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Tariffs and welfare: A common, invalid anti-tariff argument

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Abstract

President Trump imposed tariffs in 2017 on several of China's exports, notably steel. Many papers opposed these tariffs by using a common, invalid argument: rather than arguing these tariffs reduced U.S. welfare, they argue U.S. consumers and businesses pay the tariffs, a different, rhetorical issue. Their main evidence of harm is increases in imported goods' after-tariff U.S. prices, especially relative to other goods' U.S. prices. In a standard, small general equilibrium model (two countries, two goods, two factors), this price evidence is wholly ambiguous—it is even consistent with the view that Trump's tariff was optimal, increasing U.S. welfare. Even sophisticated papers are similarly ambiguous. All fail because they neglect how government uses tariff revenue. Relying on fallacious arguments makes the free-trade position look weak and encourages protectionism.

Keywords

- tariffs
- anti-tariff arguments
- optimal tariff
- free trade
- use of tariff revenue
- tariff warfare

JEL codes: F10, F11, F13, F51, F68

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Introduction

For every complex problem there is an answer that is clear, simple, and wrong.
H. L. Mencken

Under former President Donald Trump the United States started a tariff war with China.[2] A particular issue over which there is much debate is: Who pays the tariff revenues that the U.S. government collects? Trump argues that China pays the tariffs. Many U.S. observers, however—the left, the right, a wide range of news purveyors—argue that U.S. consumers pay, or U.S. consumers plus corporations pay. Some argue that U.S. consumers pay the tariffs through higher prices, or that part of the burden of the tariff falls on U.S. firms that do not to pass on all the tariff and hence reduce their profit margins. Others acknowledge that Chinese exporters might absorb part of the tariff but they argue that in fact mostly absorb little—complete or almost complete "pass through."[3] Figure 1, from a *Wall Street Journal* oped, illustrates an important strand of the argument: The figure shows that an index of U.S. prices of goods affected by tariffs rose from February, 2018 through June, 2019.[4] In contrast an index of U.S. prices of 'core goods' fell during this period.[5] Many discussions argue that this pattern of prices arises because Trump's tariffs on Chinese goods lead to higher U.S. prices and thus the United States pays the tariff.

This paper's analysis shows that, "Who pays for a tariff?" is the wrong question and is confusing on top of that. Opponents of Trump and his tariffs raised the question but Trump gladly and loudly argued, "China pays." The

[2] As well as China, Trump imposed tariffs on several countries (including NAFTA countries, Canada and Mexico) and the European Union on several different dates. Various countries imposed retaliatory tariffs on some U.S. goods. For timelines of Trump's actions, retaliatory actions, and some resolutions of the conflicts, see Fajgelbaum et al. (2020), York (2022), Brown and Kolb (2022), and Lee and Vars (2022). Nevertheless, many discussions focused on the U.S.–China tariff war. Further, much discussion focused on U.S. tariffs on steel. Hence, this paper refers mostly to China and to a large extent steel.

[3] Among many, see Al Jazeera, (2019), Amiti et al. (2019), Boehm (2019), Brinkley (2019), DeBarros and Zumbrun (2019), Frank (2019), Giovanetti (2018), Gleckman (2018), Graham (2019), Henney (2019), Jacobson (2019), Narayan (2019), Niquette (2019), Reuters (2019), Russ (2019), *South China Morning Post* (2019), Thiessen (2019), Vance (2019), Varas (2019), Wiseman and Rugaber (2018) and Yandle (2019). Note that many of these articles appeared in serious, popular publications such as the *Wall Street Journal* and *Forbes*, as well as popular newspapers such as *USA Today* and sources such as Reuters and Al Jazeera. One article is an NBER working paper, one from the Chicago Fed and another from the San Francisco Fed. See below for some quotations from these articles.

[4] The China "tariff war" lasted in effect for two years, according to Lobosco (2022).

[5] Several papers present similar graphs. Recall that the substantial general inflation in U.S. prices did not start until after President Joe Biden took office in January, 2021.

issue is a red herring. The real question is, "What are the costs and benefits of a tariff, for the country imposing the tariff and the Rest of the World?" More particularly, "Whose welfare rises, whose decreases?" Analysis below uses a standard trade theory model to analyze the issues—two countries, two goods, two factors. This model is useful for examining welfare effects: Welfare effects are a focus of the model. The model reveals that the critical commentators are wrong: the data they use do not and cannot provide a definitive answer: Figure 1's results are consistent with the view that China pays in the sense that U.S. welfare rises and China welfare falls; they are also consistent with U.S. welfare falling.

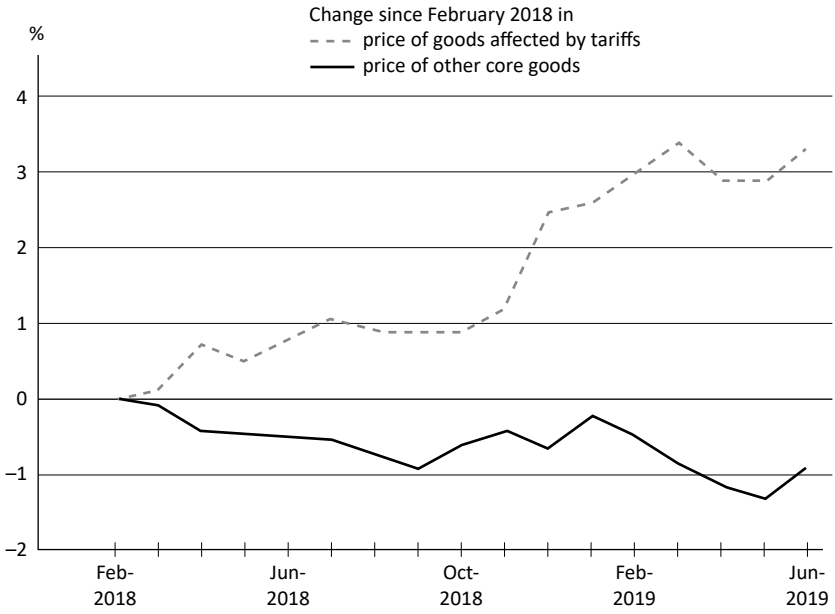

Figure 1. Do the United States pay for the tariffs?

