Analysis of Horizontal and Vertical Intra-Industry Trade: The Case of Mexico and China

Natalia Primo Dominguez
Nanjing University of Science and Technology, Nanjing, Jiangsu, China
primonati@yahoo.com

Keywords: G-L Index, Inter-Industry Trade, Intra-Industry Trade, and Vertical Intra-Industry Trade.

Abstract. The purpose of this study is to measure and analyze the extent of vertical and horizontal intra-industry trade between Mexico and China in seven sectors over a five-year period, from 2012 to 2016, using disaggregated trade data at the SITC three digit level; and to identify in what sectors IIT is mainly concentrated. Lastly, this paper aims to disentangle trade into: inter-industry trade, horizontal intra-industry trade, low quality vertical ITT (low ITTV) and high quality vertical ITT (high-ITTV). One of the main findings is that there is relatively low bilateral intra-industry trade between Mexico and China. Furthermore, the results showed that it was high-ITTV that prevailed over low-ITTV. In this type of trade, China is mainly exporting low quality goods to Mexico.

1. Introduction

Intra-industry trade (IIT) can be defined as the simultaneous import and export of commodities of the same industry group. According to Ekanayake (2001), “Intra-industry trade describes trade in similar, but slightly differentiated products based on imperfect competition, or trade in close substitutes demanded by consumers in different countries who may have distinct tastes or preferences” [1]. In the case of Mexico in particular, intra-industry trade has increased rapidly over the years and as a result has become even more important. In this context, Mexico has significantly increased cooperation and trade with China; in fact, China is currently Mexico’s second largest trading partner. Thus, it is of particular interest the analysis of IIT in order to clarify to what extent these two economies are complementary or competitive, since China has not only become one of the most important trading partners to Mexico.

The purpose of this study is to measure the extent of intra-industry trade between Mexico and China covering the period from 2012 to 2016, and to identify in what sectors IIT is mainly concentrated. Lastly, this paper aims to disentangle trade into: inter-industry trade, horizontal intra-industry trade, low quality vertical ITT (low ITTV) and high quality vertical ITT (high-ITTV).

2. Characteristics of Mexico’s Intra-Industry Trade with China

There is a very prominent shortage of literature concentrating on the IIT relationship between Mexico and China. Nevertheless, there still seems to be a general consensus, that there is an overall low level of bilateral intra-industry trade between these two nations. Furthermore, most of the bilateral intra-industry trade involves low quality exports, and some studies have even shown that there is a negative growth of high quality exports from China. As stated by Lopez (2014), “China’s trade with Mexico seems to be of an inter-industry nature, as only 11 chapters have a GL index exceeding 0.5” [2].

It is also important to mention that Mexican intra-industry trade has been known to be positively related to the following set of variables: per capita income, average country size, trade intensity, trade orientation, existence of a common border, common language, and the participation in a regional integration scheme. Additionally, in a study done by Ekanayake (2001), it was found that Mexican two-way trade was negatively associated with: income differences, differences in country size, distance, and trade imbalance. On the other hand, China’s intra-industry trade has been shown to vary
greatly across industries and trading partners. Taking into account the existing literature on China’s IIT, we can conclude a few things. First of all, China’s two-way trade is an important element in its manufacturing sector. Secondly, vertical IIT takes predominance in the Chinese two-way trade. This indicates that China’s IIT is mostly differentiated by quality as opposed to similar products.

3. Measurement of Intra-Industry Trade

The purpose of this study was to calculate and analyze the pattern of intra-industry trade, of Mexico and China, in seven sectors over a five-year period. To accomplish this task, the methodology that was used in this study was carried out over 3 distinct stages: the measurement of IIT, the classification of IIT into vertical and horizontal IIT, and lastly the distinction of low quality vertical ITT (low ITTV) and high quality vertical ITT (high-ITTV). There have been various measures of IIT that have been proposed over the years, but the G-L index that Grubel and Lloyd presented in 1975, has long been contemplated as the most appropriate method for determining the extent of intra-industry trade in a single period of time. The G-L index measures the share of intra-industry trade of industry \([i]\) for a given country \([j]\) as:

\[
GL = \frac{\left| X_i - M_i \right|}{\left| X_i + M_i \right|} \times 100 \%
\]

