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VALIDITY OF LINDER HYPOTHESIS IN BRIC COUNTRIES

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Abstract:
In this study, the theory of similarity in preferences (Linder hypothesis) has been introduced and trade in BRIC countries has been examined whether the trade between these countries was valid for this hypothesis. Using the data for the period 1996 – 2010, the study applies to panel data analysis in order to provide evidence regarding the empirical validity of the Linder hypothesis for BRIC countries' international trade. Empirical findings show that the trade between BRIC countries is in support of Linder hypothesis.

Keywords:
BRIC countries, Linder Hypothesis, panel data analysis

JEL Classification: F11, F14, F15

1. Introduction
In the study, it is mainly investigated that the trade between BRIC countries was valid for Linder hypothesis. According to this hypothesis, countries with similar standards of living will consume similar types of goods. The high-income countries, with large amounts of capital per worker, will therefore have similar tastes and largely trade with other high-income countries and poor countries will consume similar types of goods and trade largely with other poor countries. BRIC (Brazil, Russia, India, and China) countries to have specific importance in world trade, it refers to the emerging markets which are expected to become the world's strongest economies in the next 40 years. The abbreviation was first used by the Chairman of Goldman Sachs Asset Management, Jim O'Neill, in his 2001 research report. In another 2003 report by the economists Dominic Wilson and Roopa Purushotaman, BRIC countries were expected to catch up with the G6 (France, Germany, Italy, Japan, the UK and the USA) countries in less than 40 years, and would later on become the leading force for growing demand and spending power. Given the human capital and natural resources in BRIC countries, this growth seems unavoidable. One of the reasons why they have such big potential is that India and China with their crowded population provide a high amount of output for the world economy despite their low per capita income. Another reason is that these countries have the potential for economic growth (Cooper, 2006; 2). These four countries are known to have apparent differences, which is one of the reasons why they have such potential. "The diversity among the BRIC countries, the balance between their abundant resources and foreign dependence as well as their geographic trends pave the way for their integration into the world economy." (O'Neill, Wilson, Purushotaman, Stupnytska, 2005; 3). However, there is still an uncertainty as to whether these countries will remain only an abbreviation or become integration. The differences among their economic performances, demographic structures and geopolitical interests raise questions about their performances as a group as well as individuals.

As of 2010, South Africa officially became a member nation of BRIC and the group was renamed as BRICS. This paper estimates the gravity model for BRIC countries over the period of 15 years, from 1996 through 2010. This model is a variation of the one used by Choi (2002) to analyze the validity of Linder hypothesis for these countries. The Linder hypothesis claims that the countries with similar demand structures, measured by income per capita, trade more extensively between each other with the rest of the world.

Section II provides a literature review. Section III presents the modified gravity model similar to Choi (2002); discusses the data sources and gives a summary of the sample statistics. Section IV presents the empirical results. Section V summarize the paper's results and discuss their implications.

2. Literature Review

Linder presents a different explanation for the direction of trade in differentiated manufactures. He argues that producers in each country manufacture goods to satisfy the needs of the consumers in that country. Since not all consumers are alike and some prefer goods with different characteristics, international trade provides a means to obtain these other goods and benefit from a wider variety of goods (Marrewijk; 2004, 344).

While Linder did not specify a formal model of his hypothesis, empirical tests of this theory have typically modeled some measure of trade intensity against the following variables: a measure of the size of each trading partner's economy; a measure of relative prices between a given country and its trading partners; a measure of the difference in per capita incomes between a given country and its trading partners; and, relevant time-invariant factors such as distance (Mcpherson et al; 2001).

