# “Determinants of Malaysia – BRICS trade linkages: gravity model approach”


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# Determinants of Malaysia – BRICS trade linkages: gravity model approach


## Abstract

The main objective of this study is to explore the long-run and short-run relationship between trade and other macroeconomic variables of Malaysian and the BRICS countries. To test relationship between trade and other macroeconomic variables, the empirical investigation will be conducted based on the dynamic ordinary least square (DOLS) and fully modify ordinary least square (FMOLS) model for the period 1980-2015. Results of both DOLS and FMOLS show that out of all the variables included in the model distance between Malaysia and BRICS countries and corruption of both side have negative affect on bilateral trade between them. Whereas, GDP, GDP per capita and trade to GDP ratio are positively contribute in the bilateral trade. However, inflation and exchange rate of Malaysia and BRCIS countries have no effect on the bilateral trade between Malaysia and BRICS countries. The findings suggest that economic strengthening as the basis for increase in trade between Malaysia and BRICS members. Investment appears to be complementary to the trading relations in the Malaysia-BRICS case. The social capital also plays role in supporting the trade.


**Keywords:** Malaysia, BRICS, trade.
**JEL Classification:** R1, Q16, Q56.

## Introduction

Since 2010, five newly emerging economies collectively known as 'BRICS' (Brazil, India, Russia, China and South Africa) have caught the imagination and scholarly attention of political scientists, economists and development specialists. The prospect of a unified geopolitical bloc, consciously seeking to reframe international (and global) health development with a new set of ideas and values, has also, if belatedly, begun to attract the attention of the global health community. But what influence, if any, do the BRICS wield in global health, and, if they do wield influence, how has that influence been conceptualized and recorded in the literature? The BRICS (Brazil, Russia, India, China, and South Africa) is not only an economic concept but it is also a physical/material template.

The BRICS appeared likely to become the largest global economic group by the middle of this century. The role of this group in global affairs continues to gain momentum. Russia hosted the seventh BRICS summit July 9-10, 2015, in Ufa, the capital of the Republic of Bashkortostan, gathering the heads of state of the five countries. BRICS countries decided to establish the New Development Bank (NDB) and the Contingency Reserve Agreement (CRA). The combined economic output last year of Brazil, Russia, India, China and South Africa almost matched the gross domestic product of the USA. Back in 2007, the U.S. economy was double the BRICS.

"*Despite some disappointments in some of the BRIC economies, led by China and India, their collective weight in global GDP continues to rise and therefore also does their importance*," said Jim O'Neill, the former Goldman Sachs Group Inc. chief economist who coined the acronym back in 2001, without South Africa.

One of the major challenges of globalization is the liberalization of international trade. The Asian financial crisis of 1997/98 and 2008/09 world crises, and the recent plunge in the global crude oil prices together with the depreciation of the Ringgit are but a few manifestations of threats and challenges derive from globalization. As such, the tendency towards the process of regionalization is somewhat pertinent as the world economy has become increasingly integrated for the member countries to gain mutual economic benefits and eventually to protect their vested interests. Therefore, it is high time for Malaysia to response to the effects of globalization and economic liberalization by strengthening their economic and trade relations with the BRICS economy.

In recent years, it is in the interest of the Malaysian government to shift its trade dependency on the traditional markets and exploring new markets for exports and imports. This is especially so with the setting up of the National Export Council (NEC) in


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December 2014. Although there are extensive literatures on analyzing BRICS economy especially on trade relationship, specific studies dealing with bilateral trade between Malaysia and the BRICS member countries are few. Furthermore, there is very little work in most existing empirical studies using the gravity model approach in analyzing Malaysia-BRICS trade relationship. This study is an effort to fill this gap on BRICS trade literature. This study will eventually provide some policy analysis and develop policy recommendations in an effort to enhance Malaysia's trade with the BRICS member countries in the near future. There are several objectives of this study such as; (1) to examine the pattern of trade between Malaysia and the BRICS member countries; (2) to identify the determinants of Malaysia's trade with the BRICS member countries; and (3) to provide the policy recommendations to improve Malaysia-BRICS trade relationship.

The focus of this research is to examine the trade relationship between Malaysia and the BRICS member countries. In the post-September 11 world and in light with the economic and financial crises, there is a need for Malaysia to shift its trade destinations away from its traditional trading partners, and one of these destinations is in the BRICS economy. In analyzing the determinants of imports using gravity model, this research will provide political economic dimensions to the analysis, which is by incorporating the role of institutions into the gravity equations.

Applying a gravity model using panel data will provide a new perspective to the BRICS trade literature as most studies were done by using the revealed comparative advantage (RCA), trade intensity index, or the multivariate technique based on the discriminant analysis method. From geographical aspect, this study will focus on Malaysia and the rest of the BRICS member countries, unlike previous studies where most of them focusing more on the intra-BRICS trade. This study will eventually provide some policy analysis and eventually developing policy recommendations in an effort to enhance trade relationship between Malaysia and the BRICS member countries in the near future.