Where \([X_i]\) and \([M_i]\) are home country’s exports and imports of industry \([i]\), respectively. The G-L index takes values that range between 0 and 1, where 1 indicates that all trade is intra-industry, while 0 suggests that all trade is inter-industry. Inversely, if the G-L index takes the value of 0, that would imply that the country in consideration only exports or only imports good \([i]\), and consequently there would be no intra-industry trade. According to Andresen (2013), this index has been heavily criticized from suffering from categorical/subgroup aggregation issues. In order to deal with this aggregation issue, the following adjusted index was used in this research paper:

\[
GL' = \frac{\sum_{i=1}^{n} \left| X_{ij} - M_{ij} \right|}{\left| X_{ij} + M_{ij} \right|} \times 100 \%
\]

The above G-L index was used to calculate the IIT per sector as well as total IIT between Mexico and China over a five-year period, from 2012 to 2016. The seven sectors were organized as follows:

<table>
<thead>
<tr>
<th>Sectors</th>
<th>Chemical</th>
<th>Electrical</th>
<th>Food</th>
<th>Machinery</th>
<th>Metal</th>
<th>Textile</th>
<th>Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td>SITC</td>
<td>511-598</td>
<td>771-778</td>
<td>001-098</td>
<td>711-764</td>
<td>671-699</td>
<td>261-269, 651-659, 831-851</td>
<td>781-793</td>
</tr>
</tbody>
</table>

In order to break down intra-industry trade into horizontally and vertically differentiated products, this study took inspiration from the steps taken by Fontagné and Freudenberg (1997). Since the prices of goods are unknown, unit values (UV) are used instead in order to evaluate product quality in trade data. According to Ekanayake (2009), “The rationale for using unit value as an indicator of quality is that, assuming perfect information, a variety sold at a higher price must be of higher quality than a variety sold more cheaply” [4]. Therefore, if the difference in unit values is found to be below a certain threshold, in this case \([\alpha=0.15]\), this indicates that the quality of both goods is quite similar, and therefore we can consider them to be horizontally differentiated. That is to say, the difference in unit values of exports \(UV_{ix}\) and imports \(UV_{ij}\), for a product, j, and using a particular dispersion
factor \([\alpha=0.15]\), needs to satisfy the following condition in order to be considered a horizontally differentiated product:

\[
1 \quad \alpha \leq \frac{U_V^x}{U_V^m} \leq 1 \quad \alpha.
\]  

(3)

On the contrary, bilateral trade of a vertical differentiated product occurs when the difference in unit values corresponds with the following criteria:

\[
a) \quad \frac{U_V^x}{U_V^m} < 1 \quad \alpha \quad \text{or} \quad b) \quad \frac{U_V^x}{U_V^m} > 1 \quad \alpha.
\]  

(4)

It is important to mention that the threshold was set at 15% \([\alpha=0.15]\), because the assumption is that freight costs do not affect the values of exports and imports by more than 15%. Thus, after using this percentage to categorize both horizontal and vertical IIT, the results were then used to further classify vertical IIT into low quality vertical IIT (low-ITTV) and high quality vertical IIT (high-ITTV). If the difference in unit values of exports \([U_V^x]\) and imports \([U_V^m]\), was lower than 0.85 \([1-\alpha=0.85]\), as shown in incision a, then it was concluded that the quality of the imports was much greater than that of the exports, and therefore it could be regarded as low ITTV. On the other hand, if the results were in accordance with the above incision b, then they were classified as high-ITTV. That is to say, if the difference was found to be greater than 1.15 \([1+\alpha=1.15]\), then the results fell into the category of high-ITTV.

4. Results

Table 2 points out the evolution of the traditional G-L index by sectors between Mexico and China, for the years 2012 to 2016. The results demonstrate in which sectors intra-industry was most significant during that time span; as can be seen in the table, the higher the percentage of G-L index symbolizes a higher level of intra-industry trade.

<table>
<thead>
<tr>
<th>YEAR</th>
<th>SECTORS</th>
<th>TOTAL G-L INDEX FOR ALL SECTORS (2012-2016)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>CHEMICAL</td>
<td>ELECTRICAL</td>
</tr>
<tr>
<td>2012</td>
<td>28.20%</td>
<td>3.15%</td>
</tr>
<tr>
<td>2013</td>
<td>26.92%</td>
<td>2.07%</td>
</tr>
<tr>
<td>2014</td>
<td>18.05%</td>
<td>2.15%</td>
</tr>
<tr>
<td>2015</td>
<td>11.25%</td>
<td>2.39%</td>
</tr>
<tr>
<td>2016</td>
<td>17.44%</td>
<td>2.93%</td>
</tr>
</tbody>
</table>

Source: prepared by the author, on the basis of data from the United Nations Commodity Trade Statistics Database (COMTRADE).