There have been a number of studies focusing on the empirical investigation of Linder hypothesis. Hanink (1988, 1990) used gravity models to show that international trade caused by market homogeneity. Greytak and Tuchinda (1990) examine the empirical validity of Linder's demand side model and found strong support for the Linder hypothesis using interstate U.S. data. Francois and Kaplan (1996) found that general income levels rise, the relative volume of trade in manufactured consumer goods should rise, and the total volume of trade should rise, independent of changes in the intercountry difference between income levels, in their 36-country study of intra-industry trade. Tang (2003) found support that the developed APEC countries with similar per capita incomes tend to trade more with each other over the period 1985-1999 using a modified gravity model. Mcpherson and et al (2001) provided new information on the Linder hypothesis by focusing on developing countries and found support that five East African countries trade more intensively with others who have similar per capita income levels. Rauh's paper (2010) results reaffirmed the Linder hypothesis for Germany's international trade with other European countries and the results suggested that EU membership hugely increases Germany's imports and exports.

3. Emergence of BRIC's and Their Role in the World Economy

BRIC refers to the emerging markets which are expected to become the world's strongest economies in the next 40 years. The abbreviation was first used by the Chairman of Goldman Sachs Asset Management, Jim O'Neill, in his 2001 research report. In another 2003 report by the economists Dominic Wilson and Roopa Purushotaman, BRIC countries were expected to catch up with the G6 (France, Germany, Italy, Japan, the UK and the USA) countries in less than 40 years, and would later on become the leading force for growing demand and spending power. Given the human capital and natural resources in BRIC countries, this growth seems unavoidable.

Even though Goldman Sachs did not use any certain criteria in evaluating the performances of these four countries, the countries were recognized as "important developing countries" with a potential to become "a major force in the world economy" in 40-50 years after 2001 (Wilson and Purushotaman, 2003). One of the reasons why they have such big potential is that India and China with their crowded population provide a high amount of output for the world economy despite their low per capita income. Another reason is that these countries have the potential for economic growth (Cooper, 2006; 2). These four countries are known to have apparent differences, which is one of the reasons why they have such potential. "The diversity among the BRIC countries, the balance between their abundant resources and foreign dependence as well as their geographic trends pave the way for their integration into the world economy." (O'Neill, Wilson, Purushotaman, Stupnytska, 2005; 3).

Each of the BRIC countries has different characteristics. Brazil, the largest country in Latin America, possesses rich natural resources which will create the country's future economic impact. Numerous countries, including China, make major investments in Brazil to take advantage of its natural resources. Russia, too, is rich in natural resources and has a strong workforce, especially in the fields of science and engineering. India and China have a significant amount of human capital, and the economies of these countries have been developing very fast (Hitt, Li, Worthington, 2005).

Due to the favorable markets of the BRIC countries, firms in these countries have more bargaining power when setting up partnerships with multinational companies which seek to enter developing markets. BRIC firms not only get more information and resources compared to their foreign partners, but they are also likely to have relatively further capabilities especially in China and India. These countries can make use of their information and resources more quickly than their foreign partners. In addition, as they have more information and resources than their foreign partners, BRIC firms make use of the capabilities of less mature emerging markets. As a result, BRIC companies, compared to other emerging markets, have further advantages than multinational corporations (Hitt, Li, Worthington, 2005). Domestic policies and economies of the BRIC countries are also similar. While all are federal states, India has parliamentary democracy and Brazil has the presidential system. China is the Marxist People's Republic whereas Russia rules with an authoritarian democracy. Each of the four of the economies has a political structure that has formed over the centuries, and they are all home to different cultural and religious traditions (Armijo, 2007; 8). The heterogeneous structure created by such differences is one of the reasons why they are so successful.

The importance of the BRIC countries results from their economic size. These are the largest economies outside the OECD and no other developing economy has an annual GDP of over $1 trillion. The three countries, except Russia, have shown greater growth than most countries in the world during the 2008 crisis. As shown in Table 3.1, China has become the world's largest exporter and the BRIC countries have increased trade among themselves. In 2010, Chinese-Indian trade exceeded 60 billion USD. In 2008, China became the largest market among East Asia's rapidly industrializing countries. At the same time, it was the biggest producer of carbon dioxide with 6.5 million tones, which make up 22% of carbon dioxide emissions in the world. Russia and India rank the third and the fourth.