Source: (Boehm, 2019).

Though common analysis of the economic effects of Trump's tariffs on imports from China is fallacious that does not mean that his tariffs are a "good idea." Rather, opposing these tariffs with faulty analysis is weak, humiliating when recognised and ultimately self-defeating. Using bad arguments is intrinsically a bad idea.

Intuitively if the home country has market power over the goods on which it considers imposing tariffs it can exploit this power to improve the country's overall welfare. It is important, however, to use a general rather than partial equilibrium model for correct understanding and to analyze explicitly how the government uses tariff revenue it collects. To be sure import-competing industries benefit from tariff protection though home-country consumers of

protected goods suffer from higher prices, as in partial equilibrium analysis. Export industries suffer and their prices fall, but home-country consumers of these goods benefit from lower prices. If the analyst considers only these price distortions, home-country consumers and producers in the aggregate are likely worse off. If the government redistributes the tariff revenues to its residents as transfer payments, however, the country may be better off and for a carefully chosen tariff will be better off. With an optimum tariff the transfer payments arising from government exploiting its monopoly power at the Rest of the World's (ROW) expense, more than offset the domestic costs of introducing the distortions. The home country's optimum tariff increases its welfare but reduces the ROW's, as has been understood since the mid-1800s.[6]

Relative to Figure 1 a literature search finds few discussions of the Trump–China tariff war that consider its price effects under optimum-tariff analysis. Optimum-tariff theory predicts that *ceteris paribus* prices of import-competing goods rise relative to prices of export goods. Optimum-tariff theory predicts that in the face of import tariffs on Chinese-made washers and dryers U.S. domestic prices of washers and driers rise relative to prices of U.S. export goods (as graphs like those of Amiti et al., 2019, find). This prediction is consistent with the standard trade model of the optimum tariff (Heller, 1968; Meade, 1952). *The Wall Street Journal* (DeBarros & Zumbrun, 2019) and then *Reason* (Boehm, 2019) used graphs similar Figure 1, however, as evidence that the U.S. "pays the tariff."

In the following the paper briefly reviews the key propositions in trade theory and the post-World War II push towards freer trade. It then discusses how the common question, "Who pays for the tariff?" is off track and the common comparison of post-tariff U.S. import-goods prices with other U.S. prices says nothing about whether the country imposing the tariff gains in the aggregate or loses. Indeed such price comparisons that purport to show that the United States lost from the tariffs on China are consistent with the Trump tariffs being optimal, or at least improving U.S. welfare. Such arguments focus on the distortions that tariffs create but crucially neglect what the government does with the tariff revenue it collects, a key omission in many papers evaluating the tariff results. Under optimum-tariff theory the government redistributes the revenue to residents. Indeed in certain cases the country is better off even if the government keeps and wastes the tariff revenue. Rather than comparing post-tariff prices a better anti-tariff argument is the possibility of retaliation and the economic and political losses that may arise from a tariff war.

[6] Humphrey (1987) gives a fine discussion of how classical and neo-classical economists understood the modern theory of the optimum tariff (as summarized, say, in Heller, 1968; Meade, 1952): Torrens (1844), Mill (1844), Edgeworth (1894, 1925), Bickerdike (1906, 1907), Kaldor (1940), Lerner (1944). Humphrey also covers Marshall's unpublished discussion.

1. What does trade theory say about the effects of tariffs?

Consider the well-known 2 × 2 × 2 model of international trade—two counties, two goods, two factors of production. The model gives a limited number of general conclusions, including those listed below.[7] (In cases beyond these simple ones conclusions depend sensitively on a list of conditions and results may go one way or another.)[8]

A. Going from autarky to free trade leads to an increase in both countries' welfare.

B. In going from free trade to the case of an optimum tariff for the United States, U.S. welfare increases and ROW welfare decreases. The United States gains positive tariff revenues which can be interpreted as being paid wholly by the ROW. (These results require that the ROW offer curve be less than infinitely elastic, that is, the United States has monopoly power.)

C. Going from the case where the United States has an optimum tariff to free trade reduces United States' welfare but increases ROW welfare. The ROW could in principle make transfers to the United States that returned the United States to its previous level of welfare still leaving the ROW better off.[9]

D. Going from a system where both countries have tariffs to free trade *may* improve the welfare of both countries. Alternatively, the move *will* improve one country's welfare but will *reduce* the other's. If one country benefits but the other loses the winner could in principle make transfers to the losing country to return it to its previous level of welfare while leaving the winner better off.

The early years after the Second World War was largely a frozen world, perhaps the farthest from free trade since the Middle Ages. From this frozen start the United States moved, not to a free-trade policy but to a policy much more

[7] There are, however, a few more general results: For example, the Stolper-Samuelson (1941) and Rybczynski (1955) theorems, and several theorems in the Factor Price Equalization (FPE) discussion (Chipman, 1965; Lerner, 1952; Samuelson, 1948).

[8] Jones and Easton (1983) generalize FPE to two goods and three factors. As Ethier (1974) had earlier noted: "Recent years have witnessed many investigations of whether these results generalize to the case of n goods and n factors. This literature has succeeded both in clarifying our understanding of the neoclassical production model and in obtaining difficult and frequently elegant results. However, most of these results imply that the n-by-n generalizations of the simple and powerful 2-by-2 properties are true only subject to conditions on the relevant determinants that are at once stringent, complicated and, frequently, economically arcane."

