Does an Import Tariff Negatively Affect Economic Growth?

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An import tariff raises the price of imports causing a rise in producer surplus and a fall in consumer surplus on importable products inducing their domestic producers to increase production, which then raises the demand for the factor used intensively and lowers that for the factors used less intensively in their production. Also, according to the Stolper-Samuelson theorem, under the assumption of full-employment and constant capital-labor ratio, this leads to a rise in the real earnings of the factor used intensively and a fall in the real earnings of the factors used less intensively of the products. If the total of gains in producer surplus and earnings of the intensive factor is more than the loss in consumer surplus plus and earnings of less intensive factors, the nation experiences a net economic growth. We apply the VAR model on US data over the period 1990-2020 and finds an import tariff to have no impact on U.S. income and, therefore, on U.S. economic growth.

Keywords: general equilibrium model, ARDL model, unit root, cointegration, CUSUM test, Granger causality test

INTRODUCTION

An import tariff on an importable raises its domestic price raising the producer surplus and lowering the consumer surplus related to the product. On the other hand, the rise in the importable price raises the domestic producers' per-unit profit, encouraging them to increase the production. This rise in production raises the demand for the factor used intensively in its production and lowers the demand for the other factor under the assumption of full-employment and constant capital-labor ratio leading to a rise in the real earnings of the factor used intensively and lowering the real earnings of the other factor. If the gains in producer surplus and real earnings of the intensive factor are more than the loss in consumer surplus and in the earnings of the other factor, the nation experiences a net growth in income. Otherwise, the nation experiences either no growth or negative growth. This study attempts to see how U.S. import tariff affects the nation's income. We use import price index (IMPPI) as a proxy for import tariff as any imposition or increase in import tariff raises the import price index. Also, we use the real GDP as the measure of US income.

Several studies have examined the economic growth effect of an import tariff. For example, Asif et al (2022) examine how import tariffs, imports substitution and investment efficiency affect economic growth in Pakistan using the data throughout 1981-2017 and find the import tariffs to have a positive effect on the nation's economic growth.

Schularick and Solomou (2011) investigate the effect of import tariff on a nation's economic growth using data on several countries over the period 1870-1914 and find no evidence of positive relationship between import tariff and economic growth except for a few countries.

Another study by Yuri, et al (2014) on the impact of import tariff reduction on economic growth on Argentina, Brazil, Uruguay and Paraguay over the period 1991-2012 using a regression analysis shows that a one percentage point tariff reduction leads to a 1.04-1.25 percentage point economic expansion.

A similar study by Clemens and Williamson (2004) examines the impact of import tariff on economic growth of European area countries using the data for periods before and after 1950. Their findings point to the fact that while an increase in average tariff rates among trading partners by just one third might suffice to reverse any negative relationship between an average country's tariffs and its growth, an increase in own tariffs after 1950 hurt or at least didn't help growth.

Lee (2011) develops a two-country (home and foreign) and two-good (consumption and investment good), one factor (capital) and endogenous growth model with international knowledge spillover to study the relations between an import tariff and economic growth and welfare. His findings indicate that a higher import tariff on the consumption good may boost the economic growth rate when the foreign country has an absolute advantage in the investment good and may reduce the economic growth rate when the domestic country has an absolute advantage in the investment good.

A study by Kubwa, et al (2014) on the effect of trade liberalization – a reduction in import tariff on Tanzania's economic growth using the data over the period 1970-2010 and applying a simple OLS regression technique finds that trade openness had a positive effect on the nation's economic growth. However, the positive growth effect of trade liberalization was greater during the period of closed economy, i.e. 1970-1985.

Ali and Abdullah (2015) investigate the effect of trade openness on Pakistan's economic growth from 1980-2020. Their study found that while the short-run effect was positive, the long-run effect was negative.

Giang (2020) studies the role of tariff on economic growth of Vietnam. He uses the data for 1999-2017 and the ARDL model. He finds that tariff to positively affect Vietnam's economic growth both in the short-run and the long-run.

Palazzo (2022), using a panel data on several small market economies of developing nations, finds that tariff rather than free trade offer the most benefit in terms of economic growth.

