Do Free-Trade Agreements Really Work?

Antong (Andres G.) Victorio, email antong.victorio@vuw.ac.nz

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Abstract

A free-trade agreement is found to increase Thailand's agricultural imports from New Zealand, despite the short span of time for which the agreement has been operational. The finding is described by autoregressive estimates that correct for possible unit roots in the data. The agreement's effect upon imports is also estimated while considering an error-correction model of imports against gross domestic product.

I. Introduction

The removal of tariffs is supposed to increase the equilibrium quantity demanded and supplied of any commodity. In the area of trade, an important question is whether the removal results in an increase in the volume of trade. This paper presents some evidence in support of an increase in trade volume. The occasion was from a free trade (FTA) agreement between the countries of Thailand and New Zealand (NZ) signed on April 19, 2005. The agreement was to initially eliminate duties on about 79% of all Thai imports from NZ with further cuts to follow especially for sensitive items like beef, milk and other dairy products. Market entry for goods, services and investment was also supposed to be liberalized, and measures were also supposed to be introduced to enhance trade cooperation in areas such as government procurement, policy competition, customs processing, electronic commerce and intellectual property [1].

What was the effect of the FTA on trade? The FTA was found to have increased the total amount of trade between the two countries [2]-[3], focusing upon the agricultural portion of Thailand's imports. Also, the imports were increased

whenever the relative prices of domestic agricultural products increased, and the influence upon them was as expected for an increase in Thailand's gross domestic product (GDP).

The findings remained unchanged when lagged effects were considered and also when a short-run model of imports was considered in tandem with one for the long-run.

II. A Basic Model

The data for investigating the imports were quarterly observations for between the years of 2000 and 2007. The data included observations of variables that were also important to the imports, one of the variables being the relative prices of Thai agricultural products and the other being Thailand's GDP. Thus, the hypothesis that imports were increased was initially tested by a regression equation of the following form:

$$(1) \quad Qm = B_0 + B_1(GDP) + B_2(\mathrm{Pr}) + B_3(FTA) + u$$

In the equation, the dependent variable *Qm* was a variable for the total quantities of agricultural products imported quarterly from New Zealand, expressed in metric tons, based upon sectional data provided by Thailand's Information and Communication Technology Center, with the cooperation of the country's Customs Department.

GDP was a variable for Thailand's real gross domestic product, in thousand baht on a quarterly basis, also provided by the Bank of Thailand.

Pr was an independent variable for the prices of Thai agricultural products relative to NZ agricultural products, expressed in US dollars. This variable was derived by taking a weighted average of the prices of all Thai agricultural products and dividing that by a similar weighted average for all NZ agricultural products. Data on the prices were obtained from Thailand's Office of Agricultural Economics and Ministry of Agriculture and Cooperatives.

FTA was a dummy variable for capturing the introduction of the free trade agreement. The variable was set equal to zero for each of all the quarters preceding the July 2005 implementation of the agreement, and it was set equal to one beginning from the third quarter of year 2005.

u was a variable for the residual in the regression equation.

III. Some Empirical Findings

Initial estimates from using the method of ordinary-least-squares (OLS) showed that only relative prices, *Pr*, had a statistically-significant effect upon agricultural imports, *Qm*, at a level of five percent. Furthermore, the estimated coefficient for *FTA* was actually negative and, therefore, of the "wrong" sign. One reason was possibly a reverse-causality between imports and *GDP*, a problem of simultaneity that required for *GDP* to be instrumented by a variable that was exogenous to the model itself. Though not entirely ideal, the variable chosen for the instrumentation was the exchange rate between the Thai baht and the NZ dollar. This rate was provided by the Bank of Thailand, and it was expressed as a quarterly average in terms of number of Baht per NZ dollar.

TABLE I
SUMMARY STATISTICS AND INITIAL OLS ESTIMATES:
DEPENDENT VARIABLE IS QUARTERLY IMPORTS

Variable	Mean (1)	St. Deviation (2)	OLS Estimates* (3)
Quarterly imports, (Metric tons)	2.35e+07	5846646	
Independent variables:			
Gross domestic product , *GDP* (Thousand Baht)	894597.6	113857.5	7.200786 (0.56)
Relative price , *Pr* (US$ per baht)	16.73056	4.039438	594860.8 (2.13)
FTA	.3125	.4709291	2649754 (1.26)
Constant			6283043 (0.65)

[a]t-statistics in parenthesis.

