Competition between Brazil and other exporting countries in the U.S. import market: a new extension of constant-market-shares analysis

Quite often in Economics, the gain of a player is equal to the sum of all the other players’ gains and losses. In particular, when exporters compete for a specific market, the changes in one’s share of the market necessarily come at the expense of all the others’ share together. If there are more than two exporters, then it is not clear, in principle and in general, how to breakdown one’s total change of market shares, ascribing a slice of it to each competing exporter. The objective of this paper is to propose a general methodology to unravel the above problem, subject to some desirable conditions, and apply it to Brazil’s exports of goods to the U.S. comparing the changes between 1992, 1999 and 2004.

Assuming that there are more than two exporting countries and that the share of one exporter increases (decreases) from time 0 to time 1, we ask how much of that share rise (fall) can be attributed to each of all the other exporters disputing the market in that period of time. It is assumed that it is unknown how suppliers compete and the characteristics of the products they sell in the market. Therefore, in the same spirit of the constant-market-shares analysis, this methodology is based on a set of identities that result from arbitrary decompositions with no theoretical or empirical foundations. However, the method has economic appeal, as it fulfills some economic desirable properties, and should prove to be useful, as it reveals a clearer and detailed picture of the competitive position of each exporting countries, showing the sources by competitors and products of their gains and losses of market shares. The method also allows a comparison of the export performance between pairs of exporting countries, which may facilitate the test of some hypothesis as to the causes of the gains and losses of market shares of these countries in different destination markets.

This paper is divided as follows. In the first section I review the constant-market-shares analysis, including some changes and extensions that have been proposed in the literature. In section 2, I develop my own proposed extension. The traditional constant-market-shares analysis is applied to Brazil’s exports to the U.S. in the period between 1992 and 2004 in section 3 and my new extension is applied in section 4. Section 5 sums up the conclusions.

(1) The constant-market-shares analysis

Constant-market-shares (CMS) analysis has often been applied in studies of export performance and development. The CMS model is based on an identity between the change in the market share of a particular exporting country H in a given market K from

---

1 Tyszynski (1951) is one of the earliest applications of the method.
2 The analysis may be extended to include several destination markets.
the initial year $t$ to the final year $t+1$ and the so-called product composition and competitiveness effects. The model can be expressed as follows:\(^3\):\[\Delta k_H = k_{Ht}^{t+1} - k_H^t = \left( q_1^{t+1} - q_1^t \right) - a_4 \left( q_4^{t+1} - q_4^t \right) \]

Where:

\[k_H^t = \frac{X_H^t}{M_K^t}\]

is the macro share of country H’s exports $X_H$ in K imports $M_K$ both at the initial year $t$;

\[k_{Hi}^t = \left( \frac{X_{Hi}^t}{M_{Ki}^t}, \ldots, \frac{X_{Hi}^t}{M_{Ki}^t} \right)\]

is a row vector of dimension $z$ of the micro shares of country H in K imports of commodity $i=1,\ldots,z$ at the initial year $t$;

and

\[m_{Ki}^t = \left( \frac{M_{Ki}^t}{M_K^t}, \ldots, \frac{M_{Ki}^t}{M_K^t} \right)\]

is a column vector of dimension $z$ of the shares in market K of commodity $i=1,\ldots,z$ at the initial year $t$.

Using these definitions, identity [1] may be re-written as:

\[\Delta k_H \equiv \sum_{i=1}^z \left[ \frac{X_{Hi}^t}{M_{Ki}^t} \left( \frac{M_{Ki}^{t+1}}{M_K^t} - \frac{M_{Ki}^t}{M_K^t} \right) \right] + \sum_{i=1}^z \left[ \left( \frac{X_{Hi}^t}{M_{Ki}^t} \right) \left( \frac{M_{Ki}^{t+1}}{M_K^t} - \frac{M_{Ki}^t}{M_K^t} \right) \right]
\]

or

\[\left( \frac{X_H^{t+1}}{M_K^{t+1}} - \frac{X_H^t}{M_K^t} \right) M_K^{t+1} \equiv \sum_{i=1}^z \left[ \frac{X_{Hi}^t}{M_{Ki}^t} \left( \frac{M_{Ki}^{t+1}}{M_K^{t+1}} - \frac{M_{Ki}^t}{M_K^{t+1}} \right) \right] + \sum_{i=1}^z \left[ \left( \frac{X_{Hi}^t}{M_{Ki}^t} \right) \left( \frac{M_{Ki}^{t+1}}{M_K^{t+1}} - \frac{M_{Ki}^t}{M_K^{t+1}} \right) \right]
\]

Therefore, the *product composition effect* calculates to what extent the macro share gain (or loss) of country H can be attributed to the concentration of its exports in goods for which

---

\(^3\) This presentation using vector notation follows that of Fagerberg and Sollie (1987).
import spending is growing more rapidly (or slowly) in relative terms. The *competitiveness effect* calculates to what extent the macro share gain or loss of country H can be attributed to the sum of gains and losses of market shares on individual products\(^4\).