[9] This is an example of the fact that, if the system is not at a Pareto-optimal equilibrium, there exist Pareto-optimal equilibria in which both countries' welfare is improved.

open towards international trade (and capital flows).[10] For decades after the war, the United States supported and campaigned for multi-lateral trade negotiations to reduce tariffs and over time the level of tariffs decreased substantially across the world; the average tariff rate is now in the low few percent.

Post-Second World War trade negotiations have always been to move from one system of tariffs to a different system of tariffs, but lower tariffs—from one system of protection to another, with often the progress less than advertised.[11] It is well known that many sectors and communities suffered

[10] Perhaps the closest the world approached to free trade was the pre-First World War system for North America and Europe, but the U.S., an increasingly large and economically important country from 1865 on, was protectionist. For an example of the politics (see Rove, 2015). America has a long history of being difficult territory for low-tariff supporters, let along free-trade advocates. Protectionism was particularly strong in the inter-war period:

> The Smoot-Hawley Tariff Act, formally the United States Tariff Act of 1930 (June 17, 1930), raised import duties to protect American businesses and farmers, adding considerable strain to the international economic climate of the Great Depression…. In 1922 Congress had enacted the Fordney-McCumber Act, which was among the most punitive protectionist tariffs passed in the country's history, raising the average import tax to some 40 percent (…) [This] prompted retaliation from European governments (…) Throughout the 1920s, however, as European farmers recovered from World War I and their American counterparts faced intense competition and declining prices because of overproduction, U.S. agricultural interests lobbied the federal government for protection against agricultural imports. In his 1928 campaign for the presidency, Republican candidate Herbert Hoover promised to increase tariffs on agricultural goods, but after he took office lobbyists from other economic sectors encouraged him to support a broader increase (…) By raising the average tariff by some 20 percent, this tariff also prompted retaliation from foreign governments (…) Within two years some two dozen countries adopted similar "beggar-thy-neighbor" duties, making worse an already beleaguered world economy and reducing global trade. U.S. imports from and exports to Europe fell by some two-thirds between 1929 and 1932, while overall global trade declined by similar levels. (britannica.com, 2022, October 27)

In planning for the post-Second World War world, the Allies wanted to avoid pre-war protectionism to help the world recover; later in the 1940s the Cold War also led the United States to favor reduced protectionism. Thus, the United States supported the General Agreement on Tariffs and Trade (GATT) and then the World Trade Organization (WTO), and pushed for various multilateral rounds of negotiations to reduce tariffs, quotas and other hindrances to trade and capital flows. Over time, U.S. political support waned. Free traders always feared politicians would bend with political winds and favor protection. (Republican) Trump's tariffs on steel and aluminum seemed a realization of these fears. Moreover, (Democrat) Biden's industrial policy aimed at electric vehicles excluded most non-American manufacturers, making the industrial policy even worse in free traders' eyes. Trump's tariffs were an even more severe blow to free traders; he based the tariffs on national security grounds, opening a potential "black hole" for trade. (On this complicated but important issue of national security grounds, see the discussion in Bacchus, 2022.)

[11] Many analysts state that average tariffs across the world have fallen to very low levels. (See a footnote below.) Many other forms of protection are still substantial and as opposed to tariffs, it is difficult to calculate the percentage distortion from such protection. Negotiations to reduce these distortions are difficult, complex, obscure, contentious, and politically fraught:

from these agreements, often greatly. Government programs to compensate those harmed by these agreements have had mixed but largely negligible effects on average; labor unions have long judged them to have little value to their members. Moreover, as is well known, non-tariff protection is now much more important than tariffs.

An old, common trope is that protectionism prospers politically because its benefits can be large and quite concentrated on one or a few industries or a small group of people, but its costs are widespread across many in the country. Consistent with this, trade deals from the 1970s on have harmed some industries and communities greatly though benefits to consumers are widespread and often relatively thin. An example is the steel industry and the wide-spread damage to many U.S. rust-belt communities that arose from steel's decline.

Analysis of the damage to the U.S. steel industry is complicated by many deviations from simplified, tractable trade models. For decades analysts have argued convincingly that the international steel industry has substantial excess capacity. Foreign countries support their excess capacity with a variety of subsidies and other props to their steel producers, often largely hidden or at least shadowy enough to be arguable.[12] Steel cases at the World Trade Organization seem on average to have had modest effects in reducing excess capacity or moving the world towards free trade in steel. To be sure, in the United States it appears that a substantial portion of blame for the steel industry's poor state rests with incompetent steel-firm management and unions' gross abuse of power. Several other countries, France, e.g, seem as culpable on both scores.

2. Who pays the tariff revenue is the wrong question

If the United States puts a tariff on the imports from the ROW the U.S. government collects tariff revenues on U.S. imports, a conclusion trivially true in a world without privatized tax collection (the publicans in the Bible). But in a general model that takes account of all direct and indirect effects, who "pays" the tariff? Many argue that U.S. consumers pay the tariff because they must pay higher prices domestically owing to the tariff.[13]

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on average they make little progress. Examples are the legal status of foreign investments and the ability of U.S. owners to defend their intellectual property rights.

[12] One argument against protection for the steel industry is that exposure to international competition is necessary to hone the domestic industry to keep up with and perhaps exceed international best practices. Of course, severely subsidized international competition is not precisely what this argument has in mind.