When the observed values for *GDP* were replaced by the instrumented values, the estimated effect of *FTA* became positive, though not statistically-significant, as shown in column 3 of Table 1. The *FTA* was shown to increase quarterly imports by 2.6 million metric tons. A one-dollar increase in the relative price of Thai

agricultural products, Pr, increased quarterly imports by nearly six hundred thousand tons and this effect was statistically-significant.

Nonetheless, these findings were regarded with caution because of the time-series nature of the data. Completely independent time-series can exhibit strong regression results even if the variables they represent are theoretically-unrelated [4]. The presence of this potential problem - spuriousness - was investigated by subjecting each of the three variables of concern, imports, *GDP* and pr, to a unit root test of stationarity in the residuals of an auto-regression. A one-period lag was assumed for each auto-regression, these lags being *Qm(-1), GDP(-1)* and Pr(-1). Additional lags were considered unnecessary for lack of statistical influence.

The null hypothesis, of there being a unit root, was rejected for the auto-regression of imports but not rejected for the ones of *GDP* and Pr. For imports, the t-statistic for *Qm(-1)*was found to be 4.97 standard errors, in excess of the critical Dickey-Fuller [5] values of either 2.62, 2.98 or 3.71 standard errors for significance levels of ten, five or one percent, respectively. For *GDP*, the t-statistic was 1.09 standard errors, and for Pr, it was 2.46.

Because of the unit roots in *GDP* and in Pr, a secondary Dickey-Fuller test was conducted of the residuals of a regression of imports against *GDP* and Pr. Following Engle and Granger [6], the residuals of this regression are a linear combination of the three variables for which a unit root might still be rejected. A rejection of the null hypothesis would then have implied a co-integration that was favorable to OLS.

A unit root was rejected at a significance of ten percent for the residuals of a variety of regression specifications: one with just GDP and Pr as regressors and three additional others for successively including *Qm(-1), GDP(-1)* and Pr(-1). Unit roots were also rejected for augmented versions of the Dickey-Fuller test, ones that included the lag of the first difference of *Qm*.

These findings ensured that OLS could be suitably applied to an auto-regression of the following form:

$$(2)\quad Qm = B_0 + B_1(GDP) + B_2(\mathrm{Pr}) + B_3(FTA) + B_4(Qm(-1)) + B_5(GDP(-1)) + B6(\mathrm{Pr}(-1) + v$$

The estimates from this regression are shown in columns 1-3 of Table 2, with *GDP*(-1) and Pr(-1) initially omitted. The effect of the *FTA* upon imports was

increased to as much as 5.5 million tons (column 2). That of a one dollar increase in the relative price, Pr, was also increased to over eight hundred sixty thousand tons (column 2). Both effects were statistically-significant at a level of five percent. The positive effect of GDP was not significant but it was theoretically correct.

TABLE 2
AUTO-REGRESSION ESTIMATES FOR SELECTED LAG VARIABLES:
DEPENDENT VARIABLE IS QUARTERLY IMPORTS*

Independent Variables	(1)	(2)	(3)
Gross domestic product, *GDP* (Thousand Baht)	8.017362 (0.66)	54.95077 (1.58)	52.77709 (1.42)
Relative price, Pr (Baht per $NZ)	843978.4 (3.02)	867817.3 (3.16)	855332.3 (2.98)
FTA	4364880 (2.09)	5465224 (2.50)	5324111 (2.27)
Lagged quarterly imports, *Qm*(-1) (Metric tons)	-.4347 (-2.49)	-.3951387 (-2.28)	-.4076034 (-2.17)
Lagged gross domestic product, *GDP*(-1) (Thousand Baht)		-52.37818 (-1.43)	-51.21213 (-1.36)
Lagged relative price, Pr(-1) (Baht per $NZ)			67489.17 (0.19)
Constant	1.10e+07 (1.17)	1.39e+07 (1.47)	1.42e+07 (1.46)

[a]t-statistics in parenthesis.

