

## **Financial development, export performance and economic growth in BRICS: New evidence from panel unit root and ARDL cointegration**

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### **Abstract**

*In this paper, we investigate the long run relationship between financial development, export performance and economic growth, analyzing the data in the most efficient manner via panel unit root tests and panel cointegration analysis based on the Autoregressive distributed lag (ARDL) approach of cointegration for the BRICS region covering the period of 1990-2017. In addition, we use the regression analysis method based on instrumental variable analysis approach, popularly known as Hausman and Taylor estimators. The empirical results from both methods consistently provide a clear support for the hypothesis that there is a strong relationship between financial development, export performance and economic growth. The estimated results suggest that these variables, including the education level, play significant positive role in economic growth in the region. More importantly in the current situation, the way to accelerate the economic growth, as suggested by the results of the interacted variable, in the region seems to develop the financial system to support the export performance.*

**Key words:** *Financial development, Economic growth, Panel unit root, Panel ARDL cointegration*

**JEL classification codes:** *C23, O16, O40, G28*

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### **I. Introduction**

Brazil, Russia, India, China, and South Africa are five emerging economies of the world. They combinedly had total of 30 percent land, 10 percent gross domestic product (GDP), 44 percent population and 11 percent export of the world in 2005. These countries have come together for the betterment of their economies and working as an economic region as BRICS since 2009 (Tian, 2016). The progress since 2005 till 2018 are as follows: they have 24 percent of GDP, 42 percent population and about 17 percent of exports of the world. The achievement in GDP and exports are remarkable that make BRICS as the emerging countries. Notably, the population has declined in the group.

The countries are not in the neighbor, and it makes the BRICS region is unique one. This uniqueness is defined by the nature of economies, not by geography nor by language like other such groups. Therefore, it may be interesting to know how these individual countries are performing. The data presented in Table 1 shows that each of these countries', except of South Africa, export share in the world has increased in 2018 compared to that of 2005. The South Africa's share declined to 0.44 percent of the World in 2018 from 0.53 in 2005. Almost same is replicated in terms of GDP.

How these achievements have been obtained, even with the declining share of population in the world, is a good point to know. The role of financial development in economic growth is discussed widely in the literature. Most of the studies about the financial development have concluded with the positive impact of financial development in economic growth as it facilitates the export performance to boost the economic growth. This hypothesis is not tested in BRICS economy, and how financial development impact in economic growth in this region is an important research question that we aim to investigate in this paper.

In the literature of financial development, Bagehot (1873) that has established the role of financial sector in economic development. Later, Schumpeter (1934) links the entrepreneurial initiatives to economic

development. Similarly, Goldsmith (1969), McKinnon (1973), and Shaw (1973) explored the relationship between financial development and economic growth considering the role of financial system, financial intermediaries, and overall financial sector in many respects.

Arestis and Demetriades (1997), employing both cross country regression and time series method, study the relationship between financial development and economic growth to conclude that financial development plays a positive role to accelerate the economic growth. Ang and McKibbin (2007) suggest the positive relationship between financial depth and economic development in the case of Malaysia. Gries, Kraft, and Meierrieks (2009), using panel data for 16 sub-Saharan African countries, find that financial development and export performance strategies do not work in these countries to support economic growth.

Menyah, Nazlioglu, and Wolde-Rufael (2014) study in the financial development, trade openness and economic growth of African countries and conclude that financial development and trade openness do not have significant impact in economic growth. But Jaud, Kukenova, and Strieborny (2015) and Paudel (2016) suggest that exports related financial facilities boost the exports. This raises a question that how the impact of the interaction between financial development and export performance will be in economic growth.

The brief review of the literature shows that financial development and international trade may not always have positive impact in economic growth. Almost similar perception is found in case of education, but it largely depends in the proxy of the variables. Therefore, the role of financial development and export performance including the education level in economic growth in BRICS is a matter of a systematic research so that a concrete policy inferences can be made, for which this paper aims.

BRICS is a unique region for panel data study because of various reasons, such as, it represents the emerging economies and group itself is formed differently than other regions, such as, not based in geography, proximity, and language, rather based on the emerging nature of economies. This region comprises the most heterogeneous group of countries as discussed in Laidi (2012) but to serve their common interest that is economic integration and prosperity.

Also, in the literature of financial development the proxy for it does not have uniformity. We test the role of financial development index as developed in Svirydzenka (2016) in the economic growth BRICS as an economic region for the period of 1980-2017. As we detected the mixed integration of orders of the variables, i.e.,  $I(0)$  and  $(1)$ , we employ Autoregressive distributed lag (ARDL) approach of cointegration which provides both long-run and short-run coefficients despite the different order of cointegration of the variables, and for robustness check we employ Hausman and Taylor (1981).

Major findings from this paper suggest that BRICS economy is highly benefited from their status of financial development and tying with export performance. The financial development index (FD) has a strong long-run relationship indicating that a one index point (one percent increase in the index) of financial development (FD) causes to increase the GDP on average by about 0.5 percentage. Also, the finding suggests that improving the financial institution to support the export performance causes to increase the economic growth rate.

This article is divided into five sections. The following section highlights the BRICS economies discussing on financial development, export performance and economic growth. In section three, we discuss the research methodology. The estimated results are presented and discussed in Section four, and Section five concludes.

## **II. The BRICS economies**

Since the inception, BRICS as an organization has played a significant role in the acceleration of economic activities in the member countries. The main focus of the organization was improving the global economic situation and reforming financial institutions, and planning on how the member countries could better co-operate in the future for their mutual benefits. Initially at the inception in 2009, South Africa was not member but later joined in 2010.

