes through reallocation of domestic and foreign demand. The first component includes demand shifters ($\hat{E}_s$) entering through changes in the shares of different sectors and final consumers in aggregate demand. The second component (tariffs) implies that higher domestic tariffs ($d\tau_{ig} > 0$) and higher foreign tariffs ($d\tau^*_{ig} > 0$) reallocate expenditures into or away of domestic products, leading to higher or lower domestic price increases. The third component shows that domestic prices change with costs, either through input linkages or wage increases in those regions where the sector is more concentrated. The intensity of these effects is mediated by the estimated elasticities σ^* and κ, entering through the tariff component and through the constant Φ_s.

C Main Tables and Figures

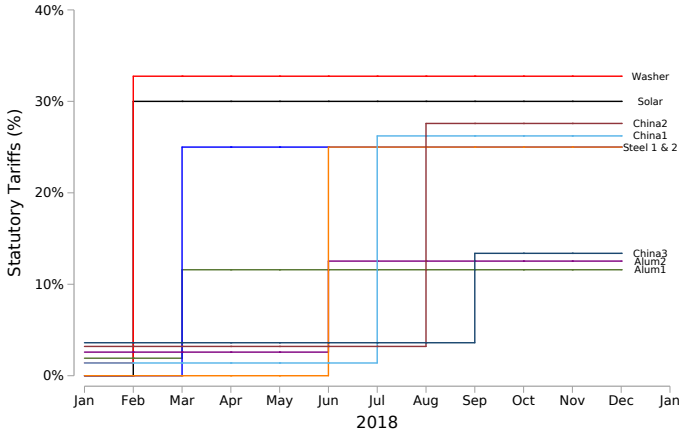
Table 1: The Global Trade War

Panel A: Tariffs on U.S. Imports Enacted by U.S. in 2018						
Tariff Wave	Date Enacted	Products	2017 Imports		Tariff (%)	
		(# HS10)	(mil USD)	(%)*	2017	2018
Solar Panels	Feb 7, 2018	8	5,782	0.2	0.0	30.0
Washing Machines	Feb 7, 2018	8	2,105	0.1	1.3	33.9
Aluminum	Mar-Jun, 2018	65	17,685	0.7	2.0	12.0
Iron and Steel	Mar-Jun, 2018	753	30,523	1.3	0.0	25.0
China 1	Jul 6, 2018	1,668	33,510	1.4	1.2	26.2
China 2	Aug 23, 2018	429	14,101	0.6	2.7	27.6
China 3	Sep 24, 2018	9,076	199,264	8.3	3.4	13.4
Total		**12,007**	**302,970**	**12.6**	**2.6**	**17.0**
Panel B: Retaliatory Tariffs on U.S. Exports Enacted by Trading Partners in 2018						
Retaliating Country	Date Enacted	Products	2017 Exports		Tariff (%)	
		(# HS10)	(mil USD)	(%)*	2017	2018
China	Apr-Sep, 2018	1,997	60,522	3.9	7.8	22.7
Mexico	Jun 5, 2018	232	6,746	0.4	9.5	27.4
Turkey	Jun 21, 2018	240	1,554	0.1	9.9	30.1
European Union	Jun 22, 2018	303	8,244	0.5	4.0	29.3
Canada	Jul 1, 2018	323	17,818	1.2	2.1	20.1
Russia	Aug 6, 2018	162	268	0.0	5.0	36.7
Total		**3,135**	**96,045**	**6.2**	**6.5**	**23.3**

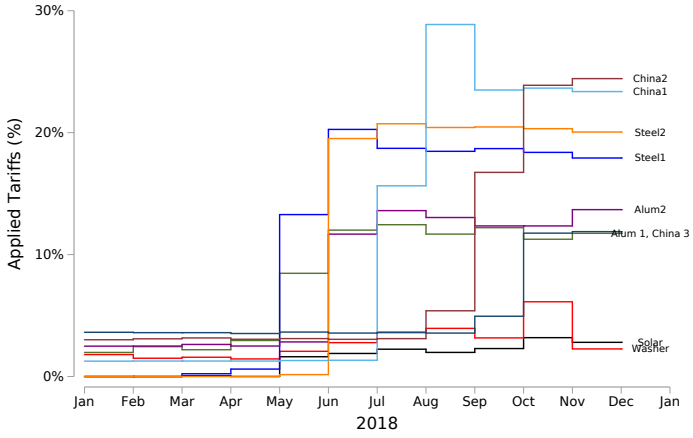
Notes: Denominator for import (export) share is the total 2017 annual USD value of all US imports (exports). Panels display unweighted monthly HS10-country average statutory tariff rates. The 2018 rates are computed using the post-tariff increase period. The total tariff rates row is computed as the trade-weighted average of table values. The US government announced import tariffs on aluminum and steel products on March 23 but granted excemptions for Canada, Mexico, and the European Union; those exemptions were lifted on June 1. The dates of Chinese retaliations are: April 6, July 2, August 23, and September 24. See text for data sources.

Figure 1: Tariff Timeline

Panel A: U.S. Statutory Import Tariffs



Panel B: U.S. Applied Import Tariffs



Panel C: Trade Partners Retaliatory Export Tariffs

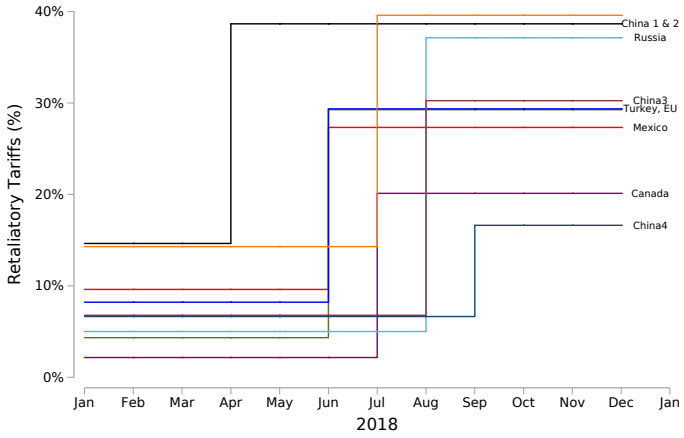


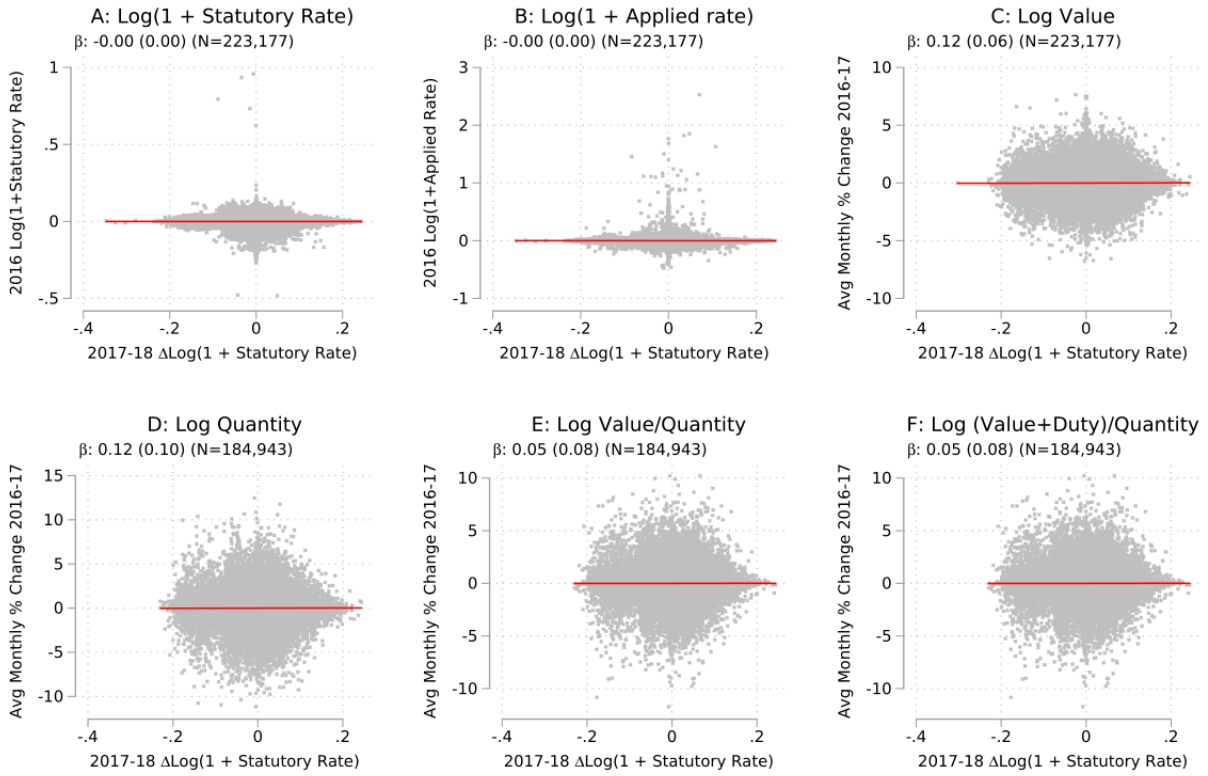
Figure shows the unweighted average tariff rate of targeted varieties over time.

Table 2: Sectoral Variation in Tariff Rate Changes

Tariff Changes for Targeted Import Varieties and Export Products, by NAICS3 Code								
		Imports				Exports		
				Δ Statutory τ			Δ Retaliatory τ	
Sector	NAICS-3	# Varieties	# HS10	Mean	STD	# HS10	Mean	STD
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Crop and Animal Production	111-2	111	111	0.10	0.01	83	0.23	0.06
Forestry and Logging	113	14	14	0.10	0.00	11	0.20	0.07
Fishing, Hunting and Trapping	114	145	145	0.10	0.00	75	0.25	0.00
Oil and Gas Extraction	211	4	4	0.10	0.00	3	0.25	0.00
Mining (except Oil and Gas)	212	47	47	0.10	0.00	5	0.20	0.08
Food	311	363	363	0.10	0.01	176	0.22	0.06
Beverage and Tobacco Product	312	10	10	0.09	0.03	31	0.25	0.04
Textile Mills	313	916	916	0.10	0.00	6	0.25	0.00
Textile Product Mills	314	146	146	0.10	0.02	10	0.23	0.05
Apparel	315	91	91	0.10	0.00	42	0.25	0.00
Leather and Allied Product	316	134	134	0.10	0.00	17	0.23	0.05
Wood Product	321	259	259	0.10	0.00	35	0.11	0.03
Paper	322	207	207	0.11	0.04	69	0.16	0.07
Printing and Related Activites	323	14	14	0.10	0.00	19	0.18	0.08
Petroleum and Coal Products	324	24	24	0.14	0.07	32	0.24	0.04
Chemical	325	1,167	1,167	0.11	0.04	289	0.17	0.08
Plastics and Rubber Products	326	236	236	0.15	0.07	40	0.15	0.09
Nonmetallic Mineral Product	327	314	314	0.10	0.03	26	0.25	0.03
Primary Metal	331	6,607	987	0.22	0.06	245	0.23	0.04
Fabricated Metal Product	332	728	567	0.12	0.06	84	0.25	0.05
Machinery	333	1,112	1,112	0.20	0.07	198	0.14	0.08
Computer and Electronic Product	334	717	535	0.21	0.07	149	0.12	0.05
Electrical Equipment and Appliances	335	488	386	0.19	0.10	57	0.21	0.06
Transportation Equipment	336	272	272	0.14	0.07	117	0.21	0.07
Furniture and Related Product	337	144	144	0.10	0.01	15	0.23	0.05
Miscellaneous	339	96	96	0.12	0.05	43	0.21	0.07

