Is Import Tariff Hurting US Welfare?

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Abstract

In 2017 the US imposed several tariffs on imports from China. In our study, we derive both the necessary and the sufficient conditions for the tariff to be welfare-enhancing using the ex-post approach. We found the data satisfies both the necessary and the sufficient conditions. So, we conclude that U.S. welfare has improved due to US import tariff on Chinese products.

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1. Introduction

On June 6, 2018 US imposed 25% tariffs on $34 billion worth of Chinese imports. In retaliation China imposed 25% tariffs on 545 goods worth of $34 billion the same day. Subsequently, US imposed 25% tariffs on a further $16 billion worth of Chinese goods on August 23, 2018, which was retaliated by China by imposing 25% tariffs on $16 billion worth of US goods the same day. US further placed 10% tariffs on $200 billion worth of Chinese imports on September 24, 2018, which was immediately retaliated by China with duties on $60 billion worth of US goods. On May 15, 2019 China increases tariffs on $60 billion worth of US products. On October 5, 2019 US increased tariffs on $200 billion worth of Chinese goods from 10 to 25%. Following this China increased tariffs on $60 billion worth of US products on June 1, 2019. On September 1, 2019 US tariffs on more than $125 billion worth of Chinese imports was to begin as expected. This tariff war ended on January 15, 2020 when China and the US signed the phase-one trade deal.

Since an import tariff increases the domestic price of imported products, it lowers consumer surplus to the domestic consumers and raises producer surplus to domestic producers of the product. Further, the importing nation also receives tariff revenue. If the total of the gain in government's tariff revenue and the producer surplus more than offsets the loss in consumer surplus, then the nation's welfare will be enhanced, otherwise there will be a net welfare loss (the dead-weight loss) to the importing nation.

This study attempts to evaluate the impact of the import tariffs on US welfare. There are two approaches found in the literature - ex-ante approach and ex-post (revealed preference) approach. The first approach assumes a functional form for the measurement of welfare. This approach, however, suffers from two problems. First, if we assume a single welfare function for the whole nation, we will be ignoring the distributional issue, because it will be difficult to rank social outcomes on the basis of potential Pareto improvement. If, on the other hand, we assume one welfare function for each consumer and aggregate all such functions to represent the whole nation, then the aggregation problem comes along, because consumers have diverse choices.

The ex-post approach does not suffer from these problems as no functional form assumption is made in this approach, rather the approach looks for some kind of indicator to infer about the welfare impact of a policy, for example, import tariff.

2. Review of Literature

Ohyama (1972), using the revealed preference approach, derives the sufficient condition for a policy to lead to welfare improvement. However, his model suffers from the same of distributional problems, because it also assumes a representative consumer. Later a work by Grinols and Wong (1991) extends Ohyama's results to many-consumer case and derives sufficient conditions for a trade policy to be welfare–enhancing putting the restriction that the welfare weights of individuals be constant. Although Dixit and Norman's work (1980, 1986) tries to overcome the limitations in Grinols and Wong's model, but they derive the welfare-improving condition for a trade policy rather than a change in trade policy. Later building on Dixit and Norman's Ju and Krishna (2000) derive the sufficient condition for a trade reform to be welfare improving in many consumers case. But their model arbitrarily chooses two periods for welfare comparison and has never been tested empirically.

There are four studies by Adhikari (2003, 2006, 2009, 2019), of those three examine the welfare impact of trade agreements and one examines the welfare impact of import tariff using an import function and testing for the sufficient condition for welfare improvement. Anne-Célia, Disdier and Marette (2010) explore the link between gravity and welfare frameworks for measuring the impact of nontariff measures. While the econometric estimation of the gravity equation reports a negative impact on imports, welfare evaluations show that in most cases, a stricter standard leads to an increase in both domestic and international welfare. Caliendo, Feenstra, Romalis, and Taylor (2015) have examined welfare impact of tariff reduction. Similarly, Chauvin, Ramos, and Porto (2016) examine trade, growth, and welfare Impacts of the CFTA in Africa. A study by Amiti, Redding, and Weinstein (2019) investigates the impacts of 2018 tariffs on prices and welfare. Similarly, Dhingra, Freeman, and Huang (2021) examine the impact of non-tariff barriers on trade and welfare. Other empirical studies on the impact of a trade policy mainly focus on a certain sector of the economy rather

than on the welfare impact on the whole economy, for example, on the impact of North American Free Trade Agreement on employment by U.S. International Trade Commission (1997), on agriculture by U.S. Department of Agriculture (1997), on auto and textile industries and U.S. trade balance by DeJanvry (1996), and on U.S. trade and industrial structure by U.S. Department of Agriculture (1999).

However, none of these studies examine the welfare impact of tariffs using revealed preference theory and using both necessary and sufficient conditions for welfare improvement. Thus, our study will be a net addition to the current body of economic literature in three ways: (1) we examine the welfare impact of tariff in bilateral trade flows between US and China, (2) we use the revealed preference approach to examine the welfare impact, and (3) we use both the necessary and the sufficient conditions as indicator to examine the welfare impact.