The identity is somewhat arbitrary as the composition effect is weighted by country H shares at the initial period (a Laspeyres indice), whereas the competitiveness effect is weighted by the shares of each commodity in total imports at the end of the period (a Paache indice). In point of fact, the identity would also hold if these weights were exchanged\(^5\).

An alternative would be to use either Laspeyres or Paache weights throughout the calculations, allowing a third term to appear\(^6\). Using Laspeyres weights, identity [1] would become:

\[
[4] \quad k_{i,t}^{3} - k_{i,t}^{1} = \left( k_{i,t}^{1} - k_{i,t}^{2} \right) m_{i,t}^{3} + \left( k_{i,t}^{2} - k_{i,t}^{3} \right) m_{i,t}^{1} + \left( k_{i,t}^{3} - k_{i,t}^{4} \right) m_{i,t}^{2}
\]

Fagerberg and Sollie (1987) show that the sign and value of this third term depend on the correlation between the competitiveness effect and the product composition effect. In fact, it measures to what degree the exporting country has succeeded in adapting the product composition of its exports to the changes in the product composition of the market. This (relative) adaptation effect will be zero if the exporting country is adapting its export

---

\(^4\) See Leamer and Stern (1970) for a detailed and critical analysis of the constant market shares model. Their version of the model is slightly different from the one presented here, since they focus on changes in export revenue rather than on change in market share. As a result, a demand effect appears in their version. But if the demand effect is subtracted from the change in export revenues, the result is the difference between actual export revenue at the end of the period and the value that would have been necessary to maintain the macro share of the exporting country constant. This, in turn, is equal to the change in market shares times the size of the import market at the final year. That is the right-hand side of identity [3].

\(^5\) Furthermore, Richardson (1971) also pointed out correctly that if the market composition effect is added to the analysis, the order in which the product and market composition effects are calculated matters for the results. It is also well known that the effects depend on the level of product aggregation. See Bowen and Pelzman (1984) for a sensitivity analysis of the CMS model to changes in the base year, level of commodity aggregation, and definition of world market.

\(^6\) This extension of the model has been developed by Fagerberg and Sollie (1987).
structure at exactly the same rate as the average of all countries exporting to the market in question. This effect will be positive if country H is gaining market share in products for which demand is growing faster than average and/or is losing market share in products for which demand is growing slower than average\(^7\).

(2) Attributing one’s gain or loss to various competitors in zero-sum games: a new extension of market share analysis

Let us consider that there are \(n\) exporters to market K so that:

\[ k_H^t = \frac{X_H^t}{M_K^t} \]

are the macro shares of each exporting country \(H=1,\ldots,n\);

The change in market share between time \(t\) and time \(t+1\) of exporter H may be defined as:

\[ \Delta k_H^t = k_{H+1}^t - k_H^t = \left( \frac{X_H^{t+1}}{M_K^{t+1}} \right) - \left( \frac{X_H^t}{M_K^t} \right) \]

The changes in micro shares may also be defined as:

\[ \Delta k_{Hi}^t = k_{Hi+1}^t - k_{Hi}^t = \left( \frac{X_{Hi}^{t+1}}{M_{Ki}^{t+1}} \right) - \left( \frac{X_{Hi}^t}{M_{Ki}^t} \right) \]

Dropping the subscript \(i\) to ease the notation, \(\Delta k_{HJ}\) may be defined as the part of the change in the micro share of exporter H that can be ascribed to the change in the micro share of exporter J, so that:

\[ \Delta k_H = \sum_{J=1}^{n} \Delta k_{HJ} = \sum_{J=1}^{n} \left[ \left( \frac{X_J^t}{M^t} \right) - \left( \frac{X_J^{t+1}}{M^{t+1}} \right) \right] \]

bearing in mind that:

\[ \sum_{J=1}^{n} \left[ \left( \frac{X_J^{t+1}}{M^{t+1}} \right) - \left( \frac{X_J^t}{M^t} \right) \right] = 0. \]

\(^7\) A sort of dynamic variant of this version of the CMS method has been applied by Wilson (2000) and Wilson et al. (2005) to compare the performance of one exporting country to a group of benchmark countries in a specific sector for every year in a period of several years.
It should be noted that $\Delta k_{H,J}$ is not necessarily equal to $\left( \frac{X'_j}{M'} - \frac{X'_{j+1}}{M'_{j+1}} \right)$, though this would just be one possible distribution of the gain or loss of competitor H to its J competitors. However, this distribution does not fulfill some desirable properties.