[13] Consider a collection of popular opinions. Reuters (2019): "U.S. business executives and economists say U.S. consumers foot much of the bill through rising prices." Graham (2019):

To be concrete, assume the world starts at a free trade equilibrium, where both countries are in the elastic ranges of their offer curves.[14] Let the U.S. impose an optimum tariff on its imports from the ROW. From above the U.S. as a whole is better off, the ROW is worse off. To go farther, suppose that the two products are "high tech" and "low tech" goods. The U.S. has a comparative advantage in the high tech good, and in both countries the high tech

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"When President Trump imposed tariffs of 10% on $200 billion worth of Chinese imports in September 2018, Walmart and other retailers announced that the tariffs would result in some combination of higher prices or lower profits." Brinkley (2019): "None of it [tariff revenue] comes from China. It all comes from American businesses that import Chinese goods." (Note that this comes from *Forbes*, a self-identified business magazine.) Giovanetti (2018): "[I]f the United States imposed a tariff on goods coming from Mexico to pay for a border wall, it would be the US businesses and consumers, not Mexico, that paid for the wall." [Recall: During the 2016 election, Trump promised to build a wall at the U.S. southern border and that Mexico would pay for it.] *South China Morning Post* (2019): Quoting a January 6 [2019] a tweet from Steve Hanke, "Tariffs on Chinese imports are paid by Americans, not by the Chinese or their government. The President's tariffs are simply a [tax] on American consumers." Yandle (2019): "The financial burden splatters in many directions, but most of it is borne by American entities." Henney (2019): "In actuality, a tariff—a tax applied on goods entering the country—is borne by American importers of foreign goods (think automakers or tech companies that depend on China for semiconductor supplies), who most likely will pass the cost of the tariff along to the consumer." Niquette (2019): "Ultimately U.S. businesses and consumers pay through higher costs (…)". Vance (2019): "There are two and only two entities that pay tariffs: importers, who directly pay tariffs, and consumers, who indirectly pay tariffs." Narayan (2019): "Who pays for tariffs? Ultimately, customers pay the price." Frank (2019): "Tariffs are a tax paid by American companies and consumers—not by the foreign governments targeted by the tariffs." Russ (2019): "Recent research shows that the new tariffs are completely passed through into increased prices paid by U.S. importers as the targeted goods cross the border and result in higher costs for U.S. firms." Varas (2019): "Research (…) shows that the costs of tariffs thus far have been completely passed on to U.S. consumers (…)". And finally, Gleckman (2018): "it depends."

[14] As is well known both countries offer curves may have inelastic sections and multiple equilibria may easily occur. Analysis below ignores many possible complications; the analysis is still valid because the optimum tariff puts the ROW in the elastic region of its offer curve.

Focusing just on tariffs, starting at a free-trade equilibrium may be a reasonable approximation. Wiseman and Rugaber (2018, July 9): "U.S. tariffs on imported goods, adjusted for trade volumes, average 2.4 percent, above Japan's 2 percent and just below the 3 percent for the European Union and 3.1 percent for Canada (…) The comparable figures for Mexico and China are higher: Both have higher duties that top 4 percent.

In using the 2 × 2 × 2 model, analysts typically assume the only distortion is the one under examination, here the optimum tariff.

For present purposes assume that several ROW distortions lay behind standard offer curves, but for convenience the distortions do not qualitatively affect curves' shapes. The ROW, like China, may have all sorts of distortions such as requiring technology sharing, industrial espionage, special provisions say on domestic banks for favored firms or industries, special regulations for foreign firms in China, and much more, including an unreliable judicial system. Under the view that the average level of tariffs is small (around 3%), assume U.S. and ROW tariffs are negligible. To begin, assume that ROW policies are unchanged when the U.S. adopts its optimum tariff; a section below discuss retaliation.

good is capital intensive. Figure 2[15] shows the free-trade equilibrium, where the offer curves OC_{US} and OC_{ROW} intersect.[16] The international price ratio and thus the domestic price ratios in both countries is equal to the slope of the ray from the origin through the OCs' intersection. The slope of the price line is P^{HT}/P^{LT}. In the free-trade equilibrium, the U.S. exports the amount of high-tech goods HT^{FT} and imports LT^{FT}. The exports HT^{FT} pay for the imports LT^{FT}, or $P^{HT}\,HT^{FT} = P^{LT}\,LT^{FT}$; the slope of the line is the rise over the run, LT^{FT}/HT^{FT}, and thus the slope is $P^{HT}/P^{LT} = p^0$.[17]

The optimum-tariff equilibrium is where the highest attainable U.S. international trade indifference curve is tangent to the OC_{ROW}; the requirement to be on OC_{ROW} constrains the indifference curve the U.S. can reach, similar to a budget constraint. This new equilibrium requires two price ratios, the international ratio and the U.S. domestic ratio, where each ratio is for high-tech relative to low-tech goods. The new international price ratio is given by the slope of the steeper ray through the new equilibrium point, similar to the

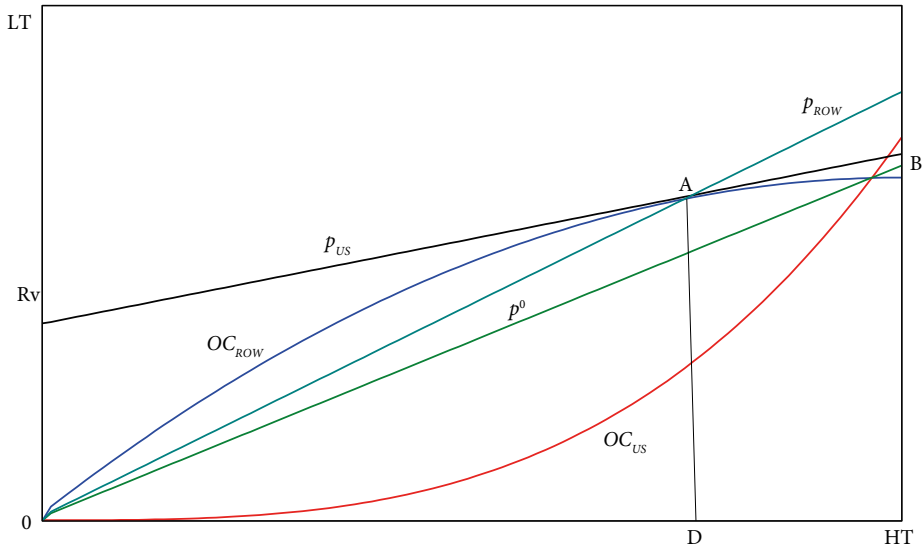

Figure 2. An optimum tariff

Source: Own work.

