

Financial development and Economic Growth: Evidence from the BRICS 1970-2009

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Abstract

We investigate in this paper the role of financial development on economic growth in BRICS countries covering the period of 1970 and 2009. For that, we make use of principal components analysis, to construct our financial development proxies, and also of dynamic panel time-series analysis, which allows us to deal with important econometric issues like non-stationarity in panels, heterogeneity bias and endogeneity. The results indicate that finance plays an important, and robust, role in determining economic growth in this sample of emerging countries. All in all, we suggest that a good institutional framework is of paramount importance for financial development, and that, in turn, financial development is indeed able to foster faster economic growth and prosperity.

Keywords: Financial development; growth, BRICS and panel time-series analysis.

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Introduction

This paper investigates the impact of financial development on economic growth in the BRICS (Brazil, Russia, India, China and South Africa) using panel time-series estimation techniques. Theory, backed by numerous empirical studies have predicted and proved the importance of finance on growth, and now it is by and large accepted that financial development comprise a potentially important mechanism for long-run growth (Levine and Zevos, 1998; Beck, Demirguc-Kunt and Levine, 2000; Benhabib and Spiegel, 2000; Beck and Levine, 2004). Following this, we investigate the role played by well functioning intermediaries (banks) and markets in propelling economic growth in the BRICS. The majority of the BRICS have in some way or the other changed their political and economic systems to better embrace those institutions that have been proved to be conducive to growth, and have thus benefited by becoming some of the world's fastest growing economies.

Hall (2002:2) indicates that the crucial part of the revolution of a centrally planned economy like that of Russia is the establishment of efficient financial markets. According to Goldman Sachs', In order to compete in the world economy, these fast growing emerging markets have all stressed among others the need to develop domestic entrepreneurship. This then brings us to Schumpeter (1911), who was one of the first to point out that access to finance is crucial to development as amongst others affords inventors and innovators the opportunity to realise their economic potentials. This is only one of the numerous ways that financial development can bolster wider and more efficient access to economic resources, which then translates to more productivity, and hence growth for the BRICS.

Financial development has been taking place in these countries for a number of decades with each boasting a number of banks (both private and state owned), as well as all having at least one stock exchange. After accounting for both economic and statistical endogeneity, the results of this study suggest that financial development indeed had a positive impact on growth in the BRICS for the period under investigation (1970-2009).

LITERATURE REVIEW

Financial development and its impact on economic growth has been a subject of great interest for a number of years now, but this interest is not recent, as can be traced as far back as 1911 to Schumpeter, a leading mind in this study, though still he was not the first that

recognised this link. Extensive research on this relationship has been carried out by the likes of Beck and Levine (2002), Bertocco (2007), Demirguc-Kunt and Levine (2009), King and Levine (1993) Rajan and Zingales (2003), and many of these have been influenced to a great extent by Schumpeter's work.

The role of banks and that of stock markets has been the main focus of studies done to determine the consequences of low and highly developed financial markets on economic development. According to Mishkin (2007:35–37), financial intermediaries lower the cost of borrowing and lending, reduce the exposure of investors to risk, especially that which is brought about by information asymmetry. Levine and Zervos (1998:538) investigation of stock markets' importance in aiding economic growth led them to the conclusion that indeed stock markets are significant in this regard, their presence result in higher current, as well as future economic growth rates. The culmination of the study was that both banking and stock market development are predictions of capital accommodation, productivity growth, and economic growth thereof.

Highly developed stock markets are in the position to offer financial services that differ from those provided by banks, and this can thus allow a different kind of investment, and hence more growth will result over and above that which results from the development of the banking system. High stock market capitalisation can enhance risk diversification as well as the mobilization of capital in an economy. High liquidity is on the other hand will assist in the lowering of transaction costs (Arestis & Demetriades, 1997:785-786).

