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International Trade and Economic Growth: Evidences From The Brics

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Abstract

The relationship between export and import of goods and services and economic growth per capita for the BRICS countries are examined using panel unit root, panel cointegration, Granger causality test, FMOLS and DOLS. Findings show that all the three variables are cointegrated and that export of goods and services and import of goods and services Granger cause economic growth per capita in the long run. It is observed that in the long run, import of goods and services and economic growth per capita Granger cause export of goods and services while export of goods and services and economic growth per capita Granger cause import of goods and services in the long run. Additionally short run bidirectional causality is observed between export of goods and services and economic growth. The study concludes that burgeoning Gross Domestic Product (GDP) and trade of BRICS are tied in knot and thus supports export oriented policies of these nations

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Keywords- BRICS, Economic growth, Export, Import. Panel Unit root, Panel Cointegration, Granger causality.

JEL Classification- O11, F14, F43, C33

1. Introduction

Development policies of most developing nations delve around export led growth which is a development strategy for fostering industrialization and hence economic growth. It aims at capturing the economic benefits of trade openness by encouraging best practice adoption; promoting product development; and exposing firms to competition. Export led growth consensus is built on arguments of comparative advantage and benefits of liberalisation including technology diffusion and knowledge spill overs. However, export led growth consensus has faced challenges from different corners. Keynes rejection of comparative advantage (Milberg 2002; Prasch 1996) highlights that in case of demand shortage, trade can reduce domestic demand, leading to reduced output, employment, and hence economic growth. Then the import-substitution school of thought believes that impediments to economic development and growth are trade protection, industrial policy, and the ability to conduct macroeconomic policy. Chang (2002) concludes that no country has successfully industrialized without such policies but his argument possibly focuses only to developing economies. Palley (2002, 2004) highlights that export-led growth promotes economic structures that deliver low quality growth and prevent the development of deep prosperity. The study argues that economic growth of countries with policies emphasising export led growth not only suffer in the long run due to shallow roots of development with external focus, but may also face situations of wage suppression, disregard for labour, deteriorating workplace conditions, tweaking with

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environmental standards and weak regulatory conditions when such policies aims at encouraging competitive advantage.

Despite arguments and findings in favour and against, the nature of linkages between economic growth, export and import is still an important area of research and the direction of linkages are very important for policy makers. The linkages are still debated possibly because empirical support for non-linkages are weak and the economic importance of empirical evidences against the linkages reported in empirical studies is not strong enough to invalidate linkages. However, the theory behind the linkages between economic growth and trade has an intuitive appeal that is hard to beat. If we look at BRICS (Brazil, Russia, India, China and South Africa), the group is the symbol of change from an economic system controlled by developed G7 economies to a new high growth trajectory lead by the developing world. The growth of BRICS intensifies competition not only in price and quality of its production but for access to energy and resources as well. With high level of population, BRICS also presents a group of affluent consumers and their economies are more open than they were 10 to 15 years ago. BRICS continued to grow their economies after the recent financial crisis led by collapse of US credit system that plunged both the US and Europe into a prolonged economic recession. Along with rapid economic growth, reformist trade policies of the BRICS nations contributed to increasing share of BRICS in global trade and it has more than doubled over the past decade. This apparent convergence of burgeoning Gross Domestic Product (GDP) and trade spawns research to explore possible relationships between them.

2. Literature Review

The relationship between international trade and economic growth has received fair attention among the researchers. Among cross country studies, Balassa (1978), Feder (1983), Ram (1985), and McNab and Moore (1998) support a positive association between export growth and output growth in developing countries. However these studies did not validate the direction of causality between export and economic growth but inherently assumed positive causal effect of export on output growth. Additionally these studies suffered from classical omitted-variables problem where effects of country specific factors were ignored. Ram (1987), Salvatore and Hatcher (1991) examined the export-led economic growth hypothesis using ordinary least square method and argued that exports are likely to contribute positively towards foreign exchange reserves and thereby facilitate import of better technologies and production methods. Subsequent studies on individual countries like Hsiao (1987), Dodaro (1993), Sharma and Dhakal (1994), and Riezman et al. (1996) suggest that export growth has no causal effect on output growth in the majority of developing countries. However, most of these studies employed causality using VAR and thus prohibits the possibility of a long-run or cointegrating relationship between the level of exports and the level of output a priori. Granger (1988) and Toda and Phillips (1993) highlighted the methodological limitations of causality based on VAR as employed in these studies. Among other studies, Van den Berg and Schmidt (1994), Ahmad and Harnhirun (1995), Dutt and Ghosh (1996), Love and Chandra (2004), Bahmani-Oskooee and Economidou (2009) suggest that in most developing countries there is a positive long run relationship between exports and output, and that causality is running from exports to output or in both directions. However, Moosa (1999) failed to detect long run and short run relationship between export and growth using cointegration and causality tests for Australia. Ekanayake (1999) provides a good summary of literature on the issue. However, most of these studies are based on individual country time-series data and may have been impaired by a short data span that lowers the power of the unit root and cointegration test. Contemporary research on the issue focuses more on panel data analysis to test causality and cointegration especially for research on a group of countries. On his work on cross country growth, Islam (1995) argued that panel procedures may provide evidences significantly different than individual cross country studies.