We will lay out the model and derive the necessary and sufficient conditions for welfare improvement in section-3, discuss the data in section-4, present the analyses and the results in section-5, and summarize the findings of this study in Section-6.

3. The Model

Below we derive the necessary and sufficient conditions for U.S. welfare improvement following the US import tariff on Chinese products in 2017. We do so based on the work of Ohyama (1972) and Ju and Krishna (2003), as following.

<u>Necessary Condition</u>:

Suppose $E(P^i, u^j)$ is the expenditure function of U.S. representative consumer (which shows the minimum expenditure required to achieve j^{th} level of utility at i^{th} level of price), $C(P^i, u^j)$ is the compensated demand of U.S. representative consumer (which shows the U.S. demand at i^{th} price when utility is held constant at j^{th} level). The superscripts 2017 and 2018 represent the level of price or utility in 2017 and 2018, i.e. before and after the imposition of import tariff by the US on Chinese products respectively. Now, suppose the representative consumer minimizes his/her expenditure initially, so that the following equation will hold.

$$E (P^{2017}, u^{2017}) = P^{2017}{}'C (P^{2017}, u^{2017}) \qquad (1)$$

Where $E (P^{2017}, u^{2017})$ and $C (P^{2017}, u^{2017})$ are the expenditure and consumption bundle of the representative consumer respectively and $P^{2017}{}'$ is the price vector prevailed before the imposition of the import tariff. Adding and subtracting $P^{2017}{}'C (P^{2018}, u^{2018})$ from equation (1) yields,

$$E (P^{2017}, u^{2017}) = P^{2017}{}'C (P^{2017}, u^{2017}) + P^{2017}{}'C (P^{2018}, u^{2018}) - P^{2017}{}'C (P^{2018}, u^{2018}) \qquad (2)$$

Equation (2) can be reorganized as following:

$$E\ (P^{2017}, u^{2017}) = P^{2017\prime}[C\ (P^{2017}, u^{2017}) - C\ (P^{2018}, u^{2018})] + P^{2017\prime}C\ (P^{2018}, u^{2018}) \qquad (3)$$

Since the expenditure function shows the minimum expenditure required to attain a given level of utility at a given price level, the following must be true.

$$P^{2017\prime}C\ (P^{2018}, u^{2018}) \geq E\ (P^{2018}, u^{2018}) \qquad (4)$$

Where $E\ (P^{2018}, u^{2018})$ is the minimum expenditure required to attain a new utility level at a new price level prevailed after the imposition of import tariff. From (3) and (4), we have

$$E\ (P^{2017}, u^{2017}) \geq P^{2017\prime}[C\ (P^{2017}, u^{2017}) - C\ (P^{2018}, u^{2018})] + E\ (P^{2018}, u^{2018}) \qquad (5)$$

For $E\ (P^{2018}, u^{2018})$ to be greater than $E\ (P^{2017}, u^{2017})$ or equivalently, for U.S. welfare to rise after the imposition of import tariff, the following has to be true.

$$P^{2017\prime}[C\ (P^{2017}, u^{2017}) - C\ (P^{2018}, u^{2018})] < 0 \qquad (6)$$

Inequality (6) means, for U.S. welfare to rise after the import tariff, the pre-tariff consumption bundle must not be affordable at post-tariff prices. Now, suppose that $X\ (P^i, V^j)$ is the U.S. domestic supply at i^{th} price and with j^{th} factor endowment and that the superscript 2017 and 2018 indicate the price and factor endowment levels before and after the import tariff respectively.

As (6) is a necessary condition, for $P^{2017\prime}[X\ (P^{2017}, V^{2017}) - X\ (P^{2018}, V^{2018})] > 0$, the following is also a necessary condition:

$$P^{2017\prime}[C\ (P^{2017}, u^{2017}) - C\ (P^{2018}, u^{2018})] - P^{2017\prime}[X\ (P^{2017}, V^{2017}) - X\ (P^{2018}, V^{2018})] < 0 \quad (7)$$

The necessary condition in (7) can be rewritten as

$$P^{2017\prime}[M\ (P^{2017}, u^{2017}, V^{2017}) - M\ (P^{2018}, u^{2018}, V^{2018}) < 0 \qquad (8)$$

This condition means that, for U.S. welfare to increase after import tariff, the value of post-tariff U.S. import evaluated at pre-tariff prices must be higher than its pre-tariff value. After simplifying (8), the necessary condition can be rewritten as following:

$$P^{2017\prime}M^{2017} - P^{2017\prime}M^{2018} < 0 \qquad (9)$$

where M^{2017} and M^{2018} are the values of U.S. imports before and after the import tariff both evaluated at pre-tariff price.