## 1. Literature review

The gravity model was first applied to international trade studies by Tinbergen (1962) and Poyhonen (1963) to analyze the patterns of bilateral trade flows among the European countries. The model is based on the analogy of Newton's law of gravity which states that the bilateral trade flows between two countries is proportional to its Gross Domestic Product (GDP) as a proxy of size and diminishes with distance, other things being equal (Krugman & Obstfeld, 2009).

Later, the model has been augmented to take into account other factors in explaining trade flows among countries. Frankel et al. (1995) for instance, added dummy variables in the model for common border and language. Other researchers have included non-economic variables, such as political and institutional variables into the extended gravity model. Such studies are conducted by Summary (1989), Dollar and Kraay (2002), Levchenko (2004) and Anderson and Marcoullier (2002). They found positive relationship between bilateral trade flows and the political and institutional qualities.

Bergstrand (1989) stressed the effect of GDP per capita on bilateral trade. Higher GDP per capita is to be associated with easy cross border and better transportation infrastructure which are at the end facilitate trade. Besides, he argues that higher income countries' consumers tend to demand superior perceived foreign products. Amin, Hamid, and Saad (2005) examined the extent of intra-trade activities among the five members of the League of the Arab States (LAS) namely Jordan, Saudi Arabia, Syria, Egypt and Sudan. By employing the gravity model in the scaled and unscaled forms, they found that the failure of integration measures undertaken. Among other things, they proposed tariff reduction and greater capacity building efforts such as improving the infrastructure to enhance intra-LAS trade.

Gundogdu (2009) explore the determinants of Intra-OIC trade using the time series data. The results of gravity model suggested that exchange rate is one of the important factors of Intra – OIC trade.

Hussin, Muhammad, Habidin and Salleh (2009) examined the economic performance of OIC member countries in terms of their exports, Foreign Direct Investment (*FDI*), *GDP*, inflation, education (adult literacy rate), total manufacturing output and their savings. Employing the multivariate technique based on discriminant analysis method, they discovered that export, education, and *GDP* are the most crucial factors in explaining growth among the four geographical groups of the OIC countries (Africa, Asia, Middle East, and Western Hemisphere). Ab Rahman and Abu-Hussin (2009) analyzed Malaysia's trade relations with the Gulf Cooperation Council (GCC) countries which consist of the United Arab Emirates (UAE), Bahrain, Saudi Arabia, Oman, Qatar, and Kuwait. Using trade intensity index, they showed that Malaysia's trade with the individual GCC country and with GCC as a group were very low during the 1990-2007 period of

study. They provided suggestions on how to improve Malaysia-GCC trade relations in the future such as to expedite the Free Trade Agreement (FTA) initiative, and focusing on niche areas which they have comparative advantage at such as Halal food services, Islamic banking and finance services, tourism sector, biofuel industries, constructions, education sector, and petrochemical industries.

Jafari, Ismail and Kouhestani (2011) identify the factors affecting export flows among the D8 countries. The results from a gravity model, which is estimated using Panel Correlated Standard Errors (PCSE), demonstrate that the trading partners' Gross Domestic Product (GDP), exchange rate, population of exporter country, border and distance are the notable factors affecting the volume of export flow among the countries in the D8 group. Furthermore results are suggested that the countries would do better if they focus on exporting more to their neighbouring countries within the group and also undertake the measures which ensure low transportation costs. Additionally, the currency depreciation would increase the trade flows among the members when other adverse effects are taking into account.

However, Evelyn, Ahmad and Thirunaukarasu (2011) find that based on their Gravity Model estimation, culture and religion are insignificant in enhancing bilateral trade between Malaysia and the GCC countries. By using a qualitative method of semi-structured interviews, Abu-Hussin (2010) has arrived into the same conclusion that religious affinity does not help in terms promoting business relations of Malaysia-GCC countries. He also explored the trade relationship between Malaysia and the Gulf Cooperation Council (GCC) countries by employing the revealed comparative advantage (RCA) and the trade intensity index. Through these analyses, he discovered that the trade linkages are still insignificant relative to Malaysia's traditional trading partners. Ismail (2008), on the other hand, examined the pattern of trade between Malaysia and eighty trading partners, where twenty of which are OIC members. In his research, he found that Malaysia trade with countries which have similar in terms of size but different in terms of factor endowment.