Yao (2006) adopted panel unit root test and dynamic panel data estimating technique to suggest that both exports and FDI have a strong and positive effect on economic growth. The results indicates that two development policies adopted in China are useful for other developing and transitional economies: export promotion and adoption of world technology and business practices. Parida and Shahoo (2007) examined export led growth hypothesis for four developing countries of South Asia like India, Pakistan, Bangladesh and Sri Lanka using Pedroni's Panel Cointegration Technique. The study finds long-run equilibrium relationship supporting export-led growth hypothesis. Using panel VECM, Safdari, et al. (2011) observed unidirectional causality running from economic growth to exports for 13 developing countries. Zeren and Savrul (2013) examined the export led growth hypothesis in 15 selected European countries using panel cointegration and concluded existence of a long term relationship between economic growth and exports. However, Ulaşan (2015) find less support for positive linkage between trade openness and economic growth using panel approach.

The motivation of the study stems from diverse findings on the issue. The interrelated relationship between export of goods and services, import of goods and services and economic growth has always been considered as an important topic for discussion since the era of import liberalization policies to the era of openness and economic growth, however the empirical work on the relationship among these three variables is limited so far as BRICS is concerned.

3. Data and Methods

3.1 Empirical specification and Data

Annual data of export of goods and services and import of goods and services and Gross Domestic Product (GDP) per capita (constant 2005 US$) of all the BRICS countries have been taken from the World Bank. The time period of the study is 1991 to 2013. Export of goods and services is represented by EXP, Import of goods and services in represented by IMP and economic growth measured by GDP per capita as GDPPC.

A multivariate model is used to examine the nexus between the three variables. All the variables are initially transformed into natural logs and the panel version of the equation is:

$$LnGDPPC_{it} = \alpha_{i0} + \alpha_{i1} LnEXP_{it} + \alpha_{i2} LnIMP_{it} + \varepsilon_{it} \quad (1)$$

Here subscript i (equation 1) denotes each of the BRICS countries respectively.

3.2 Methods

The following tests have been applied to the data for the time period 1991 to 2013.

3.2.1 Panel Unit Root Test

To ascertain the integrational properties of the data series, four types of panel unit root test has been performed at both the level and first difference of the three variables. They are Levin et al. (2002), Im et al. (2003), Fisher type tests using ADF and PP Tests as proposed by Maddala and Wu (1999). We computed the panel unit root test using individual fixed effect as regressors, chose lag difference by the Schwarz criterion. We used bandwidth selection procedure as described in Newey and West (1994).

3.2.2 Panel Cointegration Test

With the evidences of existence of a panel unit root we explore whether there exists a long run equilibrium relationship between the variables. Since all the three concerned variables are integrated on order one, we perform cointegration test amongst the variables using Pedroni (1999, 2004), Kao (1999) and Fisher-type test using Johansen Methodology (Maddala and Wu,

1999). Pedroni and Kao tests are based on Engle Granger (1987) and two step (residual based) cointegration tests. The Fisher test is a combined Johansen test. Seven tests derived for cointegration as per Pedroni (2004) was done that allow for heterogeneous intercepts and trend coefficients across cross-sections. We tested for null hypothesis of no cointegration (i.e., error term from the cointegrating regression is I(1)) against two alternative hypotheses: the homogenous alternative (which Pedroni terms the within dimension test or panel statistics test) and the heterogeneous alternative (referred to as the between dimension or group statistic test). The seven tests include of the panel v-statistic, panel rho statistic, panel PP statistic (non parametric), panel ADF statistic (parametric), group rho statistic, group PP statistic (non parametric), group ADF statistic (parametric). Kao (1999) test follows the same basic approach as the Pedroni tests, but specifies cross section specific intercepts and homogeneous coefficients on the first stage regressors. Fisher (1932) derived a combined test that uses the results of the individual independent unit root tests. Maddala and Wu (1999) use Fisher's (1932) result to propose an alternative approach to test for cointegration in panel data by combining tests for individual cross sections to obtain a test statistic for the full panel.