This study resulted in several major findings with regards to the bilateral intra-industry trade between Mexico and China. First of all, the Grubel-Lloyd index calculations demonstrated that the chemical, food, and transport sectors had the highest IIT levels. It also showed that the group of sectors with the lowest intra-industry trade indices included: electrical, machinery, metal, and textile sectors. Secondly, the results showed that vertical intra-industry trade (both high quality, and low quality) was predominant over horizontal IIT in all sectors.

In summary, the findings suggest that generally there is relatively low bilateral intra-industry trade between Mexico and China. Furthermore, the results showed that vertical IIT took predominance.
over horizontal IIT in all sectors. When further disentangling vertical IIT, we also found that it was high-ITTV that prevailed over low-ITTV. This indicated that the majority of Chinese products being exported to Mexico (during 2012-2016) were of relative low quality, in comparison to the Mexican exports going to China. The commodities that presented the highest levels of G-L index are showed in table 3. Pigments, paints, varnishes and related materials had the highest Grubel-Lloyd index, with an average of 76.78%; although chocolate and other preparations containing cocoa came in close second, with 76.48%.

<table>
<thead>
<tr>
<th>Sector</th>
<th>Commodity Code</th>
<th>Description</th>
<th>Average G-L Index</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Chemical</td>
<td>Pigments, paints, varnishes and related materials</td>
<td>76.78%</td>
</tr>
<tr>
<td>2</td>
<td>Food</td>
<td>Chocolate and other preparations containing cocoa</td>
<td>76.48%</td>
</tr>
<tr>
<td>3</td>
<td>Food</td>
<td>Crustaceans and mollusks, fresh, chilled, frozen, salted</td>
<td>76.07%</td>
</tr>
<tr>
<td>4</td>
<td>Chemical</td>
<td>Explosives and pyrotechnic products</td>
<td>75.82%</td>
</tr>
<tr>
<td>5</td>
<td>Textile</td>
<td>Vegetable textile fibers, excluding cotton, jute, and waste</td>
<td>74.88%</td>
</tr>
<tr>
<td>6</td>
<td>Food</td>
<td>Meat and edible meat offal, fresh, chilled or frozen</td>
<td>73.31%</td>
</tr>
<tr>
<td>7</td>
<td>Food</td>
<td>Sugar and honey</td>
<td>68.77%</td>
</tr>
<tr>
<td>8</td>
<td>Chemical</td>
<td>Polymerization and copolymerization products</td>
<td>59.94%</td>
</tr>
<tr>
<td>9</td>
<td>Machinery</td>
<td>Engines and motors, non-electric; parts</td>
<td>54.66%</td>
</tr>
<tr>
<td>10</td>
<td>Metal</td>
<td>Copper</td>
<td>52.56%</td>
</tr>
</tbody>
</table>

Table 3. Commodities that presented the highest levels of G-L index, 2012-2016.

These results reflect the international trend of trading intermediate inputs required by multinational firms, which is part of intra-firm trade. According to Mendoza (2016), “it has been argued that the disintegration of the manufacturing process of production of firms allows increasing trade at the international level” [5].

5. Conclusions

There is almost no research that has focused primarily on the IIT between Mexico and China, despite the fact that, as was mentioned before, China is one of Mexico’s most important trading partners. Most importantly, given the rapidly growing Mexican bilateral trade with China, a study analyzing these two countries’ IIT is warranted. There were several major findings with regards to the bilateral intra-industry trade between Mexico and China. First of all, it was discovered that there is relatively low bilateral intra-industry trade between Mexico and China. Additionally, the results revealed that vertical IIT took predominance over horizontal IIT in all sectors. These results reflect the international trend of trading intermediate inputs required by multinational firms, which is part of intra-firm trade. When further disentangling vertical IIT, we also found that it was high-ITTV that prevailed over low-ITTV.

Acknowledgement

Foremost, I would like to thank God. Secondly, I would like to thank my family, especially my mother Laura, for supporting me throughout my life, and in my pursuit of my master’s degree.

References