Similarly, Abidin and Sahlan (2013) investigate the impact of economic factors on bilateral exports between Malaysia and the OIC member countries. Using the panel estimation for gravity model, the data covers the period of 1997 to 2009. The gravity estimates imply the importance of size effects, level of openness of the economy, inflation rates, and the exchange rates as determinants of Malaysia's exports to OIC countries. The estimation of individual effects shows the significance of distance and institutions in enhancing Malaysia-OIC exports. Abidin, Jantan, Satar and Haseeb (2014) examine the trade relations between Malaysia and 55 OIC member countries for the period of 1995 to 2012. Trade Gravity Model (TGM) study isolate factors that determine Malaysia-OIC trade measured by Malaysian exports to OIC member countries. The FMOLS estimation reported that per capita GDP, FDI differential and real exchange rate of OIC member countries are supporting the expansion of the exports whereas any increase in trade per GDP ratio, corruption and real exchange rate of Malaysia creates additional impediments to the trade relation. The findings suggest that economic strengthening as the basis for increase in trade between Malaysia and OIC members. Investment appears to be complementary to the trading relations in the Malaysia-OIC case. The social capital also plays role in supporting the trade. Abidin, Bakar and Haseeb (2015) and Abidin, Satar, Jantan and Haseeb (2015) investigates the import relations between Malaysia and OIC countries. The annual time series data from 1995 to 2012 have been utilized. The results of gravity model show that real exchange rate of Malaysia and other OIC countries have a positive and significant effect on Malaysia-OIC import. Whereas, CPI of Malaysia and per capita GDP of other OIC countries shows a negative relationship with import volumes of Malaysia. This study also found the evidence of the role of quality of institutions in enhancing Malaysia-OIC import relationship. The results of the study suggested that, it is crucial for Malaysian government to focus on accelerating the efforts to establish the Islamic Common Market (ICM), liberalizing the economy, further improving the strategic sectors such as the Islamic banking and finance, and intensify endeavors in curbing corrupt practice. Bakar, Abidin, and Haseeb (2015) examine the impact of macroeconomic factors such as GDP, CPI, TRGDP and ER on exports between Malaysia and other OIC countries using a panel data for the period of 1997-2012. The panel unit root tests have been applied to confirm the stationarity and level of integration. The overall unit root tests (Dickey & Fuller, 1979; Im, Pesaran & Shin, 2003; Levin, Lin, and James Chu, 2002) result shows that all the variables are stationary at level and become non-stationary after taking first difference. The Kao cointegration test results approved the cointegration among the panel of proposed countries. After confirm the stationarity level and cointegration FMOLS test is employed to analyze whether a long-run relationship between variables exist. The results obtained show that only GDP, TRGDP and ER have significant effect on exports. In examining the short-run relationships

among variables, a panel ECM is the applied and it is observed that only ER and TRGDP have positive effect on exports. Results from this study can be used as guidance for policy makers on exports where government can give more attention on both ER and TRGDP to influence exports in the short run.

With the rapid development of the BRICS, many scholars have done researches on them. Cheng, Gutierrez, Mahajan, Shachmurove and Shahrokhi (2007) consider that while the BRICs are not sure to become economic hegemony in the world economy, the interplay between BRICS economies and other developing countries is viewed as a critical aspect of globalization and interdependence. Mcdonaldm, Robinson, and Thierfelder (2008) use a global general equilibrium trade model to analyze the impact of the dramatic expansion of trade by India, China, and an integrated East and Southeast Asia trade bloc and productivity growth in the region on developing countries. China is an integral member of the East & South East Asia bloc, with strong links through value chains and trade in intermediate inputs, while India is not a part of any trade bloc. Chakraborty and Nunnenkamp (2008) assess the proposition that FDI in India will promote economic growth by subjecting industry-specific FDI and output data to Granger causality tests within a panel cointegration framework. It turns out that the growth effects of FDI vary widely across sectors. Felipe, Lavin and Fan *International Journal of Business and Management* January, 2010. Worldwide FDI represents a major source from MNCs for capital intensive projects. Due to global economic recession since 2007 developing countries like Mexico, Indonesia, Norway, Turkey (called MINT), India, China, Asia-Pacific and other East and Southeast regions become most competitive host for foreign capital. Empirical studies regarding the link between FDI, trade and economic growth in the BRICS economies are not sufficient. However, numerous studies are FDI, trade and economic growth in the context of other developed and developing countries. FDI increases capital accumulation in the receiving country by introducing new inputs and technologies (Balasubramanyam et al., 1996; Blomstrom et al., 1996; Borensztein et al., 1998).

Alfaro (2003) concludes in his research finding that FDI exerts an ambiguous effect on growth. His work further states that FDI in the primary sector, however, tend to have a negative effect on growth, while investment in manufacturing a positive one. Several prior studies also explain the significance of FDI and trade in the process of economic development and even affirm positive linkages, for example see (Moran et al., 2005; Kobrin 2005; Le & Ataullah, 2006; Dawson, 2012; Azam et al., 2013; Azam & Ibrahim, 2014; Haseeb et al., 2014). Studies conducted by Hermes and Lensink (2003) and Durham (2004) all find that countries with better financial systems and financial market regulations can exploit FDI more efficiently and achieve a higher growth rate. Coe et al. (1997) detect the positive association between FDI and economic growth, but suggest that the host country should have an attained level of development that helps it reap the benefits of higher productivity. However, there also exist contradicting theories that predict FDI in the presence of pre-existing trade, price, financial and other distortions will hurt resource allocation and slow growth. The studies of Levy-yeyati et al. (2002) and Nunes et al. (2006) find the variables such as market size, trade openness, infrastructure, inflation, wages, human capital and natural resources are the key determinants of FDI flows. Kowalski et al. (2009) explained among others the impact of trade liberalization on economic growth in South Africa during data for the period 1988-2003 and found a positive impact of trade liberalization on growth.