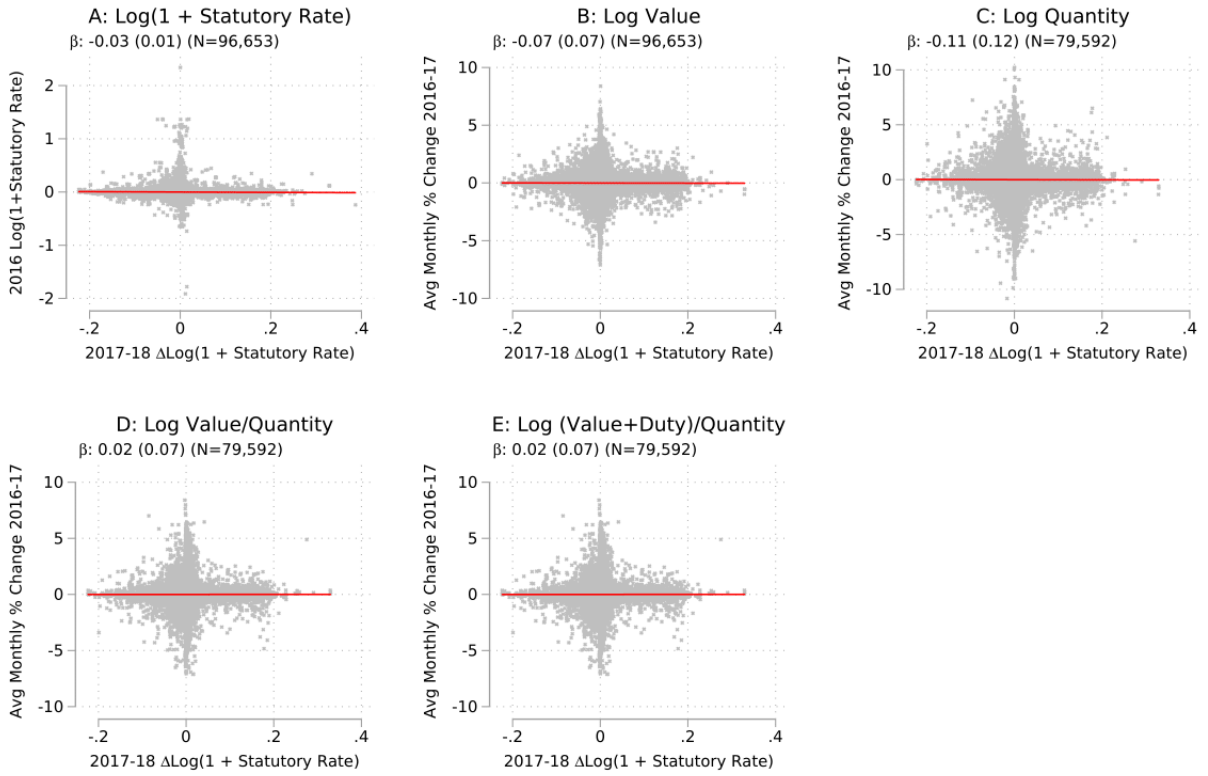
Table shows the mean and standard deviation of tariff rate increases for all tariff measures across 3-digit NAICS sectors. A 0.10 means 10% change. Sectors with the same number of targeted varieties and products in Columns 3 and 4 reflect tariffs solely targeting Chinese imports.

Figure 2: Pre-Trends and Statutory Import Tariffs



Figures plot (residuals of) variety-level outcomes against (residuals of) change in statutory tariffs, controlling for product and country-sector fixed effects. Outcomes in Panels A and B are the pre-war 2016 statutory and applied tariff rates, respectively. Outcomes in Panels C-F are 2016/1-2017/12 average monthly changes in import values, quantities, unit values, and tariff-inclusive unit values. Standard errors clustered by HS8 and country. Number of observations differ because we do not always observe quantities. Plots do not show bunching over the X-axis because we show residualized tariffs.

Figure 3: Pre-Trends and Retaliatory Export Tariffs



Figures plot (residuals of) variety-level outcomes against (residuals of) change in statutory tariffs, controlling for product and country-sector fixed effects. Outcome in Panel A is the pre-war 2016 statutory tariff rate. Outcomes in Panels B-E are 2016/1-2017/12 average monthly changes in import values, quantities, unit values, and tariff-inclusive unit values. Standard errors clustered by HS6 and country. Number of observations differ because we do not always observe quantities. Plots do not show bunching over the X-axis because we show residualized tariffs.

Figure 4: Event Study: Tariff Changes

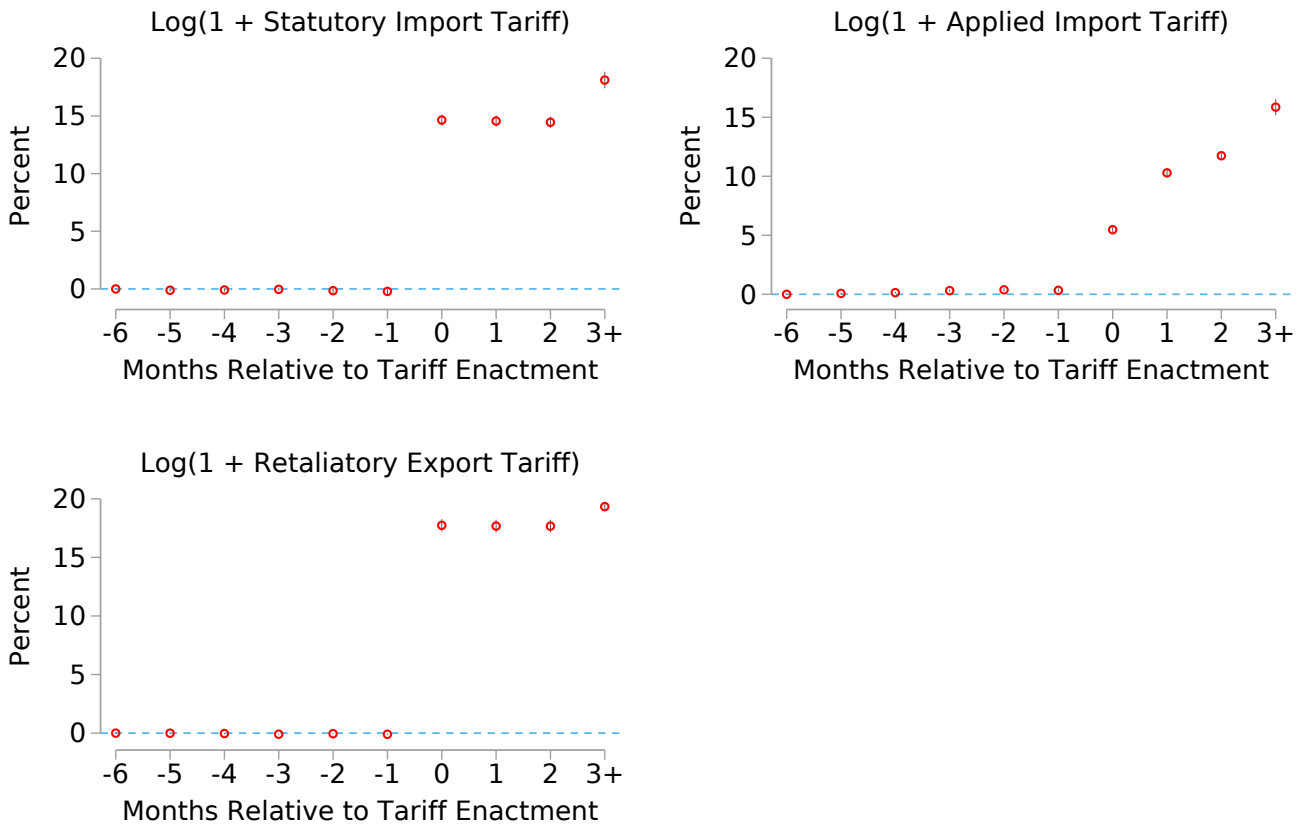


Figure plots event time dummies for targeted products relative to exempt and all other products. Regressions include variety and time fixed effects. Standard errors clustered by HS8 for imports and HS6 for exports. Error bars show 95% CIs. Event periods before -6 are dropped, and event periods >=3 are binned.

