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# THE EFFECT OF OPENNESS ON ECONOMIC GROWTH FOR BRICS COUNTRIES: A PANEL DATA ANALYSIS

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*Export, Import, Openness, co-integration, economic growth*

## ABSTRACT

*The study attempts to examine the effect of trade openness on economic growth for the most rapidly developing countries name as, Brazil, Russia, India, China and South Africa (BRICS), via panel data analysis by using the annual data during the period from 1990 to 2016. The data were obtained from world development indicator of World Bank. As a trade openness variables are Export, Import and GDP was used in this study and applied various econometric models like co-integration test, Levin-lin-chu (LLC), Im-pesaran-shin (IPS) model and Hausman test. The result conforms that the trade openness and economic growth are cointegrated. The results indicates that there is significant effect on openness and economic growth, and the Hausman test report that there is an insignificant effect on the openness and the economic growth.*

## I.INTRODUCTION

In the previous couple of decades, some vast economies, namely Brazil, Russia, India, China, and South Africa (BRICS) have obtained huge consideration on the scene of the worldwide economy and assumes an imperative part on the planet economy as makers of products and ventures, recipients of capital, and as potential purchaser markets. The BRICS economies have been recognized as a portion of the quickest developing nations and the motors of the worldwide recuperation process, which underscores the changed part of these economies. Its demonstrating amazing monetary development rates over the previous years, this gathering of nations so far delegated "rising economies" are seen to have experienced a procedure of basic changes now achieving the level of world-driving economies in a brief span. This continuous procedure may likewise prompt a move inside the worldwide economy far from right now created world groups, for example, the G7, towards the creating nations.

In the 21st century, the world has confronted various issues associated with its unipolarity built up by the United States of America (USA). The Bretton-Woods framework made the US dollar a global save money because of its light linkage to the cost of gold. Hence, the US dollar brings together the world as far as universal exchange filling in as a worldwide unit measure of riches. In this unique situation and inside the structure of the changing worldwide condition, the possibility of a substitute shaft of political and financial impact has emerged.

The developing markets of the BRICS nations assume a critical part in the present worldwide economy and business. The BRICS nations taken together have represented more than 40% of the total populace, 33% of its landmass and almost a fourth of worldwide GDP. The BRICS joint effort speaks to an idea, by which merchandise, capital, endeavors and individuals can openly move. These new performing artists are developing on the worldwide stage, adjusting the experience from driving contemporary mammoths. The developing reliance of worldwide markets requires the production of new arrangements and rectifying of connection limits. Because of the liberal approaches set up by the BRICS individuals, the worldwide exchange and capital inflows have been detectably animated. The Asian area specifically has picked up the part of an extensive speculator and value setter on the worldwide budgetary and products markets. In spite of the fact that the BRICS indicate great monetary execution, these nations still experience an extensive variety of troubles, for example, high joblessness rates, constrained access to training or issues in the medicinal services framework, all of which speak to noteworthy impediments on the way to fast financial development. Without a doubt, the ways of life in these five nations stay low rather than Western models. What's more, the BRICS nations contrast unmistakably concerning social advancement, financial execution, authentic foundation and current political points – in this way the foundation of invaluable shared relations may not succeed.

## II.REVIEW OF LITERATURE

This section of the paper presents a brief review of earlier work on the relationship between openness and economic growth both at the national and international level and the same has been presented in the tabular form for better understanding.

