

Beyond Gravity Model: Analysing impact of Preferential Trade Agreements

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1. Introduction

The world trade landscape saw a surge in Preferential Trade Agreements (PTAs) since the mid-nineties. In such agreements countries primarily liberalise trade in goods through exchange of preferential tariffs. Given their predominance in trade between nations the question naturally arises as to what is the exact impact of such PTAs on trade. Analysis of *ex-post* impact of PTAs is done mainly with help of the gravity model of trade (Aitken 1973, Frankel 1997, Feenstra 2004). The basic gravity model predicts bilateral trade flows based on the economic sizes (GDP, population) of two countries and the distance between them. In such a model a dummy variable is employed to find effect of the PTA on bilateral trade. This has been criticised in the literature as such a dummy variable cannot satisfy the strict exogeneity conditions required for Ordinary Least Square (OLS) regression (Lawrence 1998). Also the gravity equation uses total bilateral trade as the dependent variable. However, we know that all trade is not always covered under a PTA. There is often a “negative list” that gets no tariff preferences when traded bilaterally. Thus, a gravity model analysis which considers total bilateral trade may overestimate the effects of a PTA.

This paper uses an alternate panel dynamic model to find the impact of a PTA on trade more accurately. The panel methodology in itself adjusts for the endogeneity of a trade policy variable (Baier and Bergstrand 2005). Moreover in the panel setup constructed, individual commodities’ trade values are regressed on the tariff preferences such commodities enjoy under a PTA. This makes sure that impact of the PTA is reported only for items that get preferences.

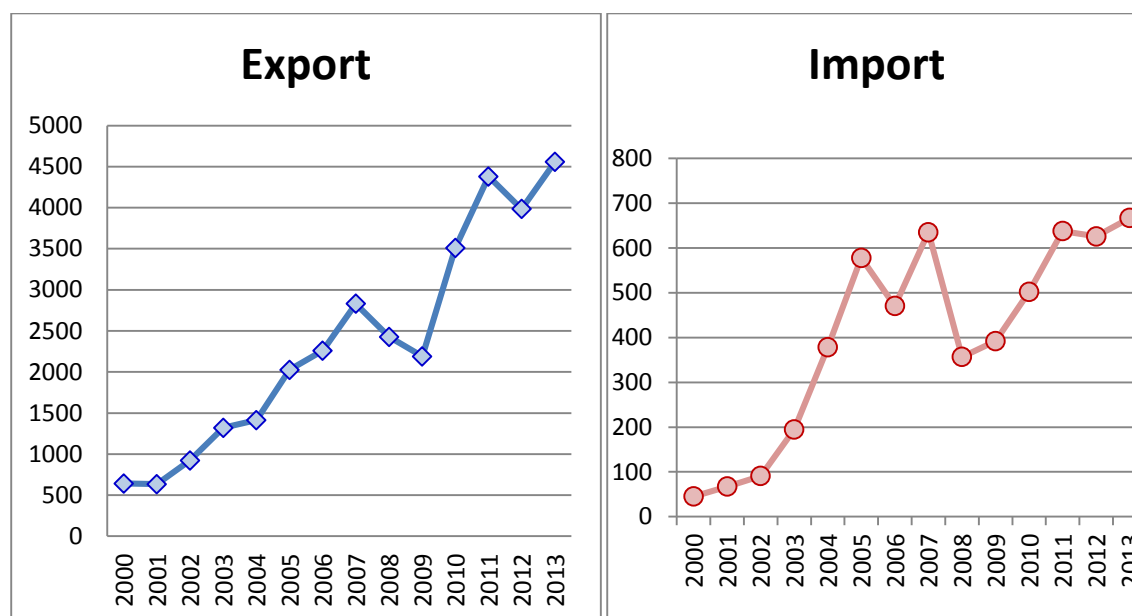
The India-Sri Lanka Free Trade Agreement (ISFTA) is analysed here using the proposed methodology. Among India’s many PTAs the ISFTA has been in force for more than a decade thereby having enough data points after the PTA came into effect to analyse its effects meaningfully.

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2. Bilateral trade trends post ISFTA

India and Sri Lanka signed the ISFTA in 1998. It came into operation in 2000. ISFTA was concluded mainly with a hope to boost bilateral trade between the two countries. Bilateral trade has seen a nearly ten-fold increase in the years since the ISFTA came into force; the total trade between India and Sri Lanka has increased from US\$ 500 million in 1999 to more than US\$ 5 billion in 2013. India's exports to Sri Lanka have risen nine times since the ISFTA came into force whereas imports saw a twenty fold jump. Figure 1 depicts the rise in India's exports and imports with Sri Lanka since 2000, when the ISFTA came into force.