In 1911 Joseph Schumpeter argued that the services provided by financial intermediaries – mobilizing savings, evaluating projects, managing risk, monitoring managers, and facilitating transactions – are essential for technological innovation and economic growth, King and Levine (1993). Thus from this it can be taken that financial development, which in itself is a form of technology, is supposed to facilitate economic growth, by giving those with innovative ideas (poor and rich alike) the power of credit, enabling them to increase their incomes.

In countries where there is little money to lend enterprising traders are long kept back, because they cannot at once borrow the capital, without which skill and knowledge are useless, Bagehot (1873). In their paper, Legal Institutions and Financial Development (2004:2), Beck and Levine indicate that “a burgeoning literature finds that financial development exerts a first-order impact on long-run economic growth.” South Africa is a

developing country with high inequality and high unemployment rates that stood at 24.25% in 2007 (of persons aged 15 to 64 years), so high growth and development are very important.

Though important in the determination of a country's financial development, the legal origins of a country are not alone (or enough) in this function. Such works as those by Beck (2002), Rajan and Zingales (2003), Baltagi, Demetriades, and Law (2009) have brought to light the importance of cross-border trade openness in promoting financial development. As Rajan and Zingales point out, structural theories of financial development do not fully explain financial development, because otherwise, a country after overcoming these structural impediments, the supply of finance should rise to meet demand, and the relative positions of different countries should not change drastically (as they have) over time, as institutions are persistent.

Rajan and Zingales (2003)'s argument is that industrial incumbents have an incentive to oppose financial development, and they do. However, with the opening up of borders to trade and the waning of capital controls, the incumbents' success rate falls. They use a panel of countries to investigate this, and indeed they find that trade and capital account openness have a positive impact on financial development (especially on bank development). In a similar study, Baltagi *et al* (2009) also find that both trade and capital account openness have a positive effect on financial development, but go further to report that the opening up of one without doing so for the other (trade and capital account) will still result in better developed financial sector. It is because of this reason that cross-border trade openness is used as an instrumental variable in the two-stage-least-square (2SLS) econometric method order to get unbiased estimators (and therefore remedy the endogeneity problem).

FINANCIAL MARKETS AND INTERMEDIARIES

There seem to be no need to distinguish between bank-based and market-based financial development or to prove the superiority of one form over the other when it comes to their importance in economic development. What matters is the reduction of transaction, information, and enforcement costs, which the financial functions view, shows that is what necessitates and subsequently results in financial intermediaries (banks) and financial markets (Levine, 2004:34). According to Levine (2004, 35), studies done by Demirguc-Kunt and Maksimovic also show that the bank and market based financial development complement each other in the development process, as the increase in stock market development has a

positive impact on bank development in developing countries. Therefore the focus of this study will be on both the financial intermediaries and the financial markets (stock markets) as important components in the economic growth of countries.

Financial development thus takes place when financial instruments, markets, as well as intermediaries ease the effects information asymmetry and high transaction costs, although it does not mean that they will be completely done away with (Bertocco, 2008:1162). “Many models emphasise that well-functioning financial intermediaries and markets ameliorate information and thereby foster efficient resource allocation and hence faster long-run growth” Beck & Levine, 2002:1). Financial development does this by (1) Making information available about possible investments (2) Putting corporate governance into operation and keeping an eye on investment (3) trading, diversifying and managing risk (4) grouping and mobilizing of savings, and (5) Exchanging of goods and services. Thus resources are put in their most productive uses, due to the resultant efficiency in their allocation (Bertocco, 2008:1162).

The neoclassical view that money and financial variables are insignificant in the determination of real variables such as wealth, income and economic growth is discarded in studies on the causal relationship between financial development and economic growth. This came about due to the realisation that markets are highly imperfect and this hinders them from performing their functions to the optimal (Bertocco, 2008:1161-1162). The most important causes of imperfections in any financial system are the presence of imperfect information, and the high costs of transactions.

DATA

Panel data for the following countries is utilised: Brazil, Russia, India, China, and South Africa. This data covers the time periods 1970 to 2009. Therefore the cross-section component is $N=5$ and the time series component is $T=40$. Again, due to data availability constraints, this data set resulted in unbalanced panel data.