| AUTHORS | COUNTRIES | PERIOD | METHOD | VARIABLES | ECONOMETRIC TECHNIQUES | RESULTS |
|---|---|---|---|---|---|---|
| Andrews (2015) | Liberia | 1970-2011 | Time series data | Export import and GDP | vector auto regression model and Granger causality test | The results confirmed the bi-directional causation between GDP and Imports and uni-directional causation between exports and GDP and exports and imports |
| Tahir and others (2015) | Sri Lanka | 1981-2012 Annual | Time series data | Export import, Investment, Unemployment and GDP | unit root test, johansion cointegration test, granger causality test and Vector Auto-Regressive | The study concluded that no short or long run relation exist between the export and GDP growth of Sri Lanka. |
| Rai and Jhala (2015) | India | 1991-2013 Annual | Time series data | Export import and GDP | Unit Root test and Granger causality test | The results revealed that there is a positive relationship between growth rate and exports |
| Kumari and Malhotra (2014) | India | 1980-2012 Annual | Time series data | exports and GDP per capita | Johansen cointegration and Granger causality approach | The cointegration test does not confirm the existence of long run equilibrium relationship between exports and GDP per capita Granger Causality test support ELG hypothesis |
| Ronit and Divya (2014) | India | 1969-2012 Annual | Time series data | real GDP, export | VAR, Granger causality test | Rejection of ELG |
| Jarra (2013) | Ethiopia | 1960-2011 Annual | Time series data | export, government consumption , household consumption (%GDP) | ADF and PP tests for satationarity, Johansen cointegration and Granger causality tests | Economic growth has an impact on exports and domestic demand in Ethiopia. |
| Dar and others (2013) | India | January 1992 to October 2011 monthly data | Time series data | IIP, real export | wavelet correlation and cross correlation | The result is exports and output are not related in the short run but are related in medium and long run. |
| Kilavuz and Topcu (2012) | 22 developing countries | 1998–2006 Annual | panel data | GDP, investment, population, high and low-tech manufacturing industry exports and imports | Panel Unit Root Tests, Random Effects , Fixed Effects and Panel Corrected Standard Errors | Export has a significant effect on the economic growth performance of those countries. |
| Mehdi and Shahryar (2012) | Iran | 1961-2006 Annual | panel data | total export, value added by sectors | Unit Root Test by ADF test, Feder Model | Export growth has a positive effect on the growth of value added in the same sector. But the effect of export growth on the value added in industry and mining sector is more than other sectors |
| Sahni and Atri (2012) | India | 1980-81 to 2008-09 Annual | Time series data | gross national product, total exports, manufactured exports and investment | OLS method | The study supports the Export - Led growth Hypothesis in India. |
| Elbeydi, Hamuda and Gazda (2010) | Libya | 1980-2007 Annual | Time series data | GDP, exports, and exchange rate | Johansen cointegration test, VECM | The study indicated that the export promotion policy contributes to the economic growth in Libya. |
| Funke and Ruhwedel (2005) | 14 East European transition economies | 1993-2000 Annual | panel data | final output, produced labour and differentiated capital goods, export, import, GDP | Panel cointegration test | No role of export variety fostering economic growth of the East European transition economies. The result showed that export product variety in capital-intensive industries and investment are spearheading the growth process is consistent with Ventura's (1997) neoclassical export-led growth model |

| | | | | | | |
|---|---|---|---|---|---|---|
| Shirazi and Manap (2004) | Pakistan | 1960-2003 Annual | Time series data | real GDP, the real export, and the real imports | Johansen and Juselius Cointegration test, Engle-Granger test and CRDW test, Granger Causality test | It has been suggested that Pakistan may continue with the imports of necessary raw material for value addition and needed technology to expand capacity and improve productivity. It may pay full attention to boost up the exports. |
| Olufemi (2004) | Nigeria | 1970-2000 Annual | Time series | GDP, Export, Import, Exchange rate premium, Net capital inflows | Johansen cointegration technique and Vector error correction model. | The results indicated a uni - directional relationship between openness and economic growth. |
| Lee and Huang (2002) | Hong Kong, Korea, Taiwan, the Philippines and Japan. | Quarterly | Time series data | output , capital, exports , imports , and the labor force | multivariate Granger causality, multivariate threshold autoregressive model | Except for Hong Kong, the relationship whereby exports lead output prevails in at least one regime for each of four of the countries being studied. |
| Ekanayake (1991) | 8 Asian developing countries India, Indonesia, Korea, Malaysia, Pakistan, Philippines, Sri Lanka, and Thailand | 1960 – 1997 Annual | Time series data | real exports and real GDP | Cointegration and error-correction models ADF Unit Root Test, Engle-Granger and Johansen Cointegration Tests | Short-run Granger causality running from economic growth to export growth in all cases except Sri Lanka. While there is strong evidence for long-run Granger causality running from export growth to economic growth in all cases, there is evidence of short-run causality running from export growth to economic growth only in Indonesia and Sri Lanka |

## Definitions of the Variables

The dependent variable in this study is GDP. It has been shown that GDP can describe the economic growth in the BRICS countries. The explanatory variables consist of three independent variables namely trade openness (total export + total import) / total GDP. All the dependent and independent variables are stated in constant price (constant 2005 US$) to ensure that there are no inflation effects.

