Trade Cooperation Indicators: Development of BRIC Bilateral Trade Flows**

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It has been nearly ten years since Goldman Sachs introduced BRIC emerging markets as economies with great future potential. BRIC still remains a non-formal group but there are tendencies for further cooperation in various fields. This paper studies the evolution of trade intensity among BRIC within the period 1995-2009. Calculations are based on the trade intensity index as well as with a closer look at the trade complementary index. An empirical analysis examines the intensity of bilateral trade flows not only between BRIC countries but also between BRIC and EU since trade relations with the EU still play a substantial role for each of the BRIC countries. This paper reveals Sino-Brazilian and Sino-Indian trade as a trade with the highest intensity progression. Russia remains the most intensive trade partner for the EU.

Keywords: BRIC, trade intensity, trade complementarity index, bilateral trade, EU

JEL Classification: F13, F14, F15, F47

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1. Introduction

It has been nearly ten years since the analysts of Goldman Sachs introduced the forecast for BRIC (Brazil, Russia, India, and China) emerging markets and pointed out their potential for future economic growth. It is obvious that BRIC countries have been increasing their economic as well as geopolitical power especially after the world economic recession since their economies recovered at a much faster rate than the developed countries. Nevertheless, each of the countries aims to remain economic/political power, at least regionally, thus making it difficult to create close relations. BRIC still remains a non-formal group but there are arising tendencies for further cooperation in various fields already stimulated by three summits. BRICs' rapid economic growth is based on their specialization enhanced by large endowments of factors of production with a comparative advantage which combined could spur their mutual cooperation and development.

BRIC economies are considered highly integrated in global trade. Their trade with the world has increased more than five times since 1999 and their share of world trade in the past decade nearly doubled, currently being around 14%. Moreover, BRIC to BRIC annual growth rate of trade is about 32%. Brazil's trade is the most geographically spread of all the BRIC countries across all continents. It has also remained the most closed economy of the group with very little trade liberalization since large tariff reductions at the turnover of the 1980s and 1990s (Freemantle and Stevens, 2010). The EU, USA and China are among its major trade partners (EC, 2010a). Most Brazilian exports consist of metals, fuels and agricultural products, thus it has closer trade relations with China and India rather than with Russia. Russian trade is characterized as the least diversified of the BRIC with a strong orientation to the EU market. Over 45% of its trade is conducted with the EU and shares tend to increase over the years. Their economic relations are guided by the Partnership and Co-operation agreement which allows Russia the implementation of flexible unilateral tariff measures (EC, 2010e). Other trade partners are China (nearly 9%) and Ukraine (over 4%) (EC, 2010b). Russia is also the only BRIC country that is not a member of the World Trade Organization (WTO). Its accession in the future could advance Russian trade liberalization but only at a small extent due to its exports of products (natural resources) which already face little trade barriers from importing countries (Sally, 2009). The EU is also a far more important trade partner for India and China, followed secondly by China (EC, 2010c) in case of India and the USA (EC, 2010d) in case of China. India has rapidly reduced its average tariffs from above 80% in the early 1990s to below 15% recently. Large tariff cuts were also implemented by China prior accession to WTO and also after (OECD, 2009). Mutual trade between India and China has been further intensified by China's accession to the Asia-Pacific Trade Agreement in 2001. China persists to be the largest exporter in the world however, it is strongly reliable in imports from other countries such as long as BRIC. Recent trade trends thus reveal tendencies towards south-south trade co-operation Brazil-South Africa-India-China.

This paper assesses inter-BRIC merchandise trade intensity and its tendencies as one of the factors determining a deepening cooperation among countries. An empirical analysis examines the intensity of bilateral trade flows not only between BRIC countries but also between BRIC and the EU since trade relations with the EU still play a substantial role for each of the BRIC countries. The study applies two
methodologies - trade intensity and trade complementarity assessment. The aim of this paper is to test whether there have been some changes in BRIC to BRIC and BRIC to EU trade observing the pre-BRIC and post-BRIC period. Data period selected for the test took place between 1995 and 2009.

2. Literature Review

For an analysis of the bilateral trade cooperation, the geographic trade distribution and to what extent countries trade with each other, various indices were developed. The simplest formula for monitoring trade flows and patterns was defined by Brown in 1949 and Kojima in 1962 as trade intensity (TI). TI describes the bilateral trade between two countries in relation to the total value of world trade and its share in it. Yamazawa (1971) applied the TI formula and further analyzed trade between pairs of countries. His work also assessed trade changes and factors affecting them. Trade intensity could be estimated not only between countries but also as intra or extra-trade intensity of some country groups/regions (Iapadre 2004).