3.2.3 Panel Granger Causality Test

We examine the direction of causality between the variables in a panel context. Engle and Granger(1987) suggested that if two nonstationary variables are cointegrated a VAR in first differences will be misspecified. Therefore when testing for Granger causality we specify a model with dynamic error correction representation where the traditional Vector Auto Regressive model is augmented with one period lagged error correction term that is obtained from the model based on OLS. The Granger causality test is based on the following regressions:-

$$\Delta LnGDPPC_t = \sum_{j=1}^{p-1} \beta_{11} \Delta LnGDPPC_{t-j} + \sum_{j=1}^{p-1} \beta_{12} \Delta LnEXP_{t-j} + \sum_{j=1}^{p-1} \beta_{13} \Delta LnIMP_{t-j} + \alpha_1 ECT_{t-1} + \varepsilon_{1t} \qquad (2a)$$

$$\Delta LnEXP_t = \sum_{j=1}^{p-1} \beta_{21} \Delta LnEXP_{t-j} + \sum_{j=1}^{p-1} \beta_{22} \Delta LnGDPPC_{t-j} + \sum_{j=1}^{p-1} \beta_{23} \Delta LnIMP_{t-j} + \alpha_2 ECT_{t-2} + \varepsilon_{2t} \qquad (2b)$$

$$\Delta LnIMP_t = \sum_{j=1}^{p-1} \beta_{31} \Delta LnIMP_{t-j} + \sum_{j=1}^{p-1} \beta_{32} \Delta LnGDPPC_{t-j} + \sum_{j=1}^{p-1} \beta_{33} \Delta LnEXP_{t-j} + \alpha_3 ECT_{t-3} + \varepsilon_{3t} \qquad (2c)$$

where Δ is the first difference operator and $\varepsilon_{1t}, \varepsilon_{2t}, \varepsilon_{3t}$ are white noise. Error correction term is denoted by ECT and the order of the VAR is represented by p, which is translated to lag of p-1 in the ECM. α_1, α_2 and α_3 represent the pace of adjustment after EXP, IMP and GDPPC deviate from the long run equilibrium in period t-1. The significance of the first differenced variables provides evidence on the direction of short run causality, while the coefficients α_1, α_2 and α_3 are expected to capture the adjustments of the three variables towards long run equilibrium. The optimal lag length is chosen based on Schwarz Information Criteria.

The above equation 2(a) is used to test the causation from export of goods and services and import of goods and services to gross domestic product per capita. When all $\beta_{12} = 0$, change in export of good and services does not Granger cause gross domestic product per capita. If all $\beta_{13} = 0$, change in import of goods and services does not Granger cause gross domestic product per capita. Similarly equation 2(b) is used to test the causality from import of goods and services and gross domestic product per capita to export of goods and services. If all

$\beta_{22} = 0$, change in gross domestic product per capita does not Granger cause export of goods and services. If all $\beta_{23} = 0$, change in import of goods and services does not Granger cause gross export of goods and services. Similarly equation 2(c) is used to test the causality from export of goods and services and gross domestic product per capita to import of goods and services. If all the $\beta_{32} = 0$, change in gross domestic product per capita does not Granger cause import of goods and services. When all the $\beta_{33} = 0$, change in export of goods and services does not Granger cause import of goods and services. As we used stationary variables for testing causality, a standard F test is used to test the null hypothesis

By testing whether the coefficients of the error correction term in each of the above equations i.e. $\alpha_i = 0$ where i=1, 2, 3, we test the null hypothesis of long run causality.

4. Results and Discussion

4.1 Panel Unit Root Test

The results for the panel unit root test are presented below:

Table 1 represents the panel unit root test results, organized both by null hypothesis as well as maintained hypothesis concerning the type of unit root process. The results of Levin et al. (2002), Im et al. (2003) and ADF - Fisher Chi-square and PP - Fisher Chi-square indicate the presence of unit root at level for logarithmic series of all the three variable EXP, IMP and GDPPC and thus fail to reject the null of a unit root. Findings of panel unit test performed at the first difference form of all the three variables viz., LnEXP, LnIMP and LnGDPPC indicates rejection of the null hypothesis of unit root at 1% level of significance by all four methods viz., Levin et al. (2002), Im et al. (2003), ADF - Fisher Chi-square and PP - Fisher Chi-square methods indicating that all the three variables are stationary at first difference form.