## Openness

Openness is defined as an economy which trades with the rest of the world. In other words, there exist economic activities such as import and export for a country. Countries like the ASEAN members who practice foreign trade are known open economies. Openness can be measured as follows:

Openness = (total export + total import) / total GDP

Economic openness brings many advantages such as consumers have plenty of choices since there are variety of goods and services in the economy. Moreover, the country's citizens have the opportunity to invest their savings abroad. Furthermore, open economy appears to be beneficial for regional development, at the same time indirectly reducing poverty among citizens,

## III.METHODOLOGY

The main focus of the present study is to empirically explore the effect of openness on economic growth performance in the context of BRICS countries will be performed in three steps: (1) initially informing the data set (2) to test for stationarity or the order of integration; and (3) test for cointegration; . The empirical study were cointegration, Levin-Lin chin (LLC) Tests, Im-Pesaran-Shin (IPS) test and the Hausman test is using in this analysis at panel level is applied.

## Data set

In this empirical study using secondary data to analyzed the effect of openness and economic growth of emerging developing countries (Brazil, Russia, India, China, South Africa) via panel data analysis by using the annual data from 1990-2014 . From the variables used in the analysis real GDP (constant 2005 US$) and trade openness (export+import/GDP) respectively. The data were obtained from world Development Indicators WDI, of the World Bank. All the data are used in the form of natural logs.

## Panel Data model Estimation Procedure

Panel data analysis is a method of studying a particular subject within multiple sites, periodically observed over a defined time frame. With repeated observations of enough cross-sections, panel analysis permits the researchers to study the dynamics of change with short time series. By combining time series of cross-section observations, panel data give "more informative data, more variability, less collinearity among variables, more degrees of freedom and more efficiency" (Baltagi, 2005, p.5). Gujarati and Sangeetha (2007, p.652) noted that panel data can enhance the quality and quantity of data in ways that may not be possible using only cross-section or time series data. Thus, panel data analysis endows regression analysis with both a spatial and temporal dimensions. The spatial dimension pertains to a set of cross-sectional units of observation. These could be countries, states, counties, firms, commodities, groups of people, or even individuals. The temporal dimension pertains to periodic observations of a set of variables characterizing these cross-sectional units over a particular time span.

Panel data models examine fixed and/or random effects of individual or time. The core difference between fixed and random effect models lies in the role of dummy variables. A parameter estimate of a dummy variable is a part of the intercept in a fixed effect model and an error component in a random effect model. Slopes remain the same across group or time period in either fixed or random effect model. The functional forms of fixed and random effect models are,

Fixed effect model: $Y_{it} = (\alpha + u_{it}) + X_{it}'\beta + v_{it}$

Random effect model: $Y_{it} = \alpha + X_{it}'\beta_{it} + (u + v_{it})$

where "$u_{it}$" is a fixed or random effect specific to individual (group) or time period that is not included in the regression, and errors are independent identically distributed, $v_{it} \sim IID(0, \sigma^2)$.

**Fixed Effect Model (FE)**

A fixed group effect model examines individual differences in intercepts, assuming the same slopes and constant variance across individual (group and entity). Since an individual specific effect is time invariant and considered a part of the intercept, $u_i$ is allowed being correlated with other regressors (independent variables). That is, assumption *OLS* (Ordinary Least Square) that the expected value of disturbances is zero or disturbances are not correlated with any regressors is not violated. This fixed effect model is estimated by least squares dummy variable *(LSDV)* regression (*OLS* with a set of dummies) and within effect estimation methods.

There are several strategies for estimating a fixed effect model. The *Least Squares Dummy Variable* model *(LSDV)* uses dummy variables, whereas the "*within" estimation* does not. These strategies, of course, produce the identical parameter estimates of regressors. The "*between" estimation* fits a model using individual or time means of dependent and independent variables without dummies.

*LSDV* with a dummy dropped out of a set of dummies is widely used because it is relatively easy to estimate and interpret substantively. This *LSDV,* however, becomes problematic when there are many individuals (or groups) in panel data. If *T* is fixed and *N*!" (*N* is the number of groups or firms and *T* is the number of time periods), parameter estimates of regressors are consistent but the coefficients of individual effects, $\alpha + u_i$, are not, since the number of these parameters increases as *N* increases. Therefore, *LSDV* loses *N* degrees of freedom but returns less efficient estimators (Baltagi, 2005, p.13). Under this circumstance, *LSDV* is not that much useful and thus calls for another strategy namely the "*within effect*" estimation.