Figure 5: Event Study: Import Outcomes

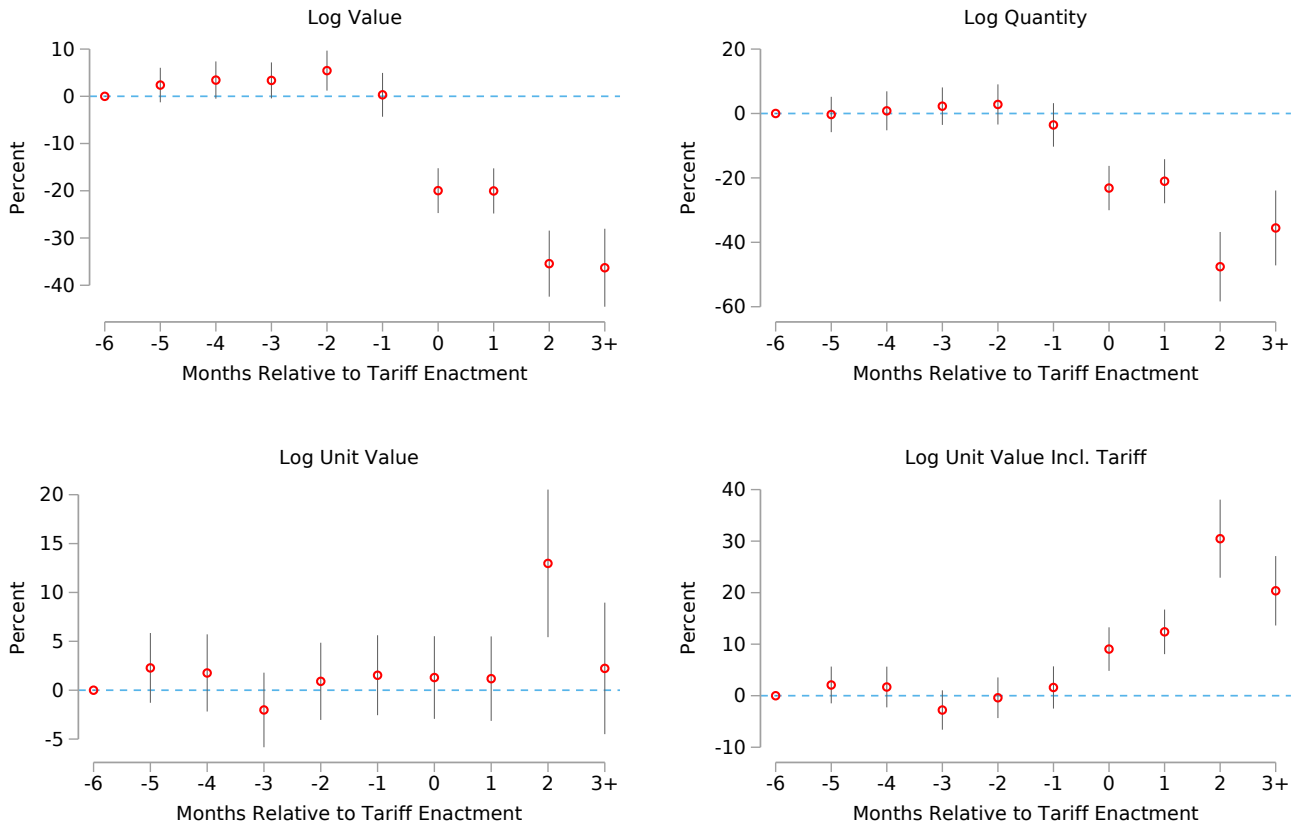


Figure plots event time dummies for targeted products relative to all other products. Regressions include country-product, product-time, and country-time fixed effects. Standard errors clustered by hs8. Error bars show 95% CIs. Event periods before -6 are dropped, and event periods >=3 are binned.

Figure 6: Event Study: Export Outcomes

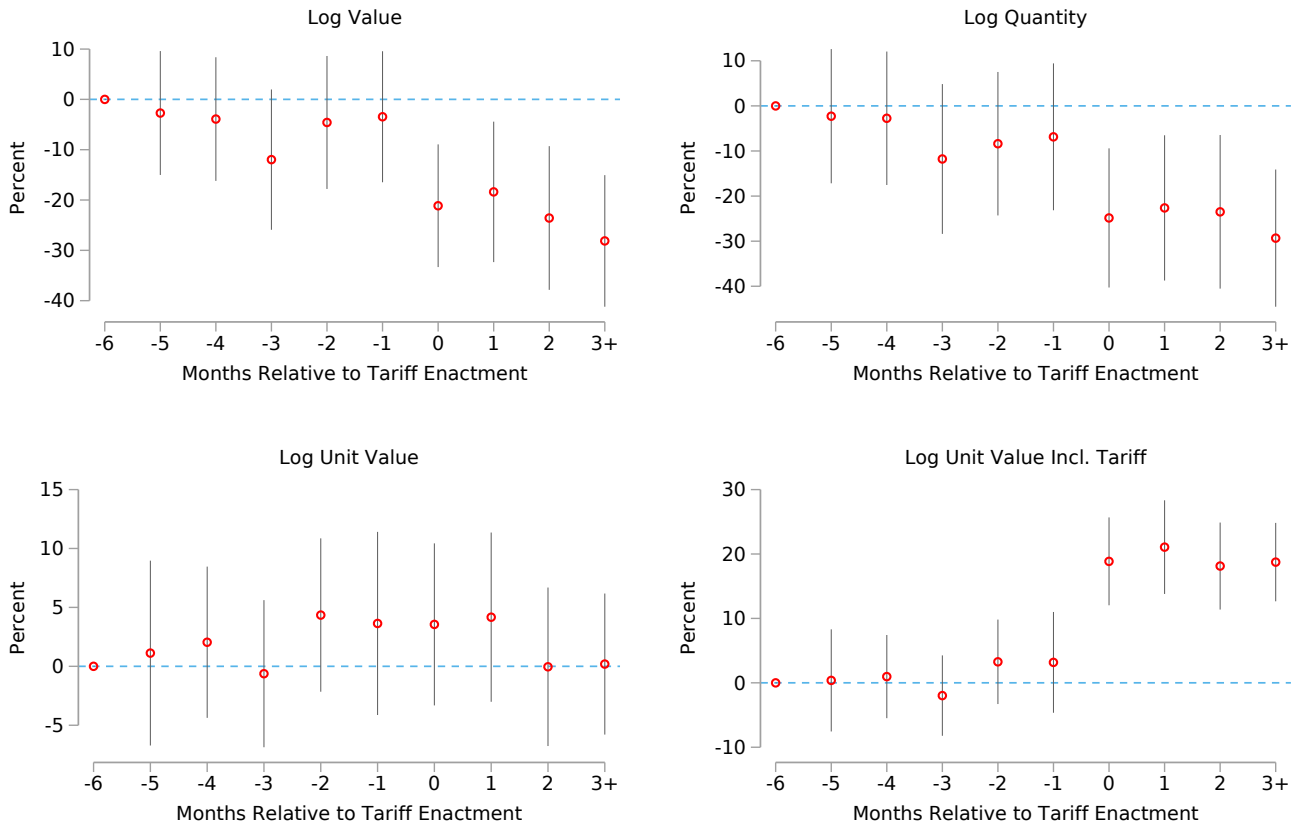


Figure plots event time dummies for targeted products relative to all other products. Regressions include country-product, product-time, and country-time fixed effects. Standard errors clustered by hs6. Error bars show 95% CIs. Event periods before -6 are dropped, and event periods >=3 are binned.

Figure 7: Event Study: Sector Outcomes

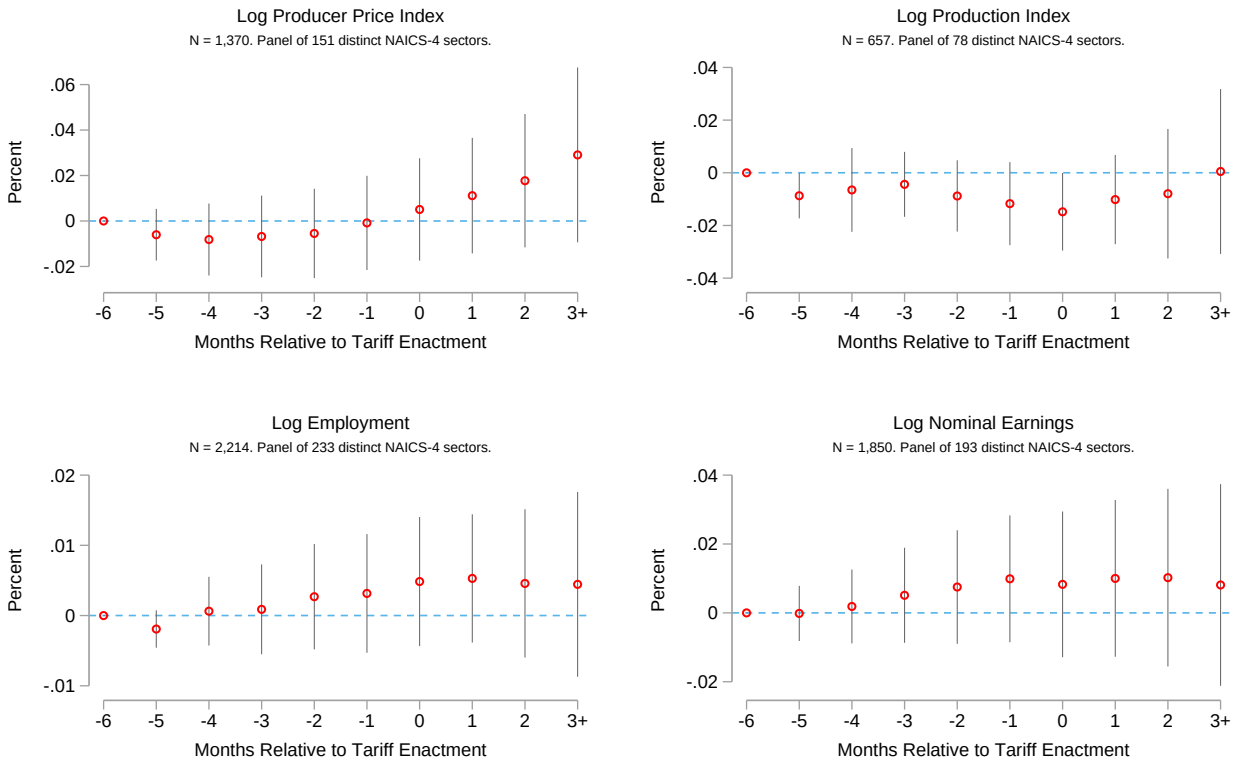


Figure plots event time dummies for a panel of NAICS4 sectors. Regressions include NAICS4 and NAICS2-time fixed effects. Standard errors clustered by NAICS4. Error bars show 95% CIs. Event periods before -6 are dropped, and event periods >=3 are binned.

Table 3: Variety Import Demand (σ) and Foreign Export Supply (σ),

	(1) $\Delta \ln p^*_{igt} m_{igt}$	(2) $\Delta \ln m_{igt}$	(3) $\Delta \ln p^*_{igt}$	(4) $\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$	(5) $\Delta \ln m_{igt}$	(6) $\Delta \ln m_{igt}$
$\Delta \ln(1+\tau^{app}_{igt})$	-2.45***	-2.53***	0.09**	1.09***		
	(0.08)	(0.09)	(0.04)	(0.04)		
$\Delta \ln p^*_{igt}$					-28.71***	
					(11.01)	
$\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$						-2.32***
						(0.07)
product × time FE	yes	yes	yes	yes	yes	yes
cty × time FE	yes	yes	yes	yes	yes	yes
cty × sector FE	yes	yes	yes	yes	yes	yes
variety FE	no	no	no	no	no	no
1st-stage F					6.2	942.0
$\hat{\omega}$ (se[$\hat{\omega}$])					-0.03 (0.01)	
$\hat{\sigma}$ (se[$\hat{\sigma}$])						2.32 (0.07)
r2	0.14	0.13	0.11	0.11	.	.
obs	2,441,121	1,980,198	1,980,198	1,980,198	1,980,198	1,980,198

Columns 1-4 report the reduced-form outcomes of import values, quantities, unit values, and duty-inclusive unit values regressed on $\Delta \ln(1+\tau_{igt})$, where τ_{igt} is the applied tariff; see equation (12). Column 5 reports the foreign export supply curve IV regression, equation (11); the first-stage is column 3. Column 6 reports the import demand curve IV regression, equation (10); the first-stage is column 4. The implied $\hat{\omega}$ and $\hat{\sigma}$ and their standard errors are reported at the bottom of the table. All regressions include product-time, country-time and country-sector fixed effects. Standard errors clustered by country and product. Significance: * 0.10, ** 0.05, *** 0.01.