Table 1: Panel unit root test of LnEXP, LnIMP and LnGDPPC

Panel unit root test:
Automatic lag length selection based on SIC
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

		At Level			At First Difference	
Method	**Variable**	**Lag**	**Statistic**	**Variable**	**Lag**	**Statistic**
Levin, Lin & Chu t stat *Null: Unit root* *(assumes common unit root process)*	LnEXP	0	-1.2461 (0.1064)	D(LnEXP)	0	-8.9711 (0.0000)
	LnIMP	0	-0.9830 (0.1628)	D(LnIMP)	0	-5.9770 (0.0000)
	LnGDPPC	1	2.0218 (0.9784)	D(LnGDPPC)	0	-5.4218 (0.0000)
Im, Pesaran and Shin W-stat *Null: Unit root* *(assumes individual unit root process)*	LnEXP	0	1.0597 (0.8554)	D(LnEXP)	0	-8.0804 (0.0000)
	LnIMP	0	1.6674 (0.9523)	D(LnIMP)	0	-4.9800 (0.0000)
	LnGDPPC	1	4.0702 (1.0000)	D(LnGDPPC)	0	-4.9252 (0.0000)
ADF - Fisher Chi-square *Null: Unit root* *(assumes individual unit root process)*	LnEXP	0	4.4689 (0.8125)	D(LnEXP)	0	62.279 (0.0000)
	LnIMP	0	2.2621 (0.9719)	D(LnIMP)	0	37.2352 (0.0000)

PP - Fisher Chi-square *Null: Unit root* *(assumes individual unit root process)*	LnGDPPC	1	0.3519 (1.0000)	D(LnGDPPC)	0	37.0315 (0.0000)
	LnEXP	0	11.0194 (0.2006)	D(LnEXP)	0	58.9852 (0.0000)
	LnIMP	0	2.2236 (0.9734)	D(LnIMP)	0	38.0019 (0.0000)
	LnGDPPC	1	0.37981 (1.0000)	D(LnGDPPC)	0	37.0950 (0.0000)

#Probability values are in parentheses.
##Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

4.2 Panel Cointegration Test

The Pedroni panel cointegration test statistics (Table 2) evaluate the null against both the homogenous and heterogeneous alternatives. In this case nine of the eleven statistics do not reject the null hypothesis of no cointegration at the conventional size of 0.05. Evidence of cointegration is found in Panel ADF statistic and Group ADF statistic and the null hypothesis of no cointegration can be rejected at 1% level.

Table 2: Pedroni Residual Cointegration Test

Pedroni Residual Cointegration Test
Series: LnGDPPC LnEXP LnIMP
Null Hypothesis: No cointegration
Automatic lag length selection based on SIC with a max lag of 4
Newey-West automatic bandwidth selection and Bartlett kernel
Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.213577	0.5846	-0.903909	0.8170
Panel rho-Statistic	0.838640	0.7992	0.896536	0.8150
Panel PP-Statistic	0.538626	0.7049	0.197411	0.5782
Panel ADF-Statistic	-0.950847	0.1708	-2.259937	0.0119***

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	1.129320	0.8706
Group PP-Statistic	-1.164692	0.1221
Group ADF-Statistic	-3.125109	0.0009***

***,** and * denotes statistical significance at 1%, 5% and 10% level.

The null hypothesis of no cointegration is rejected at 1% level of significance in Kao's test (Table 3). The long run covariance being estimated using the Kernel Estimator.

Table 3: Kao Residual Cointegration Test

Kao Residual Cointegration Test
Series: LnGDPPC LnEXP LnIMP
Null Hypothesis: No cointegration
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.478981	0.0003***
Residual variance	0.001036	
HAC variance	0.001907	

***,** and * denotes statistical significance at 1%, 5% and 10% level.

The results of the Johansen Fisher Panel Cointegration Test (Table 4) indicate that the null hypothesis of zero cointegration vector is rejected at 1% level of significance, which implies that the variables are cointegrated with at least one cointegrating vector.

Table 4: Johansen Fisher Panel Cointegration Test

Series: LnGDPPC LnEXP LnIMP
Lags interval (in first differences): 1 1

Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	41.80	0.0000	28.56	0.0004***
At most 1	21.51	0.0059	20.50	0.0086***
At most 2	11.17	0.1920	11.17	0.1920

* Probabilities are computed using asymptotic Chi-square distribution.
**MacKinnon-Haug-Michelis (1999) p-values

From the above three tests conducted we can conclude that the variables in our study have a long run relationship amongst themselves.