[15] Offer curves in this paper are drawn in the first quadrant. Often they are drawn in the fourth quadrant. This makes no logical difference.

[16] China is only one country, though important, in the ROW; further, Chinese goods and other countries' goods on which Trump imposed tariffs compete with many other goods. These considerations suggest OC_{Row} has a shallower slope than otherwise. Similarly, only a subset of U.S. goods suffered, suggesting OC_{us} is less curved than otherwise.

[17] Many discussions of international trade, perhaps the majority, refer to the terms of trade, for example, $TOT_{US} = P^{ex}_{US}/P^{im}_{US}$, where P^{ex}_{US} and P^{im}_{US} are U.S. export and import prices. The 2 × 2 × 2 model assumes $P^{HT} = P^{ex}_{US}$, $P^{LT} = P^{im}_{US}$: thus, there is no distinction here between the terms of trade and the domestic relative price level.

free-trade equilibrium. [The post-tariff OC_{US}^{OT} (not shown) goes through the new equilibrium.] The U.S. domestic price ratio is given by the slope of the U.S. indifference curve at the new equilibrium (equal to the slope of OC_{ROW}) at the U.S.'s optimum point. Necessarily the international price ratio is greater than the U.S. domestic price ratio as in Figure 2.[18]

The U.S. domestic price ratio at the optimum-tariff equilibrium, p_{US}^{OT}, is smaller in Figure 2 than the free-trade price ratio, p^{FT}. At the free-trade equilibrium, the price ratio is p^{FT}, and MRS_{US}^{FT} equals p^{FT} at the point where OC_{US} and OC_{ROW} intersect. Consider how an increase in income in the U.S. affects U.S. imports at the initial p^{FT}. With increases in income at p^{FT}, a strict analogue of the standard Engel's curve for two goods holds. For normal goods, the amount consumed of each good is either constant of increasing; for superior goods both amounts are increasing, and the Engel's curve has a positive slope.[19] Focus on the most reasonable case in a two-good world: Both goods are superior and the Engel's curve through the free-tree equilibrium thus has a positive slope. Turn to the IC_{US}^{OT} that is tangent to the OC_{ROW}, with slope MRS_{US}^{OT}. The indifference curve IC_{US}^{OT} also contributes a point on the Engel's curve with $MRS_{US} = p^{FT}$. Geometrically, necessarily along the indifference curve IC_{US}^{OT}, $|MRS_{US}^{FT}| > |MRS_{US}^{OT}|$, and hence $p^{OT} < p^{FT}$, giving:

$$(P_{US}^{HT,OT} / P_{US}^{LT,OT}) < (P_{US}^{HT,FT} / P_{US}^{LT,FT}) < (P_{ROW}^{HT,OT} / P_{ROW}^{LT,OT})$$

Internally the decrease in p_{US} (to p_{US}^{OT}) causes an increase in output of the low-tech good. Because the U.S. transformation function has the high-tech good on the horizontal axis, the fall in $p_{US} = [P_{US}^{HT}/P_{US}^{LT}]$ moves the U.S. up the function, with increased output of the low-tech good, decreased output of the high-tech good. Because the low-tech good is labor intensive, labor's real wage rate rises relative to capital's real rental rate in the U.S. U.S. suppliers of labor services benefit relative to suppliers of capital services.

What does the U.S. government do with the tariff revenue it collects? Assume the government costlessly redistributes tariff revenue to U.S. consumers.[20] The tariff causes two key changes. First, in going from the free-trade

[18] At the ***o***ptimum-***t***ariff equilibrium, the prices of the ***l***ow-***t***ech good in the United States and the ROW are $P_{US}^{LT,OT} = P_{ROW}^{LT,OT}$. The internal price of the low-tech good is $P_{US}^{LT,OT} = (1 + tr)\, P_{ROW}^{LT,OT}$, where tr is the percentage tariff rate. The price of the high-tech good in the United States and internationally is $P_{US}^{HT,OT} = P_{ROW}^{HT,OT}$. Thus, the price ratio for high-tech to low-tech goods in the United States is $P_{US}^{HT,OT}/P_{US}^{LT,OT} = p_{US}^{OT} = P_{ROW}^{HT,OT}/(1 + tr)\; P_{ROW}^{LT,OT} = p_{US}^{OT} = \frac{P_{ROW}^{HT,OT}}{(1+tr)}\, P_{ROW}^{LT,OT} = p^{ROW}/(1 + tr)$, and $p_{US}^{OT} < p^{FT} < p_{ROW}^{OT}$.

[19] For an inferior good, the Engel's curve eventually takes on a negative slope, for a luxury good eventually bends back.

[20] Other possibilities considered in the 2 × 2 × 2 model are: The government uses the tariff revenue to buy high-tech goods (see below); to buy low-tech goods; or simply throws it in the ocean (with no pollution effects!).

to optimum-tariff equilibrium, the internal price ratio in the U.S. decreases (see above) from the free-trade price ratio, p_{US}^{FT}, to the optimum-tariff price ratio, p_{US}^{OT}, or $p_{US}^{FT} > p_{US}^{OT}$. Second, at the new lower internal price ratio, p_{US}^{OT}, and thus smaller slope, the U.S. economy's budget constraint shifts out by the amount of the tariff revenue.

Manifestly, U.S. consumers in the aggregate do not "pay" the tariff and thus (in this sense) they do not generate the tariff revenue—the U.S. budget constraint has shifted outward by the tariff revenue. To be sure, the slope of the budget constraint is shallower relative to the free trade case, and this relative price change has distribution effects across U.S. consumers.