Table 4: Applied Tariffs Instrumented with Statutory Tariffs

	(1) $\Delta \ln(1+\tau^{app}_{igt})$	(2) $\Delta \ln p^*_{igt} m_{igt}$	(3) $\Delta \ln m_{igt}$	(4) $\Delta \ln p^*_{igt}$	(5) $\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$	(6) $\Delta \ln p^*_{igt}$	(7) $\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$	(8) $\Delta \ln m_{igt}$	(9) $\Delta \ln m_{igt}$
$\Delta \ln(1+\tau^{stat}_{igt})$	0.61***					0.02	0.60***		
	(0.07)					(0.08)	(0.13)		
$\Delta \ln(1+\tau^{app}_{igt})$		-2.49***	-2.57***	0.04	1.04***				
		(0.15)	(0.24)	(0.14)	(0.14)				
$\Delta \ln p^*_{igt}$								-64.44	
								(222.28)	
$\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$									-2.47***
									(0.26)
product × time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
cty × time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
cty × sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
variety FE	no	no	no	no	no	no	no	no	no
1st-stage F		80.3	76.8	76.8	76.8			0.1	20.8
$\hat{\omega}$ (se[$\hat{\omega}$])								-0.02 (0.05)	
$\hat{\sigma}$ (se[$\hat{\sigma}$])									2.47 (0.26)
r2	0.15	0.01	0.01	0.00	0.00	0.11	0.11	.	.
obs	2,441,121	2,441,121	1,980,198	1,980,198	1,980,198	1,980,198	1,980,198	1,980,198	1,980,198

Column 1 reports the first stage of the applied tariff, $\Delta \ln(1+\tau_{igt})$, on the statutory tariff, $\Delta \ln(1+\tau^{stat}_{igt})$. Columns 2-5 shows the second-stage results of import values, quantities, unit values, and duty-inclusive unit values regressed on the instrumented applied tariff. Columns 5 and 6 regress unit values and duty-inclusive unit values on the statutory tariff, respectively. Columns 7 reports the foreign export supply curve IV regression, equation (11), using statutory tariffs as the instrument (the first stage is column 5). Columns 8 reports the import demand curve IV regression, equation (10), using statutory tariffs as the instrument (the first stage is column 6). The implied $\hat{\omega}$ and $\hat{\sigma}$ and their standard errors are reported at the bottom of the table in columns 7 and 8. All regressions include product-time, country-time and country-sector fixed effects. Standard errors clustered by country and product. Significance: * 0.10, ** 0.05, *** 0.01.

Table 5: Product Elasticity η

	(1) $\Delta \ln(s_{Mgt})$	(2) $\Delta \ln p_{Mgt}$	(3) $\Delta \ln(s_{Mgt})$	(4) $\Delta \ln(s_{Mgt})$	(5) $\Delta \ln p_{Mgt}$	(6) $\Delta \ln(s_{Mgt})$
$\Delta \ln Z^{app}_{Mgt}$	-0.68***	0.28***				
	(0.09)	(0.09)				
$\Delta \ln p_{Mgt}$			-2.25***			-0.81*
			(0.71)			(0.48)
$\Delta \ln Z^{stat}_{Mgt}$				-0.77**	0.62*	
				(0.39)	(0.36)	
sector-time FE	yes	yes	yes	yes	yes	yes
product FE	no	no	no	no	no	no
1st-stage F			10.9			6.5
$\hat{\eta}$ (se[$\hat{\eta}$])			3.25 (0.71)			1.81 (0.48)
r2	0.01	0.06	.	0.01	0.07	.
obs	301,882	317,716	301,882	301,882	317,716	301,882

Columns 1-3 build the price index using the $\hat{\sigma}$ from column 6 of Table 3 and constructs the instrument using applied tariffs. Column 1 reports the reduced form, column 2 reports the first stage, and column 3 reports the second stage. Columns 4-6 repeats the analysis using a price index constructed from $\hat{\sigma}$ from column 9 of Table 4 and an instrument constructed from the statutory tariffs. The implied $\hat{\eta}$ and its standard error are noted at the bottom of the table in columns 3 and 6. All regressions include sector and time fixed effects. Standard errors clustered by product. Significance: * 0.10, ** 0.05, *** 0.01.

Table 6: Sector Elasticity κ

	(1) $\Delta \ln(\frac{P_{Mst}M_{st}}{P_{Dst}D_{st}})$	(2) $\Delta \ln\left(\frac{P_{Mst}}{p_{st}}\right)$	(3) $\Delta \ln(\frac{P_{Mst}M_{st}}{P_{Dst}D_{st}})$	(4) $\Delta \ln(\frac{P_{Mst}M_{st}}{P_{Dst}D_{st}})$	(5) $\Delta \ln\left(\frac{P_{Mst}}{p_{st}}\right)$	(6) $\Delta \ln(\frac{P_{Mst}M_{st}}{P_{Dst}D_{st}})$
$\Delta \ln Z^{app}_{Mst}$	1.96**	-1.92				
	(0.86)	(1.16)				
$\Delta \ln\left(\frac{P_{Mst}}{p_{st}}\right)$			-0.93			-1.12
			(0.90)			(0.84)
$\Delta \ln Z^{stat}_{Mst}$				1.25	-0.74	
				(0.81)	(0.67)	
sector FE	yes	yes	yes	yes	yes	yes
1st-stage F			2.0			3.1
$\hat{\kappa}$ (se[$\hat{\kappa}$])			1.93 (0.90)			2.12 (0.84)
r2	0.01	0.55	.	0.00	0.55	.
obs	1,647	2,332	1,647	1,647	2,332	1,647

Columns 1-3 build the price index using the $\hat{\sigma}$ from column 6 of Table 3 and $\hat{\eta}$ from column 3 of Table 5. The instrument is constructed using applied tariffs. Column 1 reports the reduced form, column 2 reports the first stage, and column 3 reports the second stage. Columns 4-6 repeats the analysis using a price index constructed from $\hat{\sigma}$ from column 9 of Table 4 and $\hat{\eta}$ from column 6 of Table 5, and an instrument constructed from the statutory tariffs. The implied $\hat{\kappa}$ and its standard error are noted at the bottom of the table in columns 3 and 6. All regressions include sector fixed effects. Standard errors clustered by sector. Significance: * 0.10, ** 0.05, *** 0.01.

Table 7: Foreign Import Demand σ^*

	(1) $\Delta \ln p^X_{igt} x_{igt}$	(2) $\Delta \ln x_{igt}$	(3) $\Delta \ln p^X_{igt}$	(4) $\Delta \ln p^X_{igt}(1+\tau^*_{igt})$	(5) $\Delta \ln x_{igt}$
$\Delta \ln(1+\tau^*_{igt})$	-0.89***	-0.73**	-0.12	0.88***	
	(0.25)	(0.34)	(0.13)	(0.13)	
$\Delta \ln p(1+\tau^*_{igt})$					-0.83**
					(0.33)
product × time FE	yes	yes	yes	yes	yes
cty × time FE	yes	yes	yes	yes	yes
cty × sector FE	yes	yes	yes	yes	yes
variety FE	no	no	no	no	no
1st-stage F					45.4
$\hat{\sigma}^*$ (se[$\hat{\sigma}^*$])					0.83 (0.33)
r2	0.07	0.07	0.06	0.06	0.48
obs	2,703,423	2,069,922	2,069,922	2,069,922	2,069,922

Columns 1-4 report reduced form regressions of export values, quantities, unit values, and duty-inclusive unit values on $\Delta \ln(1+\tau^{*,stat}_{igt})$, the change in retaliatory export tariffs. Column 5 reports the second-stage IV regression of quantities on the retaliatory tariffs (the first stage is column 4). The implied $\hat{\sigma}^*$ and its standard error are reported at the bottom of the table in column 5. All regressions include product-time, country-time and country-sector fixed effects. Standard errors clustered by country and six-digit HS code. Significance: * 0.10, ** 0.05, *** 0.01.

Figure 8: Dynamic Impacts: Imports

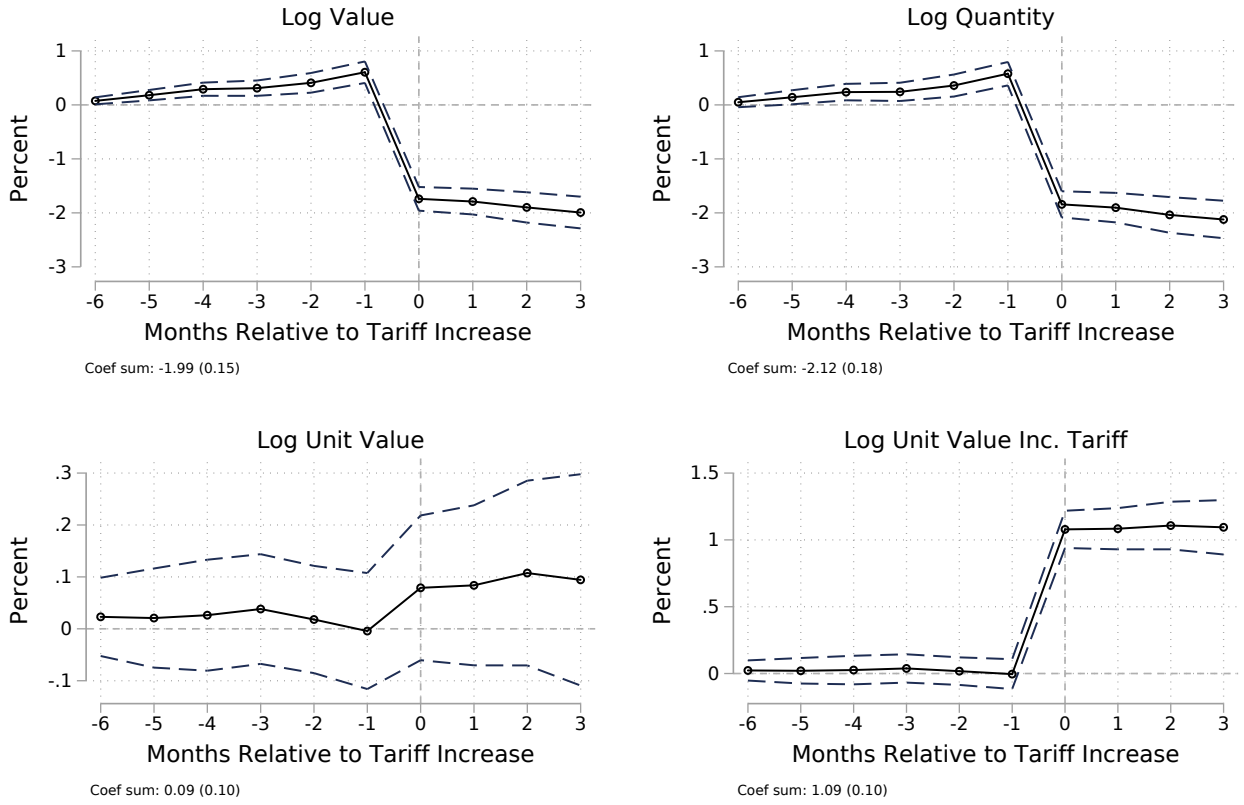


Figure plots OLS regressions of changes in each outcome on leads and lags of changes in the applied import tariff rate. Regressions include product-time, country-time, and country-sector fixed effects. Standard errors clustered by product and country. Error bands show 95% CIs. Event periods <-6 or >3 are dropped.