There are basically four desirable properties for $\Delta k_{H,J}$. First, as competitor H cannot gain from or lose to itself, I would like to make $\Delta k_{H,H} = 0$. Second, I would like the gain of exporter H from exporter J to be equal to the loss of exporter J to exporter H, or $\Delta k_{H,J} = -\Delta k_{J,H}$. Third, the sum of the gains and losses of any supplier to all its competitors would be equal to the total gain or loss of that supplier in the period, as established in identity [8]. The fourth, and perhaps the most important property, is that $\Delta k_{H,J}$ ought to have the same sign and be a function of $(\hat{x}_H - \hat{x}_J)$, where $\hat{x}_H$ and $\hat{x}_J$ are the rates of growth of the values sold by exporters H and J, respectively between t and t+1. In other words:

$$[9] \Delta k_{H,J} = \lambda_{H,J}(\hat{x}_H - \hat{x}_J),$$

where $\hat{x}_H = \frac{X_{H_{t+1}} - X_{H_t}}{X_{H_t}}$, $\hat{x}_J = \frac{X_{J_{t+1}} - X_{J_t}}{X_{J_t}}$ and $\lambda_{H,J} > 0$.

A possible alternative way of distributing the gain or loss of one supplier to its competitors has been proposed by Chami Batista (1999) and applied in a few papers. The idea there was that exporting countries, to a specific market, which gained (lost) market share in a particular product would only have gained (lost) from those that lost (gained) market share in the same period. By assuming that, one could add up the losses of all exporting countries that lost market share in the period and calculate the share of each losing country in the total loss. In this way, the gain of any country that gained market share in the period could be distributed among the countries that lost market share according to their shares in the total loss by product. Analogously, the loss of any country that lost market share could be distributed among the countries that gained market share in the period according to their shares in the total gain by product.

The problem with this methodology is that it does not satisfy our fourth condition above. Even though two or more exporters may have experienced an increase (decrease) in market shares, the relative size of these increases (decreases), which depends on the differential rates of growth between each exporter, should matter for establishing who has gained from whom and by how much.

---

In order to obtain a method that fulfills the four conditions established above, identity [8] may be re-arranged as follows. Multiplying and dividing each term in brackets by the same amounts,

\[ \sum_{j=H}^{n} \Delta k_{H,J} = \sum_{j=H}^{n} \left[ \left( \frac{X_j \ M^t}{M \ M^t} \right) - \left( \frac{X_j \ M^t}{M \ M^t} \right) \right] \]

and re-arranging,

\[ \sum_{j=H}^{n} \Delta k_{H,J} = \sum_{j=H}^{n} \left[ \left( \frac{X_j \ X_H^t}{M \ M^t} \right) - \left( \frac{X_j \ X_H^t}{M \ M^t} \right) \right] + \sum_{j=H}^{n} \left[ \left( \frac{X_j \ M^t}{M \ M^t} \right) \sum_{j=H}^{n} X_j - \left( \frac{X_j \ M^t}{M \ M^t} \right) \sum_{j=H}^{n} X_j \right] \]

Noting that the second term on the left hand side of the above identity is actually equal to zero, identity [8] may be re-written as:

\[ [10] \sum_{j=H}^{n} \Delta k_{H,J} = \sum_{j=H}^{n} \left[ \left( \frac{X_j \ X_H^t}{M \ M^t} \right) - \left( \frac{X_j \ X_H^t}{M \ M^t} \right) \right]. \]

Note that taking each change in market share \( \Delta k_{H,J} \) as the change in the market share of exporter H attributed to exporter J, I have:

\[ [11] \Delta k_{H,J} = \left( \frac{X_j \ X_H^t}{M \ M^t} \right) - \left( \frac{X_j \ X_H^t}{M \ M^t} \right). \]

From [11], it is evident that \( \Delta k_{H,H} = 0 \) and \( \Delta k_{H,J} = -\Delta k_{J,H} \), fulfilling the first and second conditions. The third condition is automatically satisfied by the equivalence between identities [6] and [8]. To show that this method of distributing the change in the market share of any exporter H to any exporter J also fulfills the fourth condition, I start by adding and subtracting \( \left( \frac{X_j \ X_H^t}{M \ M^t} \right) \) from (11) and re-arranging it, I have:

\[ \Delta k_{H,J} = \left( \frac{X_H \ X_H^t - X_H \ X_H^t}{M \ M^t} \right) \left( \frac{X_j \ X_H^t}{M \ M^t} \right) \left( \frac{X_H \ X_H^t}{M \ M^t} \right), \text{ or} \]