Kawasaki (2018) using a CGE (computable general equilibrium) model of global trade incorporating a dynamic capital formation mechanism finds the hikes of import tariff by the United States on the import of steel and aluminum to hurt the US economy at the macro level although the tariffs could have protected the relevant US sectors.

Although there have been several studies on the impact of import tariff on a country's economic growth, but this study is unique and, therefore, makes a significant contribution to the literature in the field in many ways. First, we derive a model of import price index and real GDP from the general or goods market equilibrium conditions. Second, we show the logical/theoretical channel through which any change in import tariff affects a nation's economic growth (i.e. real GDP). Third, we conduct several tests to ensure that the model we use has no serial correlation or heteroskedasticity problem and is stable over time. Fourth, we verify our model's findings using other tests, such as the Granger causality test. Fifth, our study uses the recent US data.

The organization of this study is as following. The model for this study has been developed in section-2, the data sources have been described in section-3, estimation results of the model have been laid out in section-4, and the findings of this study have been summarized in section-5.

THE MODEL

We begin with a general equilibrium model in which income measured by GDP (i.e. Y) is equal to aggregate expenditure, which includes consumption expenditure (C), gross private domestic investment expenditure (i.e. I), government consumption expenditure and gross investment expenditure (i.e. G), and export (i.e. X) minus import (i.e. M) as shown in the following identity:

$$Y = C + I + G + X - M \tag{1}$$

If we divide both sides of equation-1 by the GDP deflator for the corresponding year and multiply by the GDP deflator for the base year, i.e. 100, equation-1 can be written as,

$$\frac{Y_t\ x\ 100}{GDP\ deflator_t} = \frac{C_t x\ 100}{GDP\ deflator_t} + \frac{I_t x\ 100}{GDP\ deflator_t} + \frac{G_t x\ 100}{GDP\ deflator_t} + \frac{X_t x\ 100}{GDP\ deflator_t} - \frac{M_t x\ 100}{GDP\ deflator_t} \tag{2}$$

where, subscript, t, stands for time period ranging from 1 to n. If we let the total of the mean effects of the first, second, third, and fourth variables on the right-hand side of equation-2 to be represented by a constant term, a, and total of their random effects by an error term, u, then equation-2 can be rewritten as,

$$\frac{Y_t\ x\ 100}{GDP\ deflator_t} = a - \frac{M_t x\ 100}{GDP\ deflator_t} + u \tag{3}$$

The term on the left-hand side of equation-3 is, in fact, the real GDP (denoted by RGDP in this study). Similarly, the second term on the right-hand side of the equation is, in fact, the import price index (denoted by IMPPI in this study). So, equation-3, in its stochastic form, can be rewritten as,

$$RGDP_t = a - IMPPI_t + u_t \tag{4}$$

The negative sign in front of the variable, IMPPI, indicates that a rise in import price index lowers the country's real GDP. Again, since imposing or raising an import tariff raises the import price index, IMPPI, is expected to hurt a country's real GDP.

DATA

We obtained the data on US real GDP (i.e. variable RGDP) from FRED: Economic Data: St. Louis Fed: Real Gross Domestic Product (RGDP): https://fred.stlouisfed.org/series/GDPC1#0 and that on US import price index (i.e. variable, IMPPI) from the Economic Report of the President: https://www.govinfo.gov/content/pkg/ERP-2022/pdf/ERP-2022.pdf. Our data covers the period from 1990 to 2020.

METHODOLOGY AND EMPIRICAL ANALYSIS

To examine how an import tariff affects US real GDP in the short run and in the long run, we first attempted to find if the two model variables, RGDP and IMPPI, are cointegrated. But for any set of variables to be cointegrated, they must be integrated of the same order. So, to examine the order of their integration, we conducted the augmented Dickey-Fuller test, which produced the following result.

TABLE 1
RESULTS FROM DICKEY-FULLER UNIT ROOT TEST

Variable	t-statistic	Critical Value at 5%	Stationary?
IMPPI	-0.820274	-2.963972	Non-stationary
d(IMPPI,1)	-4.322161	-2.967767	Stationary
RGDP	-0.119007	-2.960411	Non-stationary
d(RGDP,1)	-5.766710	-2.963972	Stationary

The above result indicates that both model variables are non-stationary at their level but stationary at their first difference, meaning both are integrated of order 1. This finding allows us to examine if the two variables are cointegrated. To that end, we attempt to conduct the Johansen cointegration test. However, this test is sensitive to lag length. Therefore, we conducted the lag structure test to determine the appropriate lag length for the Johansen cointegration test and obtained the following result.