4.3 Panel Granger Causality Test

Table 5: Panel Granger Causality Test

Source of Causation ⟶	D(LnEXP)	D(LnIMP)	D(LnGDPPC)	Coefficient of ECT
D(LnEXP)	-	2.0501 (0.1359)	4.2231 (0.0205)**	-7.6678 (-0.0009)***
D(LnIMP)	2.30991 (0.1063)	-	1.0768 (0.3459)	-11.1089 (-0.0000)***
D(LnGDPPC)	3.3956 (0.032)**	0.8960 (0.4125)	-	-5.2231 (-0.0075)***

Note: ***, ** and * denotes statistical significance at 1%, 5% and 10% level.

The findings of Panel Granger Causality Test are reported above in Table 5. Evidence of long run causality running from import of goods and services and gross domestic product per capita to export of goods and services at 1% level of significance is observed. Similar long run causality is observed running from export of goods and services and gross domestic product per capita to import of goods and services at 1% level of significance. Long run causality also exists from export of goods and services and import of goods and services to gross domestic product per capita at 1% level of significance. The long run results are highly significant.

Short run Granger causality is observed from gross domestic product per capita to export of goods and services at 5% level of significance and from export of goods and services to gross domestic product per capita at 5% level of significance. So a short run bidirectional causality is observed between the variables export of goods and services and gross domestic product per capita.

After having established the cointegration as well as the direction of causality in the long run, we now examine the long run elasticity's of the impact of export of goods and services and import of goods and services on gross domestic product per capita. We use two long run estimators for this purpose and they are FMOLS estimator and DOLS estimator. The results are reported in the below Table 6.

Table 6: Panel long run estimators

	FMOLS	DOLS
Export of goods and services	0.286981 (0.0001)***	0.193058 (0.0491)**
Import of goods and services	0.191469 (0.0065)***	0.262723 (0.0105)**

***,** and * denotes statistical significance at 1%, 5% and 10% level.

Since the variables are expressed in natural logs, the coefficients on the EXP and IMP can be interpreted as elasticities. We find that 1% increase in EXP increases GDPPC by 0.19%-0.28%. We also find that 1% increase in IMP increases GDPPC by 0.19% -0.26%.

5. Conclusion

All the three cointegration tests confirms a long term relationship among export of goods and services, import of goods and services and economic growth for BRICS. We have examined the relationship between the three variables in a panel cointegration and Granger causality framework. In the long run import of goods and services and export of goods and services affects gross domestic product per capita at 1% level. Similarly it is also observed that export of goods and services and gross domestic product per capita influences import of goods and services at 1% level. We also found that import of goods and services and gross domestic product per capita influences export of goods and services at 1% level.

Short run bidirectional causality is observed between gross domestic product per capita and export of goods and services at 5% level of significance. It is also observed that 1% increase in EXP will increase GDPPC by 0.19%-0.28% and 1% increase in IMP will increase GDPPC by 0.19% -0.26%. Openness of the economy affects economic growth positively. The results obtained support the hypothesis put forward by endogenous growth theories. The role of openness in creating new technological developments through more efficient production methods, increase in total factor productivity through an optimum allocation of resources cannot be denied in terms of both achieving integration in the global economy and providing a strong and sustainable economic growth.

In line with the findings of Grossman and Helpman (1991a and 1991b) and Rivera-Batiz and Romer (1991), we argue that integration of BRICS with the global economy can sustain its growth. Trade implicitly support improvements and value additions in the goods and services through new ideas and innovation, technology diffusion and research and development. Export from BRICS creates opportunities to access new markets where export oriented firms can sell their goods and services and play a productive role in their economies. To sustain in global competition, it creates additional opportunities for innovation and stronger productivity growth. Importing countries within BRICS also benefits from trade through greater choice for consumers and lower prices for goods and services. Improved economies of scale through better utilization of the productive capacity along with better allocation of resources may lead BRICS to sustain its share of international trade and economic growth. These will be supplemented with possibility of higher level of employment creation and wider base of technological knowledge. With increasing share of international trade BRICS carry considerably more weight in international trade negotiations and occupy significant position in global supply chains. BRICS has the potential to be a decisive economic player with growing regional and global interests and responsibilities. Greater cooperation in the economic, financial, trade flows and widening the provisions of existing trade or other agreements among members of the BRICS will lead to a strong and sustained economic growth of the BRICS which is now the driver of the global economy.

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