\[ \Delta k_{H,J} = \Delta k_{H} \frac{X_j \ X_H^t}{M \ M^t}, \text{ or} \]

\[ \Delta k_{H,J} = \Delta k_{H} \frac{X_H \ X_H^t}{M \ M^t}, \text{ or} \]

\[ \Delta k_{H,J} = \Delta k_{H} - \Delta k_{J} \frac{X_H \ X_H^t}{M \ M^t}, \text{ or} \]
\[ \Delta k_{i,j} = \left( \frac{\Delta k_{i}}{k_{i}} - \frac{\Delta k_{j}}{k_{j}} \right) \cdot k_{i} \cdot k_{j}, \text{ but given that} \]
\[ \Delta k_{i,j} = \left( \frac{X_{i}^{t+1} - X_{i}^{t}}{M_{i}^{t+1}} \right) \cdot \left( \frac{M_{i}^{t+1} - M_{i}^{t}}{M_{i}^{t}} \right) = \left( \frac{X_{i}^{t+1}}{X_{i}^{t}} \cdot \frac{M_{i}^{t+1}}{M_{i}^{t}} \right) = \left( \hat{X}_{i}^{t+1} - \hat{m} \right) \cdot \frac{1}{1 + \hat{m}} , \text{ where} \ \hat{m} = \left( \frac{M_{i}^{t+1} - M_{i}^{t}}{M_{i}^{t}} \right) \]

then,

\[ [12] \Delta k_{i,j} = \frac{\left( \hat{X}_{i}^{t+1} - \hat{X}_{j}^{t} \right)}{1 + \hat{m}} \cdot k_{i} \cdot k_{j} \]

Therefore, \( \Delta k_{i,j} \) will have the same sign as \( \left( \hat{X}_{i}^{t+1} - \hat{X}_{j}^{t} \right) \) and

\[ \lambda_{i,j} = \frac{1}{1 + \hat{m}} \cdot k_{i} \cdot k_{j} > 0 , \text{ as required by the fourth condition.} \]

(3) Brazil’s gains and losses in the U.S. import market of goods

The share of Brazil in U.S. imports fell almost continuously from 1989 to 1998, beginning then a recovery that led the share of Brazil to reach in 2004 a level approximately equal to that of 1992, as shown in Figure (1).

---

Figure (1): Share of Brazil in U.S. Imports

---

The data for U.S. imports by country of origin used in this work are from the United States International Trade Commission and are customs value (FOB) classified at the 5-digit level of the Standard International Trade Classification, Revision 3.
I have applied the constant-market-shares analysis to the exports of Brazil to the U.S. in the periods between 1992 and 2004 and between 1999 and 2004. The share of Brazil in 1992 was approximately equal to the average share of Brazil in the early 1990s, which was negatively affected by the frustrated attempt to stabilize the economy through a price and exchange rate freeze. By breaking down the period in 1999, the analysis should be able to pick up the negative effects of NAFTA and of the unfavorable changes in the exchange rate up to 1998 on Brazilian exports to the U.S. and the positive effects of the depreciation of the real since 1999.

Indeed, as Table (1) reveals, Brazil exported only US$ 120 million in 2004 in addition to what was necessary to maintain constant its 1992 share of the U.S. import market. However, this performance came about as a result of a rise in Brazilian export revenues that reached 2004 at a level US$ 5.0 billion higher than what was necessary to keep its 1999 share constant. By difference, this means that the fall in the share of Brazil between 1992 and 1999 was equivalent to US$ 4.9 billion or 23% of Brazilian export revenue in 2004.

Table (1): Gains and Losses of Brazil in the U.S. Import Market

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>(a) Aggregate effect = (b)+(c)</td>
<td>120</td>
<td>-4893</td>
<td>5013</td>
</tr>
<tr>
<td>(b) Product composition effect</td>
<td>-1712</td>
<td>-1480</td>
<td>-231</td>
</tr>
<tr>
<td>(c) Paache competitiveness effect = (d)+(e)</td>
<td>1832</td>
<td>-3412</td>
<td>5244</td>
</tr>
<tr>
<td>(d) Laspeyres competitiveness effect</td>
<td>43</td>
<td>-2945</td>
<td>2989</td>
</tr>
<tr>
<td>(e) Relative adaptation effect</td>
<td>1788</td>
<td>-467</td>
<td>2255</td>
</tr>
</tbody>
</table>

The same table also shows that the product effect was negative in both subperiods, revealing that Brazil tends to export products whose demand are less dynamic than the U.S. import market as a whole. The competitiveness effect measured at the final year (2004 – Paache measure) reached US$ 1.8 billion, more than compensating for the negative product effect in the 1992-2004 period. Again, this competitiveness gain came about as a result of a positive competitiveness effect of US$ 5.2 billion in the period between 1999 and 2004 and a negative effect of US$ 3.4 billion in the period between 1992 and 1999 (calculated by difference). Measured at the initial year (1992), the Laspeyres competitiveness effects are more or less of equal size but with opposite signs in the periods 1992-1999 and 1999-2004. Therefore, although the Laspeyres competitiveness effects dominate in each subperiod, they cancel each other out so that it is the relative adaptation effect that dominates and ultimately explains the positive Paache competitiveness effect for the whole period between 1992 and 2004.