Table 1 shows some important comparative information of the individual countries in BRICS with world. The entire BRICS hold about 30 percent of the world's land producing about 24 percent of the world's GDP by about 42 percent of population as of 2018. Notably, the share of GDP was just about 11 percent in 2005. This means the BRICS's GDP share in the world has been more than doubled in past 13 years.

The major contribution for this increment has been from China which has increased the GDP by more than three folds during this time. The remarkable increment in the China's GDP has become possible by increasing the export value to about double than the level of 2005. The share of GDP in the world GDP of all countries, except of South Africa, has increased visibly since 2005. There has been fluctuation in case of Brazil, Russia and South Africa but we see consistently increasing pattern in the case of India and China. In term of population, only India and South Africa has increased share in 2018 compared to that of 2005.

Figure 1 presents the trend of financial development index BRICS countries for the period of 1990-2017 as developed in Svirydzenka (2016). The data show that China's position tops the countries followed by

South Africa, Brazil, Russia and India. The Russia's case seems most fluctuated over the period and a consistently increasing trend of China.

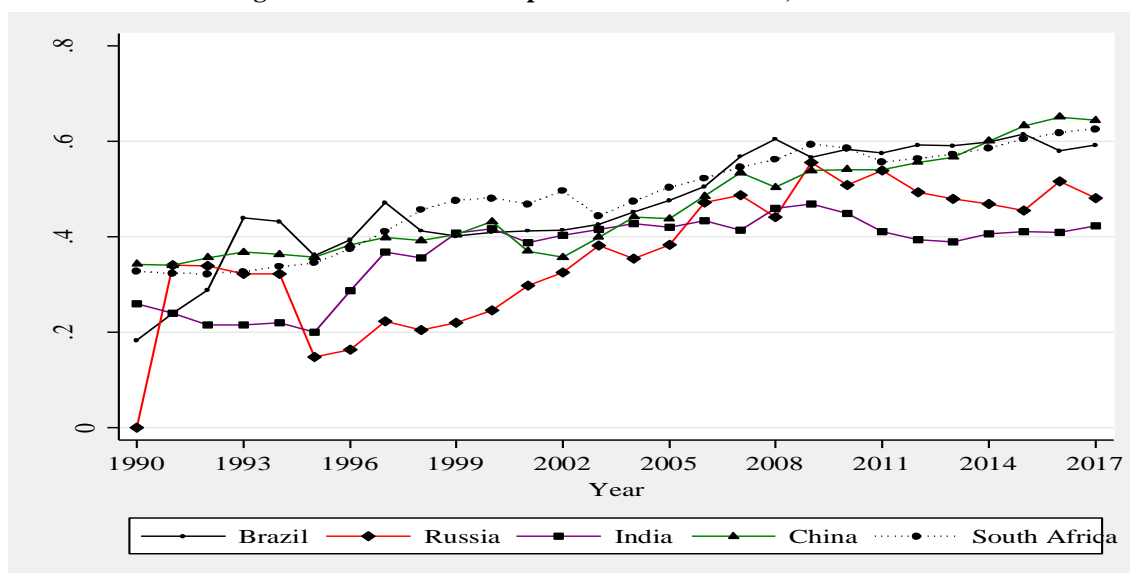
Traditionally, financial development has been largely proxied by the ratio of broad money to GDP and domestic credit to private sector, both expressed in percentage. Considering this fact, we present the Figure 2 for the same period. It shows that again, China's position in both proxies seems stronger than the rest of the countries' case. Surprisingly, the portion of domestic credits to private sector remains high for the entire period in the case of South Africa and some initial periods in Brazil and China, while it remains well below than the broad money for entire period in case of India.

**Table 1: Some indicator in selected years, measured as % of the World**

Country	Year	Land %	GDP %	Population %	Exports %
Brazil	2005	6.56	1.88	2.86	1.05
	2010	6.56	3.34	2.83	1.26
	2015	6.56	2.40	2.79	1.09
	2018	6.56	2.18	2.76	1.10
Russia	2005	12.86	1.61	2.20	2.08
	2010	12.86	2.31	2.06	2.34
	2015	12.86	1.82	1.96	1.83
	2018	12.86	1.93	1.90	2.09
India	2005	2.33	1.73	17.62	1.24
	2010	2.33	2.54	17.83	1.97
	2015	2.33	2.80	17.85	1.95
	2018	2.33	3.16	17.81	2.14
China	2005	7.37	4.82	20.02	5.97
	2010	7.37	9.22	19.32	8.69
	2015	7.37	14.68	18.68	11.07
	2018	7.37	15.84	18.34	10.57
South Africa	2005	0.95	0.54	0.74	0.53
	2010	0.95	0.57	0.74	0.56
	2015	0.95	0.42	0.75	0.45
	2018	0.95	0.43	0.76	0.44

