# Bilateral Trade in Textiles and Apparel in the U.S. under the Caribbean Basin Initiative: Gravity Model Approach


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## Abstract

Economic theory informs us that at the individual country level, border relaxation reduces domestic prices that help local consumers and increases the profit for low-cost exporters through increased sales in the foreign market. At the global level, free trade causes demand and supply to expand, both of which improve price signals and improves world welfare. For over 40 years, the U.S. has relied on unilateral trade preferences as an integral part of its foreign economic policy. Trade preferences give market access to selected developing country goods, duty-free or at tariffs below (NTR) rates, without requiring reciprocal trade concessions. They come in many form and are intended to promote economic development in poor countries by stimulating export promotion and investment, and to encourage the use of U.S. inputs in foreign manufacturing.

The Caribbean Basin has benefited from multiple preferential trade arrangements, the best known being those linked to the Caribbean Basin Initiative (CBI) which begun in the mid-1980s. One of the more successful preferential trade agreements under this initiative is the outward processing programs in apparel and textiles. The largest apparel producers in the CBERA region were Costa Rica, Dominican Republic, El Salvador, and Honduras. CBERA exports grew 145% between 1992-93 and 1998-99, from $3.4 billion to $8.4 billion. Since then, the growth of free trade agreements (FTAs) has signaled a shift in the U.S. trade policy, raising questions about the future path for those few countries depended on trade preferences.

This study therefore, develops an econometric model that uses to bilateral trade factors to estimate the trade potential of textile and apparel under these market access programs from 1990 to 2005. The bilateral trade factors include (1) differences in income per person; (2) ratio of CBI country economy to that of U.S.; (3) the sum of the national income of U.S. and that the CBI countries; (4) the real exchange rate to the dollar; (5) and the distance between each country and the U.S. which is use as proxy for trade cost. The model takes into account time and across countries effects.

The results indicate that the export of textile and apparel by all the five countries (Costa Rica, Dominican Republic, El Salvador, Honduras, and Guatemala) are rising during the study period. Also, besides the distance factor all the remaining four factors strongly influence the bilateral trade. The differences in income per person, ratio of the size of the economy, and exchange rate, all positively impacts the exports of textile and apparel into U.S. For example, 1 percent rise in the ratio of a CBI economy to that of U.S raises the value of exports of textiles and apparel into U.S. by about $42 million. Also, 1 percent rise in the value of the U.S. dollar will raise textile and apparel from these countries by $10.8 million. As the exports of textiles and apparel expand, these countries would expand their operations and import more raw cotton from the U.S. as the agreement requires.

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## Background

Preferential trading is viewed as an important tool used by developed country textile and apparel imports to expand trade with developing countries, to reduce the cost of apparel and textile production, to initiate development in some developing countries, and in some cases to protect their own domestic industries by securing demand for domestic apparel and textiles inputs. Outward processing programs in apparel and textiles under the Caribbean Basin Initiative (CBI), one of the more successful preferential trade agreements, have become an important part of US apparel during the last two decades. In 1999 outward processing apparel trade from the Caribbean countries to the US constituted 14% of US apparel imports, as compared to 9% in 1992. The US imported $55 billion worth of apparel in 1999, and accounted for 36% of world apparel trade (TRAINS 2001 and USITC 2000). US outward processing firms have enjoyed significant preferences in the Caribbean. The average preference margin (the difference between most favored nation (MFN) duties and preferential duties) in 1992-93 was 11.7% and went down to 9.9% in 1998-99. Corresponding preferential duties stood at 6.6% in 1992-93 and 5.8% in 1998-99 (USITC 2000). As a result of such high preference margins, outward processing firms in the US earned higher profits, increased their operations, and increased employment of foreign labor and the usage of intermediate textiles.

The US established the Special Access Program (SAP) in 1986 that encouraged outward processing trade in apparel and textiles with countries of the Caribbean. The beneficiary countries have used the SAP arrangements and its provisions extensively. On the average for all CBERA (Caribbean Basin Economic Recovery Act which is one of the trade components of CBI) countries the share of US outward processing apparel in the total apparel trade with the US was 83% in 1992-93 and 85% in 1998-99 (USITC 2000).Total average value of apparel exports to the US from CEBRA countries in 1998-99 was 8.4 billion dollars. The largest apparel producers in the CBERA region were Costa Rica, Dominican Republic, El Salvador, and Honduras. CBERA exports grew 145% between 1992-93 and 1998-99, from \$3.4 billion to \$8.4 billion. Also, the US adopted the Trade and Development Act of 2000 (TDA 2000) that improved preferential treatment of the outward processing from CBI countries. These new preferences require the usage of US made materials as was required under SAP, but now completely eliminates tariffs (from an average of 5.8% in 1998-99 to zero).