When looking at financial development from the banking system’s point of view, one can measure for the overall size of the financial sector or financial depth of the economy and this is done by using the money measure, $M2$ (liquid liabilities) and it is divided by GDP (denoted by $M2$). The data for the money aggregate $M2$ comes from the macro time series

data set of the New York University (NYU) Global Development Network Growth Database. To measure how effective the financial sector is in channelling funds from the surplus units to the deficit economic units, also known as the savers and borrowers and credit to the private sector is used for this purpose, and this is done by dividing credit provided by the monetary sector to the private sector by GDP (denoted as *PCred*), and the data for private credit comes from the financial development database of the World Bank Development Indicators. Private credit is most likely the most important indicator of banking development as it captures the extent to which new firms have opportunities to obtain bank finance, i.e. it captures the ease (or difficulty) with which any entrepreneur with a good project can obtain finance (Baltagi, Demetriades, & Law 2009:289).

Looking at financial development from the stock market side, Turnover Ratio (denoted *TOR*), a measure of stock market liquidity is utilised. Turnover Ratio equals the value of trades of domestic shares on domestic exchanges relative to the size of the market (Levine & Zevos, 1998:540) as well as Beck and Levine (2004:428) have proved Turnover Ratio to be a superior measure of liquidity as high *TOR* is an indicator of low transaction costs. More liquid stock markets lessen the disincentive to long-run investment as highly liquid markets afford investors a ready exit option, helping faster growth by fostering more efficient resource allocation (Beck & Levine 2004:428). Data for Turnover Ratio comes from the financial development database of the World Bank Development Indicators. The other proxies of stock market development; Value Traded (a measure for market liquidity) and Market Capitalisation (a measure for market size), were proven to not be very good measures of stock market development by (Levine & Zevos, 1998 and Beck and Levine, 2004).

To get a single measure for financial development from these three different proxies for financial development, the principal components method is utilised. Using this method, the linear combination of *M2*, *PCred*, *TOR* is taken to produce an index for overall financial development, which is denoted *FinDev*. By replacing a number of these proxies of financial development with only one that contains most of the information contained in the four, potential omitted variable problems, as well as multicollinearity can be avoided. As Huang and Temple (2005) put it, there could be significant advantage in combining the various indicators of financial development, and they too make use of principal component analysis to get a new measure for financial development. The first principal component is then used as

it accounts for as much of the variability in the data as possible, and in this case it accounts for 52% of the variation in $M2$, $PCred$, TOR .

As an instrument for financial development, cross-border trade openness is used to deal with the endogeneity problem that is associated with the financial development and economic growth relationship. This is because of works such as those by Beck (2002); Rajan and Zingales (2003); and Baltagi *et al* (2009) that show that trade openness leads to more developed financial markets. The proxy used for trade openness is Openness ($Open$), and this is just the sum of exports and imports as a ratio of GDP. Open datasets come from the macro time series data set of the NYU Global Development Network Growth Database.

The real GDP per capita growth rates of the five countries comes from the macro time series data set of the NYU Global Development Network Growth Database. A healthy growth in the GDPs the BRICS in the last number of years (the obvious exception off course being during the recent years that were affected by the sub-prime financial crises that resulted in the worldwide recession) is another one of the common trades shared by these emerging economies. Besides the variables central to this study, several control variables are used as a means of avoiding the “omitted variable biasness” that can result in endogeneity (which means the model would be misspecified). These control variables include (1) tax inflation (2) government debt (3) investment (4) constraints to the executive (5) structural development.

Investment (Inv), results in increased productivity as contained in the Solow model, therefore as a priory, is expected to show a positive impact on growth. Data for the investment share of real GDP per capita (2005 constant prices) comes from the Penn World Table (PWT) data set mark 6.3. Inflation can result in macroeconomic instability, and Fischer (1993) in his study of the effects of inflation on a panel of countries did indeed find that high inflation rates had a detrimental effect on growth. Data for inflation comes from the macro time series data set of the NYU Global Development Network Growth Database. This was then transformed using the following equation; $\left[\ln \left(1 + \frac{\pi_t}{100} \right) \right]$ to capture inflation tax. It is the normal consensus that large governments are detrimental to economic growth, and one of the major reasons for this is because large governments crowd out private investment (a major driver of growth). To capture the size of the respective governments, gross government debt ($GovDebt$) is used, and this data comes from the Historic Public Debt Database (2010).