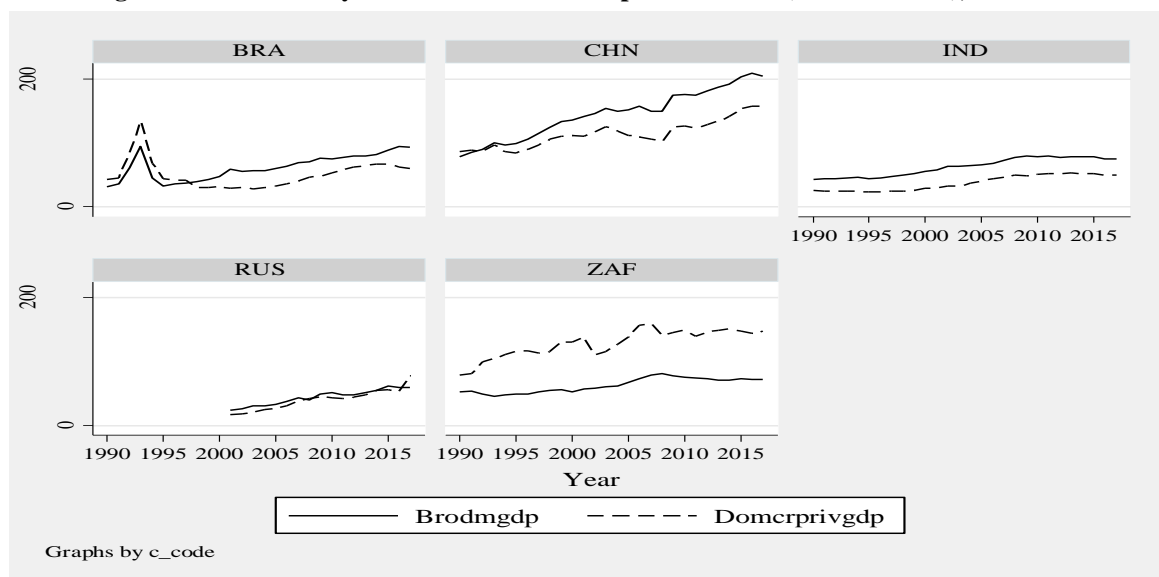
Source: Authors' calculation based on World Bank (2020)

**Figure 1: Financial development index in BRICS, 1990-2017**



Source: Authors' calculation based on Svirydzenka (2016)

**Figure 2: Broad money and domestic credit to private sector (Share of GDP), 1990-2017**



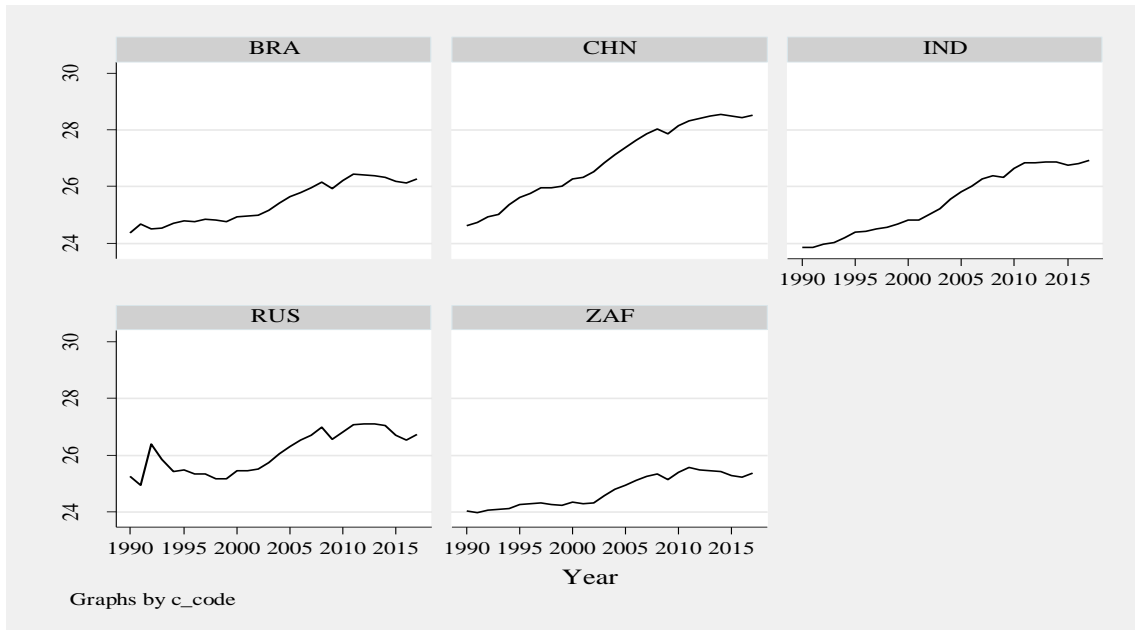
Source: Author's presentation using the data from World Bank (2020)

Figure 3 shows the overall export values expressed in the log form for all countries. A consistently increasing trend is found for China while India's seems smooth but increasing in a slow pace. The export of Brazil and South Africa maintains almost similar pattern in the export growth trend, however, Brazil's has much stronger than South Africa's export trend. The case of Russia seems fluctuated heavily over the period but remain competitive with Brazil and India in the later periods.

Figure 4 presents the GDP growth of each countries for the same period. The data show that only the China's case economic growth remains positive without being negative in any year for the entire period. Rest of the countries in the group went negative at least for a year, that is India went to negative during 1991, Brazil's growth rate was negative for many years, even remained negative during last four years. The case of Russia is heavily fluctuating over the period, that is, went to negative for almost seven years during the 1990s and after a year of global financial crisis, and again during 2014 and 2015. The South Africa's growth rate is not impressive and not highly fluctuated, but it has remained plus and minus 5 percent being negative few times during the selected period. Notably, for the almost this decade, South Africa's growth has remained around one percent only.