The BRICS' significance has risen sharply in recent years since the economic crisis, as has been the case for trade flows. Outward investment is relatively concentrated in sectors where the home economy has relatively-well developed capabilities, while also underlining the importance of outward investment in the further development of those capabilities. In addition, the financial services and pharmaceutical cases underline that there are important complementarities in key sectors supporting capability development and internationalization of firms when BRICS are both home and host economies (Stephen, 2014). The study of Ho (2013) also analyzed that trade between BRICS countries and the rest of the world has grown expressively with China and Brazil being the world's quickest rising economies. As international consumption and international production has been shifted to emerging economies (BRIC), MNCs are increasingly investing in these countries. To utilize this trend of FDI it becomes important to look back the status of India's FDI attracting position among the other BRICS countries (Mathipurani, 2014). This study is likely to contribute to the literature on BRICS.

Lo and Liu (2009) extend other scholar' model to demonstrate why China has been so successful in disproportionately attracting foreign offshore manufacturing activities, while India has been engaged mainly in offshore service activities. They argue that the host country's industry-specific technology capabilities make the difference in FDI composition between China and India. They also find that, after excluding overseas Chinese investment, India is almost on par with China in

terms of the market size it offers to marketing-seeking FDI. Fabry and Zeghni (2002) develop their understanding of FDI in Russia by asking a main question: Why is Russia an exception in the context of FDI globalization? Is Russia willing to stay outside the general trend of fierce competition for FDI and able to developed endogenously sustainable growth? Giner and Giner (2004) elaborate an interpretative model of foreign direct investment in China based on an integrated view of economic policy. The principal conclusions are both macroeconomic determinants and socio-political factors that bear upon the flow of direct foreign investment towards China should be taken into account. Wei (1995) explores the determinants of inward FDI in China and India and the causes for their huge difference. It was found that China's much higher FDI from OECD countries was mainly due to its larger domestic market and higher international trade ties with OECD countries. India, however, had advantage in its cheaper labor cost, lower country risk, and geographic closeness to OECD countries and cultural similarity.

## 2. Methodology and model specification

**2.1. The gravity model.** The gravity model of world trade originates from the law of gravity in Physics called the Newton's law of universal gravitation. This law is discovered by English physicist, Sir Isaac Newton in his famous work, *Philosophiae Naturalis Principia Mathematica* in 1687. This law basically states that the attractive force between two bodies is directly related to their size and inversely related to the distance between them. Mathematically, it can be expressed as:

$$F = G\frac{M_i M_j}{D^2}, \tag{1}$$

where $F$ denotes the gravitational force between two objects $i$ and $j$, and $G$ is the gravitational constant. In this equation, the gravitational force is directly proportional to the masses of the objects ($M_i$ and $M_j$) and inversely proportional to the square of the distance $D^2$ between the point masses. Contextualizing it to the flow of international trade, the equation becomes as follows:

$$Trade_{ij} = \frac{Pop_i Pop_j}{D_{ij}}, \tag{2}$$

where $Trade_{ij}$ is the value of bilateral trade between country $i$ and country $j$, $Pop_i$ and $Pop_j$ are country $i$'s and country $j$'s population respectively, where in this case, mass is associated with country's population. $D_{ij}$ is the distance between country $i$ and country $j$. Thus, it states that the volume of trade are measured by trade, exports, or imports between any two countries is proportional, other things being equal, to the population of the two countries, and diminish with the distance between them.

To facilitate the econometric estimation, the model in equation (2) is transformed into a log form to obtain a linear relationship of the model as:

$$ln\left(Trade_{ij}\right) = \alpha + \beta\, ln\left(Pop_i * Pop_j\right) - \gamma\, ln\left(D_{ij}\right), \tag{3}$$

where $\alpha$, $\beta$, and $\gamma$ are coefficients to be estimated. Equation (3) says that there are three reasons that determine the volume of trade between two countries; the size of their populations and the distance between them, where the size of the population is expected to have a positive effect on trade and the distance is negative.

**2.2. Model specification.** The gravity model applied in this study is based on the gravity model used by Sharma and Chua (2000) and Rahman (2003, 2009). Employing panel data analysis using a gravity model, the years estimated is in the period of 2000-2015. One of the econometric advantages in using panel data is that it allows individual heterogeneity which is not an available characteristic if time series or cross sectional data is used (Baltagi, 2005). Using panel data would also provide more informative data, more variability, less collinearity among the variables, more degrees of freedom, and more efficiency. Furthermore, it allows the assumptions stated in the cross-sectional analysis to be relaxed and tested (Maddala, 2001).