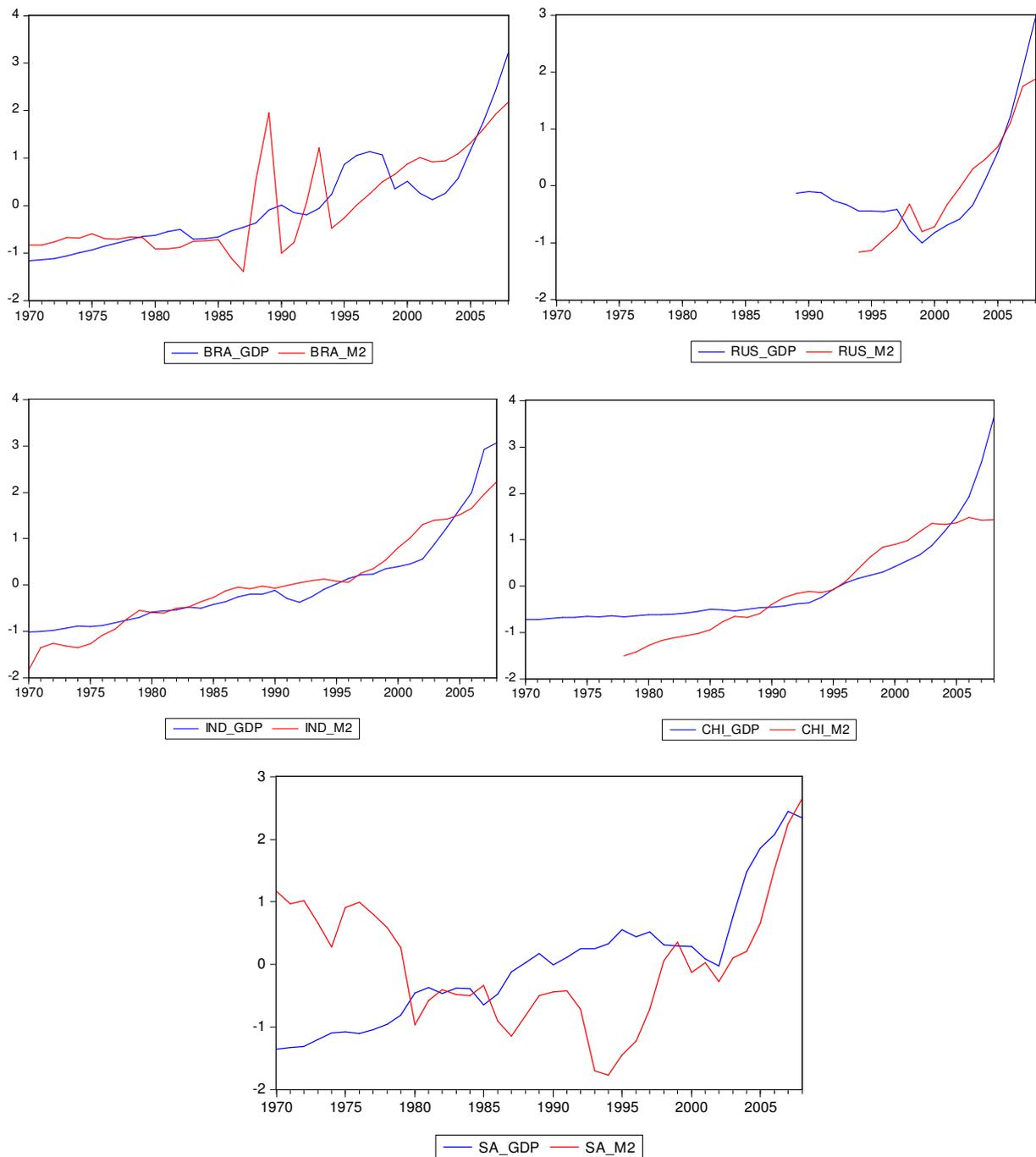
Education leads to increased human capital (more skilled workers). Physical capital and human capital are complementary (Acemoglu, 2008:392) and this means that an accumulation of more physical capital will increase the productivity of societies with higher levels of human capital than that of low skilled workers. Again, “As an economy develops, more individuals move from rural areas to cities...” (Acemoglu, 2008:865). An index for structural development (*SDev*) from these two (education and urbanisation) is therefore constructed to express what is contained in the unified growth theory; that communities that are more educated and more urbanised tend to grow faster (Galor, 2005). The dataset for education comprises school enrolment at secondary (% gross) and is from the social indicators dataset of the NYU Global Development Network Growth database, while data for urbanisation comprises urban population (% of total population) and it comes from the macro time series of the same dataset.