Finally, the US apparel outward processing has experienced (or will soon experience) another indirect shock due to the introduction of the Agreement on Textiles and Clothing (ATC) by WTO in 1995, which replaced the Multi-Fiber Agreement (MFA) and gradually eliminates apparel and textile quotas by 2005. The ATC should result in significant liberalization of apparel and textile trade between WTO member countries, including China.

Elimination of tariffs on outward processing apparel imports from the Caribbean region increases returns to capital which creates an incentive for outward processing firms to expand their production capacity. The expansion of production capacity will result in increased derived demand for U.S. raw cotton. About one-third of U.S. textile and apparel imports (measured by fiber volume) made from cotton are imported from non-NAFTA Western Hemisphere trade partners. This is equal to about 20 percent of cotton products purchased by U.S. consumers. If U.S. tariffs on textile imports from these countries were eliminated, trade volume and competitor prices remained unchanged, and the tariff changes were fully passed through to consumers, the removal of 17.5 percent tariff could cause prices of U.S. cotton textile products to fall 3 percent (ERS-USDA 1998). Because U.S. textiles tariff reductions would be confined to Western Hemisphere countries, the increased use of raw cotton to produce textiles would also be confined to Western Hemisphere countries. U.S. raw cotton consumption would be unlikely to rise, but U.S. exports to other countries would rise.. However, the growth of these free trade agreements (FTAs) has signaled a shift in the U.S. trade policy, raising questions about the future path for those few countries depended on trade preferences. This paper therefore, applies gravity equations to bilateral trade factors to estimate the trade potential of textile and apparel under these market access programs from 1990 to 2005.

## The Generalized Gravity Framework

Originally inspired by Newton's gravity equation in physics, the gravity model has become common knowledge in regional science for describing and analyzing spatial flows. Anderson (1979) was the first to draw linkages to economic theory and was pioneered in the analysis of international trade by Tinbergen (1962); Po□□yhonen (1963); and Linneman (1966). The generalized framework Anderson developed incorporates the

Armington assumption that goods produced by different countries are inherently imperfect substitutes by virtue of their provenance. This framework assumes Cobb-Douglas expenditure system. Under the assumption of monopolistic competition, each country is assumed to specialize in different products and to have identical homothetic preferences. Zero balance of trade is also assumed to hold in each period. Then the equilibrium trade flow from country *i* to *j* ($X_{ij}^*$) at any time period ***t*** can be expressed as:

$$X_{ij}^* = \theta_i Y_j$$

(1) *or*

$$\theta_i = \frac{X_{ij}}{Y_j}$$

where $\theta_i$ denotes the fraction of income spent on country ***i***'s products (the fraction is identical across importers) and $Y_j$ denotes real GDP in importing country *j*. Since production in country *i* must be equal to the sum of exports and domestic consumption of goods, country *i*'s GDP is expressed as follows:

$$Y_i = \sum X_{ij}^* = \sum \theta_i Y_j = \theta_i \left(\sum Y_j\right)$$

(2) *or*

$$\theta_i = \frac{Y_i}{\left(\sum Y_j\right)} \equiv \frac{Y_i}{Y_w}$$

Where $\sum Y_j = Y_w$ is world real GDP, which is constant across country pairs. Equating equation (1) and (2) and rearranging yields:

(3) $$X_{ij}^* = \frac{Y_i Y_j}{\left(\sum Y_j\right)} = \left(T_{ij}\right)\left(\frac{Y_i Y_j}{Y_w}\right)$$

Therefore, this simple gravity equation relies only upon the adding-up constraints of a Cobb- Douglas expenditure system with identical homothetic preferences and the specialization of each country in one good. The basic empirical gravity equation is obtained by taking a natural logarithm of both sides of (3) as follows:

(4) $$\ln X_{ij}^{*} = \alpha + \beta \ln Y_i + \gamma \ln Y_j + \Phi \ln T_{ij}$$

where $\alpha = \left(-\ln Y_w\right)$, and $T_{ij}$ is a vector of time-invariant variables such as distance and border effects. Because, in reality, countries do not have identical and homothetic taste, the coefficients should not be unity, but are not significantly different from unity in aggregate level trade (Anderson 1979).

## Model Specification of Gravity Models

More recently, the application of gravity models has enjoyed a big revival. However, this has not so much been driven by its more rigorous theoretical foundation (Anderson, 1979; Bergstrand, 1985, 1989, and 1990; Helpman and Krugman, 1985; and Helpman, 1987; and so on) but the opportunity to project bilateral trade relations (Hamilton and Winters, 1992; Baldwin, 1994). According to the traditional concept of the gravity equation, bilateral trade can be explained by GDP and GDP per capita figures and both trade impediment (distance) and preference factors (common border, common language, etc.). The economic framework in most cases was cross-section analysis (Wang and Winters, 1991; Hamilton and Winters, 1992; Brulhart and Kelly, 1999; and Nilsson, 2000; and so on). Only a few authors made use of (random effects) panel econometric methods (Baldwin, 1994; Gros and Gonciarz, 1996; Mátyás, 1997; and Egger, 2000).