The gravity model for Malaysia-BRICS trade is as follows:

$$\begin{aligned} ln\left(Trade_{ijt}\right) &= \mu_0 + \phi_1 ln\left(GDP_{it}\right) + \phi_2 ln\left(GDP_{jt}\right) + \\ &+ \phi_3 ln\left(PCGDP_{it}\right) + \phi_4 ln\left(PCGDP_{jt}\right) + \phi_5 ln\left(DIST_{ij}\right) + \\ &+ \phi_6 ln\left(PCGDPD_{ijt}\right) + \phi_7 ln\left(ER_{ijt}\right) + \phi_8 ln\left(INF_{it}\right) + \\ &+ \phi_9 ln\left(INF_{jt}\right) + \phi_{10} ln\left(TR/GDP_{it}\right) + \phi_{11} ln\left(TR/GDP_{it}\right) + \\ &\phi_{12} ln\left(INS_{it}\right) + \phi_{13} ln\left(INS_{jt}\right) + \Omega_{ijt}, \end{aligned} \tag{4}$$

where, $Trade_{ijt}$ = Country $i$ (Malaysia) trade with country $j$ (in million USDs), $DIST_{ij}$ = Distance between county $i$ capital to country $j$ capital (in kilometers), $INS_{it}$ = Corruption perceptions index of country $i$, $INS_{jt}$ = Corruption perceptions index of country $j$, $GDP_i$ = Gross Domestic Product of country $i$, $GDP_j$ = Gross Domestic Product of country $j$, $PCGDP_i$ = Per capita GDP of country $i$, $PCGDP_j$ = Per capita GDP of country $j$, $PCGDPD_{ijt}$ = Per capita GDP differential between country $i$ and $j$, $ER_{ijt}$ = The real effective exchange rate index (2005 = 100). The real exchange rate in this study is defined as the relative price of foreign goods in terms of domestic goods (Stockman, 1987).

$INF_{it}$ = Inflation rate for country *i*, $INF_{jt}$ = Inflation rate for country *j*. $TR/GDP_{it}$ = *Trade/GDP* ratio of country *i*, $TR/GDP_{jt}$ = *Trade/GDP* ratio of country *j*. $\Omega_{ijt}$ = error term, *t* = time period; $\mu$, $\varnothing$ = parameters.

**2.3. Data sources.** All observations are based on annual data. The data used are in real terms. Data on Gross Domestic Product (*GDP*), *GDP* per capita, foreign direct investments (*FDIs*), real exchange rates, total exports, total imports are obtained from the *World Development Indicators* (*WDI*) database of the World Bank and also from the *International Financial Statistics* (*IFS*), *CD-ROM* database and website of International Monetary Fund (*IMF*). Data on Malaysia's exports (country *i* export) to all other countries (country *j*'s), Malaysia's imports (country *i* imports) from all other countries (country *j*'s) are obtained from the *Direction of trade statistics*, *CD-ROM* database and website of International Monetary Fund (*IMF*).

Data on the distance (in kilometer) between Kuala Lumpur (capital of Malaysia) and other capital cities of country *j* are obtained from an Indonesian website: www.indo.com/distance. The data on Consumer Price Index (*CPI*) of all the Muslim countries are collected from the *World Development Indicators (WDI)* database of the World Bank and the Center of Advanced Research & Studies of the Islamic Common Market website: www.carsicm.ir. For the measurement of the level of institutional quality, that is measured by the corruption index is obtained from the Corruption Perceptions Index (CPI) from Transparency International (TI) and retrieved from TI database at www.transparency.org/cpi.

## 3. Method of analysis and results

**3.1. Test for cross-sectional dependence.** M. Hashem Pesaran (2007) demonstrates that violation often leads to undesirable finite sample properties of the IPS test. Therefore, we used the general diagnostic test for cross-section dependence in panels proposed by M. Hashem Pesaran (2004) to find whether the cross-sectional dependence existed within our panel variables.This test uses the correlation coefficients between the time series for each panel country. For this test, the null hypothesis assumes cross-sectional independence against the alternative hypothesis of cross-sectional dependence. The rejection of null hypothesis confirmed the existence of cross sectional dependence across the countries. Table 1 displays the findings of the Pesaran CD test for the considered variables. The null hypothesis of cross-sectional independence was strongly rejected for all of the variables. We conclude the presence of cross-sectional dependence as expected.