Focusing only on the Paache competitiveness effect, Table (2) shows the main gainers and losers in the U.S. import market in 2004 compared to 1992, while Table (3) shows the same effect but comparing 2004 to 1999. Table (2) clearly reveals the phenomenal gain of China and the equally phenomenal loss of Japan in the period from 1992 to 2004. In the most

---

10 Chami Batista (2004) compares the product effects of the largest Latin American exporting countries to the U.S. in the period between 1996 and 2002 and shows that the slow growth of exports of non-differentiated resource-based products account for the negative product effects observed in most of these countries.
recent subperiod, the gains are even more concentrated in China, as Mexico moves from being the main gainer in 1992-1999 (calculated by difference) to becoming a loser in 1999-2004. On the other hand, Canada shows larger competitiveness losses in 1999-2004 than in 1992-2004, joining Japan as the main losers. Table (3) also reveals that Brazil was the fourth largest gainer in 1999-2004, as its competitiveness gains accounted for 3% of the total gains of gaining exporters.

Table (2): Main Gainers and Losers of Competitiveness in the U.S. Market: 1992-2004 (US$ billion)

<table>
<thead>
<tr>
<th>Gainers</th>
<th>Gains</th>
<th>Losers</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>134</td>
<td>Japan</td>
<td>-112</td>
</tr>
<tr>
<td>Mexico</td>
<td>48.9</td>
<td>Taiwan</td>
<td>-36</td>
</tr>
<tr>
<td>Ireland</td>
<td>17.1</td>
<td>Canada</td>
<td>-27.5</td>
</tr>
<tr>
<td>Russia</td>
<td>9.4</td>
<td>U.K.</td>
<td>-20.9</td>
</tr>
<tr>
<td>Others</td>
<td>83.4</td>
<td>Others</td>
<td>95.8</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>292.9</strong></td>
<td><strong>TOTAL</strong></td>
<td><strong>292.9</strong></td>
</tr>
</tbody>
</table>

Table (3): Main Gainers and Losers of Competitiveness in the U.S. Market: 1999-2004 (US$ billion)

<table>
<thead>
<tr>
<th>Gainers</th>
<th>Gains</th>
<th>Losers</th>
<th>Losses</th>
</tr>
</thead>
<tbody>
<tr>
<td>China</td>
<td>91.7</td>
<td>Japan</td>
<td>-35.6</td>
</tr>
<tr>
<td>Ireland</td>
<td>8.9</td>
<td>Canada</td>
<td>-32.3</td>
</tr>
<tr>
<td>Nigeria</td>
<td>5.8</td>
<td>Taiwan</td>
<td>-13.3</td>
</tr>
<tr>
<td>Brazil</td>
<td>5.2</td>
<td>U.K.</td>
<td>-12.5</td>
</tr>
<tr>
<td>Vietnam</td>
<td>4.4</td>
<td>Mexico</td>
<td>-8.6</td>
</tr>
<tr>
<td>Others</td>
<td>38.5</td>
<td>Others</td>
<td>-52.3</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td><strong>154.5</strong></td>
<td><strong>TOTAL</strong></td>
<td><strong>-154.5</strong></td>
</tr>
</tbody>
</table>

(4) Attributing Brazil’s gain & loss to its competitors in the U.S. import market

Applying now the method developed in section (2) to the Paache competitiveness effects of Brazil, it is possible to see from which countries and by how much Brazil gained competitiveness and to which countries and by how much Brazil lost competitiveness in each subperiod. Table (4) shows that Brazil’s gains came mostly from Canada in the whole period of 1992-2004. In point of fact, Brazil gained from Canada even in 1992-1999, despite its overall loss of competitiveness in this subperiod, since the gain from Canada in 1992-2004 in Table (4) is greater than the gain in 1999-2004 in Table (5).