“At some level it is obvious that institutions matter. Witness for example the divergent paths of North and South Korea, or east and West Germany, where one part of the country stagnated under central planning and collective ownership, while the other prospered with private property and a market economy” (Acemoglu, Johnson & Robinson, 2001). South Africa went through a major institutional change in the early 1990s (with collapse of apartheid), Brazil in the 1980s (Bittencourt, 2010), and Russia after the collapse of Soviet Union in 1991, and all these transitions are expected to be evident in the model.

Therefore to capture the role of institutions in these countries, The variable used for this purpose is that of “constraints to the executive” (*XConst*), which measures the degree of checks and balances between the various parts of government, and it ranges from 1 (unlimited executive) and 7 (executive parity). This variable comes from the Polity IV Project (of the centre for systemic peace).

In Figure one below, data for GDP was plotted against that of liquid liabilities (*M2*) for Brazil, Russia, India, China and South Africa respectively. This just from the notion that a picture is worth a thousand statistical tests and it can be seen that these two variables (GDP and *M2*) are moving together for Brazil, Russia, India and China, indicating a positive relationship. As for South Africa, it seems that before democracy, these two variables only moved together more or less from the period 1980 to 1991 and there seems to be a definite co-movement from 1998 onwards.

Figure 1: GDP per capita and Financial Development for Brazil, Russia, India, China and South Africa, 1970-2009



Data source: the macro time series data set of the New York University (NYU) Global Development Network Growth Database.

Going further, Table one gives the correlation matrix of the used variables. *Growth* and *FINDEV* present the expected positive statistical sign (i.e. they are positively correlated), indicating the presence of positive statistical relationship between our two major variables. The control variables *INFL*, *GOVDEBT*, *INV*, and *XCONST* also present the expected against