**3.2. Panel unit root test.** For the panel with cross-sectional dependence, the first generation unit root tests tend to over-reject the null hypothesis (reference). Therefore, to address the cross-sectional dependence while identifying the order of integration of the variables in the panel, we applied the recently developed technique. With average individual statistics, M. Hashem Pesaran (2004) develops a panel root t-statistic as cross sectional augmented IPS (CIPS) test. This test considers both heterogeneity and cross-sectional dependence across panels, and is considered a popular second generation panel unit root test. The findings are in lower panel of Table 1, which show that all of the variables were integrated of same order, i.e., *I*(1). This also indicates that all of the variables are non-stationary at levels, and stationary at their first-order differentials. The CIPS test results suggest that there may be a long-run equilibrium relationship among the variables since all of the variables are integrated with the same order. We explore this in the following section.

Table 1. Tests for cross-sectional dependence and unit root

| Variables | $Trade_{ijt}$ | $DIST_{ij}$ | $INS_{it}$ | $INS_{jt}$ | $GDP_{it}$ | $GDP_{jt}$ | $PCGDP_{it}$ |
|---|---|---|---|---|---|---|---|
| Pesaran CD test | 78.19* | 71.01* | 75.56* | 36.12* | 40.01* | 12.23* | 89.67** |
| *P*-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Variables | $PCGDP_{jt}$ | $PCGDPD_{ijt}$ | $ER_{ijt}$ | $INF_{it}$ | $INF_{jt}$ | $TR/GDP_{it}$ | $TR/GDP_{jt}$ |
| Pesaran CD test | 112.12** | 115.67*** | 32.98* | 12.34 | 20.19* | 98.32*** | 86.15*** |
| *P*-value | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| The unit root test with cross-sectional dependence | | | | | | | |
| CIPS test (level) | 2.123 | 1.031 | 3.289 | 4.121 | 3.891 | 2.321 | 1.281 |
| CIPS test (1st difference) | -1.231** | -1.671** | -2.121*** | -3.980** | -2.976** | -1.213** | -2.234*** |
| CIPS test (level) | 2.908 | 3.451 | 2.678 | 3.409 | 4.091 | 3.021 | 3.012 |
| CIPS test (1st difference) | -2.431** | -1.321** | -3.121** | -2.786*** | -2.456** | -1.897*** | -1.210*** |

Notes: **indicates the rejection of null hypothesis of cross-sectional independence (CD test) and the null hypothesis of unit root at 5% significance level. CIPS test is estimated using constant and trend with 1 lag. *** indicates the rejection of null hypothesis of cross-sectional independence (CD test) and the null hypothesis of unit root at 1% significance level. CIPS test is estimated using constant and trend with 1 lag.

Table 2. Pedroni Cointegration test results

| Dependent $Trade_{ijt}$ | | |
|---|---|---|
| | No trend | With trend |
| Panel v-stat | 3.113*<br>[0.000] | 2.245*<br>[0.001] |
| Panel rho-stat | -5.213 *<br>[0.000] | -4.331*<br>[0.000] |
| Panel PP-stat | -6.563*<br>[0.009] | -7.801*<br>[0.003] |
| Panel ADF-stat | -6.221*<br>[0.000] | -7.754*<br>[0.000] |
| Group rho-stat | -0.532<br>[0.987] | -0.612<br>[0.675] |
| Group PP-stat | -2.691**<br>[0.041] | -2.686**<br>[0.031] |
| Group ADF-stat | -3.521**<br>[0.045] | -3.181*<br>[0.000] |

Note: *, ** indicates statistical significance at 1% and 5% level, respectively.

**3.3. Panel cointegration test.** In the next step, we examine whether a long-run equilibrium relationship exists between the variables. Each of our variables is integrated of order one, we conducted panel cointegration test developed by (Pedroni, 1999, 2004). Seven test statistics are proposed: the panel v-statistic, panel rho-statistic, panel PP-statistic (nonparametric), panel ADF-statistic (parametric), group rho-statistic, group PP statistic (nonparametric), and group ADF-statistic (parametric). The first four statistics are within dimension based statistics and the rest are between dimension based statistics. In his paper Pedroni (1999) describe the seven test statistics, "The first of the simple panel cointegration statistics is a type of non-parametric variance ratio statistics. The second is a panel version of a non-parametric statistics that is analogous to the familiar Phillips Perron rho-statistics. The third statistics is also non-parametric and is analogous to the Phillips and Perron Statistics. "The fourth statistics is the simple panel cointegration statistics which is corresponding to augmented Dickey-Fuller statistics" (Pedroni, 1999, p. 658). The rest of the statistics are based on a group mean approach. "The first of these is analogous to the Phillips and Perron rho-statistics and the last two analogous to the Phillips and Perron statistics and the augmented Dickey-Fuller statistics respectively" (Pedroni, 1999, p. 658). The findings are presented in Table 2. Out of seven test statistics, five confirm the presence of cointegration among the variables. Therefore, following the (Pedroni, 1999, 2004) test in the series, we conclude that $Trade_{ijt}$, $DIST_{ij}$, $INS_{it}$, $INS_{jt}$, $GDP_{it}$, $GDP_{jt}$, $PCGDP_{it}$ series shared a long-run equilibrium relationship. For robustness, we also estimated long-run relationships among the variables using two other panel cointegration techniques such as Kao (1999) and Fisher-type Johansen cointegration test which is proposed by (Maddala & Wu, 1999). The results from these two cointegration tests also confirmed the existence of long-run equilibrium relationship among the variables.