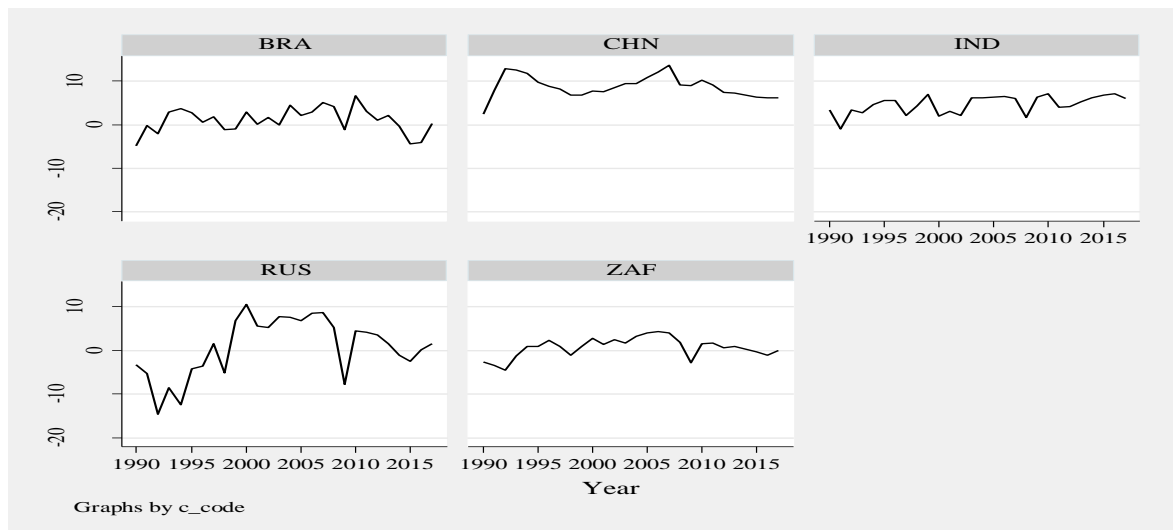
Up to now, we looked the different economic variables in individual countries' cases in the BRICS region. Let's think on how as an economic region BRICS has performed in term of income. The most appropriate way to observe the economic performance of the nation seems to compare the per capita GDP over the period. If we look the average per capita GDP, the region has maintained overall increasing trend. To quantify some cases, we see that the average per capita GDP in the region was about USD 2000 during the early 1990s, and below USD 2000 in the late 1990s but it has increased sharply to reach around USD 6000 in 2008. It declined by few hundreds in 2009 due to the negative impact of global financial crisis. But again, it increased sharply to reach more than USD 8000 in 2011. It declined since 2015 to remain around USD 6500 and increased to remain around USD 7500 in 2017. These countries did quite well to increase the per capita GDP sharply since 2009/10 when they came together forming the BRICS as an organization. As a region achieving these results for a region with such large number of population and magnificent economies was not an easy task as such economies face many difficulties grow faster for the long time consistently. It seems the dominance in the regional data largely come from the China's performance in financial development, export performance and economic growth. But other countries also seem having the great motivation for their economies working together with almost similar income status emerging economies but in the heterogeneous nature.

Figure 3: Exports scenario in BRICS, 1990-2017



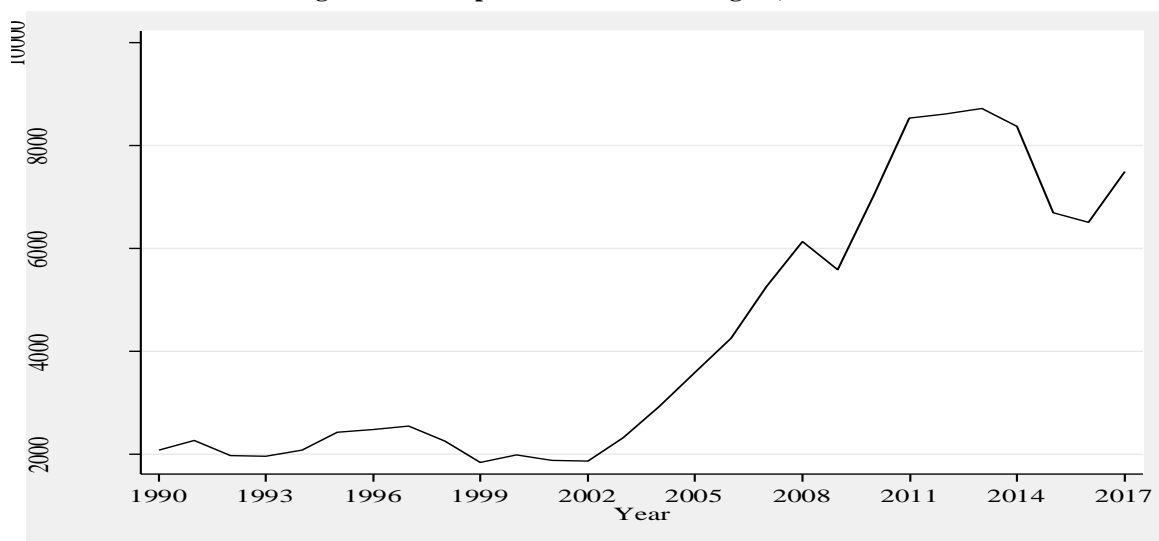
Source: author's presentation using the data from World Bank (2020)

Figure 4: Per capita GDP growth in BRICS (percent), 1990-2017



Source: Author's presentation using the data from World Bank (2020)

Figure 5: Per capita GDP in BRICS region, 1990-2017



Source: Author’s presentation using the data from World Bank (2020)

### III. Research Methodology

#### 3.1 Model, variables, and data

The rate of economic growth is not unique in all countries. Even a same country passes through different rate of economic growth every year. Therefore, measuring the economic growth and finding the major determinants of economic growth is always a concern of the policy makers and academicians of the countries. While modelling the determinants of economic growth, we are largely motivated by Chen and Feng (2000) but incorporate the financial development and working aged labor force in the model for different time period and context. The entire research methodology of this study is based on the findings of timeseries, cross-country and panel-country economic growth literature. We adopt the following benchmark model to investigate the impact of financial development in economic growth across countries in BRICS economic region.