Figure 1: India's trade with Sri Lanka since ISFTA (values in US\$ Million)

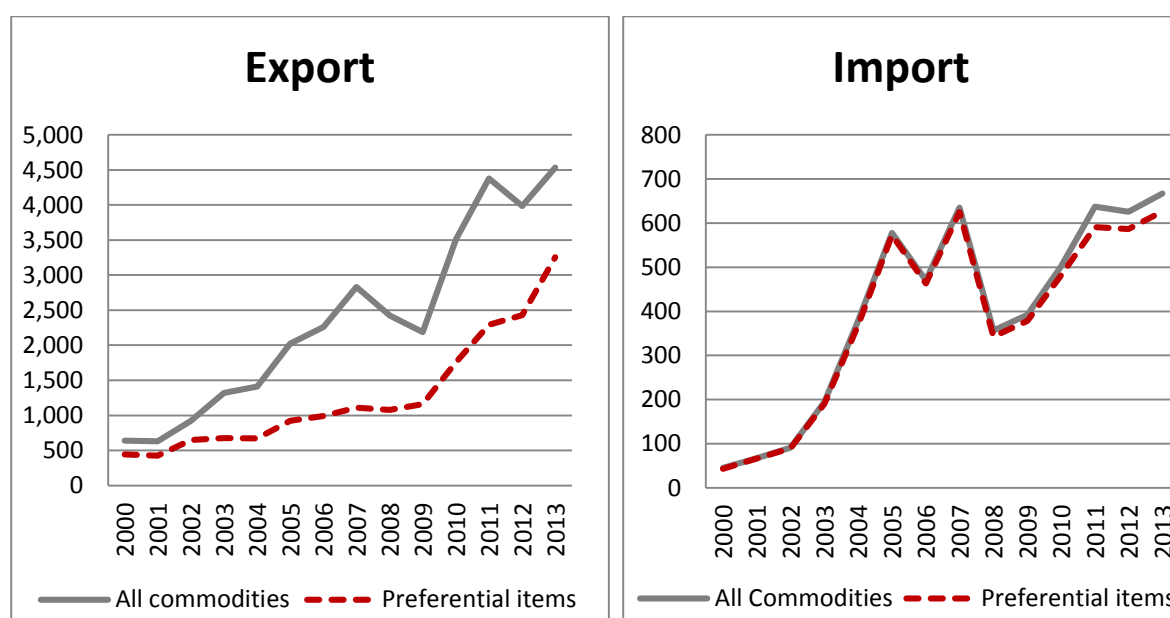


Source: Drawn from data available with Department of Commerce (India) website

From the figure we find that there was a downturn in the increasing trends in export during 2008 and 2009 on account of the global economic recession. Exports rebounded from 2010. The dip in 2012 was mainly on account of decline in exports of motor vehicles from India to Sri Lanka due to increase of excise and customs duties in Sri Lanka. Exports regained their momentum in 2013. Imports increased steadily from 2000-2005 and 2009-2013. During 2006-2008 there was some volatility in imports, again due to the global economic recession.

The question we need to ask is whether the increase in bilateral trade is truly because of ISFTA. To answer this question first we need to find if the increase in trade is because of an increase in trade of items that got preferences under ISFTA. To find this the value of preferential trade is compared with total trade. Official trade statistics do not provide data on preferential trade. So preferential exports and imports are calculated by deducting negative list items' trade values from total trade values at the HS 6 digit level (preferences are exchanged under ISFTA at HS 6 digit level). The comparison of preferential exports (/imports) with total exports (/imports) is shown in Figure 2.

Figure 2: India's trade with Sri Lanka (values in US\$ Million)



Source: Calculated from data available with Department of Commerce (India) website

The dotted lines in both the panels depict values of trade in items that are covered under the ISFTA i.e. these are the preferential items eligible to get preferences. They are not preferential trade *per se* as we do not know for sure if such items actually get tariff preferences. Rules of Origin and customs verification related transaction costs may result in eligible imports to pay the usual most favored nation (MFN) tariffs instead of the lower preferential tariffs. So the dotted lines depicted in the figure can be taken to be the upper boundary of preferential trade between India and Sri Lanka. It depicts the situation when all items eligible to get preferences enter each other's borders with tariff preferences.