**3.4. Panel data analysis of long-run output elasticities.** The long-run output elasticities are estimated using ordinary least square (OLS), dynamic OLS (DOLS) and fully modified OLS (FMOLS) models. The main advantage of FMOLS and DOLS is that it corrects for both serial correlation and simultaneity bias. Another reason why OLS is not appropriate is that its estimation produces biased results since the regressors are endogenously determined in the $I(1)$ case. The empirical findings of these models are presented in Table 6. The three approaches produce very similar results for each variable in terms of sign and significance, however in terms of magnitude they vary slightly. For the empirical interpretation, we only consider DOLS and FMOLS results, since these two approaches account for serial correlation and endogeneity that may exist in the model.

For the DOLS results, all the variables are significant except exchange rate and inflation of both country *i* and countries *j*. The results shows that 1% increase in distance between country *i* and *j* decrease $Trade_{ij}$ by-0.127%, similarly, 1% increase in corruption both country *i* and *j* cause -0.341% and -0.212% decrease in $Trade_{ij}$, respectively. In addition, 1% increase in corruption, *GDP*, *GDP* per capita, and trade to *GDP* ratio of country *i* and *j* cause 0.432%, 0.231%, 0.412%, 0.343%, 0.351% and 0.287% increase, respectively. For the FMOLS results, all the variables are significant except exchange rate and inflation of both country *i* and countries *j*. The results shows that 1% increase in distance between country *i* and *j* decrease $Trade_{ijt}$ by -0.147%, similarly, 1% increase in corruption both country *i* and *j* cause -0.345% and -0.236% decrease in $Trade_{ijt}$, respectively. In addition, 1% increase in

corruption, GDP, GDP per capita, and trade to GDP ratio of country *i* and *j* cause 0.412%, 0.276%, 0.489%, 0.304%, 0.312% and 0.266% increase, respectively. Each of the variables in the DOLS and FMOLS estimations are statistically significant at 1%, 55 and 10 % level. The findings on long-run elasticities suggest that along with distance between countries i and j, corruption of both sides are played significant role in the decrease of international trade among them. Similarly, long-run elasticities of *GDP*, *GDP* per capita, inflation and trade to *GDP* ratio played significant role in the increase of international trade between Malaysia and BRICS countries.

Table 3. Panel data analysis of long- run output elasticities

| Variables | DOLS | | FMOLS | |
|---|---|---|---|---|
| | Coefficient | t-statistic | Coefficient | t-statistic |
| $DIST_{ij}$ | -0.127 | 31.092*** | -0.147 | 23.987*** |
| $INS_{it}$ | -0.341 | 34.866** | -0.345 | 2.866** |
| $INS_{jt}$ | -0.212 | 2.976*** | -0.236 | 1.087*** |
| $GDP_{it}$ | 0.432 | 3.980** | 0.412 | 23.973** |
| $GDP_{jt}$ | 0.231 | 10.898* | 0.276 | 28.098* |
| $PCGDP_{it}$ | 0.412 | 11.287*** | 0.3.89 | 4.987*** |
| $PCGDP_{jt}$ | 0.343 | 30.765** | 0.304 | 67.987** |
| $ER_{ijt}$ | 0.135 | 23.987 | 0.176 | 38.098 |
| $INF_{it}$ | 0.563 | 20.988 | 0.502 | 45.098 |
| $INF_{jt}$ | 0.342 | 3.876 | 0.323 | 12.984 |
| $TR/GDP_{it}$ | 0.351 | 2.799** | 0.312 | 9.984** |
| $TR/GDP_{jt}$ | 0.287 | 1.987* | 0.266 | 10.976* |
| *R*-squared | 0.999 | | 0.998 | |

Notes: DOLS and FMOLS are the ordinary least square, dynamic and fully modified ordinary least square methods, respectively. *, **, *** denotes the significance level at 10%, 5% and 1%, respectively.

**3.5. Heterogeneous panel causality test.** Once the long-run dynamics are established among the variables, the next step is to find the direction of causality in the short-run. For this purpose, we conduct a pairwise Dumitrescu and Hurlin (2012) panel causality test. The significance of this approach is that it assumes all the coefficients to be different across cross-sections. This test requires variables to be stationary; we, therefore, apply on the first difference of the series. The findings established unidirectional causality from $GDP_{it}$ to $Trade_{ijt}$, $Trade_{ijt}$ to $GDP_{it}$, $GDP_{jt}$ to $Trade_{ijt}$, $Trade_{ijt}$ to $GDP_{jt}$, $ER_{ijt}$ to $Trade_{ijt}$, $Trade_{ijt}$ to $ER_{ijt}$, $TR/GDP_{jt}$ to $Trade_{ijt}$. All the results of heterogeneous panel causality test are presented in Table 4.