$$\begin{aligned}
 LGDPPC_{i,t} = & \alpha + \beta_1 LGDP90_i + \beta_2 EDU90_i + \beta_3 FD_{i,t} + \beta_4 LWAGPOP_{i,t} + \beta_5 LEXPORT_{i,t} + \beta_6 FERTLT_{i,t} \\
 & + \beta_7 INFL_{i,t} + \varepsilon_{i,t} \dots \dots \dots (1)
 \end{aligned}$$

Where,  $\alpha$  is a constant term,  $\beta_1 \dots \beta_7$  are the coefficients of variables of the model,  $\varepsilon$  is the error term,  $i$  refers to the country in the BRICS economic region (Brazil, Russia, India, China and South Africa),  $t$  refers to the time period, i.e., year as we are using the annual data for the period of 1990-2017. The dependent variable in the model is the log of per capita gross domestic products (LGDPPC) to measure the economic growth. Among the independent variables, initial income and education at 1990’s level (LGDP90) and (EDU90) are used to know how these countries are converging over the period, financial development (FD) is used to measure the overall financial development’s impact in economic growth, log of working aged populations (LWAGPOP) is used to proxy the labor force, log of export (LEXPORT) value measured in the United States Dollar is used to know the impact of export trade in these countries, fertility rate (FERTLT) is the fertility rate of women, and the inflation (INFL) is used to know the impact of price level in these economies. Based on the literature, we expect  $\beta_2 \dots \beta_5$  to be positive, and  $\beta_1, \beta_6$  and  $\beta_7$  negative.

This work adopts both a panel cointegration and a panel regression approaches in a fairly long period. The advantage of the cointegration method is that it allows us to examine the long run and short run impacts of the independent variables in economic growth, and with the regression approach, we can check the robustness of the results in the long-run. Also, the advantage of panel data over the cross-sectional data is that it uses the variable as its level forms including more information unlike just the averages in the cross-sectional analysis.

Most of the regressors are widely discussed in the literature. Therefore, they do not need further long discussion for their relevancy. Just briefly, the neoclassic model of growth suggests us that the economic growth tends to be negatively associated with the absolute level of GDP because of the diminishing returns to capital

(Solow, 1956); and this has been supported by numerous empirical findings, such as, Robert J. Barro (1991), Chen and Feng (2000) and Paudel (2014) among many others. Considering this fact in this study, we use GDP in 1990 as an indicator of initial level of income.

It has been widely discussed in the literature, such as Romer (1990), that the quality—particularly the education of human capital contributes in economic growth positively. Considering this fact, the second independent variable is the 1990’s level of education measured by the secondary school enrollment gross percentage as a proxy of the quality of the human capital at the initial period of the study.

The role of financial development in economic growth is widely discussed in the literature and suggest the positive contribution in economic growth. This has been discussed widely mainly in King and Levine (1993) and Levine (1997), and in many other literature. Measuring financial development has been a complex issue. Normally, money supply, banking facilities, credit supply, capital formation, credit to private sector and so on are used as proxies of financial development. It was confusing because there was not uniformity in the proxy and conclusions were made on based on different assumptions and proxies. To get rid of such situation, we use the financial development index (FD) as developed in Svirydzienka (2016). The FD is replaced by financial institutions (FI) and financial markets (FM) in the alternative specifications of the model for the robustness check, also have been used from Svirydzienka (2016).

The role of labor force is represented by the working aged populations (LWAGPOP) and it is expected to contribute positively to economic growth of these countries. Another regressor, the log of export (LEXPORT) also is expected to have a positive association with economic growth in these countries as most of these countries have become emerging economies due to the implementation of the export promotion strategies and have adopted the outward looking economic policies.

The literature on the role of high fertility in the economic growth shows that the high fertility rate involves the high opportunity cost of economic growth, as a consequence it would have a negative impact on growth (Robert J Barro, 1996). The impact of inflation (INFL) in economic growth is found both to be positive and negative in the literature. The inflation is measured in this study using the consumer price index (CPI) expressed in percentage. The channel inflation impacts positively is via lowering the interest and increasing the investment in the economy as discussed in Mallik and Chowdhury (2001). On the other hand, (Robert J Barro, 1995) states that an increase in inflation causes to decrease the investment and lowers the economic growth. Therefore, we are prepared the result for this variable can go either way. However, we expect the negative results in the developing countries case.

The data used in this empirical analysis are collected from the world development indicators as given in World Bank (2020) except for FD, FI and FM which are collected from Svirydzienka (2016).

The descriptive statistics’ in Table 2 shows the strongly balanced panel data for 5 countries for the period of 1990-2017 making the 28 observation for all countries that makes total of 140 observation. The standard deviation shows that the countries are from different backgrounds, thus are heterogeneous. The level of inflation, initial level of education, initial income level, working aged population and exports have greater variation compared to financial developing indicators.

Table 3 presents the correlation matrix, and the data shows none of the variables have correlation with other variable more than 70 percent. The highest relationship appears to be between FM and LEXPORT, which is natural as financial market impacts to the exports. Therefore, FM is used only in the alternative specification whether this positive correlation between the independent variables creates the biasedness in the regression results. Similarly, precaution to be maintained by the negative correlation between LEXPORT and FERTLTY.