Figure 9: Dynamic Impacts: Exports

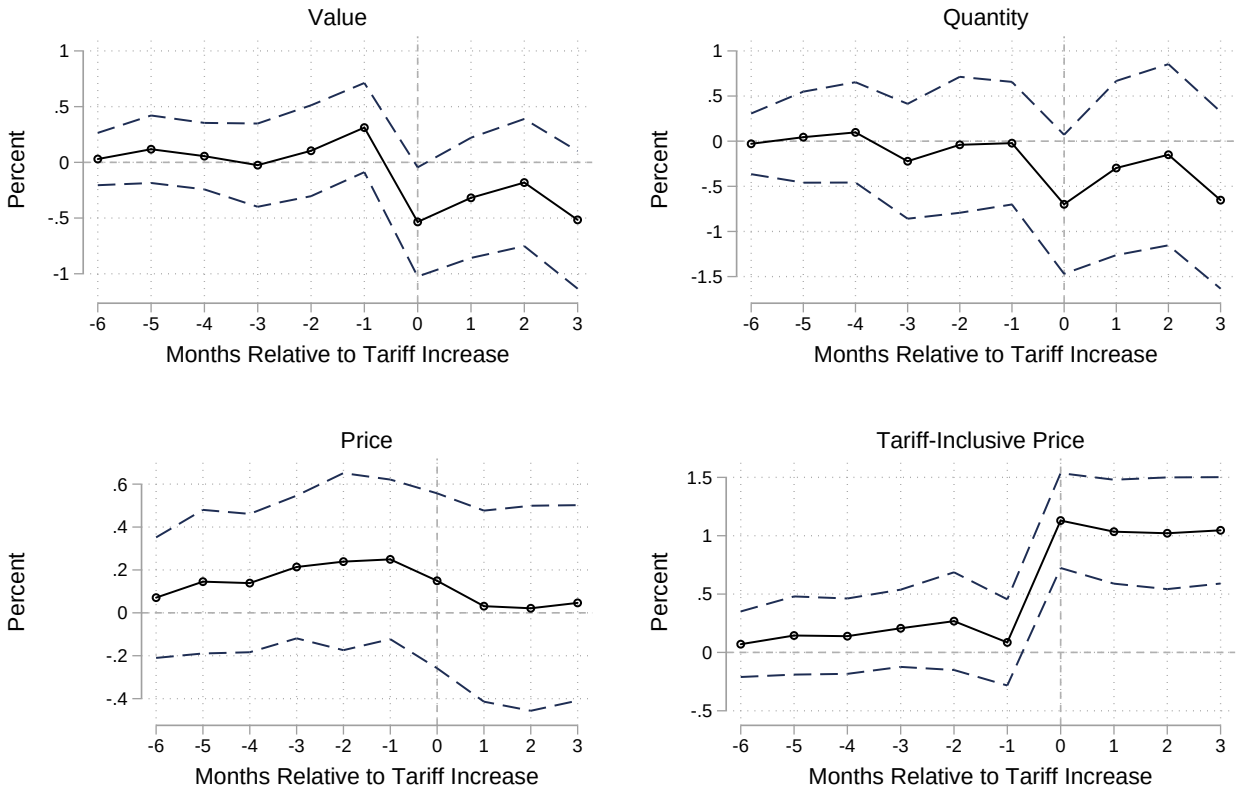


Figure plots reduced form regressions of changes in each outcome on leads and lags of changes in the statutory export tariff rate. Regressions include product-time and country-sector-time fixed effects. Standard errors clustered by product and country. Error bands show 95% CIs. Event periods <-6 or >3 are dropped.

Table 8: Aggregate Impacts

	EV^M	ΔR	EV^X	EV
	(1)	(2)	(3)	(4)
	Full War			
Change ($ bil)	-68.8	39.4	21.6	-7.8
Change (% GDP)	-0.37	0.21	0.12	-0.04
Change ($ capita)	-213	122	67	-24
	No Retaliation			
Change ($ bil)	-68.8	39.6	26.3	-3.0
Change (% GDP)	-0.37	0.21	0.14	-0.02
Change ($ capita)	-213	122	81	-9

Table reports the aggregate impacts of the trade war in column 4, and the decomposition into EV^M, tariff revenue (ΔR) and EV^X in columns 1-3. The bottom panel reports a hypothetical scenario where trade partners do not retaliate against U.S. tariffs. The first row in each panel reports the overall impacts of each term in billions of USD. The second row scales by 2016 GDP. The third row scales by 2016 population. These numbers are computed using the model described in Section 5 and sets $\{\hat{\sigma} = 2.47, \hat{\eta} = 1.81, \hat{\kappa} = 2.12, \hat{\omega}^* = 0, \hat{\sigma}^* = .83\}$.