Table 4. Heterogeneous panel causality test

| Null hypothesis | Zbar-statistics | P-value |
|---|---|---|
| $DIST_{ijt}$ does not homogeneously cause $Trade_{ijt}$ | -1.232 | 0.184 |
| $Trade_{ijt}$ does not homogeneously cause $DIST_{ijt}$ | 2.876 | 0.321 |
| $INS_{it}$ does not homogeneously cause $Trade_{ijt}$ | -3.097 | 0.874 |
| $Trade_{ijt}$ does not homogeneously cause $INS_{it}$ | 2.089 | 0.001 |
| $GDP_{it}$ does not homogeneously cause $Trade_{ijt}$ | 5.974** | 0.004 |
| $Trade_{ijt}$ does not homogeneously cause $GDP_{it}$ | -2.973* | 0.009 |
| $GDP_{jt}$ does not homogeneously cause $Trade_{ijt}$ | 0.834*** | 0.006 |
| $Trade_{ijt}$ does not homogeneously cause $GDP_{jt}$ | -1.765*** | 0.008 |
| $PCGDP_{it}$ does not homogeneously cause $Trade_{ijt}$ | 1.977 | 0.345 |
| $Trade_{ijt}$ does not homogeneously cause $PCGDP_{it}$ | 0.924 | 0.456 |
| $ER_{ijt}$ does not homogeneously cause $Trade_{ijt}$ | -1.386** | 0.002 |
| $Trade_{ijt}$ does not homogeneously cause $ER_{ijt}$ | 2.922* | 0.001 |
| $INF_{it}$ does not homogeneously cause $Trade_{ijt}$ | -1.234 | 0.003 |
| $Trade_{ijt}$ does not homogeneously cause $INF_{it}$ | 2.752 | 0.422 |
| $INF_{jt}$ does not homogeneously cause $Trade_{ijt}$ | 1.823 | 0.342 |
| $Trade_{ijt}$ does not homogeneously cause $INF_{jt}$ | -0.975 | 0.342 |
| $TR/GDP_{it}$ does not homogeneously cause $Trade_{ijt}$ | 3.865 | 0.123 |
| $Trade_{ijt}$ does not homogeneously cause $TR/GDP_{it}$ | 4.875*** | 0.001 |
| $TR/GDP_{jt}$ does not homogeneously cause $Trade_{ijt}$ | -1.234** | 0.002 |
| $Trade_{ijt}$ does not homogeneously cause $TR/GDP_{jt}$ | 0.876 | 0.233 |

Notes: *, **, *** denotes rejection of null hypothesis at 10%, 5% and 1% significance level.

## Conclusions

The worldwide attention towards economic development has accelerated international trade in recent decades. The significant role of international trade in the economic growth attracts researchers to investigate the factors effecting international trade

between two countries. Using heterogeneous panel estimation techniques, we established the long-run dynamics of factors effecting international trade between Malaysia and BRCIS countries. This study utilized time series data covering the time period between 1980 and 2015. The analysis uncovers cross-sectional dependence across the countries. Therefore, we used the general diagnostic test for cross-section dependence in panels proposed by M. Hashem Pesaran (2004) to find whether the cross-sectional dependence existed within our panel variables. The null hypothesis of cross-sectional independence was strongly rejected for all of the variables. We conclude the presence of cross-sectional dependence as expected. Furthermore, unit root test apply to confirm the stationarity level. The CIPS test results suggest that there may be a long-run equilibrium relationship among the variables since all of the variables are integrated with the same order.

In the next step, we examine whether a long-run equilibrium relationship exists between the variables. Each of our variables is integrated of order one, we conducted panel cointegration test developed by (Pedroni, 1999, 2004). Seven test statistics are proposed: out of seven test statistics, five confirm the presence of cointegration among the variables. The results from these two cointegration tests also confirmed the existence of long-run equilibrium relationship among the variables. The long-run output elasticities are estimated using ordinary least square (OLS), dynamic OLS (DOLS) and fully modified OLS (FMOLS) models. Each of the variables in the DOLS and FMOLS estimations are statistically significant at 1%, 55 and 10 % level. The findings on long-run elasticities suggest that along with distance between countries *i* and *j*, corruption of both sides are played significant role in the decrease of international trade among them. Similarly, long – run elasticities of *GDP*, *GDP* per capita, inflation and trade to *GDP* ratio played significant role in the increase of international trade between Malaysia and BRICS countries. These finding and results are important especially for policy makers in crafting policies to improve Malaysia-BRICS trade relationship in the future. In line with the empirical findings, it is crucial for Malaysian government to focus on accelerating the efforts to establish the trade with BRICS countries, liberalizing the economy, further improving the strategic sectors such as the Islamic banking and finance and intensify endeavors in curbing corrupt practice.

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