<table>
<thead>
<tr>
<th>Gains</th>
<th>6,400</th>
<th>100%</th>
<th>Losses</th>
<th>-4,569</th>
<th>100%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canada</td>
<td>1,858</td>
<td>29%</td>
<td>China</td>
<td>-1,705</td>
<td>37%</td>
</tr>
<tr>
<td>France</td>
<td>0,982</td>
<td>15%</td>
<td>Mexico</td>
<td>-0,686</td>
<td>15%</td>
</tr>
<tr>
<td>Japan</td>
<td>0,741</td>
<td>12%</td>
<td>Russia</td>
<td>-0,430</td>
<td>9%</td>
</tr>
<tr>
<td>United Kingdom</td>
<td>0,621</td>
<td>10%</td>
<td>Ireland</td>
<td>-0,306</td>
<td>7%</td>
</tr>
<tr>
<td>Netherlands</td>
<td>0,300</td>
<td>5%</td>
<td>Peru</td>
<td>-0,231</td>
<td>5%</td>
</tr>
<tr>
<td>Others</td>
<td>1,898</td>
<td>30%</td>
<td>Others</td>
<td>-1,211</td>
<td>26%</td>
</tr>
<tr>
<td><strong>Net Gain</strong></td>
<td><strong>1,832</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Brazil also gained from France, Japan, the U.K., and the Netherlands. Therefore, Brazil’s gains tended to come mainly from the losses of the largest advanced economies\(^{11}\). It should also be noted that, except for Germany to which Brazil had small losses in 1992-1999, Brazil gained from those advanced economies in this period too, despite its overall loss. Therefore, although the competitiveness performance of Brazil appears to have been substantially affected by the appreciation of the exchange rate in the 1992-1998 period and by the depreciation in the 1998-2003 period, there seems to be a more permanent pattern that transfers export capacity from most of the advanced economies to Brazil and other emerging exporters.

Table (4) shows the countries to which Brazil lost competitiveness too. China accounted for 37% of Brazil’s losses in 1992-2004. China also accounted for almost half of Brazil’s gross losses in 1999-2004, a period in which Brazil was the fourth largest gainer of competitiveness. Brazil also lost to Mexico in the whole period of 1992-2004, but the losses were concentrated in the first subperiod, 1992-1999, as Brazil gained from Mexico in the second subperiod, 1999-2004.

It should be noted that Brazil tended to lose to developing country exporters, except for Ireland, suggesting that these countries, compete among themselves to attract export capacity from the advanced economies, largely through foreign direct investment (FDI).

Again, there seems to be a permanent pattern between Brazil and the main exporters to which Brazil lost competitiveness, since even in the period between 1999 and 2004, when Brazil experienced a positively large competitiveness effect, it lost significant shares of the market to China, Russia, Ireland, Vietnam, Peru, Turkey, Czech Republic and Slovakia, among others. As already seen, Mexico was an exception here.

---
\(^{11}\) Brazil also gained, among others, from Italy, Sweden, Spain, Switzerland, Denmark, Germany, Finland, New Zealand, and Australia in 1992-2004.
The gross\textsuperscript{12} competitiveness gains of Brazil from Canada reached US$ 3.1 billion in 2004 compared to 1992, of which 16% were obtained by exports of aircrafts\textsuperscript{13}. The vast majority of these gains, however, came from resource-based manufactured exports such as pig iron, non-ferrous metals, wood, pulp, and paper, and natural resources such as iron ore and crude petroleum. Altogether, these products, including aircrafts, accounted for over 60% of Brazil’s gross gains from Canada. Considering all the products for which Brazil gained from Canada in the whole period between 1992 and 2004, approximately 60% of the gains were obtained in the last five years.

The gross gains of Brazil from France totaled US$ 1.1 billion in 1992-2004 and came, by and large, from exports of aircrafts, which accounted for 74% of these gains. Although Brazil gained from France in both subperiods, the gains in 1999-2004 were almost 70% of the total.

Brazil’s gross gains from Japan were more widespread by products, but 69% of these gains came from machinery and transport equipment (SITC 7), especially general industrial machinery and equipment (SITC 74)\textsuperscript{14}, road vehicles (SITC 78)\textsuperscript{15} and telecommunications equipment (SITC 76)\textsuperscript{16}, and 22% from manufactured goods classified chiefly by material (SITC 6), particularly iron and steel (SITC 67)\textsuperscript{17}. The gross gains of Brazil from Japan appear to have been less sensitive to exchange rate movements, since the gains in 1999-2004 accounted for only 39% of the total gains in the whole period from 1992 to 2004.

The gross gains of Brazil from the U.K. and the Netherlands were very concentrated in exports of aircrafts and a major part of them took place in the first subperiod, since exports of aircrafts from the U.K. and the Netherlands to the U.S. fell sharply between 1992 and 1999 and remained low in 2004. This is part of the answer as to why Brazil gained from these two countries in the first subperiod. The Netherlands also showed a substantial increase in its relative share of some oil derivatives in 1999-2004, which also helps to explain its gains from Brazil in this second subperiod.