The optimum tariff generates two distribution effects in the U.S. First, owners of capital services lose, owners of labor services gain. Second, because of the rise in the relative price of low-tech goods, those who consumed more low-tech goods than average at the initial free-trade equilibrium lose relative to those who consumed less than average. Ceteris paribus, the former would have to pay more to consume their initial basket, the latter less.[21] In principle the government can redistribute the tariff revenue so that every household is at least as well off and some better off.[22]

3. What happens within the United States?

The decrease in the U.S. relative price from p_{US}^{FT} to p_{US}^{OT} causes an increase in U.S. production of its import good LT and a decrease in U.S. production of its export good HT. As far as U.S. consumption is concerned the change in the relative price causes a substitution effect against consumption of LT and in favor of consumption of HT. In addition, on the consumption side, there is a positive wealth effect that by itself leads to increases in consumption of both LT and HT, assuming both are superior goods.

[21] Both groups, however, adjust their baskets in response to the price ratio change, so the former are less damaged, the latter are even better off. The first comparison is from the equivalent variation, the second from the compensating variation in Hicks' analysis.

[22] Imagine that before the optimum tariff is imposed the government costlessly redistributes ownership of capital and labor services so that (a) each consumer's income is left the same at the initial wage and rental rates, and (b) each holds the same ratio of labor to capital services. Hence, each individual gains in the same proportion from the wage-rate increase, loses in the same proportion from the rental-rate decrease, eliminating capital-labor redistribution effects.

In the standard 2 × 2 × 2 model each industry has constant returns to scale. At both the free-trade and optimum-tariff equilibria, after paying wages for labor and rent rates for capital, profits for every firm are zero. Thus no issues of distribution effects arise from the differences in equity holdings in this model.

For the United States the substitution effect in favor of consuming HT and the positive wealth effect cause increases in U.S. consumption of HT. The production effect causes a decrease in production of HT. On balance U.S. consumption of HT increases, production decreases, and so the quantity of exports of HT declines. Because the price of LT goods increases relative to HT goods, the decreased amount of HT exports buys a smaller amount of LT imports.

The increase in wealth in the above analysis is the tariff revenue that the government collects on imports. The government is not a visible actor in this model. The model is in real terms and omits money-stock issues. The simplest way of dealing with the government is to assume that real government spending G is zero, $G = 0$, real government taxation (including tariff revenue) is zero, $T = 0$, and real transfer payments are initially zero, $TP = 0$. Thus the budget deficit, $G - (T - TP) = 0$. With the tariff in place, T rises by Rv. Suppose G is kept constant and the government distributes Rv as an increase TP. Thus, $(T - TP)$ remains constant at a net of zero and the government budget constraint remains constant at zero.

In a more sophisticated analysis the government might not increase TP but use Rv to finance part of G, and in this way reduce government borrowing to finance its deficit. In a Ricardian equivalence world, this has the same effect as redistributing Rv. Alternatively if the government uses *Rv* to increase G, the effects depend on the effects of increased G. (a) If the $\Delta G = Rv$ is simply wasted in a neutral way, both the U.S. and ROW are worse off. (b) If the government spends $\Delta G = Rv$ in ways that are the same as consumers would have done, the optimum-tariff analysis goes through as above. Clearly the ceteris paribus assumptions matter greatly to analytical outcomes. For example, suppose the government uses Rv to reduce its borrowing and thus consumers' future tax liabilities rather than redistribute Rv: It is difficult to measure the extent to which consumers recognise the implications and take them into account. This is an added complication in the model: Unsurprisingly it changes the clear-cut results above to, "It depends."

4. Retaliation and tariff warfare

Those who opposed Trump's tariffs have a stronger position: China will not acquiesce in the U.S. imposing tariffs. Indeed China did *not* acquiesce. It retaliated against the United States by putting tariffs and, more importantly, administrative restrictions on imports of U.S. goods, particularly those produced in states important to Trump's political standing, including agricultur-

al products from mid-west America.[23] In one accounting Trump's tariff war ended in an agreement with China within two years. Who won? It is hard for an objective observer to say, and likely the world is lucky that the economic warfare did not escalate.

Starting early in the post-Second World War period as the frozen world thawed economists analyzed tariff warfare, a curse of the inter-war period (see Johnson, 1951, 1953, 1965). This literature strongly suggests that moving from a free-trade equilibrium to a particular country's optimum tariff provokes retaliation and ends in tariff warfare. Further both sides may well end with reduced welfare relative to free trade. Under some conditions, however, one country may be better off, a boon to protectionists. Later analyses include a variety of complications.[24] Games may be non-cooperative or cooperative, for one period or sequential, with or without signaling of various types or side payments or threats of various type. There may be international institutions to facilitate freer trade. More than two countries may be involved. Domestic special interests may represent various industries with influence. One can construct games in which a country may benefit by moving from free trade to an optimum tariff even with the possibility of retaliation. History suggests the burden is on protectionists to provide a convincing argument that a given proposed tariff is different from the base case of both countries losing.

No country has trade as its sole international concern and this greatly complicates analysis. China is a difficult case for the U.S. free traders. China is an aggressive political, military and ideological competitor, not subtle and prone to insults, with much human-rights' baggage. China has engaged in intellectual espionage and continues to do so. American politicians seldom lose ground with their voters by calling out the Chinese government and Chinese companies. Moreover, many Chinese leaders view free trade as a mere useful pretense. Giving China "one in the eye" sells politically.

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[23] International (though not U.S. domestic) agricultural markets are fairly competitive, and China appears not to have much market power there. China apparently stiffed middlemen that provided U.S. ag goods and moved to others to buy roughly the same amount. In the short run this hurts U.S. farmers who must make new marketing connections. Over time buyers and sellers make new connections with presumably little ongoing harm to U.S. farmers.

China paid particular attention to soybeans, of which it imports a good deal (Simpson, 2020). Whatever short-run market power this gave China there are other soybean importers; over time U.S. soybean producers can shift, though with costs, to other crops.