Unlike *LSDV,* the "*within*" estimation does not need dummy variables, but it uses deviations from group (or time period) means. That is, "*within*" estimation uses variation within each individual or entity instead of a large number of dummies. This "*within*" estimation needs three steps:1) compute group means of the dependent and independent variables; 2) transform dependent and independent variables to get deviations from their group means; 3) run *OLS* on the transformed variables without the intercept term. The "*within*" estimation is,

$$y_{it} = \alpha + \beta x_{it} + u_i + v_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Averaging over time (dividing by't')

$$\bar{y}_i = \alpha + \beta \bar{x}_i + u_i + \bar{v}_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Subtracting equation (2) from (1), gives

$$y_{it} - \bar{y}_i = \beta(x_{it} - \bar{x}_i) + (v_{it} - \bar{v}_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where $\bar{y}_i$ is the mean of dependent variable (DV) of individual (group) $i$, $\bar{x}_i$ represent the means of independent variables (IVs) of group $i$, and $\bar{v}_i$ is the mean of errors of group $i$. Alternatively, averaging across all observations in equation (1)

$$\bar{y}_{..} = \alpha + \beta \bar{x}_{..} + \bar{v}_{..} \quad \ldots\ldots\ldots\ldots\ldots\ldots (4)$$

In this "within" estimation, the incidental parameter problem is no longer an issue. The parameter estimates of repressor's in the "within" estimation is identical to those of *LSDV*. The *"within"* estimation reports correct sum of squared errors *(SSE).*

**Random Effect Model (RE)**

The random effect model incorporates a composite error term, $w_{it} = u_i + v_{it}$. The $u_i$ are assumed independent of traditional error term $v_{it}$ *and* repressors' Xit, which are also independent of each other for all $i$ and $t$. It should be remembered that this assumption is not necessary in a fixed effect model. This model is,

$$Y_{it} = \beta_{1i} + \beta' X_{it} + u_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where $\beta_1 i$ is assumed as a random variable with a mean value of $\beta_1$. Then the intercept for each '$i$' can be expressed as

$$\beta_{1i} = \beta_1 + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

Where $\varepsilon_i$ is a random error with zero mean and variance *(0,* $\sigma\varepsilon^2$*).*

If the composite error $w it = \varepsilon_i + u_{it}$, and each individual reflected in the error term $\varepsilon_i$ then

$$Y_{it} = \beta_1 + \beta' X_{it} + \varepsilon i + u_{it} \quad \ldots\ldots\ldots\ldots\ldots\ldots (7)$$
$$= \beta_1 + \beta' X_{it} + wi_t$$

As long as there is no correlation between the regressors and either $u_{it}$ or $\varepsilon_i$, the random effects technique, which is just generalized least squares *(GLS),* will provide consistent and efficient estimates of the parameters. Unlike the fixed effects model, this procedure utilizes variation in the data both between firms at a given point in time as well as within each firm through time to estimate the coefficients. If there really is no correlation between the regressors and $u_i$, this added variation gives random effects a significant advantage over fixed effects estimates.

**Fixed vs Random Effects - *Hausman Test***

In summary, if there is no correlation between the regressors and $u_i$, the random effects specification is most efficient and hence is preferred. On the other hand, if correlation between the regressors and $u_i$ is present, the fixed effects specification is theoretically superior because it can provide consistent estimates. In fact, Mairesse and Sassenou (1991) argue that the random effects specification may actually be preferred in spite of its failure to remove the correlation between the regressors and $u_i$. Traditionally, the way to choose between these two models is to employ the *Hausman* statistic, which measures the distance between the estimated fixed and random effects coefficients. Given a model and data in which fixed effects estimation would be appropriate, a Hausman test tests whether random effects estimation would be almost as good.

The Hausman test thus tests the null hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the fixed effects estimator. If they are, then it is safe to use random effects. In other words, the Hausman test is a test of $H_0$: that random effects would be consistent and efficient, versus $H_1$: that random effects would be inconsistent. (Fixed effects would certainly be consistent). So if the Hausman test statistic is large, one must use *FE.* If the statistic is small, one may proceed with *RE.* In short, if the P-value is insignificant *(P-value, Prob>chi*$^2$ *larger than .05),* then it is safe to use random effects. However, if the value of *P*-is significant (less than .05), one should use fixed effects.

***Panel Unit Root Test***

The traditional Augmented Dickey Fuller and Phillips and Perron unit root test is usually used to check the stationarity of time series variables. But the limitation of this technique is that it has a problem of low power in rejecting

the null hypothesis of stationarity of the time series, particularly for small size of data. The literature suggests that panel unit root test has higher power than the unit root test based on univariate time series. A number of such tests are available in the literature. For the panel data Levin-Lin (LLC) Tests and Im-Pesaran-Shin (IPS) Test has been identified for the current study. In principle, the IPS test also can be used in association with any parametric unit-root test, as long as the panel is balanced and all the t-statistcs for the unit-root in every crosssection are identically distributed so that they will have the same variance and mean. Then the Central Limit Theorem (CLT) can be applied. Although the IPS test requires a balanced panel, it is the test most often used in practice because it is simple and easy to use.