The first thing to note from the graph is that there has been an increase in the values of both preferential export and import items (dotted lines) after ISFTA came into effect. We can also see clearly that preferential items' imports into India from Sri Lanka explain majority of the increase in total imports. However, India's exports to Sri Lanka in preferential items, even though increasing, do not explain total exports. In fact since the ISFTA came into force, on an average, preferential export items explained only 55 per cent of total exports; the corresponding figure for imports has been 97 per cent. So, even though ISFTA may have played a part in rising exports, there are clearly other factors that contribute to the increasing trend in exports to the island nation as 45 per cent of exports, on an average, are items that get no preferences under ISFTA.

The increase in imports from Sri Lanka in preferential items can be due to the ISFTA. We cannot say this with certainty as apart from reduced customs duty there can be other factors like increasing import demand that is driving imports from Sri Lanka to India. Therefore to understand the exact impact of ISFTA in the increasing imports we construct a model. A new methodology is proposed, in place of the usual gravity model, the reasons for which were already explained in the introduction.

3. Impact of ISFTA on trade: A panel data analysis

The methodology developed here is simple. In a panel setup import values of items getting preferences under a PTA are regressed on the tariff preferences such items are eligible to get. The regression specification is given in Equation 1.

$$M_{it}^{PTA} = \alpha_i + \beta_1 TP_{it} + u_{it} \quad \dots (1)$$

Values of preferential import items from a PTA partner country is the dependent variable here (M_{it}^{PTA}). We regress the import values on the tariff preference margins (TP_{it}). u_{it} is the usual error term.

Tariff preferences under a PTA are expected to result in a product being imported more from a partner country. Thus we expect a positive relation between the two. A product can also be imported more from a partner if import demand for that particular product has gone up, or if there are favourable changes in government policies in importing it, apart from tariffs. In our model we use product-specific fixed effects to capture non-PTA effects on imports (the term α_i in equation 1). In a panel dataset fixed effects models are used to capture the unobserved heterogeneity (Wooldridge 2000). Under a fixed effects model common slopes are assumed for all cross-sections (products in our model) but intercepts are allowed to be cross-section specific.

We consider top twenty preferential import items ($i = 1$ to 20) from Sri Lanka at the HS 6-digit level and see their import value from a decade before the ISFTA to a decade after i.e. from 1990-91 to 2009-10 ($t = 1$ to 20). We use only the top twenty preferential import items from Sri Lanka as on an average these products together have a trade value of more than US\$ 200 million annually after ISFTA came into effect. These products also explained about 73 per cent of preferential imports from Sri Lanka in 2007, a year before the global slowdown and declining trade values.

The top twenty products are calculated by averaging their values, over the first ten years for which the ISFTA has been in force. As trade values at such disaggregated levels fluctuate a lot from year to year we resort to averaging the data to see which items were imported most in the first decade after the ISFTA came to effect. The products, along with their tariff preference margin (Margin of Preference - MoP), are listed in Table 1.

The import values of preferential items from Sri Lanka are taken from the India Trades database. Table 1 also shows the tariff preference margins for the top 20 import products from Sri Lanka in 2009-10. The tariff preference on each item is calculated from the TRAINS database available at the WITS website. The TRAINS database provides information on both MFN tariffs and preferential tariffs. We take the MFN tariff data and deduct preferential tariff from it to get the tariff preference margin for a particular product (TP_{it}) under ISFTA.

Table 1: Top 20 import products from Sri Lanka eligible for preferences in India

Rank	HS Codes	Product description	MoP (%)
1.	151620	Vegetable fats and oils	44
2.	740319	Unwrought refined copper	5
3.	090700	Cloves	35
4.	890110	Ships, boats and similar vessels	10
5.	740312	Wire-bars of refined copper	5
6.	090411	Pepper, neither crushed nor ground	70
7.	854419	Other winding wire of copper	8
8.	230990	Animal feed	30
9.	680221	Marble, travertine and alabaster	10
10.	741300	Stranded wire & cables of copper, not electrically insulated	10
11.	470790	Unsorted waste and scrap of paper	10
12.	760511	Aluminium wire-not alloyed	5
13.	890400	Tugs and pusher craft vessels	10
14.	740311	Cathodes of refined copper	5
15.	841850	Refrigerating or freezing chests or cabinets	8
16.	151790	Margarine	35
17.	854411	Winding wire of copper	8
18.	720449	Other ferrous waste & scrap	5
19.	401120	New pneumatic tyres used on buses/lorries	10
20.	780199	Other unwrought lead	5

Note: MoP is tariff preference margin of each product in 2009-10 i.e. it is the difference between MFN and preferential tariffs.