Table 3.1 Total Trade Volume between BRICs – 1996-2010, (000$)

	1996-2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
BRA-CHN	1.173.547.758	3.230.511	4.074.972	6.681.162	9.152.222	12.189.516	16.391.711	23.366.568	36.443.061	36.101.975	56.379.045
BRA-IND	224.948.004	828,198	1.226.920	1.039.440	1.208.622	2.340.844	2.412.844	3.122.782	4.665.945	5.605.938	7.734.723
BRA-RUS	401.940.026	1.566.919	1.680.250	2.055.381	2.466.082	3.639.565	4.385.982	5.450.706	7.984.849	4.280.668	6.062.751
CHN-BRA	1.339.220.073	3.698.157	4.469.402	7.985.547	12.346.965	14.819.733	20.289.600	29.740.543	48.670.899	42.399.500	62.560.099
CHN-IND	940.262.580	3.594.926	4.945.035	7.594.602	13.614.037	18.700.493	24.858.745	38.668.535	51.844.266	43.380.848	61.760.271
CHN-RUS	4.574.186.812	10.669.266	11.927.432	15.757.995	21.225.527	29.101.226	33.386.814	48.218.473	56.908.611	38.796.723	55.526.067
IND-BRA	211.660.554	501,494	700,461	700,928	1.203.496	1.852.974	2.452.518	2.777.501	4.409.879	4.679.202	6.890.546
IND-CHN	1.145.905.166	2.750.091	4.151.453	6.182.287	10.149.771	17.350.853	23.468.231	34.067.749	41.679.950	40.983.423	58.689.107
IND-RUS	576.226.349	1.318.180	1.316.853	1.481.224	1.846.241	2.742.637	2.746.567	3.608.591	5.542.070	4.402.043	4.984.776
RUS-BRA	486.080.862	1.114.310	1.534.073	1.735.775	1.738.110	2.951.369	3.713.000	5.237.590	6.711.368	4.593.000	5.799.156
RUS-CHN	1.053.264.478	7.242.513	9.238.075	11.566.269	14.851.298	20.312.327	28.668.000	39.573.250	55.916.050	39.528.880	58.813.800
RUS-IND	658.397.390	1.665.952	2.127.472	3.320.090	3.153.291	3.098.398	3.893.000	4.342.640	6.945.062	7.461.454	7.548.989

Source: COMTRADE Database

BRIC countries have a distinctive macroeconomic performance in the world economy. These four economies hold 40% of the total foreign exchange reserves in the world and are among the ten countries with the largest foreign exchange reserves. China has foreign exchange reserves worth 2.4 trillion USD and is the second largest net creditor after Japan. When Russia began its market reforms in 1992, it did not have any foreign exchange reserves. However, today Russia holds 420 billion USD in its reserves. One sixth of foreign exchange reserves of the BRIC countries is enough to create a fund as large as the IMF (The Economist, 15th April 2010). Their foreign assets protected these countries against the 2008 global financial crisis and turned them into financial powers. While Western countries were struggling to cover their budget deficits and increasing debts, many investment banks recommended BRIC countries thanks to their stable public debt levels.

To better understand the current position of the BRIC countries today, I believe the projected figures in the Goldman Sachs report of 2001 should be compared to current figures. According to the projections in the 2001 report, in case BRIC countries continued with their strong growth at the same speed, these countries would hold a larger share of the world's economy. The best-case scenario suggested that these countries would account for 8% of the world's GDP. However, according to World Bank, this figure turned out to be 17% in 2010. China was estimated to reach Germany's economic size, yet in February 2011 Chine surpassed Japan and almost doubled the German economy. Brazil was estimated to reach Italy's economic size. In 2010, Brazilian economy passed Italian economy and became the 7th largest in the world (Table 3.2). In addition, despite their 2001 GDP worth 2.6 trillion USD, BRIC economies created a GDP worth over 11 trillion USD in 2010.