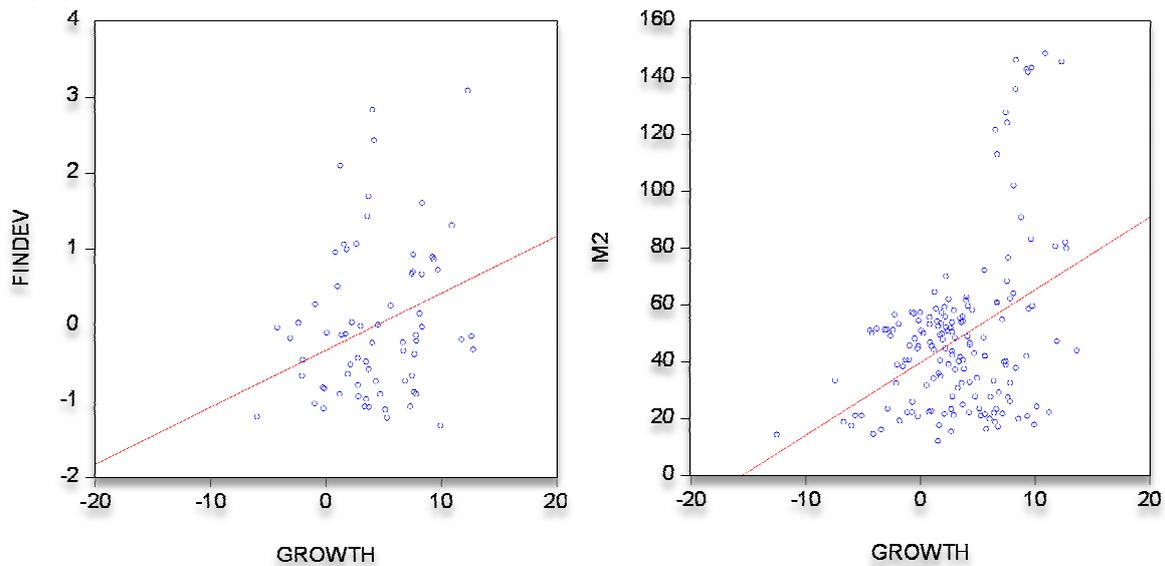
GROWTH. The negative signs presented by *INFL* and *GOVDEBT* suggest that high levels of inflation as well as those of government debt are detrimental to growth in the BRICs, as is suggested by theory. The positive sign on *INV* indicates that investment has the expected positive impact on growth, and the positive sign presented by *XCONST* show that more constraints on the executive do lead to better run nations, and thus good for growth. One of the most important correlations between variables in this study is that one between *FINDEV* and *OPEN*, and this is because *OPEN* is used as an instrument for *FINDEV* in the econometric modelling. *OPEN* presents the expected positive statistical impact *FINDEV* (and one of the highest correlations) and this is good. *INFL* also presents the expected negative sign against *FINDEV*, indicating that for the BRICs, inflation does have a detrimental impact on growth (as dictated by economic theory).

Table 1: The Correlation Matrix of Brazil, Russia, India, China and South Africa, 1970-2009.

Correlation	GROWTH	FINDEV	OPEN	INFL	GOVDEBT	INV	SDEV	XCONST
GROWTH	1.000							
FINDEV	0.371	1.000						
OPEN	-0.034	0.455	1.000					
INFL	-0.218	-0.066	-0.194	1.000				
GOVDEBT	-0.438	-0.559	-0.172	0.272	1.000			
INV	0.289	0.458	0.090	-0.040	-0.317	1.000		
SDEV	-0.251	-0.186	0.207	0.053	0.134	-0.104	1.000	
XCONST	0.063	-0.084	-0.001	0.022	0.098	0.033	0.117	1.000

Finally, Figure Two below shows that there is a significant positive economic relationship between financial development (*FINDEV* and *M2*) and economic growth in BRICs for the period 1970 to 2009. All these data analyses (one graphical, one statistical and the last economical) suggest that finance and growth are positively related in the BRICs, which is in line with economic theory.

Figure 2: OLS Regression Line of Growth and Financial Development for Brazil, Russia, India, China and South Africa, 1970-2009.



Data Source: the macro time series data set of the New York University (NYU) Global Development Network Growth Database.

Empirical Strategy and Analysis

The empirical strategy for econometric modelling is based on panel time-series analysis and this is because the data set is of the $T > N$ nature. For such a case such as this one where there is a large enough T (time-series component) that it makes it possible to estimate a separate regression for each cross-section (country), then it only makes sense consider heterogeneity across these units, and this heterogeneity can be tested for (Fuertes & Smith, 2008:4). Since this heterogeneity may have its roots in individual-specific characteristics which do not change over time (such as institutions and the presence of lack of natural resources), one would surely expect heterogeneity across the BRICs countries, especially considering that they are spread across four continents.