The gross losses of Brazil to China amounted to US$ 1.9 billion in 1992-2004 and were quite concentrated in one type of leather footwear\textsuperscript{18}, which accounted for 49% of this total. The section of miscellaneous manufactured articles (SITC 8), accounted for 59% of these total gross losses and wood furniture goods, in addition to leather footwear, were among the top losses of Brazil to China in this section. The section of manufactured goods classified mainly by material (SITC 6) accounted for 20% of these losses and iron and steel, plywood

\textsuperscript{12} As country A gains in some products and loses in others to country B, country A’s gross gain will be obtained by adding up all the gains by products and analogously for the gross loss. The difference between the gross gain and the gross loss is the net gain or loss of country A to country B. For example, Brazil gained US$ 3.1 billion from Canada, but also lost US$1.2 billion to Canada, resulting in a net gain of Brazil from Canada of US$ 1.9 billion in the 1992-2004 period.
\textsuperscript{13} SITC 79230.
\textsuperscript{14} Mainly compressors for refrigerating equipment - SITC 74315.
\textsuperscript{15} Mainly motorcycles from 50 cc to less than 250 cc - SITC 78513.
\textsuperscript{16} Mainly mobile phones - SITC 76432.
\textsuperscript{17} Mainly flat-rolled steel products – SITC 67413.
\textsuperscript{18} SITC 85148.
and rubber tires were among the top losses in this section. Another 17% of these losses were made of products classified in the section of machinery and transport equipment (SITC 7) among which were: air conditioning equipment, data processing equipment and parts, and various automotive parts and accessories such as radios for vehicles and brakes. Brazil’s gross gains totaled US$ 182 million only, less than 10% of the gross losses. Among the top gains of Brazil were mobile phones, rubber or plastic footwear and some kitchen, toilet and bed linen made of cotton and other materials. These four products accounted for 60% of Brazil’s gross gains from China.

Examining the gross losses of Brazil to China in 1999-2004 by main products, it can be seen that Brazil continued to lose to China in almost every product among the top losses, notwithstanding the sharp depreciation of the Brazilian currency. This includes leather footwear, iron and steel products, air conditioning, plywood, data processing equipment and parts, wood furniture, and brakes. In point of fact, for some parts and accessories for motor vehicles, including radios and rubber tires for buses and trucks, Brazil gained in the subperiod from 1992 to 1999, but the loss in the period from 1999 to 2004 surpassed the gain. In the case of mobile phones, Brazil also lost to China in the 1999 to 2004 subperiod, but the gain in the previous subperiod was greater.

China has become a large importer of raw hides and skins and an exporter of manufactured leather and leather footwear in the 2000s. Brazil, on the other hand, has been a traditional exporter of the whole chain from hides and skins to leather footwear. However, Brazil has been losing market share in the world and in the U.S. in both hides and skins and leather footwear markets, while gaining in the manufactured leather markets, especially in the parchment-dressed or prepared after tanning bovine and equine leather\textsuperscript{19}. In the U.S. import market since 1999, China has gained from Brazil in the whole chain of value of the leather-footwear industries, indicating that the Chinese firms have become more competitive than Brazilian firms even in the U.S. manufactured bovine and equine leather import market.

Therefore, the depreciation of the real after 1998 appears to have helped Brazil’s exports of manufactured leather, but made almost no difference for Brazil’s exports of leather footwear, which continued to lose market share, especially to China. Figure (2) reveals that the unit value of China’s exports of leather footwear\textsuperscript{20} to the U.S. relatively to Brazil’s unit value changed little in the period from 1989 to 2004, while the relative quantities (pairs) increased dramatically in favor of China in the same period. This clearly indicates that Brazilian firms have failed to reduce costs and/or differentiate their products to the extent necessary to compete with Chinese firms.

\textsuperscript{19} SITC 61142.
\textsuperscript{20} Product classified as 640399 of the Harmonized classification system: footwear, with outer soles of rubber, plastics or composition leather and uppers of leather nesoi, not covering the ankle.
The net loss of Brazil to Mexico took place in the subperiod of 1992 to 1999, since Brazil gained from Mexico in the subperiod of 1999 to 2004. This is interesting because the first subperiod coincides with the implementation of NAFTA and with a strong appreciation of the Brazilian currency against the Mexican currency. On the other hand, in the second subperiod, the Brazilian currency suffered a major depreciation with respect to the Mexican currency. Although the total net gain of Brazil from all countries taken as a group in the second subperiod more than compensated for the net loss of the first subperiod, Brazil had a net loss to Mexico in the whole period 1992-2004, since the gains in the second subperiod did not compensate for the losses of the first subperiod.