There are several ways to capture the degree of trade specialization. But the most common is Balassa's index. Balassa (1965) proposed the revealed comparative advantage (RCA) index which is calculated at a commodity level. A variation of his formula was further interpreted by Kunimoto (1977) and more critically reviewed by Iapadre (2001).

To measure the compatibility of trade profiles the complementarity index (TCI) is proposed. The first TCI was proposed by Kojima and perfected by Drysdale in 1967. TCI shows whether or not one country exports products that another country imports. This index matches only the demand of partners and does not include others parameters (e.g. distance of partners).

Each of the indices gives different overview and therefore for a better understanding of the problem it is useful to combine them. Current papers using combined approach were published e.g. by Chandran (2010) who discusses trade intensity as well as revealed comparative advantage on Indian-ASEAN trade relations. ASEAN regional trade intensity together with China, Japan and Korea was also studied by Kim (2002). Another complex analysis elaborating Indo-Chinese bilateral trade was conducted by Bhat, Guha and Paul (2006).

3. The Methodology and Data

This paper is based on two methodologies - the trade intensity index (TII) and the trade complementarity index (TCI). The measures of changing trend patterns in trade among BRIC countries and between BRIC and the EU are applied in this paper. Data series from 1995 to 2009 were selected for measurements in order to enable a time comparison between the pre-BRIC period and the current status.

The analysis of the international trade intensity flow in this paper stems from the basic trade share formula (S) which tells us the relative importance of a trade partner.

\[
S_{ij} = \frac{T_{ij}}{T_{iw}} = \frac{\sum_k x_{ij} + \sum_k m_{ji}}{\sum_k x_{iw} + \sum_k m_{wi}}
\]
$T$ – trade; $x$ – export; $m$ – import; $k$ – set of industries; $i$ – source country; $j$ - partner country

For the comparison of trade shares of different countries it is more suitable to use the intensity index instead of trade shares (S), which at least partly reflects the size of the market. The trade (intra-trade) intensity index ($I_i$; hereof ITI), is defined as a ratio with trade shares of the partner trade between country $i$ and $j$ to the total trade of country $i$ as a numerator to the trade shares of the total trade of partner country $j$ to a whole world trade as denominator.

$$I_{ij} = \frac{T_{ij}}{T_{iw}} \frac{T_{iw}}{T_{w}}$$

$T_{ij(w)}$ – trade between country $i, j$ or world; $T_w$ – total world trade

The trade intensity index holds the value of 0 (no bilateral trade) to infinity. One indicates that partners are trading without geographic bias. The value below (above) indicates that the trade is less (more) intensive than is expected. For a better comparison the intensity $I$ is normalized to the symmetric form ($SI_{ij}$).

$$SI_{ij} = \frac{I_{ij} - 1}{I_{ij} + 1}$$

Where 0 means geographic neutrality, -1 no bilateral trade, and the values between 0 and 1 indicate greater importance of the partner.

The formula ($SE_{ij}$) for extra-trade which indicates the intensity trade between source country $i$ and all others countries excluding the destination country $j$ can be defined in a similar way. In this case:

$$E_{ij} = 1 - \frac{T_{ij}}{T_{iw}} \frac{T_{iw}}{1 - T_{jw}} \frac{T_{jw}}{T_w}$$

and

$$SE_{ij} = \frac{E_{ij} - 1}{E_{ij} + 1}$$

In most cases the trends of $EI_{ij}$ is opposed to $SI_{ij}$.

The data sources used for the trade intensity index calculation were derived from the official UNCTAD online database. The problem of discrepancy between export prices listed in FOB and import prices based on CIF was excluded by the average mean between FOB and CIF prices. Possible arising inconsistency in trade reports caused by the accounting of exports and imports assigned to different months, and the divergent beginning period of the fiscal year in India are nearly eliminated due to a long time series. Hong Kong and Macau SARs have been excluded from all data in this paper regarding China.
The trade complementarity index (TCI) is the second indicator used in this paper. It is one of the overlapping indices that enable a comparison of export and import profiles between two countries i.e., how the export set of industries from the source country matches with the import set of industries from a destination country.

\[ TCI = \left(1 - \sum_i \left[ \frac{\sum w M_{iwd}}{\sum w M_{wd}} - \frac{\sum w X_{isw}}{\sum j X_{sw}} \right] \right) \times 100 \]

Where: \(d\) - importing country of interest; \(s\) - exporting country of interest; \(w\) - set of all countries in the world; \(i\) - set of industries; \(x\) - commodity export flow; \(X\) - total export flow; \(m\) - commodity import flow; \(M\) - the total import flow.