Ma′tya′s, (1997 and 1998) provides insights in the question of proper econometric specification without dealing with the issue of trading potentials.

According to the endowment-based new trade model with Dixit and Stiglitz (1977) preferences, bilateral trade is an increasing sum of factor income G, relative size S, and the difference in relative factor endowments R. Additionally, bilateral trade is affected by more traditional measures of transportation cost which is represented by distance $D_{ij}$ and lastly, the real bilateral exchange rate $E_{ijt}$.. Accordingly, bilateral trade can be estimated by:

(5) $Y_{ijt} = \beta_0 + \beta_1 G_{it} + \beta_2 S_{ijt} + \beta_3 R_{ijt} + \beta_4 D_{ij} + \beta_5 E_{ijt} + \varepsilon_{ijt}$

where all variables are in real figures and expressed in natural logs, and the error term can be written as

(6) $\varepsilon_{ijt} = u_{ij} + w_{ijt}$

with $u_{ij}$ as the (one-way fixed or random) unobserved bilateral effect and $w_{ijt}$ as the remaining residual error. Using the Helpman (1987) model, the Heckscher-Ohlin bilateral trade determinants can be formulated in the following way:

(7) $G_{ijt} = \log\left(GDP_{it} + GDP_{jt}\right)$

(8) $s_{ijt} = \frac{GDP_{jt}}{GDP_{it}}$

(9) $R_{ijt} = \left|\ln\left(\frac{GDP_{it}}{N_{it}}\right) - \ln\left(\frac{GDP_{jt}}{N_{jt}}\right)\right|$

where, N denotes a country's population and GDP per capita is commonly used as a proxy for a country's capital-labor ratio.

For the panel econometric projection of potential bilateral trade, researchers have concentrated on random effects model (REM), which requires that $u_{ij} \sim (0, \sigma_{\mu}^2)$, $w_{ijt} \sim (0, \sigma_{v}^2)$, and the $u_{ij}$ are independent of the $w_{ijt}$. Moreover, the $X_{ijt}$ (i.e. the explanatory variables) have to be independent of the $u_{ij}$ and $w_{ijt}$ for all cross-sections (*ij*) and time periods (*t*). Whereas the fixed effects model (FEM) is always consistent in the absence of endogeneity or errors in variables, the REM is only consistent if the above-mentioned othogonality conditions are fulfilled. Then, the REM has the advantage of more efficiency as compared to the FEM. If these conditions do not hold, only the FEM is consistent since it wipes out all the time-invariant effects ($u_{ij}$). The decision between FEM and REM can be based on the Hausman (1978) test.

## Data and Empirical Results

Apparel and textile export data from each CBI country were obtained from the USITC website (http://www.usitc.gov/). Real GDP data for each country were obtained from the Euromonitor International Database (2006). These figures are converted to U.S. dollars to maintain a common unit of measure. Populations, measured in thousands of inhabitants were obtained from the Euromonitor International Database (2006). The distances, measured in meters were obtained using GDA Vincenty Calculation Results (inverse) from Australian Geodetic Datum. (http://www.ga.gov.au/bin/gda_vincenty.cgi).

Figures of real exchange rate of each CBI country currency to the U.S. dollar were obtained from Euromonitor International Database (2006).

The descriptive statistics of the variables in the model are presented in Table 1 while Table 2 presents the estimation results for the two-way fixed effect panel estimator. According to the test statistics we cannot ignore the cyclic and cross-sectional effects as the F-test for the two-way FEM is significant at ($P < 0.0001$) with $R^2$ of 0.92. Thus, the probability that there are no effects in the model is 0. Besides Dominican Republic, all the four CBI countries have intercepts significantly different from 0 relative to Honduras as reported in Table 2. This occurred as no surprise as all the countries enjoy the same program in terms of accessing U.S. textile and apparel market. Also, the intercepts of all the first fifteen years (i.e. 1990 to 2004) are negative and significant relative to 2005. This informs us that imports trend is positive and significant as depicted in Figure 1.