Looking at the losses of Brazil to Mexico by product in the period 1992-2004, it is clear that more than half of these losses occurred in products of the steel and automotive industries. More interestingly, out of a total gross loss of US$ 1.27 billion to Mexico, 10% were in a group of products for which Brazil gained competitiveness overall (against all competitors taken together) in the period, 37% were in a group of products for which Mexico accounted for at least 75% of Brazil’s losses, and 34% were in a group of products for which Mexico accounted for between 10% and less than 75% of Brazil’s losses. Together these products were responsible for US$ 1.04 billion, 81% of Brazil’s gross loss in the period, or 4.7% of Brazil’s exports to the U.S. in 2004. Considering the first two groups of products only, together they accounted for US$ 600 million, 47% of Brazil’s gross loss, or 2.8% of Brazil’s exports to the U.S. in 2004.

Brazil paid import tariffs in 1994 and 2004 for at least 98% of the losses made in the products of the first group, 96% of the second group and 78% of the third group. One should bear in mind that the existence of a margin of preference to Mexico does not necessarily imply that Brazil’s losses were entirely due to NAFTA. On the other hand, NAFTA may have played a part even in products for which imports are free in the U.S., due to economies of scope, economies of scale and externalities generated by NAFTA.
regarding the production and transport to the U.S. of all goods from Mexico. Furthermore, one can argue that even in products where Brazil gained market share from Mexico, NAFTA may have reduced these gains. Therefore, one could rather conservatively estimate the negative effect of Mexico participation in NAFTA on Brazil as something between 2.8% and 4.7% of Brazil’s exports to the U.S., compared to an expectation, before the implementation of NAFTA, of less than 1% of Brazil’s exports to the U.S.  

Although Brazil gained overall from Canada, as it was already analyzed in this section, Brazil’s net gain of US$ 1.86 billion resulted from a gross gain of US$ 3.12 billion and a gross loss of US$ 1.26 billion to Canada. Out of this gross loss, only 1% was in products for which Brazil gained overall but lost to Canada, and only 20% in products Brazil lost at least 75% to Canada. This is in marked contrast with the losses of Brazil to Mexico.

Two products of the steel industry account for 74% of the gross loss of Brazil to Russia in the period 1992-2004. Ferroalloys and oil derivatives were responsible for 12% of this gross loss. On the other hand, chemical, pharmaceutical and medical materials were responsible for over 95% of Brazil’s gross loss to Ireland in the period 1992-2004. Generally speaking, Brazil continued to lose market share to Russia and Ireland in these products in the period 1999-2004, despite the depreciation of the Brazilian exchange rate.

**Conclusions**

The method developed in this paper to distribute the gains and losses of market share of an exporting country among its competitors in a specific destination product market has clearly improved on the previous method. They both satisfy the conditions that: one country does not lose to or gain from itself; the gain of country A over country B is equal to the loss of country B to country A; and the sum of the changes in market shares of one exporting country that are attributed to each of its competitors is equal to the overall change in market shares of the country. However, this new method satisfies one important condition not satisfied by the previous method. That is, the change in market shares of one exporting country that is attributed to one of its competitors is directly related to the difference between the rates of growth of exports of the two countries.

Applying the method to Brazil’s exports to the U.S. in 1992, 1999 and 2004 has proved useful to give a clearer picture of some different changes in Brazil’s competitiveness over these periods. Although Brazil lost competitiveness in the subperiod from 1992 to 1999 and gained competitiveness in the subperiod from 1999 to 2004, it tended to gain competitiveness from most of the advanced economies and lose competitiveness to most emerging countries in both periods. This more permanent trend is also observed for the main gains and losses of Brazil by products and competing countries.

The gains from advanced economies are largely related to the exports of aircrafts, some resource-based products, and some equipment such as mobile phones, compressors for refrigerating equipment, road vehicles and their parts. The gains in equipment are most

---

often related to transfers of export capacity from advanced economies to emerging countries through foreign direct investments.

The losses of Brazil were largely to emerging countries, especially to China and to a lesser extent to Mexico. The losses to China were concentrated in leather footwear, while those to Mexico were in steel products and products of the automotive industry, including engines, radios for motor vehicles and parts. These losses of the automotive industry to Mexico can easily be attributed to NAFTA and its attracting effect on foreign direct investments. The losses to Russia, Vietnam and Peru were mostly resource-based products, either primary goods or very low-tech manufactures, while those to Ireland were concentrated in chemicals and pharmaceuticals.

Considering the products for which Brazil lost market share to Mexico in the U.S. in 2004 compared to 1992 but gained from all other countries taken as a group, and the products for which Mexico accounts for a large share of Brazil’s losses in the period, it is possible to have an idea of the NAFTA effect on Brazil’s losses to Mexico. Indeed, this effect may be estimated as something between 2.8% and 4.7% of Brazil’s exports to the United States.

References


