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Effect of Import Tariff on U.S. Welfare

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Abstract

Last year, the Trump administration imposed import tariffs of 10 and 25 percent on the import of steel and aluminium respectively. The administration also imposed an additional tariff on more than $200 billion worth of imports from China. In this study, we examine the welfare impact of such tariffs on the U.S. welfare in general. We apply Ju and Krishna's (2003) sufficient condition for trade reform to be welfare enhancing and test the condition using an import function. The sufficient condition for a trade policy (i.e. the import tariff) to be welfare improving as laid out by them requires that the value of import be higher than that before tariffs when the value of import before and after both are evaluated at post-tariff prices. Based on this condition, we develop an import function, in which the value of U.S. import (IM_t) is a function of import price index (IPI_t) and U.S. real GDP ($URGDP_t$). If the coefficient associated with IPI turns out to be positive and significant, then we conclude that the rise in import price including that due to the import tariff, will increase the value of import satisfying the sufficient condition for welfare improvement, which leads us to conclude that the import tariff has improved U.S. welfare.

We estimated our model using Vector Error Correction technique. In the long run equation, the coefficient associated with the variable $\boldsymbol{IPI_{t-1}}$ is found to be negative and significant at 5% significance level, implying that an increase in import price caused by a tariff will lower the value of import in the long run. In the short-run equation, on the other hand, the coefficients associated with the variables ΔIPI_{t-1} and ΔIPI_{t-2} both turned out to be positive but insignificant, which implies that any tariff-raised increase in import price will have no effect on the value of import in the short run failing to satisfy the sufficient condition. Therefore, we conclude that the import tariff currently imposed by the United States may not improve U.S. welfare and may rather worsen it in the long run.

Keywords: **sufficient condition for welfare improvement, import function, import price index, real GDP, vector error correction, short-run equation, long-run equation**

JET CLASSIFICATION: F13

INTRODUCTION

While in developing countries the main objective of the import tariff is to collect revenue to finance government spending, in developed countries it is mainly used to protect domestic firms from foreign competition and to lower trade deficits with their trade partners. An import tariff, however, has a varying effect on different segments of the population in importing nation. On one hand, an import tariff raises the domestic price of importable encouraging the domestic producers to increase production, raise the nation's income, generates tariff and income tax revenues to the government, raises the income of the supplier of inputs to import-substituting industries, and raises the producer surplus. These are the benefits of import tariff. But, on the other hand, an import tariff raises the price of importable for domestic customers, thereby lowering the consumers' surplus (welfare), which is a cost to the nation. So, a country as a whole only benefit from an import tariff, in other words, a country's welfare only improves following the institution of an import tariff, if its benefits outweigh its costs.

Last year, the Trump administration imposed import tariffs of 10 and 25 percent on the import of steel and aluminium respectively. The administration also imposed an additional tariff on more than $200 billion worth of

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imports from China. In this study, we examine the welfare impact of such tariffs on the U.S. welfare in general.

The studies carried out, so far, on the impact of an import tariff fall into one of the four categories. The first category includes theoretical analyses on the impact on a nation's welfare of lowering or eliminating of an import tariff. For example, Ju and Krishna (1996, 2000, 2003) have derived sufficient condition for an import tariff reform on a nation's welfare based on various conditions, such as, whether the reform is on a piecemeal basis, whether the rules of origin have been imposed on trade, or whether the value of import is evaluated at pre- or post-reform price. The second category includes empirical analyses on whether or not a tariff led or a deliberate change in exchange rate produces a J-curve effect on the nation's trade balance. Some of the studies in this category are include those by Gupta, et al (1999) on Japan, Wilson (2001) on Singapore, Narayan (2004) on New Zealand, Bahmani-Oskooee and Kutan (2009) on Bulgaria, Croatia, and Russia, Bahmani-Oskooee and Harvey (2009) on Malaysia, Shahbaz, et al (2012) on Pakistan, Dollery (2013) on Malaysia, and Wijeweer Kyophilavong, et al (2013) on Laos, Adhikari (2018(1)) on Brazil, and Adhikari (2018(2)) on China. The third category includes those that empirically evaluate the welfare impact of trade reform, that is, removing or lowering of existing import tariff. For examples, Adhikari (2003, 2009-1, 2009-2, & 2009-3). These studies examine whether lowering or removing of import tariff affects the importing country's welfare. Then there is a fourth category of studies that empirically examine the impact of import tariff on a nation's welfare. For example, Felbermay et al (2006) characterizes analytically the optimal tariff of a large one-sector economy with monopolistic competition and firm heterogeneity in general equilibrium and concludes that the optimal tariff internalizes a mark-up distortion, an entry distortion, and a terms-of-trade externality. Naito (2015) examines growth, revenue, and welfare effects of tariff and tax reform with a two-good, two-factor endogenous growth model and concludes that trade liberalization raises (or lowers) the growth rate if and only if the import sector is more effective-labor-intensive (or capital-intensive). Felbermay et al (2015) explore the qualitative and quantitative distinction between tariffs and iceberg trade costs and finds that the quantitative welfare consequences of cost-versus demand-shifting tariffs can be important. Irwin (2010) calculates a trade restrictiveness index, i.e., the uniform tariff that yields the same welfare loss as an existing tariff structure for nearly a century of US data and concludes that the static deadweight loss from US tariffs is about 1 percent of GDP and 40 cents for every dollar of revenue. Naito and Abe (2008) examine the welfare and revenue effects of tariff and tax reform in a country importing final and intermediate goods, both produced under imperfect competition. Based on their results they specify the condition under which each reform strategy raises welfare without decreasing government revenue. We apply Ju and Krishna's (2003) sufficient condition for trade reform to be welfare enhancing and test the condition using an import function, which to our knowledge has never been done before. We will present the model in Section 2, outline data sources in section 3, detail the methodology and empirical findings in section 4, and finally summarize the study in section 5.