Table 3.2 GDP Ranking of BRIC and G7Countries

2000		**2010**	
Country	**Ranking**	**Ranking**	**Country**
USA	1	1	USA
Japan	2	2	China
Germany	3	3	Japan
UK	4	4	Germany
France	5	5	France
China	6	6	UK
Italy	7	7	Brazil
Canada	8	8	Italy
Brazil	9	9	India
Mexico	10	10	Canada
Spain	11	11	Russia

Source: World Bank World Development Indicators GDP data

In the past 50 years, the world economy has developed significantly. In the next 50 years, it is expected to continue to change as the BRIC's share in the world GDP increases. When we compare BRIC economies with G6 economies, we can estimate that BRIC economies will reach half the size of G6 economies by 2025, and only the USA and Japan will remain among the largest 6 economies of the world by 2050. It was also estimated that the BRIC countries would play a more significant role in determining world's economic policies and that they would become a part of a

group like G7 or G8. However, this did not happen. The foreign affairs ministers of the four countries began political talks in New York in 2006 and the first BRIC Summit was held in Yekaterinburg, Russia in 2009. In the second summit in 2010, the countries reached a consensus on the inclusion of South Africa to the BRIC. In the 2011 summit, a series of decisions were agreed upon that would make these countries less dependent on the dollar.

The population of the BRIC countries has more than doubled in the past 50 years. This increase is expected to slow down in the next few decades, except for India. Despite expectations for an increase in the elderly population in developed countries, this increase is estimated to be get in the BRIC countries. By 2060, the average age will have increased from 40 to 44 in developed economies, and from 32 to 45 in the BRIC countries (Wilson, Burgi, Carlson, 2011). An aging and shrinking labor market is expected to slow down the growth rate in the BRIC countries, which were responsible for over half of global growth in the past decade. In the Goldman Sachs report "The BRICS 10 Years on: Halfway Through the Great Transformation" dated December 7, 2011, it is stated that global growth will reach a peak with a 4.3% increase in this decade and go down to 3.9% in 2020. The report points out that the long-term economic growth rate of the BRIC countries has probably reached its peak. It also states that a decline in the growth speed of the working age population in these countries will lead to a smaller labor supply. This situation will limit the potential growth rate for the BRIC countries. According to the report, even though the BRIC countries will join the USA and Japan as the world's largest economies by 2050, it is expected that their contribution to the world's economic growth will decline.

4. Empiricial Analysis: Methodology and Data

The gravity model is frequently used in empirical studies on economic integration. The model is successfully applied also to capital flows between countries, migration and tourism. The model is based Newton's "Law of Universal Gravitation". Newton's gravity model says that attraction between two bodies is inversely proportional to their masses and reversely proportional to the distance between them. According to the bilateral trade gravity model, in its most basic form, trade between two countries is inversely proportional to their GDPs and reversely proportional to the distance between them (Frankel, 1997; 50). According to the basic gravity model, the volume of trade between two countries is also a function of several variables including population, geographic distance, common language, common border, cultural proximity and common regional trade agreement (Amin, Hamid and Saad, 2009;20).

Following the literature, the study applies a gravity equation with panel data. In the study, it is mainly investigated the trade between BRIC countries was valid for Linder hypothesis. In order to analyze the validity of Linder hypothesis for these countries, I adopt a modified gravity model similar to Choi (2002) but add some variables such as population and crisis.

$$\boldsymbol{RATIO_{ijt} = \beta_0 + \beta_1 LINDER_{ijt} + \beta_2 PGPDSUM_{ijt} + \beta_3 DIST_{ijt} + \beta_4 POP_{it} + \beta_5 CRISIS_{it} + \varepsilon_{ijt}}$$

where the dependent variable is the RATIOijt for the ratio of export volume from country i to j to the sum of these two countries' GDP's at the time period t. The independent variables are; LINDERijt is the ratio of the difference in per capita GDP to the sum of exporting and importing country's per capita GDPs at the time period t; PGDPSUMijt is the sum of per capita GDP of both countries at the time period t; DISTijt is the distance between two countries i and j; POPit is the total population and CRISISit is the dummy variable showing the crisis years, 1997 and 2008; finally ε_{ijt} is the residual.