TABLE 2
RESULTS FROM LAG STRUCTURE TEST

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-327.6871	NA	1.38e+08	24.42097	24.51696	24.44952
1	-247.8913	141.8522*	505270.3*	18.80676*	19.09472*	18.89239

The above lag structure test indicates that the appropriate lag length for the test is 1. As such, using the lag length of 1, we conducted the Johansen cointegration test, which produced the following result.

TABLE 3
RESULTS FROM JOHANSEN COINTEGRATION TEST

Unrestricted Cointegration Rank Test (Trace)				
Hypothesized		Trace	0.05	
No. of CE(s)	Eigenvalue	Statistic	Critical Value	Prob.**
None	0.186456	8.403884	15.49471	0.4233
At most 1	0.080048	2.419564	3.841465	0.1196

The two model variables are not integrated since none of the trace statistics in the above table is greater than their critical value at 5% significance level. As such a VECM (vector error correction model) cannot be used and the proper model in this case is VAR (vector autoregressive) model. So, based on the estimated VAR model, we lay out the estimated function as the following:

<u>VAR Equation</u>:

$$\mathrm{RGDP}_t = 726.565 + 1.292\mathrm{RGDP}_{t-1} - 0.309\mathrm{RGDP}_{t-2} - 23.484\mathrm{IMPPI}_{t-1} - 20.570\mathrm{IMPPI}_{t-2} \quad (3)$$

t-value = (1.11) (5.34) (-1.24) (-1.183) (1.041)

R-squared = 0.993195 Adj. R-squared = 0.992061 F-statistic = 875.6808 Prob.(F-statistic) 0.000000

Figures in parentheses are corresponding t-values of the estimated coefficients associated with the independent variables. Before using the estimated model to draw any conclusion, it is important to make sure that the results are not biased, and for that it is important that residuals of the model do not suffer from serial correlation and heteroskedasticity problem and that the model is stable over time. To that end, we conducted the serial correlation test and obtained the following results.

TABLE 4
RESULTS FROM SERIAL CORRELATION LM TEST

Breusch-Godfrey Serial Correlation LM Test:
Null hypothesis: No serial correlation at up to 2 lags

F-Statistic	3.668494	Prob. F (2,25)	0.0401
Obs*R-squared	7.033637	Prob. Chi-Square (2)	0.0294

Since the probability of Chi-Square (2) is greater than 0.05, the test indicates that the residual from this model does not have a serial correlation problem. Next we conducted the heteroskedasticity test, which produced the following results.

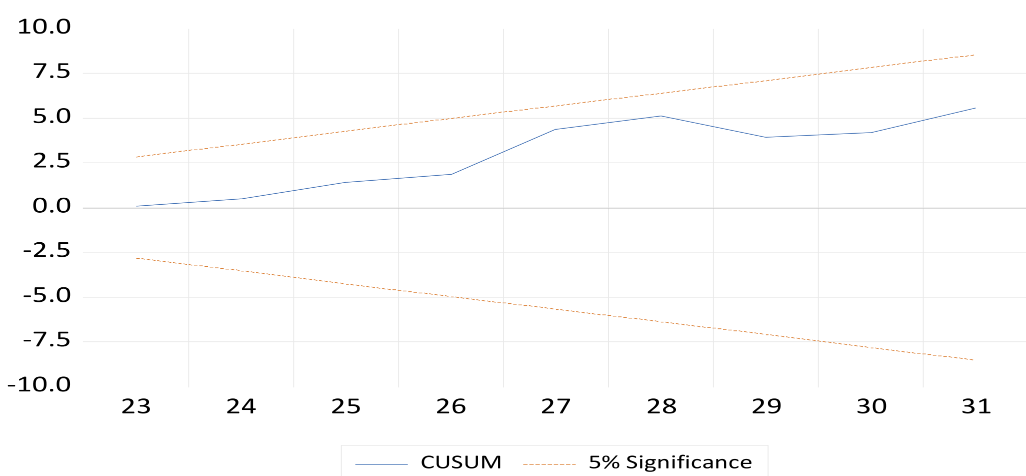
TABLE 5
RESULTS FROM HETEROSKEDASTICITY TEST

Heteroskedasticity Test: Breusch-Pagan-Godfrey
Null hypothesis: Heteroskedasticity