Source: Calculated from data available at India Trades and TRAINS databases.

Because in our model the time period is not small (20 years), before conducting the panel regression we ran unit-root tests for the variables. The importance of unit-roots and non-stationarity of data and resultant ‘spurious regression problem’ was first shown in a seminal

paper by Granger and Newbold (1974). They showed that doing a simple ordinary least squares (OLS) regression with two $I(1)$ variables (variables that are non-stationary but become stationary on first differencing) will result in significant t statistic even if there is no actual relation between the two variables. This they termed ‘spurious regression’. The econometric theory dealing with panel data initially did not require unit root tests, as data sets mainly had relatively large cross-section dimension i.e. number of groups or individuals (i) were large, whereas the number of time series observations (t) were small (mostly four or five time-periods). However, during the last two decades many work with panel datasets employ longer time-periods. That is why in recent years there has been an explosion in the number of papers on the subject of unit roots and cointegration in panel methodology (Barbieri 2008).

Unit-root tests in general have low power. In order to improve power we ran summary unit-root tests: the Levin-Lin-Chu test (Levin *et al.* 2002), the Im-Pesaran-Shin test (Im *et al.* 2003), the Fisher-ADF test and the Fisher-PP test (Maddala and Wu 1999, Choi 2001). The test statistics were calculated using EVIEWS (version 7). The null hypothesis of a unit-root could not be rejected for any of the variables – it was found that the dependent variable (import value of top 20 items from Sri Lanka) and the independent variable (tariff preferences) were not stationary. Panel unit root tests could not summarily reject the null hypothesis of ‘no unit root’ for each of these series at the level. However, the first difference of the variables were found to be stationary indicating the series were integrated of order one $I(1)$.

We then tested for cointegration between the variables. Cointegration refers to the idea that if a set of variables are individually integrated of order one, it is then possible that some linear combination of these variables will be stationary (Wooldridge 2000). Cointegration was discussed fully in Engel and Granger (1987). Pedroni (1999) suggests a suite of seven tests designed to test the null hypothesis of no cointegration in a panel data setup. The first four tests are based on the *within panel* estimator. The last three tests are termed as ‘group mean panel tests’ by Pedroni, and are calculated by pooling along the *between dimension* (Bjørnstad and Nymoen 2008). The null of ‘no cointegration’ was rejected in most of the tests. Therefore we concluded that our variables were cointegrated.

In the case of non-stationarity of a series, OLS is no longer efficient. OLS still estimates consistently, but it is no longer asymptotically normally distributed and the t statistic for the

estimated coefficient does not have a t distribution. If the variables are not co-integrated a general suggestion is to difference the $I(1)$ variables and then estimate the relationship between them by OLS. If, however, the variables are cointegrated the literature suggests two methods for running regression. Either a panel dynamic OLS (DOLS) or panel dynamic GLS (DGLS) developed by Stock and Watson (1993) based on Saikkonen's (1991) model can be run. Or, a panel fully modified OLS (FMOLS) developed by Pedroni (1997) based on Phillips and Hansen's (1990) model can be employed. The FMOLS estimator is constructed by making corrections for endogeneity and serial correlation to the OLS estimator. DOLS corrects for endogeneity using the past and future values of the independent variables as additional regressors. Kao and Chiang (2000) state that in a panel setting DOLS returns better results than FMOLS.

To explain the DOLS model let us take a simple example. Say $Y = f(X)$ be the functional form of a time-series model. The regression specification is given in equation 2.

$$Y_t = a + bX_t + u_t \quad \dots (2)$$

Now to run OLS the model needs to satisfy one important assumption: the assumption of zero conditional mean, which requires the explanatory variable (X_t) to be strictly exogenous implying X_t and u_t (the error term) to be uncorrelated. If, however, Y_t and X_t are $I(1)$ and cointegrated then the usual inference procedures do not apply. Also the error term may have serial dependence (autocorrelation). OLS estimates still are consistent but no longer unbiased. Lack of strict exogeneity of the regressor (X_t) can be fixed by using a dynamic model.

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