In this study, annual data for the period 1996-2010 from four BRIC countries were used. GDP and population data were collected from World Bank World Development Indicators, foreign trade data from United Nations Commodity Trade Statistics Database (COMTRADE), and the distance data from the website http://www.daftlogic.com/projects-google-maps-distance-calculator.htm. Distances were calculated according to the "great circle" method in kilometers. The empirical study deals with 4 BRIC countries over the period 1996-2010 with 60 observations totally.

Table 4.1 Descriptive Statistics

Variables	Abbr.	Definition	Source
Ratio	RATIO	A trade ratio defined as export from country *i* (exporting country) to country *j* (importing country) divided by the sum of country *i*'s GDP and country *j* 's GDP at period *t*.	COMTRADE Database & World bank World Development Indicators
Linder hypothesis	LINDER	Calculates the per capita income similarity between countries	World bank World Development Indicators
Sum of per capita GDP	PGDPSUM	Calculates the sum of per capita GDP of both countries at the time period *t*.	World bank World Development Indicators
Distance	DIST	The distance between countries	http://www.daftlogic.com/projects-google-maps-distance-calculator.htm
Population	POP	Total population of countries	World bank World Development Indicators
Crisis years	CRISIS	Shows the crisis years affected these countries; 1997 and 2008	Author's choice

5. Empirical Results

The results obtained in the empirical analysis are in line with the earlier studies in the literature reviewed. All the coefficients are consistent with predictions. Panel regression results show that the trade between BRIC countries is in support of Linder hypothesis.

All the variables are not stationary in level, but stationary in the first differences for the model. To determine which panel regression model to be chosen, Chow and Breush Pagan (BP) test results have been given in Table 5.1. While H0 hypothesis is pooled regression and H1 hypothesis is FEM in Chow test, in BP test H0 hypothesis is pooled regression and H1 is REM.

Table 5.1 Panel Regression Estimation Method Selection Test Results

Test	p value	Decision
Chow(F test)	0.124	Ho accepted
BP(χ^2 test)	0.193	Ho accepted

As a result of both tests, the pooled regression has been approved for use. In this case, not only the need Hausman test and pooled model estimation was analyzed using the EGLS (Cross-section weights) algorithm.

According to Table 5.2, panel regression results show that the trade between BRIC countries is in support of Linder hypothesis. LINDER, DIST and CRISIS variables are negative and statistically significant. The finding of a negative and statistically significant effect of LINDER variable provides evidence in favor of the Linder hypothesis. The finding of a negative and statistically significant effect of DIST variable confirms the literature. The more distant the two countries are, the less they trade. The finding of a negative and statistically significant effect of CRISIS dummy variable reduces the trade volume between countries. PGDPSUM and POP variables are positive and statistically significant. The finding of a positive and statistically significant effect of PGDPSUM variable means that the richer countries tend to trade more. The finding of a positive and statistically significant effect of POP variable means that the more crowded countries tend to trade more.

Table 5.2 Panel Regression Results

Variables	Coefficient
DLINDER	-0.005208 ** (0.001222)
DPGDPSUM	1.03E-07 ** (1.21E-08)
DDIST	-1.58E-07 ** (4.39E-08)
DPOP	2.72E-12 ** (1.01E-12)
CRISIS (dummy)	-0.000412 ** (0.000160)
R-squared	0.439475
Prob (F-statistic)	0.000006
Observations	60

Note: Estimated standard errors appear in parentheses.
****** Indicate the significance at the 1% level..

6. Conclusion

Trade between BRIC countries is growing in each year and these countries have a potential to become the largest economies in the world. In this study, trade in BRIC countries has been examined whether the trade between these countries was valid for Linder hypothesis by using modified gravity model. Previous researches have found similar results. This study used an extensive dataset and a modified gravity model. It was found that countries with a smaller difference of per capita GDP tend to trade more. It was also found that richer and more crowded countries trade more. Different from other studies, CRISIS dummy variable added and found that in crisis years which affected these countries, trade volume between them is reduced.

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