The dollar value of China's decreased ag imports was notably less than the revenue from U.S. tariffs. This led to the suggestion that the government could aid the farmers hurt by China's reaction. See Steil and Della Rocca (2020).

The tariff war lasted for two years and ended with agreements between the United States and China but it left American farmers (especially soybean farmers) jittery about depending on China's markets (Simpson, 2020; see also Zhang et al., 2019).

[24] Khurana (2022), poorly written, contains a useful bibliography.

In the multidimensional game of international relations free traders have two strong arguments. First, protectionism, especially protectionism aimed at a particular country or group of countries is likely to create political problems, including national hostility, that dominate any economic gains. Second, retaliation undermines any gains, either economic or political.[25] Neither argument's free-trader conclusions are logically necessary but they have much history on their side.[26]

5. Further analysis: Use of tariff revenues, and effects on welfare

The discussion above emphasizes that the home country may benefit from a tariff if the government transfers the tariff revenue to its residents and this increase in their wealth more than compensates for the price distortions and thus resource misallocation the tariff creates. As this section briefly shows some analyses may err by neglecting issues surrounding government use of tariff revenue.

In Figure 3 the U.S. government imposes a 100% tariff on imports of low-tech (LT) goods and takes the proceeds in terms of LT goods. The initial international free-trade relative price, the same relative price in the United States and the ROW, is the slope of the ray p^0 from the origin through the intersection of the initial offer free-trade curves, OC_{US} and OC_{ROW}, at point A. The tariff shifts the new tariff-inclusive U.S. offer curve upward to OC_{US-tar}, giving the intersection with OC_{ROW} at point C. The tariff-inclusive internal U.S. price ratio p^{US-tar} is the slope of the ray from 0 through point C. The United States is on a higher indifference curve (not shown) than at the initial equilibrium at A. The ROW is at point B on its initial OC_{ROW}. With the 100% tariff taken in LT, then $BC = BE$. Note that post-tariff the ROW is on a lower international trade indifference curve (not shown), and the post-tariff ROW price ratio $p^{ROW-tar}$ is the slope of the ray (not shown) from 0 through B, with $p^{ROW-tar} < p^0$. Thus, $p^{ROW-tar} < p^0 < p^{US-tar}$: because these price ratios are val-

[25] Instead of using this 2 × 2 × 2 apparatus to examine China–U.S. tariff warfare why not include three trading entities, the U.S., China, and the ROW? After all many discussions refer to third countries; indeed, some make third-country effects and reactions a key part of the complications they consider. The focus is on two countries because adding a third increases complexity exponentially. It takes very few complications to the 2 × 2 × 2 model to ensure that the predominant analytical result is, "I don't know." See the Ethier (1974) quotation in a footnote above.

[26] Related, since Kant (1795), many have argued that economic interdependence through free trade is a powerful force for peace.

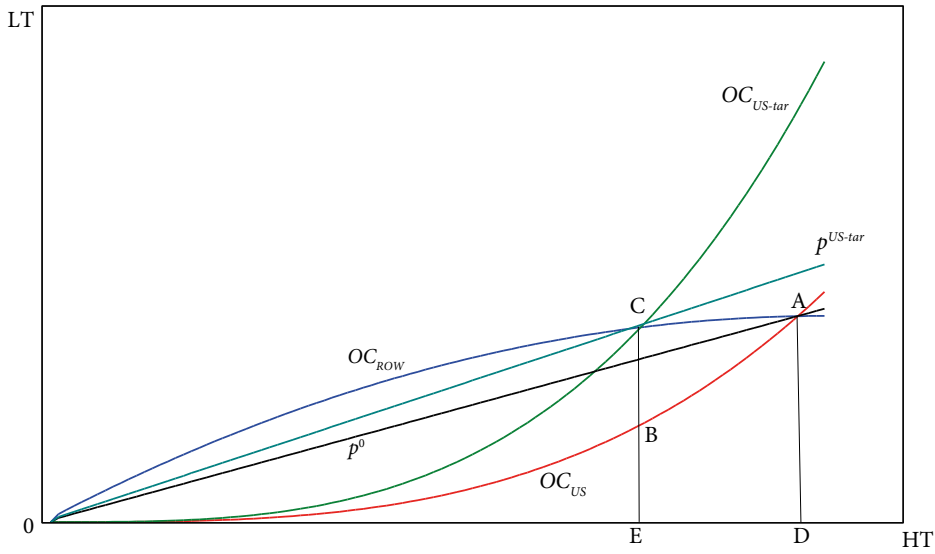

Figure 3. Improved welfare in the absence of redistribution

Source: Own work.

ues of P_{HT} relative to P_{LT}, the prices of imports and import-competing goods in the United States decline relative the U.S. high-tech export good, and the international price of the high-tech goods rises relative to low-tech goods prices.[27] What does the U.S. government do with the high-tech goods it buys with the tariff revenue? Presumably it uses these goods for its own purposes, but they affect neither country's welfare. (As far as U.S. and ROW residents go the U.S. government might waste the goods or throw them in the ocean).

The tariff forces a wedge between the prices faced in the United States and the rest of the world. (And this distortion feeds through to distortions in world factor markets.) Intuitively these distortions lead to resource misallocation and a reduction in world welfare and ROW welfare does indeed decline. How does the United States end up better off? The key is that the U.S. government exercises the monopoly power that the curvature of OC_{ROW} reveals. Under the optimum tariff in Figure 2 and the discussion around it the government exploits some of the monopoly power and transfers the revenue to its residents, allowing an increase in welfare. In the case in Figure 3 suppose the domestic high-tech industry were monopolized. The industry could then use its power to *reduce output* and increase its price (relative to the low-tech price) by shifting up the U.S. offer curve to the position of OC_{US-tar}. Though industry lacks this power, government can do it for the industry by imposing

[27] These results are hardly new. See Heller's (1968) textbook, pp. 142–145, for this case (his Figure 9.2) and the case discussed below (his Figure 9.3).