The very nature of panel time-series data warrants that unit roots be tested for and be dealt with accordingly, otherwise spurious regressions could result. Since T is sufficiently large, unit roots can be tested for in the country time-series, and the Im, Pesaran and Shin (IPS (2003)) test is used. The IPS (2003) is based on the Augmented Dickey Fuller (ADF) test that looks like this:

$$IPS = \frac{\sqrt{N[\bar{t} - E(t)]}}{\sqrt{var(t)}} ; \bar{t} = N^{-1} \sum_{i=1}^N ADF_i$$

$$\Rightarrow N[0,1] \text{ for } T \rightarrow \infty$$

Where $E(\bar{t})$ and $Var(\bar{t})$ are tabulated for different $[N, T]$

This test is preferred and used because of the added advantage it has over other tests, i.e. it allows heterogeneous parameters and serial correlation. A trend is included when performing the IPS (2003) test for some of the variables, which include the financial development proxy (*Findev*), the proxy for openness, investment, structural development, government debt, and inflation, as these variables tend to exhibit some trend over time. With the IPS (2003), it is assumed that all series are non-stationary under the null hypothesis, and that some (but not all) of the individual series have unit roots (i.e. $\rho < 0$ for at least one i) under the alternative hypothesis. The data of the appropriate variables is then transformed to get their differences values, and these are then used in regressions.

The first stage of regressions involves using the pooled OLS (Ordinary Least Squares) estimator as this is the benchmark model. This estimator looks like this:

$$\dot{g}_{it} = \alpha + \beta x_{it} + e_{it} \sim IN(0, \sigma^2)$$

Panel estimators make provision for similarities amongst the different cross-sections under investigation, but as can be seen from the above model, the pooled OLS estimator (POLS) does not allow for heterogeneity amongst these units (assumes equal intercepts). This issue is dealt with by using the one-way Fixed Effects (FE) estimator (with robust standard errors) which looks like this:

$$\dot{g}_{it} = \alpha_i + \beta x_{it} + \mu_i + v_{it}, v_{it} \sim IID(0, \sigma_v^2)$$

($\mu_i = \text{unobservable individual specific effect}$)

This is a much better estimator since it takes heterogeneity into account (heterogeneous intercepts) and is therefore more efficient. The respective BRICs countries do have a number of similar attributes (for example high levels of growth amongst the emerging world economies), hence why they are grouped together for this study, but they do differ quite significantly as well, for example, South Africa's economy is only a quarter of that of Russia.

The next regressions involve dynamic panel analysis. This is because economic theory indicates that a lot of economic relationships are dynamic in nature, for example, economic growth is one such process shows a trend over the long-run. Heterogeneity again comes into the picture as heterogeneity bias in these dynamic $T > N$ panels can arise when homogeneity is wrongly assumed. Therefore inconsistent estimators will result as the explanatory variables (x_s) will not be independent of the lagged dependent variable (growth in this case), and the error term becomes serially correlated. Again, the one-way Fixed Effects estimator is used to deal with this issue, and this is because as $T \rightarrow \infty$ (i.e. as T gets larger and larger relative to N) the Fixed Effects estimator provides consistent estimators in dynamic models.

The causality issue often rears its head whenever the financial development – economic growth relationship is being investigated. For example Levine (2004:49) points out that it can and may be questioned as to whether it is just that the financial market development is just the result of anticipated future economic activity, i.e. it is just a leading indicator, or if it is indeed a fundamental cause of development. Therefore to deal with the present economic and statistical endogeneity (due to finance not being entirely exogenous in determining growth), instrumental variables (IV) are made use of in the Two Stage Least Squares (2SLS) estimation. The first instrument that is used is the lag of financial development ($findev_{-1}$) and this is because the dynamic nature of economic relationships, and therefore it would make sense that the biggest determinant of $findev_t$ would be $findev_{t-1}$. Trade openness is used as the next instrument for financial development in estimations (as suggested by the likes of Thorsten Beck (2002) and therefore the Fixed Effects with instrumental variables (FE-IV) estimator with robust standard errors is used. The lag of $findev$ and trade openness are used to instrument financial development in this case and this is because: (i) They are highly correlated with our endogenous explanatory variable (financial development), and (ii) They are not in our original model ($\dot{g}_{it} = \alpha_i + \beta x_{it} + \mu_i + \nu_{it}, \nu_{it}$), and therefore are not correlated with the disturbance term. The just mentioned properties of our instruments and the nature of the data ($T \rightarrow \infty$) will ensure that the FE-IV estimator is asymptotically consistent and efficient. To test the presence of endogeneity, the Hausman specification test is used, with the null indicating exogeneity (the preferred outcome), while the alternative indicates endogeneity (the more likely outcome).