The Model

Our empirical model is built on that of Ju and Krishna's. They derive the following sufficient condition for a trade reform to be welfare improving.

$$P^1 [M(P^1, T^1) - M(P^0, T^0)] > 0, \quad (1)$$

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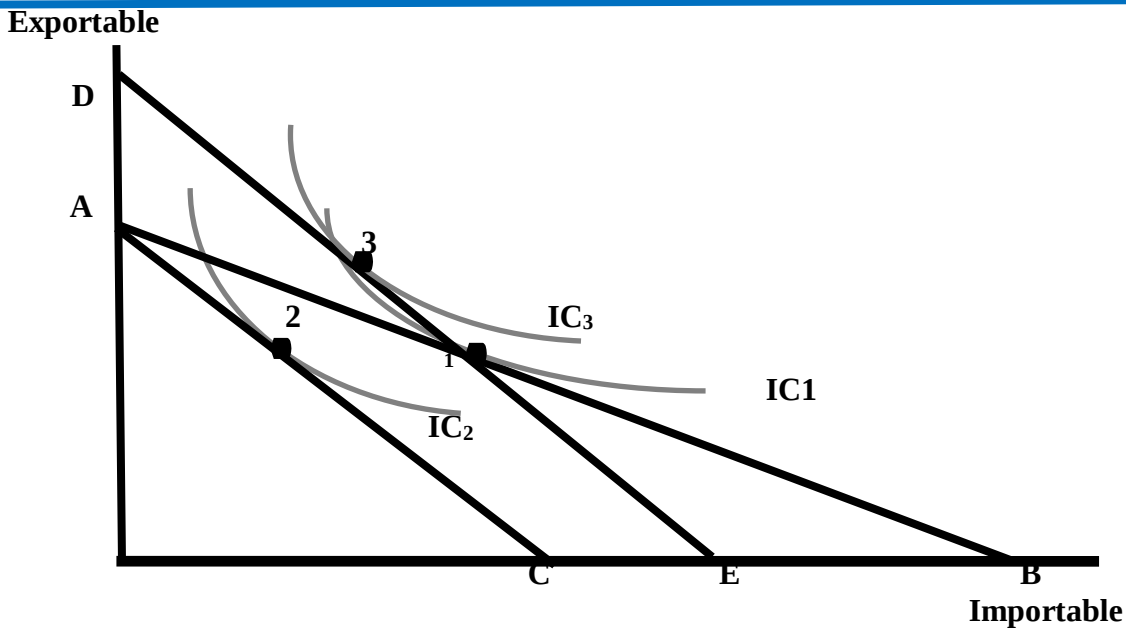

where P1and T1 are the vectors of import prices and tariff rates after an import tariff is imposed or raised and P0 and T0 are the vectors of import prices and tariff rates before the import tariff is imposed or raised. Similarly, M (P1, T1) and M (P0, T0) are the vectors of import bundles after and before the change in import tariff respectively.

The condition in equation (1), thus, requires that the old import bundle be affordable at post-tariff prices, which is a sufficient condition for a new tariff policy to result in a potential Pareto (welfare) improvement. The sufficient condition shown in equation (1) can also be explained by the above diagram. Suppose, the relative price before a tariff is imposed is AB and the national consumer in the importing country chooses bundle-1 on the indifference curve, IC1. Now, suppose that a tariff is imposed on the importable making it more expensive now shifting the relative price to AC position and forcing the national consumer to choose bundle-2 on a lower indifference curve, IC2. Also, suppose that the national consumer now is subsidized in a way that the old bundle, bundle-1, becomes affordable at the tariff included relative price of DE. If the national consumer now chooses bundle-3, which is at the higher indifference curve, IC3, then clearly the national consumer becomes better off and realizes a Pareto improvement following the imposition of import tariff. Thus the sufficient condition for an import tariff to ensure Pareto (welfare) improvement is that the value of import after the imposition of an import tariff be higher than that before the tariff when the value of import before and after both are evaluated at post-tariff prices. Based on this condition we develop the following empirical model.