**Table 2: Descriptive Statistics of the variables**

<i>Variables</i>	<b>Observations</b>	<b>Mean</b>	<b>Standard deviation</b>	<b>Minimum</b>	<b>Maximum</b>
LGDP90	140	7.90	1.08	5.71	9.68
LGDP90	140	26.48	0.53	25.47	26.97
EDU90	140	72.19	29.22	36.72	112.25
FD	140	0.43	0.12	0.00	0.65
FI	140	0.45	0.15	0.00	0.74
FM	140	0.40	0.14	0.00	0.67
LWAGPOP	140	19.03	1.29	16.84	20.72
LEXPORT	140	25.73	1.18	23.84	28.53
FERTLTY	140	2.25	0.73	1.16	4.05
INFL	140	104.45	398.94	-1.40	2947.73

**Table 3: Correlation Matrix**

Variables	LGDP90	LGDP90	EDU90	FD	FI	FM	LWAGPOP	LEXPORT	FERTLTY	INFL
<b>LGDP90</b>	1.00									
<b>LGDP90</b>	-0.01	1.00								
<b>EDU90</b>	0.61	0.33	1.00							
<b>FD</b>	0.59	-0.21	0.02	1.00						
<b>FI</b>	0.72	-0.42	0.24	0.85	1.00					
<b>FM</b>	0.26	0.08	-0.24	0.82	0.41	1.00				
<b>LWAGPOP</b>	-0.55	0.47	-0.63	-0.07	-0.46	0.38	1.00			
<b>LEXPORT</b>	0.38	0.39	-0.20	0.51	0.20	0.68	0.49	1.00		
<b>FERTLTY</b>	-0.42	-0.55	-0.26	-0.22	-0.10	-0.28	-0.12	-0.65	1.00	
<b>INFL</b>	0.03	0.19	0.29	-0.30	-0.22	-0.28	-0.13	-0.18	0.03	1.00

**3.2 Panel unit root tests**

Our next step is to conduct the unit root test of the variables of the model to confirm whether each series is integrated and has a unit root. As we are using the countries from different geographical continent, culture, economic status over the period and demographic feature, we accept that these data would have been influenced by many heterogeneous factors. Therefore, we assume heterogeneous slopes and use Im, Pesaran, and Shin (2003)(IPS here after) which is broadly based on the widely accepted Dickey Fuller (DF) and Augmented Dickey Fuller (ADF) test procedures in panel data.

The test results are achieved assuming the presence of a unit root (non-stationary variable) in the null hypothesis (H0) and no unit root (stationary variable) in the alternative hypothesis (Ha). For this, a decision is made based on p-value at 5 percent level of significance; that is, if the p-value is higher than 5 percent, then H0 is not rejected and the considered variable is non-stationary (has a unit root). To make the test systematic and reliable, we observed in level and then in first differences, including the intercept and time trend, because this is the most flexible specification of the test, as illustrated in equation (2).

$$\Delta Z_{i,t} = \alpha_1 + \gamma_i Z_{i,t-1} + \sum_{j=1}^k \beta_j \Delta Z_{i,t-j} + \varepsilon_{i,t} \dots \dots \dots (2)$$

Where, Δ is the first difference operator, Z is the variable of interest, α<sub>1</sub> is the intercept, t is the time, ΔZ the augmented terms, k is the appropriate lag length of the augmented terms and ε is the white noise error term. The IPS test is essentially the test of significance of the coefficient γ in the above equation. The test is performed without the augmented term. Looking the sample size, we select lag length k=1 under the Schwarz Criterion(SC).

Table 4 presents the unit root test results of all 10 variables with test statistics and p-value using a constant and a constant and a trend. The upper panel presents the results of the unit root tests in the level and the lower panel presents the tests at first difference. The results of the unit root tests show that total of five variables are I (0) and other five variables are I (1). The variables such as LGDPPC90, EDU90, LWAGPOP, FERTLTY and INFL are found to be stationary at level so recorded as I (0). The rest of the variables, LGDPPC, FD, FI, FM and LEXPORT are recorded I (1) even at 1 percent level of significance. This situation refers that the order of cointegration of our variable is not unique, some are integrated at the level and other variable are integrated at the first difference.

**Table 4: IPS unit root test results of the variables**

Unit root tests at level	Test with a constant		Test with constant & trend		Remarks	Variable category
	Statistics	P-value	Statistics	P-value		
LGDP90	2.02	0.98	-0.25	0.401	NS	NC
LGDP90	Time invariant variable				Stationary	I (0)





As we could not capture the impact of LGDP90 and EDU90 because of their time invariant nature, we estimate the benchmark model as specified in equation (1) using Hausman–Taylor (HT) estimators as discussed in Hausman and Taylor (1981). Here we prefer the HT estimator due to various reasons. The fixed effect estimator (FE) is not suitable, as the main explanatory variables “LGDP90 and EDU90” are specified as a time-invariant variable for each country. The random effect (RE) estimator ignores the country-specific effects in the panel as our sample includes the heterogeneous group of countries with few common features. Therefore, HT estimator is more effective than RE because it eliminates bias related to lack of independence of the explanatory variables from the joint disturbance term. Moreover, the problem of heteroscedasticity is eliminated using the general least square method and addresses the issues of endogeneity in the model that may have a presence between some variables such as inflation and exports (Paudel, 2014). For these reasons, the HT estimator is used as the preferred estimation method for the robustness check of the results.

#### **IV. Results and Discussions**

This section reports the empirical results and discusses with the interpretation to suit the sensible economic meaning. We estimated the model in different settings under panel ARDL cointegration procedures, then for the robustness check Hausman Taylor estimation procedures. The results are consistent under both methods and answer well our queries in this research paper.