Figure 10: Regional Variation in U.S. and Retaliatory Tariffs

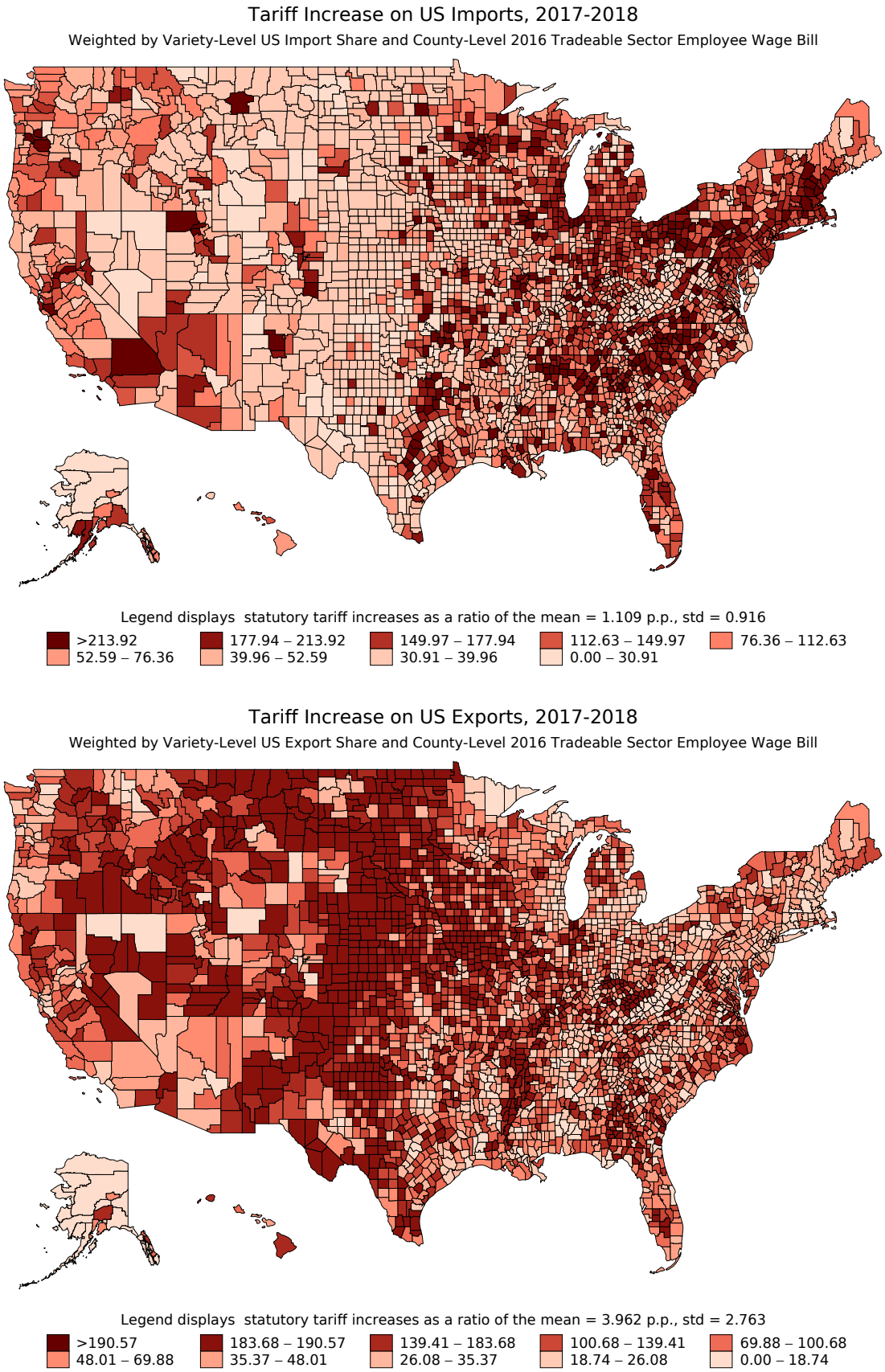


Figure 11: Real Tradeable Wages in Model-Based Counterfactuals of the Trade War

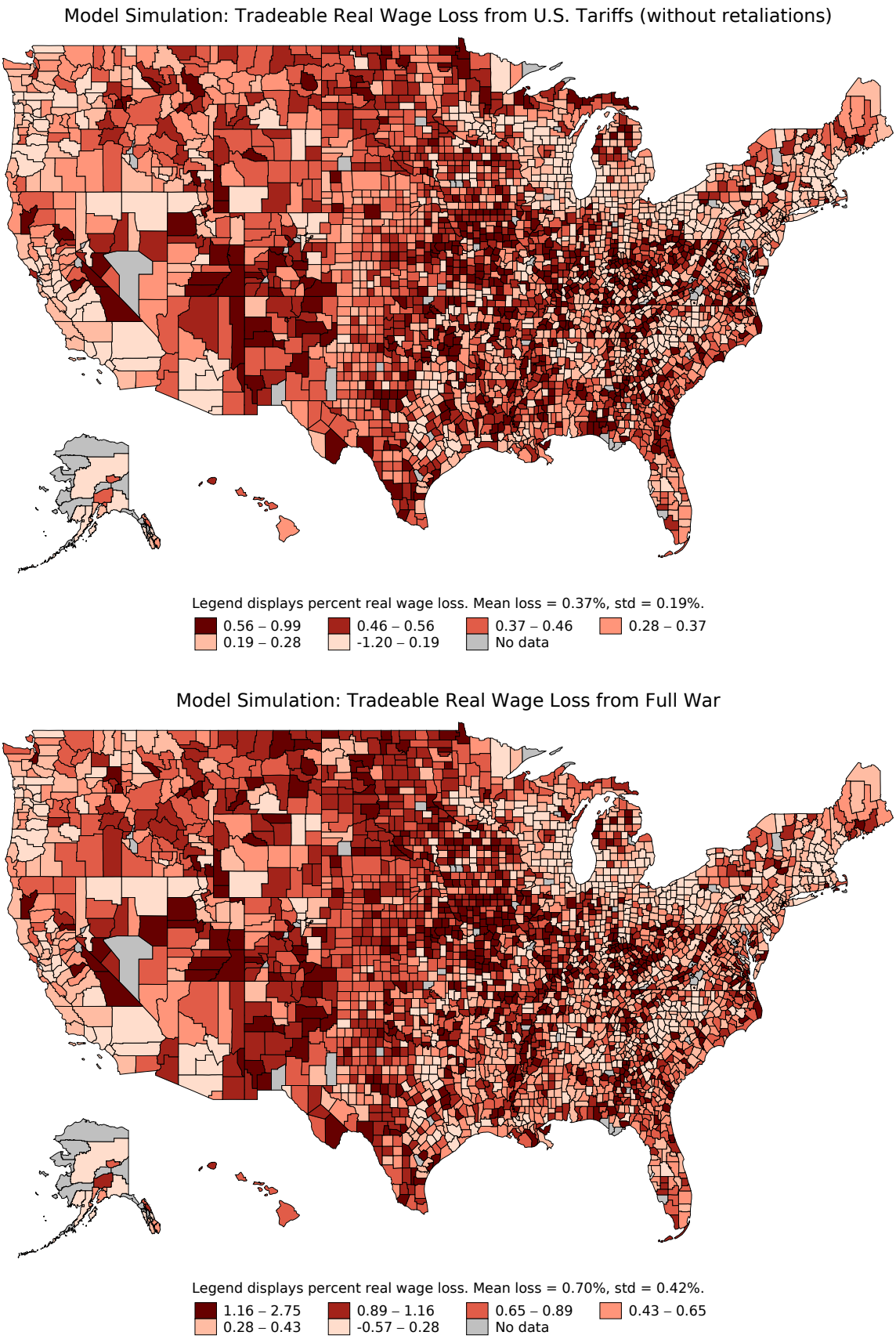
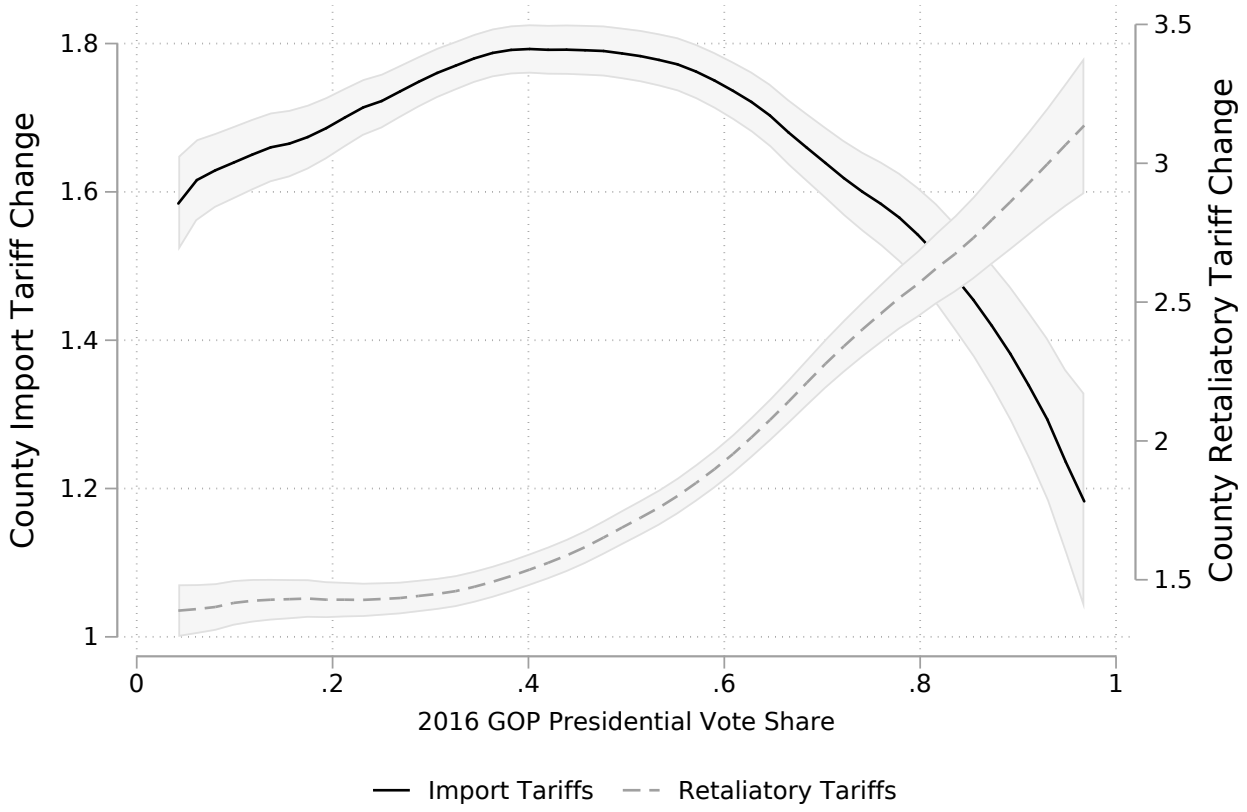
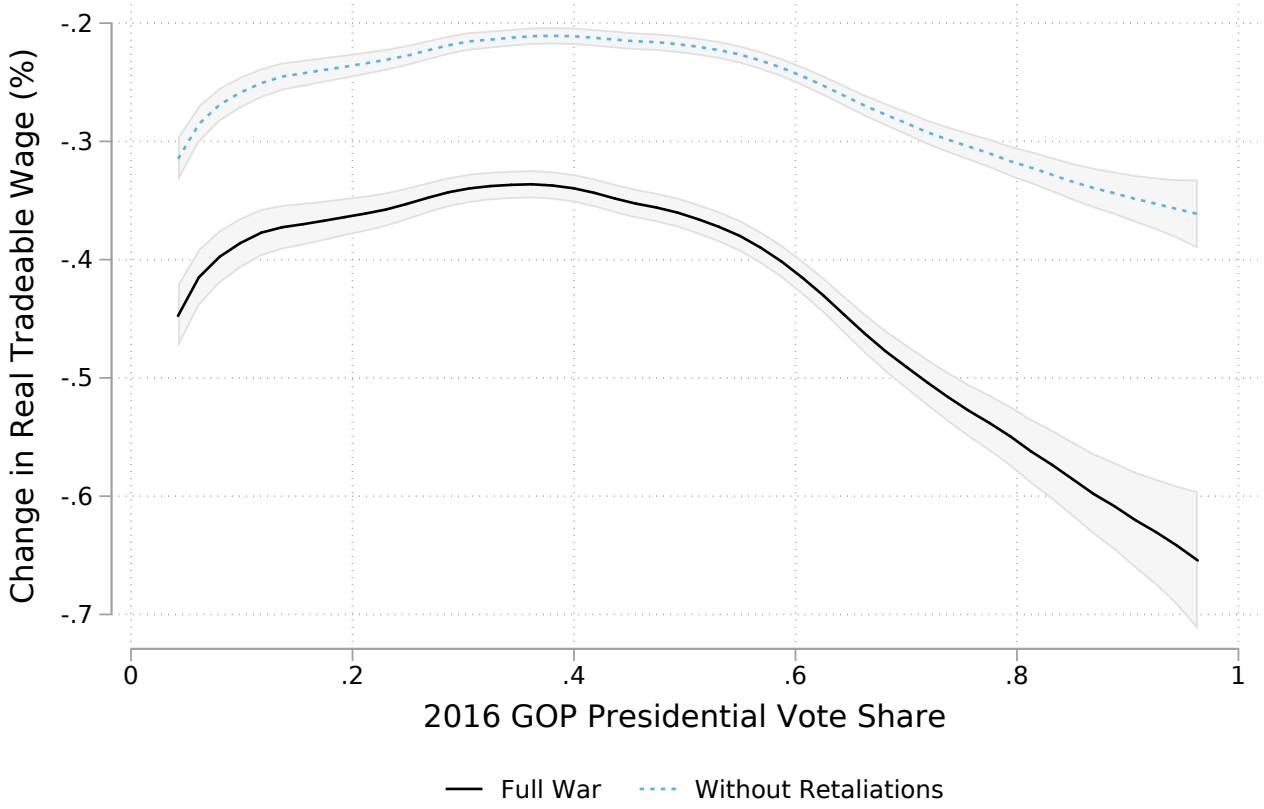


Figure 12: 2017-18 Tariff Changes vs. 2016 Republican Vote Share



Non-parametric curve weighted by county population, N=3145. County tariff increases computed as the tradeable wagebill-weighted sum of sector-level tariff changes.

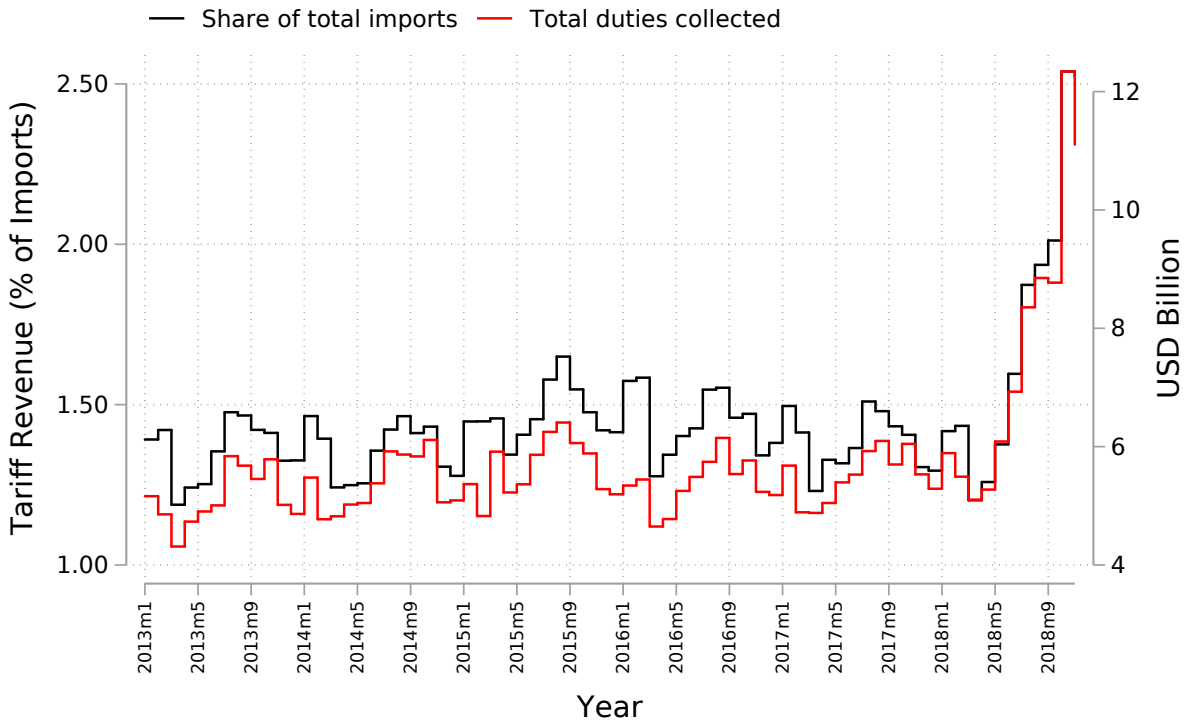
Figure 13: Change in tradeable Real Wages vs. GOP Vote Shares



Non-parametric curve of N=3145 U.S. counties weighted by population. Figure plots 2016 GOP Presidential vote share vs. the estimated change in real tradeable wages implied by the model. Dashed line shows the simulation in the hypothetical scenario without foreign retaliations, and solid line shows the full trade war.