The Empirical Model

Let Y_1 and Y_o be the vectors of the values of U.S. import after and before the imposition of import tariff respectively evaluated at post-tariff prices. Then the welfare improving condition (1) implies the following:

$$\mathbf{Y_1 - Y_o > 0} \qquad (2)$$

That means, if the mean value of U.S. import after the imposition of the import tariff is greater than that before tariff when both values are evaluated at post-tariff prices, then the U.S. welfare has improved.The satisfaction of this condition is guaranteed if the price elasticity of the value of import is positive, which in turn is guaranteed if, in the regression of the value of import on the import price, the coefficient associated with the import price is positive and significant. To see if this condition is satisfied in case of U.S. import we lay out the following empirical model:

$$IM_t = a_0 + a_1 IPI_t + a_2 URGDP_t + \varepsilon_t \qquad (3)$$

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where, IM_t = value of U.S. import in the $\mathbf{t}_{th}$ year,
IPI_t = import price index computed as the U.S. import value index over U.S. import volume index in the $\mathbf{t}_{th}$ year,
$URGDP_t$ = U.S. real GDP in the $\mathbf{t}_{th}$ year, and
ε_t = a white-noise disturbance.

If the coefficient associated with the import price index (IPI), a1, is positive and significant the price elasticity of import will be positive implying that an increase in import price caused by an import tariff will raise the value of import and will, thus, satisfy the sufficient condition for Pareto (welfare) improvement. But if it turns out to be negative the result fails to satisfy the welfare improvement condition. As for the coefficient associated with the variable URGDP, a2, it is expected to be positive, because the increase in real GDP tends to raise demand for goods and services including those produced in foreign countries thereby raising the value of the nation's import.

DATA

Data on U.S. import, import value index, and import volume index have been obtained from the World Development Indicators, 2017. The data in our study range from 1992 to 2016.

METHODOLOGY AND EMPIRICAL FINDINGS

But a major problem dealing with two or more-time series is that if two-time series have the same time path, they may exhibit a spurious correlation even though they may not be correlated, which may lead an investigator to draw a wrong conclusion. Therefore, our objective here is to investigate if any long-term relationship exists at all among our model variables by applying the co-integration test. But this test requires that all model variables be integrated of the same order. Therefore, we first applied the augmented Dickey-Fuller test on all model variables, which produced the following results.

Variable	t-statistic	Critical Value at 5%	Stationary?
IM	-1.20038 <	-2.99188	No
ΔIM	-4.46653 >	-2.99806	Yes
IPI	-1.15209 <	-2.99188	No
ΔIPI	-4.16085 >	-2.99806	Yes
URGDP	-1.31057 <	-2.99188	No
ΔURGDP	-3.07673 >	-2.99806	Yes

The above test results show that all model variables are non-stationary at their levels but stationary in their first differenced values, which implies that all model variables are integrated of order on. Based on this finding we conducted the Johansen (1990) cointegration test. But since the cointegration test is sensitive to leg length, we first conducted the lag selection test with the following test results.

Lag Selection						
Lag	**Log L**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-1375.64	NA	2.33E+48	119.8814	120.0295	119.9186
1	-1286.26	147.6606*	2.17E+45	112.8924	113.4848*	113.0414
2	-1275.08	15.56297	1.88e+45*	112.7023*	113.7391	112.9631*
* indicates lag order selected by the criterion						

Since a majority of criteria selected a lag length of 2, we conducted the Johansen cointegration test with the selected lag length that produced the following results:

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Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.676917	33.78101	29.79707	0.0165
At most 1	0.304399	8.924422	15.49471	0.3724
At most 2	0.041779	0.938887	3.841466	0.3326
Trace test indicates 1 cointegration eqn(s) at the 0.05 level				

The trace statistics of **33.78101** against the hypothesis of no cointegrating vector is greater than the 5% critical value of **29.79707**, which rejects the null hypothesis of no cointegration.