## IV. RESULT ANALYSIS

Table I represents the test of the stationarity on the data series at panel level. Stationarity check of any time series data is one of the most important requirements before analysis of co-integration and causality. The results indicate that all the time series variables that used in the study have unit roots. When we study on the results on Table 4, it is observed that y and open series aren't stationary in level value and series became stationary in the first difference. In other words, in the studied period it is found out that macroeconomic variables are nonstationary and the shock effects on these variables do not disappear after a while. So we can say that the last economic crisis was destabilized the countries' economies considerably (Mercan2013). The estimated statistics the estimated statistics cannot reject the nullhypothesis of non-stationarity at 5% level of significance.

However, the variables are found to be stationary at the first difference level, as the null hypothesis of non-stationarity is rejected at 5% level of significance. This indicate that the variables are integrated of order its shows this table I.

**Table: I**
**IPS and LLC Panel Unit Root Test Results**

| | IPS | | LLC | |
|---|---|---|---|---|
| **Variable** | **Statistic** | **p.value** | **Statistics** | **p.value** |
| GDP | 0.17 | 1.000 | -0.923 | 0.1778 |
| ΔGDP | -2.61* | 0.000 | -3.496* | 0.0002 |
| OPEN | -1.71 | 0.186 | -3.571 | 0.002 |
| ΔOPEN | -3.230* | 0.000 | -4.393* | 0.000 |

Note: GDP=Economic Growth (GROSS DOMESTIC PRODUCT), OPEN= Trade Openness and Δ=Δ symbol indicates that the first differences of the variables were taken. **indicates significant and 1% level of significance*

Table II reveals that the impact of Trade openness on Economic Growth in BRICS is positive and statistically significant, in the random effect model the estimated co efficient of 0.099 is found for the openness variable statistically significant at 5 percent level of significance. The estimated co efficient indicates that an increase of one percentage point in trade openness leads to increase in GDP by 0.0954 until percentage for each specific country and its statistically significant relations with the economic growth in BRICS countries. In the fixed-effect model also reveals that the impact of openness on economic growth in BRICS countries and it is also positive and statistically significant. The $R^2$ explains 6 percent variation in the dependent variable by the explanatory variable in both random-effect and fixed-effect models.

**Table: II**
**Pannel Data Estimates**

| | RANDOM EFFECT | | FIXED EFFECT | |
|---|---|---|---|---|
| **Variables** | **Coefficient** | **t-ratio** | **Coefficient** | **t-ratio** |
| OPPEN | 0.0996** | 2.39 | 0.0954** | 2.31 |
| C | 0.0409* | 3.44 | 0.0410* | 11.47 |
| $R^2$ | 0.062 | | 0.062 | |
| P Value | 0.000 | | 0.000 | |
| HAUSMAN TEST (P.value) = (0.51) | | | | |

Note: Asterisks * and ** shows statistically significant at 1 %. And 5% respectively.
Periods included: 25 Cross-sections included: 5 Total panel (balanced) observations: 125.

The hausman's specification test is utilized for the choice of random effects or fixed effect models, in the present study, the Hausman test report that there is insignificant relations at both random effect and the fixed effect model, we employ both random effect or fixed effect model and their respective results are reported in table II.

## CONCLUSSION

In this study analyzed the effect of openness and economic growth of emerging developing countries (Brazil, Russia, India, China, South Africa) via panel data analysis by using the annual data from 1990-2014 . From the variables used in the analysis the real GDP (constant 2005 US$) and trade openness (export + import / GDP) respectively. The data were obtained from world Development Indicators WDI, of the World Bank. All the data are used in the form of natural logs, for the panel data Levin-Lin (LLC) Tests and Im-Pesaran-Shin (IPS) Test has been used for the current study and to using the Hausman test to estimate the panel data reveals that the impact of Trade openness on Economic Growth in BRICS is positive and statistically significant, in the random effect model the estimated co efficient of 0.099 is found for the openness variable statistically significant at 5 percent level of significance. The estimated co efficient indicates that an increase of one percentage point in trade openness leads to increase in GDP by 0.0954 until percentage for each specific country and its statistically significant relations with the economic growth in BRICS countries. In the fixed-effect model also reveals that the impact of openness on economic growth in

BRICS countries and it is also positive and statistically significant. The $R^2$ explains 6 percent variation in the dependent variable by the explanatory variable in both random-effect and fixed-effect models. The Hausman test reports that there is an insignificant relations between the openness and the economic growth.

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