IV. An Error Correction Model

Equation (2) is a partial adjustment model of imports. But it is devoid of long-run theory. In the short-run, imports do not have to be at their long-run equilibrium values. If they are at some disequilibrium, provision has to be made for how they might converge towards an equilibrium. The provision for some error correction process, through an error correction model (ECM), is derived as follows [7].

First, suppose that in the long-run, imports, *Qm*, are a constant fraction of *GDP*, the constant of proportionality being *K*:

(3) $Qm = K(GDP)$

From taking the logarithm of both sides of this equation, the logarithm of imports, denoted by the lowercase letters, *qm*, is therefore the sum of the logarithms *k* and *gdp*. For the long-run, assume the existence of some equilibrium values denoted as *qm**, *k** and *gdp**.

Second, following the findings in Table 1, suppose that in the short-run the logarithm of imports adapts to lagged values of itself and of *gdp* according to the following auto-regressive process:

(4) $qm = B_0 + B_1(gdp) + B_2(gdp(-1)) + B_3(qm(-1)) + w$

Then it can be shown that the short-run will be consistent with the long-run if in the long-run, $w = 0$, and also if the following condition holds:

(5) $(qm - qm(-1)) = B_0 + B_1(gdp - gdp(-1) + (B_1 + B_2)(gdp(-1) - qm(-1)) + w$

Equation (5) is an ECM of imports that can be estimated by a regression of differences, while treating as exogenous variables, the FTA and the logarithm of the relative price, denoted as *pr*. In this model, the error-correction difference for any short-run disequilibrium is *(gdp(-1) – qm(-1)).*

Estimates for the model are presented in Table 3. In columns 1-2 of this table, there is no change to the assumption that the FTA has a full effect immediately upon implementation: its designated values change from 0 to 1 beginning from the third quarter of year 2005. In column 3, this assumption is modified to allow for a gradual effect: its designated values only gradually become equal to 1, in the second quarter of year 2006, after being initially 0.25 in the third quarter of 2005, 0.50 in the fourth quarter of 2005, and 0.75 in the first quarter of 2006 [8].

In all of the columns, the error-correction coefficient, (B_1+B_2), is positive and statistically-significant. Any short-run disequilibrium in imports thus appears to be considered in the long-run. The FTA also continues to have a positive effect, this time upon differenced imports. The effect is significant in both columns 2 and 3. Likewise, of relative prices.

TABLE 3
ERROR-CORRECTION ESTIMATES: DEPENDENT VARIABLE IS THE FIRST DIFFERENCE OF IMPORTS*

Independent variables	(1)	(2)	(3)
gdp	-.0838556	-1.093661	-1.00971
	(-0.17)	(-2.21)	(-2.19)
(gdp– gdp(-1))	2.513249	2.763451	2.654204
	(1.44)	(1.91)	(1.94)
(gdp(-1)– qm(-1))	1.224587	1.365235	1.384724
	(6.45)	(8.40)	(8.69)
FTA	.1839209	.1739109	.2093566
	(1.63)	(1.86)	(2.22)
pr		.6067361	.5916158
		(3.57)	(3.57)
Constant	5.048205	17.65101	16.60535
	(0.75)	(2.67)	(2.70)

t-statistics in parenthesis. All variables are in logarithms.

V. Concluding Remarks

Thus it can be said that the FTA has increased the quantity of agricultural products imported by Thailand from New Zealand. The regression estimates were statistically significant when refinements were applied in order to correct for simultaneity and lagged effects. Aside from this were strong empirical results showing that higher relative prices for Thai agricultural products enticed more imports. The theoretical influence of GDP was supported in sign, though not in terms of statistical significance. Evidence was also found in support of the idea that any short-run disequilibrium is returned to a long-run equilibrium and furthermore, that the FTA significantly influenced the process of return.

All of the findings corroborated economic predictions concerning the effects upon trade of changes in commodity prices and of the dismantling of trade barriers. Nonetheless, they are tentative and more may be uncovered when the FTA shall have been in place for a longer duration of time.

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