The coefficients of resource factor endowment and the relative size of the economies are all positive and statistically significant ($p < 0.0001$). Thus, the larger the per capita GDP difference between U.S. and a CBI country, the larger the imports. Our empirical result-- with positive coefficients for relative factor endowment differences lends to support the H-O explanation of trade. Heckscher-Ohlin (H-O) theory leads one to expect that textile and apparel trade would be positively related to the exporter-to-importer per capita GDP differences. Textiles and apparel require relative intensive use of labor. The elasticity of 1.2052 implies a 1percent change in the level of resource endowment differences will raise imports by about 1.2 percent or $14.4 million. Similarly, the larger the ratio of a CBI economy relative to that of U.S., the larger the volume of exports. The elasticity of 3.4885 informs us that 1 percent increase in the GDP ratio raises a CBI country's exports of textiles and apparel in to the U.S. by about 3.5 percent or $42million. This result is consistent with primary goal of the U.S. trade policy for the Caribbean. The purpose is to stimulate the exports of these countries to promote economic growth and development.

The real exchange rate of a CBI currency relative to the dollar as expected is negative statistically significant ($P < 0.0001$). This means a stronger dollar relative to a CBI currency raises imports. Or as a CBI currency depreciates the volume of textiles and apparel exported to U.S. increases. The elasticity of the exchange rate is -0.9026. This informs us that 1 percent appreciation of the U.S. dollar raises the value of textile and apparel imports into the U.S. by 0.9 percent. Or 1 percent depreciation of a CBI currency raises their export of textile and apparel by 0.9 percent or $10.8 million.

Exchange rate is one of the most important factors affecting trade flows, Koo, Kamera, and Taylor (1994). The appreciation of a country's currency against other currencies reduces the country's exports and increases imports, while depreciation stimulates the country's export. If the real exchange rate rises, future trade appears relatively more profitable to exporters, so export supplies will vary directly with change in the exchange rate, Daly (1998).

By contrast, the sum of the bilateral trade GDP is negative but statistically significant ($P < 0.0001$). The income of exporting countries represents the country's production capacity, and the income of importing countries represents the country's purchasing power, both of which are positively related to trade flows. A higher level of income in the exporting country indicates a high level of production of which increases the availability of products for export, while a high level of income in the importing country suggests higher imports.

## Conclusions

Economic theory informs us that at the individual country level, border relaxation reduces domestic prices that help local consumers and increases the profit for low-cost exporters through increased sales in the foreign market. At the global level, free trade causes demand and supply to expand, both of which improve price signals and improves world welfare.

Theory also teaches us that there are many other socio-economic and political-institutional determinants of cross-border trade, including market size, resource endowments, geographical proximity, tastes and preferences, cultural ties, and financial linkages. This paper used the two-way fixed effect panel estimation to determine the influence of the various factors driving the volume of U.S. imports of textile and apparel from the CBI countries.

One noteworthy finding is that the relative factor endowment differences matters. The per capita difference between the importer and exporter was positive and statistically significant. By contrast, the exchange rate relative to the U.S. dollar is negative. Thus, a stronger dollar expands imports of textile and apparel which in turn causes an expansion of the operations in the exporting countries to be able export more for development. This result is consistent with primary goal of the U.S. trade policy for the Caribbean. The purpose is to stimulate the exports of these countries to promote economic growth and development.

Another important finding was that the relative GDP of CBI country to that of U.S was shown to have had an appreciable effect on exports. By contrast, the bilateral trade GDP was negative but significant.

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**Table 1. Descriptive Statistics of Variables (N=80)**

| Variable | Units | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Value of Exports | Billion $ | 1.244 | 0.753 | 0.69 | 2.752 |
| Bilateral Trade GDP | Million $ | 8.706 | 2.036 | 5.806 | 12.448 |
| Differences in Endowment | Ratio | 30.133 | 5.818 | 21.305 | 41.711 |
| Size of the Economy | Ratio | 0.0014 | 0.00052 | 0.0005 | 0.0025 |
| Distance | Miles | 2952.36 | 315.917 | 2580 | 3363 |
| Exchange Rate | Ratio | 60.618 | 112.077 | 4.10 | 477.787 |

**Table 2: Results of the Fixed Effect Panel Estimation Procedure**

| **Variable** | **Estimate** | **Standard Error** |
|---|---|---|
| Intercept | 2.499.*** | 0.8184 |
| Exchange Rate | -0.9026*** | 0.1635 |
| Bilateral Trade GDP | -0.5006*** | 0.1643 |
| Size of the Economy | 3.4885*** | 0.5952 |
| Differences in Endowment | 1.2052*** | 0.1932 |
| Distance | 2.4434 | 1.7839 |
| Costa Rica | 3.2954*** | 0.7000 |
| Dominican Republic | -0.3394 | 0.4623 |
| El Salvador | -1.1597*** | 0.2466 |
| Guatemala | -1.7023 | 0.4078 |
| $R^2$ | 0.92 | |
| *F(19, 55) Test for No Fixed Effects* | 12.91 | P < 0.0001 |

*** Indicates significance at 1% confidence level
** Indicates significance at 5% confidence level

**Figure 1. U.S. Imports of Textile and Apparel from CBI Countries (1990 -2005)**