Unrestricted Cointegration Rank Test (Maximum Eigenvalue)				
Hypothesized		Max-Eigen	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None *	0.676917	24.85658	21.13162	0.0142
At most 1	0.304399	7.985535	14.2646	0.3802
At most 2	0.041779	0.938887	3.841466	0.3326
Max-eigenvalue test indicates 1 cointegrating eqn(s) at the 0.05 level				

The maximum-eigenvalue test also confirms the existence of at least one cointegrating vector, as the Max-Eigen statistic of **24.85658**, against the hypothesis of no cointegration, is higher than its 5% critical value of **21.13162**. In fact, both tests show that there exists 1 cointegrating vector at 5% significance level. These findings allow us to estimate the vector error correction model (VECM). So, we estimated both the long-run and the short-run equations applying the vector error correction method. The estimation produced the following results:

Long-Run Equation:

$$\mathrm{IM}_{t-1} = -1.72E^{12} - 8.92E^{8}\mathrm{IPI}_{t-1} + 0.28166\mathrm{URGDP}_{t-1} \quad (4)$$

t-value = (-2.26551) (98.7733)

Short-Run Equation:

$$\Delta\mathrm{IM}_t = -3.65E^{10} + 0.60534\Delta\mathrm{IM}_{t-1} + 0.327786\Delta\mathrm{IM}_{t-2} + 9.53E^{8}\Delta\mathrm{IPI}_{t-1} + 5.07E^{9}\Delta\mathrm{IPI}_{t-2} + 0.198554\Delta\mathrm{URGDP}_{t-1} - 0.09839\Delta\mathrm{URGDP}_{t-2} - 2.57586\mathrm{ECT}_{t-1} \quad (5)$$

(-0.45887) (0.75647) (0.61718) (-0.84210)
(1.13869) (0.49689) (-0.29592) (-2.95303)

The corresponding t-values are given in the parentheses. In the long run equation, the coefficient associated with the variable $\mathbf{IPI_{t-1}}$ is negative and significant at 5% significance level, implying that an increase in import price including the one caused by a tariff will lower the value of import in the long run. This result fails to satisfy the sufficient condition for the U.S. import tariff to be welfare enhancing for the country. In the short-run equation, on the other hand, the coefficients associated with the variables $\Delta\mathrm{IPI}_{t-1}$ and $\Delta\mathrm{IPI}_{t-2}$ both are positive but insignificant, which implies that any increase in import price will have no effect on the value of import. The short-run result also fails to satisfy the sufficient condition for welfare improvement. Thus, the results suggest that the import tariff imposed by the United States on the import of steel and aluminium in particular and on its import in general may not improve U.S. welfare and may rather worsen it.

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SUMMARY AND CONCLUSIONS

While developed countries mostly use import tariff as a tool to protect domestic industries from foreign competition and to lower trade deficits with their trade partners, a majority of developing countries uses it as one of the revenue sources to finance government spending. Whatever be the objective, an import tariff, however, has a varying effect on different segments of the people in importing nation. One of the effects of an import tariff is it raises the domestic price of importable encouraging the domestic producers to increase their production, which in turn, raises the nation's income and tariff and income tax revenues to the government, yields a larger producer surplus to the domestic producers and sellers of importable products, and raises the income of input suppliers of import-substituting industries, which is considered as a benefit to the nation. But an import tariff also produces negative effects, because an import tariff raises the price of importable for domestic customers, thereby lowering the consumers' surplus (welfare). If the loss in consumer surplus is less than the benefit, then the nation will be better off after the import tariff is imposed, otherwise, it will worsen the nation's welfare.

Last year, the Trump administration imposed import tariffs of 10 and 25 percent on the import of steel and aluminum respectively. The administration also imposed an additional tariff on more than $200 billion worth of imports from China. In this study, we have examined the welfare impact of such tariffs on the U.S. welfare in general.

We apply Ju and Krishna's (2003) sufficient condition for trade reform to be welfare enhancing and test the condition using an import function, which to our knowledge has never been done before. The sufficient condition for trade policy to be welfare improving as laid out by them requires that the value of import after the policy be higher than that before the policy when the value of import before and after both are evaluated at post-tariff prices. Based on this condition we develop an import function, in which the value of U.S. import (IMt) is a function of an import price index (IPIt) and U.S. real GDP (URGDPt). If the coefficient associated with IPI turns out to be positive and significant, then we conclude that the rise in import price including that due to the import tariff will increase the value of import satisfying the sufficient condition for welfare improvement, which leads us to conclude that the import tariff has improved U.S. welfare.

We estimated our model using the Vector Error Correction technique. In the long run equation, the coefficient associated with the variable 〖IPI〗_(t-1) has been found to be negative and significant at 5% significance level, implying that an increase in import price caused by a tariff or otherwise will lower the value of import in the long run. This result fails to satisfy the sufficient condition for the import tariff imposed by the U.S. to be welfare enhancing for the country in the long run. In the short-run equation, on the other hand, the coefficients associated with the variables 〖ΔIPI〗_(t-1) and 〖ΔIPI〗_(t-2) both are positive but insignificant, which implies that any tariff-raised or otherwise increase in import price will have no effect on the value of import in the short run failing to satisfy the sufficient condition. Therefore, we conclude that the import tariff currently imposed by the United States on the import of steel and aluminum in particular and on its import, in general, may not improve U.S. welfare, and may rather worsen it.

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