The degree of TCI ranges between 0 and 100 percent. Higher complementarity value indicates a better export/import match, while 0 value indicates no complementarity at all.

TCI data calculations were collected from UN COMTRADE for the purpose of this paper and accessed from the International Trade Centre online database. A cross-pair comparison between all BRIC members and the EU was conducted for two years. The particular years examined were 2001 and 2009 enabling a comparison of the complementarily degree since the new-coined BRIC group was brought in. The trade data for TCI calculations was computed from a 2-digit SITC level of exports and imports.

4. The Findings

By implementation of the collected data from UNCTAD to the \(S_{ij}\) formula this paper studies the bilateral trade intensity among BRIC economies and the intensity of bilateral trade between all BRIC countries separately with the EU. In order to provide a complex overview, all presented figures highlight the intra-trade intensity index as well as the extra-trade intensity indices from 1995 to 2009. The paper confirms that behavior of the intra-trade intensity and extra-trade intensity indices are, according to assumption, complementary. In terms of growth it means that one index is increasing while the complementary is declining and vice versa. According to definition the extra-trade intensity index measures trade intensity between country \(i\) and all other countries besides country \(j\). Due to the size of the total trade, it is clear that the complementary extra-trade intensity index is affected much less than the intra-trade intensity index. The left axis contains a scale of figures from the intra-trade intensity index, and the right axis contains the extra-trade intensity index.

Figure 1 illustrates the trade intensity indices between Brazil and Russia. It is evident that the trend of ITI overall was increasing until 1999 followed by the down swing in 2000. As the BRIC group was introduced in 2001, ITI reached neutrality at the same time and succeeded with a short-term growth of the index, reaching neutrality again at the turn of the year from 2003 to 2004. Since then the trend of ITI registered a general downward trend and had remained bellow neutrality, which means an under-representation of mutual trade intensity between Brazil and Russia.

The ITI between Brazil and India is represented in Figure 2. The variations of the ITI value have changed from the lowest level of -0.4 in 1998 to the highest level 0.1 in
2002 with further fluctuations below and above neutrality threshold. Since 2007 ITI trend had shown a growing propensity and in 2009 it exceeded zero value towards over-representation.

Figure 3 portrays the Sino-Brazilian ITI development. In comparison to the aforementioned trade relations the ITI trend between 1999 and 2009 practically remained in an increasing manner. And in 2006 it raised above the neutrality level. From all of the studied BRIC bilateral relations it recorded the biggest change not only in the value but also towards over-representation.

Both ITI's between Russia and India (Figure 4) and Russia and China (Figure 5) indicate some similarities. The observations reveal long-term increasing trade intensity. By 2004 the ITI trend was characterized by upward and downward movements but only above the neutrality threshold. The year 2004 was a turning point in both bilateral trade linkages, and as the latter years followed, the ITI was decreasing. Even though Sino-Russian ITI registered one upswing in 2007, later tendencies were of declining character. On the contrary, in 2008 Russia-India ITI indicated some increasing nature. However, in 2009 it still remained below the Sino-Russian ITI level.

The early Sino-Indian bilateral trade relations show nearly identical development as in the Sino-Brazilian case. However, their ITI had already reached zero value on the turn of the year 2003 to 2004. ITI had maintained its value between neutrality and 0.08. In contrast to Sino-Brazilian ITI the index between India and China had slightly decreased as of 2008 and had been reaching neutrality.

The bilateral EU-BRIC intra/extra-trade intensity indices are represented in Figures 7 to 10. The figures illustrate that all bilateral ITIs range above the zero thresholds. A closer look at EU-BRIC relations reveals that while the intensity of intra-trade between EU-Brazil and EU-India is falling, the intra-trade intensity with China and Russia shows a rising pattern. In particular, the relationship between EU and Russia corresponds to a higher than standard behavior. EU-Russia ITI reached its peak at the level of 0.62 in 2006, and then it slightly declined to 0.6. In general, EU-China intra-trade intensity continued growing with periodic ups and downs (2002 and 2005) but without any significant declines. On the contrary, EU-India trade relations reveal the most dramatic decline in intra-trade intensity from 0.32 to 0.15. Interestingly, even after the striking drop, ITI ended in 2009 at about the same value as ITI between the EU and China.