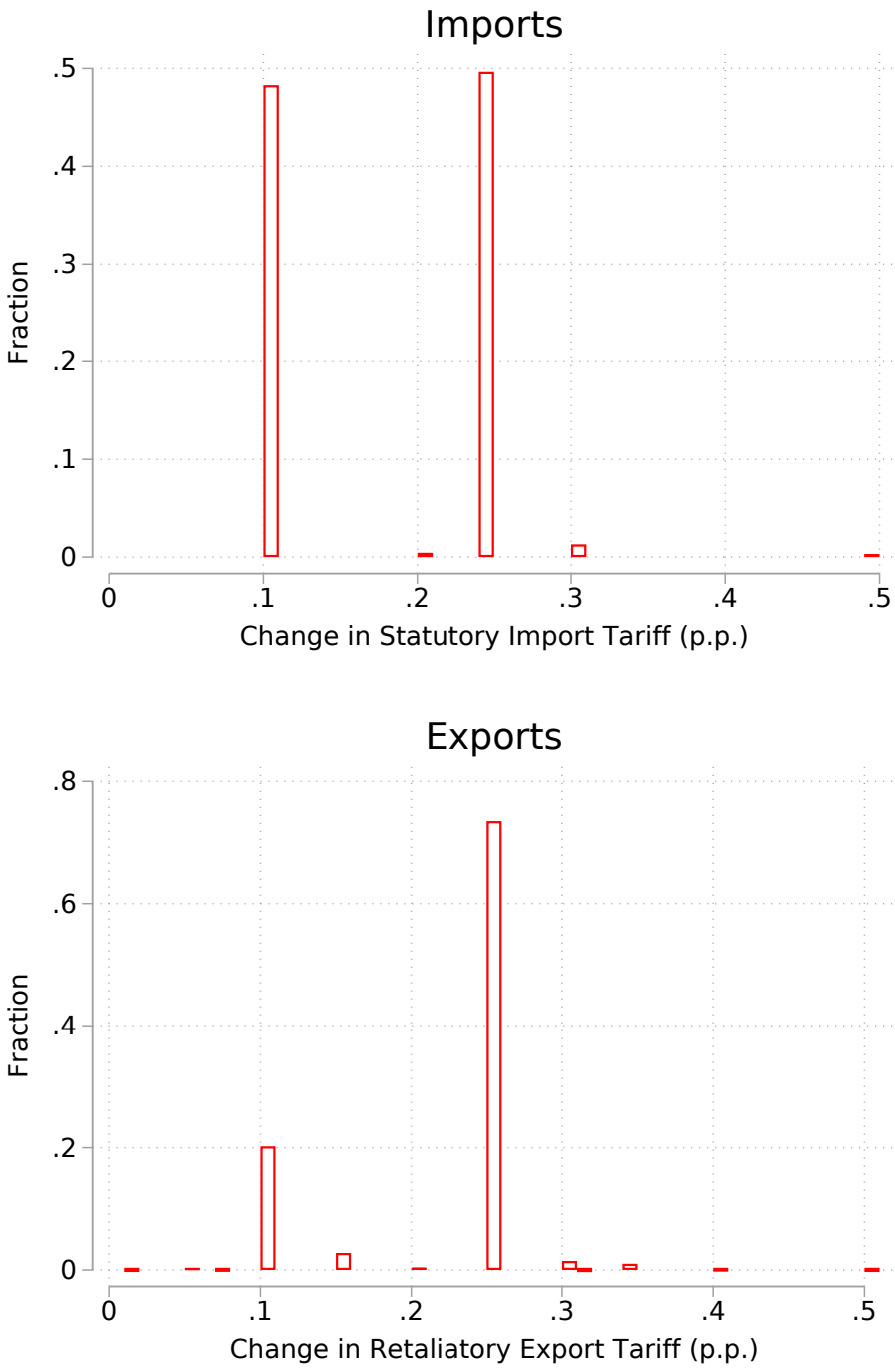
D Appendix Tables and Figures

Figure A.1: Tariff Revenue Collected



Total tariff revenue collected in 2016, 2017 and 2018 from Jan-Oct is $54.2 billion, $55.2 billion, and $73.1 billion, respectively.

Figure A.2: Statutory Tariff Changes



Figures show the distribution of tariff increases in 2018 due to the trade war.

Figure A.3: Political Contributions and Statutory Tariff Changes

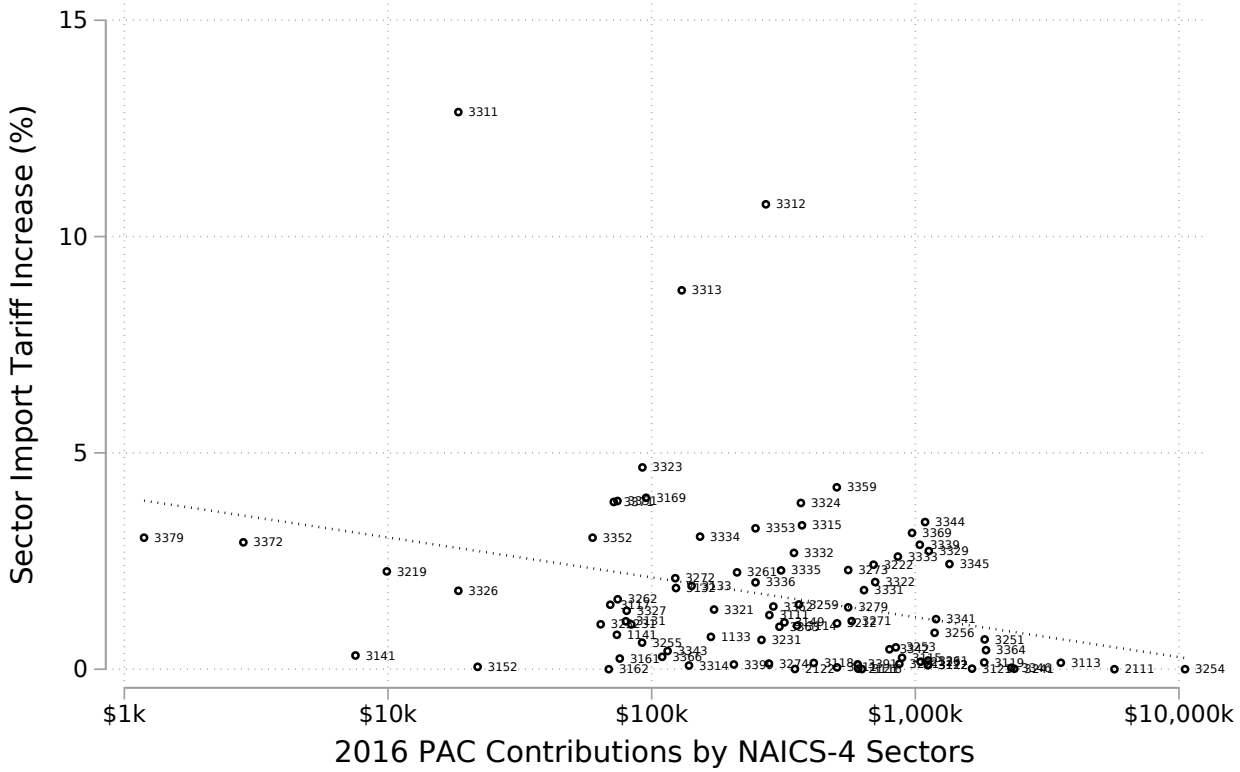
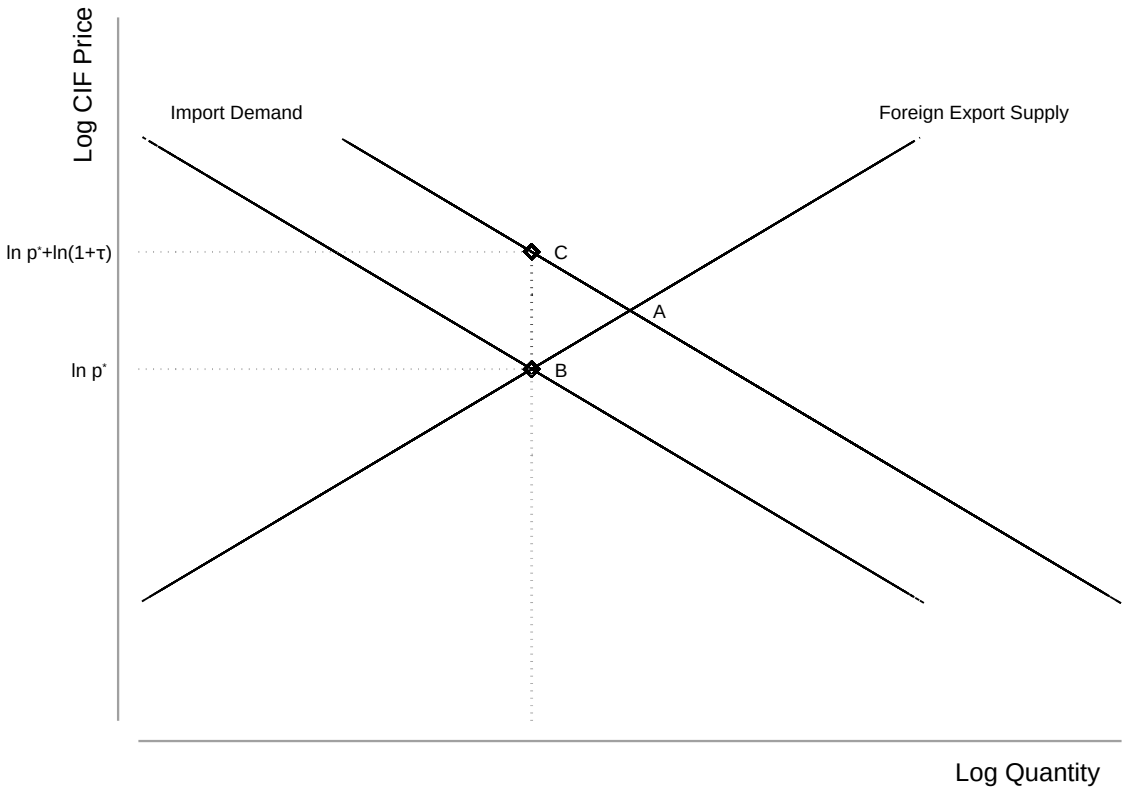


Figure plots 2016 financial campaign contributions against tariff changes at the sector level. Campaign contributions are measured using legal disclosure data compiled by the Center for Responsive Politics and cover contributions to candidates for the U.S. House of Representatives during the 2016 election cycle. Import tariffs are trade-weighted averages within NAICS-4 sectors.

