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

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Background

- Preferential trading is an important tool used by developed countries
  - to expand trade with developing countries
  - to initiate development in some developing countries, and in some cases,
  - to protect their own domestic industries by securing demand for domestic primary and intermediate inputs for the final products.

- Caribbean Basin Initiative (CBI)- A unilateral preferential agreement
Background

- Outward processing programs in apparel and textiles under the Caribbean Basin Initiative (CBI) are some of the more successful preferential trade agreements.

- Have become an important part of U.S. apparel during the last two decades.

- In 1999, outward processing apparel trade from the Caribbean countries to the U.S. constituted 14% of US apparel imports, as compared to 9% in 1992.
Background

- The U.S. imported $55 billion worth of apparel in 1999, and accounted for 36% of world apparel trade (TRAINS 2001 and USITC 2000).

- U.S. outward processing firms have enjoyed significant preferences in the Caribbean.

- The average preference margin (the difference between MFN duties and preferential duties) in 1992-93 was 11.7% and went down to 9.9% in 1998-99.
As a result of such high preference margins, outward processing firms in the U.S. earned higher profits, increased their operations, and increased employment of foreign labor and the usage of intermediate textiles.

The largest apparel producers in the region were Costa Rica, Dominican Republic, El Salvador, and Honduras.
Exports grew 145% between 1992-93 and 1998-99, from $3.4 billion to $8.4 billion.

Since then, the growth of 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.
Objective of Study

This study therefore, develops an econometric model that uses bilateral trade factors to estimate the trade potential of textile and apparel under these market access programs from 1990 to 2005.
Gravity Model for Bilateral Trade Potentials

Gravity model has become a common knowledge in regional science for describing and analyzing spatial flows.

Pioneered in the analysis of international trade by Tinbergen (1962).

It yields sensible parameter estimates and explains a large part of the variation in bilateral trade.

Recent applications - Anderson (1979); Bergstrand (1989; 1990); Helpman (1987); and so on.
The Generalized Gravity Framework

- The generalized framework incorporates the Armington assumption that goods produced by different countries are inherently imperfect substitutes by virtue of their provenance.

- 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.
The Generalized Gravity Framework

- 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:

\[
X_{ij}^* = \theta_i Y_j \quad (1)
\]

- $\theta_i$ denotes the fraction of income spent on country $i$'s products.

- $Y_j$ denotes real GDP in importing country $j$. 
Production in country $i$ must be equal to the sum of exports and domestic consumption of goods.

Therefore country $i$'s GDP is expressed as follows:

$$Y_i = \sum X^*_{ij} = \sum \theta_i Y_j = \theta_i (\sum Y_j) \quad (2)$$

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

$$X_{ij}^* = \frac{Y_i Y_j}{(\sum Y_j)} = \left( T_{ij} \right) \left( \frac{Y_i Y_j}{Y_w} \right)$$  \hspace{1cm} (3)

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:

\[ \ln X_{ij}^* = \alpha + \beta \ln Y_i + \gamma \ln Y_j + \Phi \ln T_{ij} \]  

where \( \alpha = (- \ln Y_j) \), and \( T_{ij} \) is a vector of time-invariant variables such as distance and border effects.

In reality, countries do not have identical and homothetic taste, therefore coefficients should not be unity, but are not significantly different from unity in aggregate level trade (Anderson 1979).
The Econometric Specification


- Only few studies have made use of random effects panel models - Baldwin, 1994; Gros and Gonciarz, 1996; Egger, 2000.
The Econometric Specification

- According to the traditional concept of gravity equation, bilateral trade can be explained by GDP and GDP per capita figures.

- Both trade impediment (distance) and preference factors (common border, common language, and so on).

- Based on the endowment-based new trade model (Dixit and Stiglitz, 1977)

- Bilateral trade is an increasing sum of factor income $G$, relative size $S$, and the difference in relative factor endowments $R$. 
The Econometric Specification

- Bilateral trade is affected by more traditional measures of transportation $D_{ij}$ and real bilateral exchange rate $E_{ijt}$.

- Thus bilateral trade can be estimated by

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

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

$$ \epsilon_{ijt} = u_{ij} + \nu_{ijt} \quad (6) $$

- $\mu_{ij}$ as the (fixed or random) unobserved bilateral effect and $\nu_{ijt}$ as the remaining error.
The Econometric Specification

Using the Helpman (1987) model, the Heckscher-Ohlin (H-O) bilateral trade determinants can be formulated as follows:

\[ G_{ijt} = \log \left( GDP_{it} + GDP_{jt} \right) \]  

(7)

\[ S_{ijt} = \frac{GDP_{jt}}{GDP_{it}} \]  

(8)

\[ R_{ijt} = \log \left( \frac{GDP_{it}}{N_{it}} \right) - \log \left( \frac{GDP_{jt}}{N_{jt}} \right) \]  

(9)

where, \( N \) denotes a country’s population and GDP per capita is commonly used as a proxy for a country’s capital-labor ratio.
The Econometric Specification

- For the panel econometric projection of potential bilateral trade, researchers have concentrated on random effects model (REM).