Table 5 presents the long-run relationship results for the model of different specifications in column (1), (2) and (3) under the ARDL approach of cointegration. In a similar fashion, Table 6 presents the results for error correction model (ECM). Combining both tables show the long-run and short-run coefficients of ARDL with different lags as shown in their headings for the given model. Considering the sample size Schwartz-Bayesian Criteria (SBC). In both tables, the column (1) presents the results for the model with financial development index (FD), column (2) presents the results with financial institutions (FI) and the column (3) presents the results with financial market (FM). However, our main interest is on FD among these three variables.

Briefly, the results in Column (1) of Table 5 show that financial development (FD) index does have a strong long-run relationship with economic growth and has the correct positive sign as expected. The results for this variable clearly indicate that an index point increase in the FD index cause to increase the economic growth in the BRICS countries on average by 1.20 per cent holding other variables in the model constant. This suggests developing financial development itself may be a way to accelerate economic growth in BRICS economic region.

The results for the working aged population seem unfavorable for economic growth as it has negative and statistically significant association with economic growth. It seeks the urgent attention from policy makers to occupy well all the labor force in the production activities with better plan so that their contribution would be in favor of their economy. Traditionally, this results about the role of labor force in economic growth seems to be strange but it has been quite common in the literature if the countries have high populations with comparatively lower per capita GDP as discussed in Gylfason (2001). It shows that a country's economic growth can be negative if the human resource is unskilled or have a lower productivity. Thus, it emphasizes on proper policies for overall human development, not just for increasing the number of labor force. Also, it may be due to the high number of the out migrated working aged population so that they have not really contributed in the country's economic growth.

The role of export performance in economic growth is widely discussed in the literature. It has a correct sign and statistically significant impact in economic growth suggesting a one percent increase in export value causes to increase the economic growth by about 0.88 per cent on average holding other variables in the model constant. This result supports that the literature of the East Asian Miracle that was created by the export performance of the East Asian countries. We did not find the strong impact of the fertility rate and inflation in this case.

In Column (2) of the same table, we include financial institution variable (FI). The results suggest that building the financial institution both in term of access and depth contributes positively in economic growth. The coefficient of this variable is almost similar as of FD in the Column (1) of the same table. The results for the rest of the variables in this specification are consistent with that of the Column (1) of the same table. In Column (3) of Table 5, we include financial market variable (FM). The result for this variable is not statistically significant but has a positive sign as expected. The results for the rest of the variables in this specification are consistent with that of the Column (1) of the same table.

Table 6 presents the results for error correction model (ECM) for all specification in different column. The exports have a significant impact in economic growth in the short run too. The financial institution FI has a short run positive impact too. The fertility rate has inconsistently significant in economic growth in the short run. The inflation has a negative impact, but the magnitude is too small to explain. The ECM (-1) results in all columns are statistically highly significant with expected negative sign indicating the disequilibrium occurred in the last year are adjusted in the moderate speed. Then, for the robustness check, we estimate our benchmark

model in four different specification under Hausman and Taylor(1981) estimation, and the results are presented in different 4 columns of Table 7. The results in Column (1) show that the convergence effect does not have statistically significant role in economic growth, however in all columns it has correct sign as expected. The financial development index (FD) has maintained the same level of significance as in Column (1) of Table 5 but the magnitude is small indicating the financial development has a significant role in economic growth of these countries. The working aged population variable does not have the statistically significant impact and it is not consistent with the results in Table 5. The variable, the log of export also has maintained almost similar magnitude and statistically significant impact in all specification. The initial education variable in all cases as specified in the Columns (2), (3) and (4) has strong positive impact as in the literature. We introduce the interacted dummy variable of FDxLEXPORT and BRICS dummy in Table 8. The results suggest that both variables are significant with positive impact maintaining consistency results for our main variables of interest. Overall, our main variables of interest, such as, Financial development, Export performance and Education has consistent results indicating their strong positive impact in economic growth in BRICS economic region. Therefore, we concluded our results are robust and the findings are credible.

**Table 5: ARDL (1 0 0 1 0 0) model long-run coefficients Results, 1990-2017**

<i>Dependent Variable export-log</i>	(1)	(2)	(3)
Financial development index (FD)	1.203** (0.568)		
Financial institution index (FI)		1.632** (0.638)	
Financial markets index (FM)			0.483 (0.359)
Working aged populations-log (LWAGPOP)	-2.400*** (0.923)	-2.519*** (0.880)	-2.106** (0.945)
Export value-log (LEXPORT)	0.876*** (0.058)	0.872*** (0.054)	0.900*** (0.060)
Fertility-per cent (FERTLTY)	0.003 (0.230)	-0.079 (0.227)	0.097 (0.232)
Inflation-per cent (INFL)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
<i>Number of observations</i>	<i>140</i>	<i>140</i>	<i>140</i>
<i>Number of groups</i>	<i>5</i>	<i>5</i>	<i>5</i>
<i>Dynamic Fixed Effect</i>	<i>Yes</i>	<i>Yes</i>	<i>Yes</i>

Note: \*\*\*, \*\* and \* indicate that the statistics are significant at 1%, 5% and 10% level of significance. The figures in the parenthesis are the standard error.

**Table 6: ARDL (1 0 0 1 0 0) model, ECM Results, 1990-2017**

<i>Dependent variable: ΔLGDPPC</i>	(1)	(2)	(3)
FD (-1)	-0.252 (-0.232)		

FI (-1)		0.619**	
		(0.286)	
FM (-1)			(0.098)
			(0.161)
LWAGPOP (-1)	-3.136	-0.805	-4.811
	(3.888)	(4.106)	(3.186)
LEXPOR (-1)	0.11*	0.106*	0.116*
	(0.063)	(0.062)	(0.065)
FERTLITY (-1)	0.569**	0.564	0.617***
	(0.239)	(0.233)	(0.241)
INFL (-1)	-0.0001***	-0.0001***	-0.0001***
	(0.000)	(0.000)	(.000)
ECM(-1)	-0.391***	-0.401***	-0.376***
	(0.000)	(0.000)	(0.059)

Note: \*\*\*, \*\* and \* indicate that the statistics are significant at 1%, 5% and 10% level of significance. The figures in the parenthesis are the standard error.