Figure A.4: Identification of Import Demand and Foreign Export Supply



A denotes the pre-tariff equilibrium. If the tariff increases, import demand falls.
B denotes the price the exporter receives. C denotes the price the importer pays. The government collects the tariff.

Table A.1: Import Demand (σ) and Foreign Export Supply (σ), Applied Tariffs and Trends

	(1)	(2)	(3)	(4)	(5)	(6)
	$\Delta \ln p^*_{igt} m_{igt}$	$\Delta \ln m_{igt}$	$\Delta \ln p^*_{igt}$	$\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$	$\Delta \ln m_{igt}$	$\Delta \ln m_{igt}$
$\Delta \ln(1+\tau^{app}_{igt})$	-2.46***	-2.54***	0.09***	1.09***		
	(0.08)	(0.09)	(0.03)	(0.03)		
$\Delta \ln p^*_{igt}$					-28.18***	
					(10.14)	
$\Delta \ln p^*_{igt}(1+\tau^{app}_{igt})$						-2.33***
						(0.07)
product × time FE	yes	yes	yes	yes	yes	yes
cty × time FE	yes	yes	yes	yes	yes	yes
cty × sector FE	yes	yes	yes	yes	yes	yes
variety FE	yes	yes	yes	yes	yes	yes
1st-stage F					7.0	1022.5
$\hat{\omega}$ (se[$\hat{\omega}$])					-0.04 (0.01)	
$\hat{\sigma}$ (se[$\hat{\sigma}$])						2.33 (0.07)
r2	0.17	0.17	0.15	0.15	.	.
obs	2,405,233	1,949,262	1,949,262	1,949,262	1,949,262	1,949,262

Columns 1-4 report the reduced-form outcomes of import values, quantities, unit values, and duty-inclusive unit values regressed on $\Delta \ln(1+\tau_{igt})$, where τ_{igt} is the applied tariff. Column 5 reports the second-stage IV regression of import quantities on unit values (the first stage is column 3). Column 6 reports the second-stage IV regression of import quantities on duty-inclusive unit values (the first-stage regression is column 4). The implied $\hat{\omega}$ and $\hat{\sigma}$ and their standard errors are reported at the bottom of the table. All regressions include variety, product-time, country-time and country-sector fixed effects. Standard errors clustered by country and product. Significance: * 0.10, ** 0.05, *** 0.01.

Table A.2: Import Demand (σ) and Foreign Export Supply (σ), Statutory Tariffs and Trends

	(1) $\Delta \ln(1+\tau_{igt}^{app})$	(2) $\Delta \ln p_{igt}^{*} m_{igt}$	(3) $\Delta \ln m_{igt}$	(4) $\Delta \ln p_{igt}^{*}$	(5) $\Delta \ln p_{igt}^{*}(1+\tau_{igt}^{app})$	(6) $\Delta \ln p_{igt}^{*}$	(7) $\Delta \ln p_{igt}^{*}(1+\tau_{igt}^{app})$	(8) $\Delta \ln m_{igt}$	(9) $\Delta \ln m_{igt}$
$\Delta \ln(1+\tau_{igt}^{stat})$	0.61***					0.04	0.62***		
	(0.06)					(0.09)	(0.13)		
$\Delta \ln(1+\tau_{igt}^{app})$		-2.44***	-2.56***	0.07	1.07***				
		(0.16)	(0.26)	(0.14)	(0.14)				
$\Delta \ln p_{igt}^{*}$								-37.10	
								(75.15)	
$\Delta \ln p_{igt}^{*}(1+\tau_{igt}^{app})$									-2.40***
									(0.24)
product × time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
cty × time FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
cty × sector FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
variety FE	yes	yes	yes	yes	yes	yes	yes	yes	yes
1st-stage F		90.5	86.9	86.9	86.9			0.2	21.2
$\hat{\omega}$ (se[$\hat{\omega}$])								-0.03 (0.05)	
$\hat{\sigma}$ (se[$\hat{\sigma}$])									2.40 (0.24)
r2	0.17	0.01	0.01	0.00	0.00	0.15	0.15	.	.
obs	2,405,233	2,405,233	1,949,262	1,949,262	1,949,262	1,949,262	1,949,262	1,949,262	1,949,262

Column 1 reports the first stage of the applied tariff, $\Delta \ln(1+\tau_{igt})$, on the statutory tariff, $\Delta \ln(1+\tau_{igt}^{stat})$. Columns 2-5 shows the second-stage results of import values, quantities, unit values, and duty-inclusive unit values regressed on the instrumented applied tariff. Columns 5 and 6 regress unit values and duty-inclusive unit values on the statutory tariff, respectively. Columns 7 is the second-stage IV regression of import quantities on unit values using statutory tariffs as the instrument (the first stage is column 5). Columns 8 is the second-stage IV regression of import quantities on duty-inclusive unit values using statutory tariffs as the instrument (the first stage is column 6). The implied $\hat{\omega}$ and $\hat{\sigma}$ and their standard errors are reported at the bottom of the table in columns 7 and 8. All regressions include variety, product-time, country-time and country-sector fixed effects. Standard errors clustered by country and product. Significance: * 0.10, ** 0.05, *** 0.01.

Table A.3: Product Elasticity η, Trends

	(1) $\Delta \ln(s_{Mgt})$	(2) $\Delta \ln p_{Mgt}$	(3) $\Delta \ln(s_{Mgt})$	(4) $\Delta \ln(s_{Mgt})$	(5) $\Delta \ln p_{Mgt}$	(6) $\Delta \ln(s_{Mgt})$
$\Delta \ln Z^{app}_{Mgt}$	-0.71***	0.52***				
	(0.09)	(0.08)				
$\Delta \ln p_{Mgt}$			-1.37***			-1.33
			(0.26)			(0.99)
$\Delta \ln Z^{stat}_{Mgt}$				-0.76*	0.53	
				(0.42)	(0.34)	
sector-time FE	yes	yes	yes	yes	yes	yes
product FE	yes	yes	yes	yes	yes	yes
1st-stage F			43.6			2.5
$\hat{\eta}$ (se[$\hat{\eta}$])			2.37 (0.26)			2.33 (0.99)
r2	0.03	0.23	.	0.03	0.24	.
obs	301,420	317,325	301,420	301,420	317,325	301,420

Columns 1-3 build the price index using the $\hat{\sigma}$ from column 6 of Table 3 and constructs the instrument using applied tariffs. Column 1 reports the reduced form, column 2 reports the first stage, and column 3 reports the second stage. Columns 4-6 repeats the analysis using a price index constructed from $\hat{\sigma}$ from column 9 of Table A.2 and an instrument constructed from the statutory tariffs. The implied $\hat{\eta}$ and its standard error are noted at the bottom of the table in columns 3 and 6. All regressions include product and time fixed effects. Standard errors clustered by product. Significance: * 0.10, ** 0.05, *** 0.01.

Table A.4: Aggregate Impacts, Mobile Labor

	EV^M	ΔR	EV^X	EV
	(1)	(2)	(3)	(4)
	Full War			
Change ($ bil)	-68.8	39.4	23.2	-6.1
Change (% GDP)	-0.37	0.21	0.12	-0.03
Change ($ capita)	-213	122	72	-19
	No Retaliation			
Change ($ bil)	-68.8	39.6	27.3	-1.9
Change (% GDP)	-0.37	0.21	0.15	-0.01
Change ($ capita)	-213	122	84	-6

Table reports impacts of the war assume imperfectly mobile labor. The aggregate impacts of the trade war are reported in column 4, and the decomposition into EV^M, tariff revenue (ΔR) and EV^X in columns 1-3. The bottom panel reports a hypothetical scenario where trade partners do not retaliate against U.S. tariffs. The first row in each panel reports the overall impacts of each term in billions of USD. The second row scales by 2016 GDP. The third row scales by 2016 population. These numbers are computed using the model described in Section 5 and sets $\{\hat{\sigma} = 2.47, \hat{\eta} = 1.81, \hat{\kappa} = 2.12, \hat{\omega}^* = 0, \hat{\sigma}^* = .83\}$.

Table A.5: Correlates of County-Level Tariff Exposure

Panel A: Outcome is Change in Import Tariff Exposure

	(1) $\Delta(\tau_r)$	(2) $\Delta(\tau_r)$	(3) $\Delta(\tau_r)$	(4) $\Delta(\tau_r)$
2016 GOP Pres. Vote Share	2.81***	1.64**	1.43***	1.54***
	(0.71)	(0.66)	(0.53)	(0.57)
2016 GOP Pres. Vote Share Sq.	-3.23***	-1.36**	-1.37**	-1.29**
	(0.68)	(0.66)	(0.56)	(0.63)
Ag Employment Share		-7.54***	-7.38***	-7.22***
		(1.05)	(1.15)	(1.16)
Demographic Controls	No	No	Yes	Yes
Pre-Trends	No	No	No	Yes
R2	0.03	0.12	0.13	0.14
N	3,111	3,111	3,111	3,111

Panel B: Outcome is Change in Export Tariff Exposure

	(1) $\Delta(\tau_r^*)$	(2) $\Delta(\tau_r^*)$	(3) $\Delta(\tau_r^*)$	(4) $\Delta(\tau_r^*)$
2016 GOP Pres. Vote Share	2.61***	0.27	-0.52	-0.55
	(0.30)	(0.20)	(0.37)	(1.00)
2016 GOP Pres. Vote Share Sq.				-0.20
				(1.02)
Ag Employment Share		27.56***	25.13***	24.96***
		(2.17)	(1.95)	(1.94)
Demographic Controls	No	No	Yes	Yes
Pre-Trends	No	No	No	Yes
R2	0.08	0.38	0.41	0.42
N	3,111	3,111	3,111	3,111

Unit of analysis is U.S. counties. Outcome variable in Panel A (B) is the 2017-18 change in import (export) tariff exposure due to the trade war, defined as the county-specific tradeable wage-weighted average of sector-level tariff increases. Employment and demographic variables measured in 2016 from Census CBP and 5Y ACS. Agriculture industries defined as NAICS codes beginning with 11. Demographic controls are: share unemployed, share white, share with a college degree, and log mean income. Pre-trend controls are 2013-2016 changes in: manufacturing and agriculture employment shares, share unemployed, and log mean income. Regressions weighted by county population. Standard errors clustered by state.