Moreover, from the information above it is evident that due to the extent of China’s market its extra trade is less dependent on changes in bilateral intra-trade as it is illustrated in Figures 3, 5 and 6. The EU market records similar effects. There are hardly any changes in extra-trade for EU-Brazil and EU-India trade partners. However, the significance of China’s market for EU trade relations can be well observed in the Figure 10.
The second introduced index in this paper is the trade complementarity index. Cross-pair calculations of TCI for 2001 and 2009 are inserted in Table 1 and Table 2 respectively.

Table 1 Trade Complementarity Indices for BRIC, EU Cross-pairs, 2001

<table>
<thead>
<tr>
<th>Importing</th>
<th>Exporting</th>
<th>Brazil</th>
<th>Russia</th>
<th>India</th>
<th>China</th>
<th>EU</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brazil</td>
<td>-</td>
<td>36</td>
<td>41</td>
<td>58</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>Russia</td>
<td>59</td>
<td>-</td>
<td>45</td>
<td>53</td>
<td>71</td>
<td></td>
</tr>
<tr>
<td>India</td>
<td>40</td>
<td>54</td>
<td>-</td>
<td>40</td>
<td>46</td>
<td></td>
</tr>
<tr>
<td>China</td>
<td>50</td>
<td>34</td>
<td>42</td>
<td>-</td>
<td>67</td>
<td></td>
</tr>
<tr>
<td>EU</td>
<td>68</td>
<td>49</td>
<td>60</td>
<td>65</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>

Source: calculated by author based on data from the International Trade Centre database (2010)
The tables reveal that TCI for Indian exports in 2009 contain greater cross-pair import matches with all partner economies in comparison to 2001. Nonetheless, the TCI for Russia (as exporter) to trade partners embodied only cutbacks. TCI change between Brazil as an exporting country and its BRIC/EU partners shows mixed results. TCI improved for Brazil-India and Brazil-China as opposed to worsening TCI for the rest of the trading pairs. Moreover, the TCI between EU-Brazil and EU-Russia remained substantially high in 2009, on the comparison to EU-China pair.

Comparing the results from intra-trade intensity figures and TCI tables it is evident that there is a decrease of TCI and also of ITI for the examined cross-pair Brazil-Russia. The situation in the case of Brazil-India is opposite, ITI and TCI both increased. Significant TCI growth of India-Brazil gave a substantially great potential for future trade expansion. Brazil-China ITI grew while the TCI of China (as exporter) was more or less stable and TCI of Brazil (as exporter) increased. Quite a different situation occurs for cross-pairs Russia-India and Russia-China. In both cases the changes in cross-pairs of TCI are either similar or increase but their ITI plunges.

As for EU-Brazil the TCI slightly increases and for Brazil-EU TCI rapidly falls. This behavior corresponds with the downward trend of ITI. As far as the Russia-EU cross-pair similar situation occurs. The TCI of Russia-EU heavily decreases while the TCI of the EU-Russia increases. At the same time trend of ITI is slightly growing. The different situation arises for two cross-pairs EU-China and EU-India. In the first case the TCI falls but ITI increases and in the second case (EU-India) TCI growths while ITI decreases.

In order to find out whether there are any tendencies of regional trade integration among BRIC countries, the symmetric intra-regional trade intensity (IRTI) index (lapatde 2004) was also applied. The IRTI index compares intra-regional trade shares and extra-regional trade shares. For the given time period the analysis didn’t find any evident tendency of these indicators which could provide support to this thought.

### 5. Conclusion

This paper assessed the statistical data of merchandise trade between BRIC countries and BRIC economies with the EU. The analysis of data was based on a measure of the ITI index and the CTI. The results revealed that the ITI, which describes the quality of intra-trade comparing with other partners, has increased its
value for China-India and China-Brazil cross-pairs. As for Brazil-India the trend has constantly been around zero for the past ten years and is in accordance with trade development with all world partners. The ITI between Russia and other BRIC partners implies decreasing trends from 2001. But the EU is a very important partner for Russia with a very high ITI score. The EU also maintains a persistent positive ITI index with Brazil and India, but the trends are descending. This is different with EU-China, where the ITI is still lower than that of EU-Brazil or EU-India, but the average trend is progressive for all observed period.

Although the trade complementarity index does not reflect other determining factors such as distance, possibility of transport, trade barriers etc., the findings of ITI are consistent with the changes of CTI values in almost all cases. Nevertheless, for both cross-pairs EU-India and EU-China the results are contradictory.

Overall, the paper didn’t observe any significant tendency among BRIC countries which would correspond to a higher degree of cooperation in terms of merchandise trade. It is argued that even though BRIC is making an effort to make the best of their current situation their closer relationships to developed countries, such as the EU, and/or neighbors remain persistent.

6. References