**Table 7: Hausman Taylor estimation, 1990-2017**

<i>Dependent variable: LGDPPC</i>	(1)	(2)	(3)	(4)
Initial income level-log (LGDP90)	-0.065	-0.674	-0.351	-1.088
	(1.190)	(0.616)	(0.561)	(0.662)
Initial Education-per cent (EDU90)		0.032**	0.024**	0.041***
		(0.013)	(0.012)	(0.014)
Financial development index (FD)	0.592**	0.576**		
	(0.241)	(0.243)		
Financial institution index (FI)			0.773***	
			(0.253)	
Financial markets index (FM)				0.234
				(0.175)
Working aged populations-log (LWAGPOP)	-0.201	-0.179	-0.323	0.032
	(0.312)	(0.293)	(0.271)	(0.303)
Export value-log (LEXPOR)	0.829***	0.828***	0.822***	0.845***
	(0.031)	(0.030)	(0.030)	(0.029)
Fertility-per cent (FERTLTY)	0.522***	0.521***	0.466***	0.576***
	(0.088)	(0.082)	(0.079)	(0.085)

Inflation-per cent (INFL)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
<b>Number of observations</b>	<b>140</b>	<b>140</b>	<b>140</b>	<b>140</b>
<b>Number of groups</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>F-statistics</b>	<b>383</b>	<b>329</b>	<b>336</b>	<b>321</b>
<b>Sargan-Hansen statistics</b>	<b>3.34</b>	<b>3.24</b>	<b>2.82</b>	<b>3.53</b>
<b>Sargan-Hansen p-values</b>	<b>0.34</b>	<b>0.20</b>	<b>0.24</b>	<b>0.17</b>

Note: \*\*\*, \*\* and \* indicate that the statistics are significant at 1%, 5% and 10% level of significance. The figures in the parenthesis are the standard error.

**Table 8: Hausman Taylor estimation, 1990-2017**

<i>Dependent variable: LGDPPC</i>	(1)	(2)	(3)	(4)
Initial income level-log (LGDP90)	0.556 (0.515)	0.477 (0.478)	-0.023 (1.012)	-0.042 (0.335)
Initial Education-per cent (EDU90)				0.015** (0.007)
Financial development index (FD)	0.447** (0.218)	-11.281*** (3.594)	-15.086*** (3.745)	-12.393*** (3.602)
Working aged populations-log (LWAPOP)	-0.818*** (0.190)	-0.816*** (0.178)	-0.345 (0.284)	-0.574*** (0.170)
Export value-log (LEXPORT)	0.782*** (0.029)	0.543*** (0.078)	0.502*** (0.084)	0.514*** (0.079)
Fertility-per cent (FERTLTY)	0.361*** (0.063)	0.236*** (0.071)	0.317*** (0.093)	0.272*** (0.064)
Inflation-per cent (INFL)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)	-0.000 (0.000)
BRICS-Dummy	0.247*** (0.044)	0.212*** (0.044)		0.192*** (0.045)
FD x LEXPORT		0.464*** (0.142)	0.619*** (0.147)	0.506*** (0.142)
<b>Number of observations</b>	<b>140</b>	<b>140</b>	<b>140</b>	<b>140</b>
<b>Number of groups</b>	<b>5</b>	<b>5</b>	<b>5</b>	<b>5</b>
<b>F-statistics</b>	<b>398</b>	<b>375</b>	<b>371</b>	<b>335</b>
<b>Sargan-Hansen statistics</b>	<b>1.89</b>	<b>1.84</b>	<b>3.10</b>	<b>4.51</b>
<b>Sargan-Hansen p-values</b>	<b>0.60</b>	<b>0.61</b>	<b>0.38</b>	<b>0.12</b>

Note: \*\*\*, \*\* and \* indicate that the statistics are significant at 1%, 5% and 10% level of significance. The figures in the parenthesis are the standard error.

## V. Conclusions

We document the brief scenario of financial development, export performance and economic growth in the BRICS economic region. In this process, we highlight the main issues and trends of the financial

development in a comparative perspective in the country specific with in the region. Then we proceed to investigate the role of financial development and export performance in economic growth using the panel ARDL approach of cointegration with panel unit root analysis employing a comprehensive financial development indicator for the period of 1990-2017.

During the empirical estimation, we follow the standard procedures and detect the long-run and short-run relationship among the dependent and independent variables in the model with various specifications. Then, for the robustness check of the estimation, we conduct Hausman and Taylor(1981) estimation including initial income and initial education as the time invariant variables in the model.

From the empirical analysis, the results show that the financial development does have a significant impact in economic growth in BRICS economic region. The estimated results show that financial development, export performance and education level play significant positive role in economic growth in Brazil, Russia, India, China, and South Africa. There is a room to improve the entire financial market to provide more benefits to the economic players in these countries, but the financial development and financial institution have contributed economic growth substantially. It helps to make a general assumption that emerging countries may be benefited by attracting more financial institution in their financial system to contribute their economies. Again, improving education quality, managing excellent financial system and focusing on export performance are the suggestive ways to accelerate the economic growth in the BRICS economic region.

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