Sufficient Condition:

Following the same line of reasoning as (1) through (5), the sufficient condition can be derived as following:

$$P^{2018\prime}[C\ (P^{2018}, u^{2018}) - C\ (P^{2017}, u^{2017})] > 0 \qquad (10)$$

This condition means the consumption bundle chosen by the representative consumer before the import tariff must be affordable at post-tariff prices. Since (10) is a sufficient condition, for $P^{2018'}[X (P^{2018}, V^{2018}) - X (P^{2017}, V^{2017})] > 0$, the following is also a sufficient condition:

$$P^{2018'}[C (P^{2018}, u^{2018}) - C (P^{2017}, u^{2017})] - P^{2018'}[X (P^{2018}, V^{2018}) - X (P^{2017}, V^{2017})] > 0 \quad (11)$$

Where, X stands for export and V stands for volume. The sufficient condition in (11) can be rewritten as

$$P^{2018'}[M (P^{2018}, u^{2018}, V^{2018}) - M (P^{2017}, u^{2017}, V^{2017}) > 0 \quad\quad\quad\quad\quad\quad (12)$$

By simplifying (12), the sufficient condition can be rewritten as following:

$$P^{2018'}M^{2018} - P^{2018'}M^{2017} > 0 \quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad\quad (13)$$

So, the sufficient condition implies that the increase in the value of US import must be greater than the increase in the value of U.S. exports after the imposition of import tariff by the US on Chinese products when all values are evaluated at post-tariff prices.

4. The Data

Data on U.S. import from China US export to China have been collected from "Economic Report of the President, 2021" and that on US import and export price indices from the annual series of "International Financial Statistics" published by IMF (International Monetary Fund). The data on all the variables in the model are annual and cover the years 2017 and 2018.

5. Empirical Analysis

We choose year 2018 as the post-tariff year and 2017 as the pre-tariff year to evaluate the values of U.S. imports and exports to apply the necessary and the sufficient conditions. The rationale for choosing year 2018 as the post-tariff year is because the first batch of import tariffs by the US on Chinese products was imposed in 2018.

We evaluate the values of U.S. import/export at pre-tariff (2017) and post-tariff (2018) prices as following:

X_1 = Value of US export to China in 2017 @ 2017 prices = US export to China in 2017 x 100 / Export price index in 2017

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X_2 = Value of US export to China in 2018 @ 2017 prices = US export to China in 2018 x 100 / Export price index in 2017

X_3 = Value of US export to China in 2017 @ 2018 prices = US export to China in 2017 x 100 / Export price index in 2018

X_4 = Value of US export to China in 2018 @ 2018 prices = US export to China in 2018 x 100 / Export price index in 2018

M_1 = Value of US import from China in 2017 @ 2017 prices = US import from China in 2017 x 100 / Import price index in 2017

M_2 = Value of US import from China in 2018 @ 2017 prices = US import from China in 2018 x 100 / Import price index in 2017

M_3 = Value of US import from China in 2017 @ 2018 prices = US import from China in 2017 x 100 / Import price index in 2018

M_4 = Value of US import from China in 2018 @ 2018 prices = US import from China in 2018 x 100 / Import price index in 2018

Necessary Condition (inequality (9)):

Left Hand Side = $M_2 - M_1$ = 30.07 - 28.09 = 1.98

Right Hand Side = $X_2 - X_1$ = 25.10 - 23.62 = 1.48

Sufficient Condition (inequality (13)):

Left Hand Side = $M_4 - M_3$ = 29.53 – 27.59 = 1.94

Right Hand Side = $X_4 - X_3$ = 24.27 – 22.83 = 1.44

Since the increase in the value of import is greater than the increase in the value of export when both import and export are evaluated at pre-tariff (2017) prices (i.e. $M_2 - M_1 > X_2 - X_1$) and the increase in the value of import is greater than the increase in the value of export when both import and export are evaluated at post-tariff (2018) prices (i.e. $M_4 - M_3 > X_4 - X_3$), the data meets both the necessary and the sufficient conditions for welfare improvement following the imposition of import tariff by the US on Chinese products. Therefore, US welfare has not reduced due to the import tariff rather has enhanced.

5. Summary and Conclusion

We apply the necessary and sufficient conditions for welfare improvement following a trade policy developed by Ju and Krishna using ex-post approach to examine the impact on US welfare of the imposition of tariffs by the US on Chinese products in 2018. Our necessary condition requires that the increase in the value of import from China be greater than the increase in the value of export to China when both import and export be evaluated at pre-tariff (2017) prices between 2017 (before the imposition of import tariff) and 2018 (after the imposition of import tariff. Similarly, the sufficient condition requires that, within the same period (2017 to 2018), increase in the values of U.S. imports from China be greater than the increase in the value of U.S. export to China when both import and export are evaluated at post-tariff prices. We found that the data meets both the necessary and the sufficient conditions. Therefore, we conclude that US imposition of tariff on imports from China has not compromised US welfare, rather it has enhanced it.

This study has certain limitations, such as it only examines a bilateral trade rather than evaluating the welfare impact of US import tariff on goods coming from all trading partners, which could have produced a different result. Also, use of other methodology could have produced a different result.

The major policy implication of this study is that import tariff on selective trading partners may be welfare enhancing rather than welfare compromising.

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