a well-chosen tariff. To be sure, comparing Figures 2 and 3 shows that U.S. welfare would be even higher than in Figure 3 if the government chose the optimum tariff and redistributed the tariff revenue to its residents.[28]

Using the above consider the analysis in Fajgelbaum et al. (2020). A key defect is that they do not specify what happens to tariff revenue that the U.S. government collects, either redistribution to consumers, or alternatively what the government spends it on, high- or low-tech goods, or into the ocean. Regarding their parameterized model, they write:

> We obtain a ballpark estimate of the aggregate and regional effects of the 2018 tariff waves. We estimate producer gains of $9.4 billion, or 0.05% of GDP. Adding up these gains, tariffs revenue, and the losses from higher import costs yields a short-run loss of the 2018 tariffs on aggregate real income of ***$7.2 billion***, or 0.04% of GDP. Hence, we find substantial redistribution from buyers of foreign goods to U.S. producers and the government, but a small net loss for the U.S. economy as a whole (which is not statistically significant at conventional levels after accounting for the parameters' standard errors). Although we cannot reject the null hypothesis that the aggregate losses are 0, the results strongly indicate large consumer losses from the trade war. If trade partners had not retaliated, the economy would have experienced a modest (and also not statistically significant) gain of ***$0.5 billion***. (Bold italics added)[29]

Taken at face value, this analysis suggests one might interpret Trump's tariffs as falling short of being an optimum tariff but not significantly affecting U.S. welfare. This, however, is not standard welfare analysis.[30] First, welfare analysis takes producers' wealth gains as accruing to firms' owners, that is, consumers (and this is so in rigorous analysis of wealth effects[31]). Second,

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[28] Consider a closely related example of how U.S. government use of tariff revenue can matter greatly. Like above, suppose the U.S. government imposes a 100% tariff on imports of low-tech goods but takes the proceeds in terms of (spends the tariff revenue on) ***high***-tech (HT) goods. The tariff-inclusive U.S. offer curve shifts horizontally to the right, rather than vertically upwards as in Figure 3. In this horizontal-shift case the U.S. is on a lower trade indifference curve than at the free-trade equilibrium, and the ROW is also on a lower trade indifference curve than under free trade—both countries are worse off. Further, note that in distinguishing the horizontal-shift case, the qualitative effects on price ratios are reversed from Figure 3: In this case, $p^{ROW-tar} > p^0 > p^{US-tar}$.

[29] They argue "The aggregate effects could be larger under tariff uncertainty or different assumptions on the input-output structure." They refer the reader to Freund et al. (2018), Altig et al. (2018), and Bellora and Fontagné (2019) "for analyses that incorporate some of these forces in the context of the 2018 trade war."

[30] Conventional welfare analysis goes back to the post-World War II period (Bator, 1957) and is intimately connected with the substitution and income (or wealth) effects apparatus in Hicks' *Value and capital* (1939, rev. ed. 1946). The wealth effects in Fajgelbaum et al. (2020) are not consistent with Hicks' analysis. Thus they are not consistent with standard micro theory or conventional welfare analysis.

[31] In the equivalent variation, a wealth effect of a change in a variable that is parametric to consumers' decisions is the product of the change in consumers' wealth times the coeffi-

tariff revenues accruing to government are not considered in welfare analysis—consumer welfare is under consideration not some dollar measure of "government welfare." To add to welfare government revenue must be transferred to consumers. Or, third, in the absence of transferring revenue to consumers, how the government spends tariff revenue matters greatly to consumers' welfare, as discussion around Figure 3 above shows.[32]

Conclusions

This paper's analysis is necessarily limited. It is static, does not consider growth, ignores issues of China's contribution to global pollution, does not consider geopolitical issues, neglects all the many human rights issues, is highly aggregated and thus neglects differential issues of autos, rare earths, agriculture, etc., and overlooks much more.

Nevertheless the simplified analysis shows that common analyses of Trump's China tariffs, as around Figure 1, are fallacious as are more sophisticated analyses of tariff pass through on particular goods, for example, washing machines (Amiti et al., 2019a,b). Tariff opponents frequently claim that consumers pay all taxes; tariffs are a tax and hence consumers pay the tariff—a different issue from how the tariff affects welfare. Trump willingly fell into this rhetorical trap claiming that China would pay.

This paper's analysis does not settle the issue of the effect of Trump's China tariff on U.S. welfare. Rather it shows that many papers that claim to show that the tariffs reduced U.S. welfare are fallacious. The above analysis mostly ignores China's retaliation but China was fast to retaliate.

One of the key issues raised above but ignored in most analyses discussed here is whether the U.S. government redistributed the tariff revenues to U.S. consumers to offset the losses caused by tariff-induced resource misallocation. Late in the Trump administration Congress passed government expenditure and transfer payment increases ostensibly in response the COVID-19 pandemic (but including many unrelated pet projects). Early in the Biden ad-

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cient of consumers' response to a change in wealth (Hicks, 1946; Slutsky, 1952). The changes in wealth include those arising through the business and government sectors. See Sweeney (1988, and detailed references there) for analysis that integrates effects on wealth through both the business and government sectors.

[32] Fajgelbaum et al. (2020) write:

> These results have two important caveats. First, our analysis considers short-run effects, but relative prices could change over longer horizons. Second, our estimation controls for country-time and product-time effects and therefore is unable to capture import price declines from *relative wage changes* across countries or sectors. (…)

ministration (starting January 20, 2022) a string of major bills much further increased expenditures, transfer payments, and huge deficits. Within this welter of spending and transfers and noting that money is fungible, were tariff revenues transferred to consumers? Tariff revenue is a rounding error compared to government spending, taxation, even the deficit. Who knows?

Sorting out these qualifications is difficult though they weaken the case that the tariffs are a "good idea," and do not rely fallaciously on the price-indices graphs or the misguided and misleading question, "Who pays for a tariff?".

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