- Whereas the fixed effects model (FEM) is always consistent in the absence of endogeneity or errors in variables.

- The REM is only consistent when the $X_{ijt}$ are independent of the $u_{ij}$ and $v_{ijt}$ for all cross-sections $(ij)$ and time periods $(t)$. 
The Econometric Specification

- If these conditions do hold, only the FEM is consistent since it wipes out all the time-invariant time-effects \((u_{ij})\).

- The decision between FEM and REM can be based on the Hausman (1978) test.
Data and Estimation Procedure

- Panel data from 1990 to 2005 were used

- Several variations across individual country are analyzed.
  - one-way FEM
  - one-way REM
  - two-way FEM

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

- 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)
## Results of the Estimated Equations

Table 1. Descriptive Analysis of the Variables (N=80)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Units</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Minimum</th>
<th>Maximum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value of Exports</td>
<td>Billion $</td>
<td>1.244</td>
<td>0.753</td>
<td>0.69</td>
<td>2.752</td>
</tr>
<tr>
<td>Bilateral Trade GDP</td>
<td>Million $</td>
<td>8.706</td>
<td>2.036</td>
<td>5.806</td>
<td>12.448</td>
</tr>
<tr>
<td>Differences in Endowment</td>
<td>Ratio</td>
<td>30.133</td>
<td>5.818</td>
<td>21.305</td>
<td>41.711</td>
</tr>
<tr>
<td>Size of the Economy</td>
<td>Ratio</td>
<td>0.0014</td>
<td>0.00052</td>
<td>0.0005</td>
<td>0.0025</td>
</tr>
<tr>
<td>Distance</td>
<td>Miles</td>
<td>2952.36</td>
<td>315.917</td>
<td>2580</td>
<td>3363</td>
</tr>
<tr>
<td>Exchange Rate</td>
<td>Ratio</td>
<td>60.618</td>
<td>112.077</td>
<td>4.10</td>
<td>477.787</td>
</tr>
</tbody>
</table>
# Results of the Estimated Equations

## Table 2. Results of the Fixed Effect Panel Estimation Procedure

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

**Indicates significance at 1% confidence level**

** Indicates significance at 5% confidence level
Results of the Estimated Equations

Figure 1. U.S. Imports of Textile and Apparel from CBI countries (1990 -2005)
Results and Discussions

- Table 2 presents the estimation results for the two-way fixed effect panel estimator.

- According to the test statistics, the cycle and cross-sectional effects cannot be ignored as the F-statistics for the time and cross-sectional effects are all significant.

- Besides Dominican Republic, all the four CBI countries have intercepts significantly different from 0 relative to Honduras as reported in Table 2.

- The intercepts of all the first fifteen years (i.e. 1990 to 2004) are negative and significant relative to 2005. This confirms that imports trend is positive and increasing as shown in Figure 1.
Results and Discussions

- 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.

- The positive coefficients for relative factor endowment differences lends to support the (H-O) explanation of trade. Based on the H-O theory we expect that textile and apparel trade would be positively related to the exporter-to-importer per capita GDP differences.

- The elasticity of 1.2052 implies a 1 percent change in the level of resource endowment differences will raise imports by about 1.2 percent or $14.4 million.
Results and Discussions

- 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 indicates that a percent increase in the GDP ratio raises a CBI country’s exports of textiles and apparel to the U.S. by about 3.5 percent or $42 million.

- These results are consistent with the primary goal of the U.S. trade policy for the Caribbean Basin.

- The real exchange rate of a CBI currency relative to the dollar is statistically significant and shows the expected negative sign. Thus, 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 shows 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 $10.8 million.
Results and Discussions

- Exchange rate is one of the most important factors affecting trade flows - Koo, Kamera, and Taylor (1994). 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. 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.
Conclusion

- Economic theory shows that at individual country level, border relaxation reduces domestic prices 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.

- Furthermore, economic theory reveals that there are many other socioeconomic 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.
Conclusion

- One noteworthy finding is that the relative factor endowment differences matter.

- 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 to export more for development.

- This result is consistent with primary goal of the U.S. trade policy for the Caribbean Basin. The purpose of which 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.