F-Statistic	1.457728	Prob. F (2,25)	0.2482
Obs*R-squared	4.321165	Prob. Chi-Square (2)	0.2288
Scaled explained SS	5.198056	Prob. Chi-Square (3)	0.1579

Since all the probabilities in the above table are greater than 0.05, the residual of this model does not have a heteroscadesticity problem either. Following this we conducted the Cusum stability test and obtained the following diagram.

FIGURE 1
RESULT FROM CUSUM TEST



Since the blue line in the above diagram is within the two red lines, the model is stable over time. As the model passes all the tests, the estimated model in equation-3 can be used to conclude. The value of R-squared and F-statistic reveals that the overall model is significant, but the t-values associated with the coefficients of the model reveal that the only independent variable that is significant is $RGDP_{t-1}$ and all other independent variables are insignificant. It means when one-period lagged value of real GDP is positive (negative) it has positive (negative) impact on the current period real GDP. On the other hand, the import price index (i.e. IMPPI) has no impact on the real GDP. Since the import price index also includes import tariff, it also means that raising or lowering import tariff will have no impact on the US real GDP. A Granger causality test was conducted to further verify this finding, which produced the following result.

TABLE 6
RESULTS FROM GRANGER CAUSALITY TESTS

Pairwise Granger Causality Tests
Date: 01/05/24 Time: 13:38
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob
IMPPI does not Granger Cause RGDP	29	0.70234	0.5053
RGDP does not Granger Cause IMPPI		1.68126	0.2073

Since the probability against the null hypothesis, "IMPPI does not Granger cause RGDP" is greater than 0.05, the null hypothesis is not rejected. It means, any change in import price index including that due to any change in import tariff, will have no impact on the real GDP. The possible explanation of this finding is that the gains in producer surplus and that in real earnings of the factor used intensively in the production of importable products resulting from the imposition or raising of import tariff is just enough to offset the loss in consumer surplus and that in the earnings of the other factor that is used less intensively in the production of importable products leading to an import tariff having no impact on the US real GDP.

SUMMARY AND CONCLUSION

When the government imposes a new tariff on the import of an importable or raises the rate of an existing one, it raises the domestic price of the product. This, in turn, raises producer surplus to domestic producers and lowers consumer surplus to domestic product consumers. On the other hand, the rise in the domestic price of the importable raises per-unit profit to its domestic producers, encouraging them to increase production. A rise in domestic production then raises the demand for the factor used intensively in its production and lowers the demand for the factors used less intensively in the production of the product under the assumption of full-employment and constant capital-labor ratio, which leads to a rise in the real earnings of the factor used intensively and a fall in the real earnings of the factors used less intensively. If the gains in producer surplus and that in real earnings of the intensive factor are more than the loss in consumer surplus and that in the earnings of less intensive factors, the nation experiences a net growth in income. Otherwise, the nation experiences either no growth or negative growth.

This study attempts to see how import tariff affects the US real GDP. We use import price index (IMPPI) as a proxy for import tariff, because imposing a new import tariff or raising the rate of an existing one raises the import price index. Also, we use the real GDP to measure US national income. The study applied the VAR (vector autoregressive) model on US data from 1990 to 2020 and confirms the findings from the VAR model by conducting the Granger causality test. The study finds that IMPPI has no positive or negative impact on RGDP. It means any change in import price index and by construction in import tariff will have no impact on US real GDP.

The major policy implication of the findings of this study is, that since an imposition of an import tariff has no impact on US real GDP an import tariff can be used selectively to protect domestic industry of importable products. However, there is a note of caution: the imposition of import tariff on a wider range of importable products may negatively impact the nation's economy (i.e., real GDP).

This study, however, has its limitations. Since the US only imposes import tariffs on selected products and on imports from selected countries, the findings of this study cannot be generalized to all importable products and all countries.

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