Regressions involving static and dynamic models using the following basic dynamic equation are estimated:

$$Growth_{it} = \alpha_i + \beta Findev_{it} + \lambda Infl_{it} + \delta GovDebt_{it} + \gamma Inv_{it} + \xi XConst_{it} + \varphi SDev_{it} + \Omega Growth_{it-1} + \varepsilon_{it}$$

Growth is the GDP growth rates, thus indicates the economic growth rates of the respective BRICs countries. *Findev* is the constructed proxy for financial development, consisting of the unobservable common factors of bank development stock indicators, comprising liquid liabilities and credit to the private sector, as well as stock market development indicators, comprising value traded and market capitalisation. *Infl* represents inflation rate, the annual change in consumer prices; *Inv* is the share of investment to GDP; *XConst* is constraints on the executive; and *SDev* is structural development, which is just an interaction between education and urbanisation.

The above is estimated using different estimators; POLS (pooled ordinary least squares model, which is the benchmark model), FE (Fixed Effects model) and FE-IV (Fixed Effects with instrumental variables). This is done to provide more reliable and informative estimates as we move from POLS to FE-IV, thus better dealing with different economic and econometric issues.

Results

The first set of results that are reported are those from unit root testing. Table one below shows the results from the IPS (2003) unit root tests that were performed on the relevant variables as well as their interpretations.

Table 2: IPS (2003) Unit Root Results

Variable	Test statistic	p-value	Conclusion
Growth	4.88	0.0000	stationary
Findev	1.60	0.0543	stationary
Infl	9.10	0.0000	stationary
Open	5	0.0000	stationary
GovDebt ^a	1.39	0.0822	non-stationary
SDev ^a	0.71	0.9102	non-stationary
Inv ^a	5	0.8452	non-stationary

^ataking first differences of these initially non-stationary variables produced stationary variables, and hence these were used in regressions.

The regression results are reported in Table two. As a priori, the coefficients of *Findev*, *Inv*, *XConst* and *Growth₋₁* are expected to have a positive sign as these variables have a positive impact on economic growth, while the coefficients of *Infl* and *GovDebt* are expected to have negative sign as high levels of these variables have a detrimental impact on growth (as poor institutional quality is detrimental to a county's growth).

Figure 3: POLS, FE and FE-IV Estimates on Economic Growth, 1970-2009.

Growth	POLS (1)	FE (2)	FE (3)	FE-IV (4)	FE-IV (5)	FE-IV (6)	FE-IV (7)
Findev	1.294*** (4.76)	0.867* (1.77)	0.749* (1.56)	1.202* (1.68)	1.163* (1.65)	3.328*** (2.76)	3.026*** (2.57)
Infl	-1.447 (-3.19)	-0.808 (-2.07)	-0.626 (-1.61)	-0.791 (-1.88)	-0.631 (-1.49)	-1.440 (-2.69)	-1.250 (-2.33)
GovDebt ^b	-0.049 (- 1.32)	-0.037 (-1.34)	-0.020 (-0.74)	-0.032 (-0.96)	-0.017 (-0.50)	-0.077 (-2.10)	-0.061 (-1.65)
Inv ^b	0.897 (4.22)	0.887 (5.91)	0.818 (5.47)	0.810 (5.36)	0.813 (5.47)	0.760 (4.10)	0.720 (4.00)
Xconst	0.031 (0.99)	0.012 (0.52)	0.002 (0.09)	0.240 (0.29)	-0.371 (-0.47)	0.007 (0.24)	0.012 (-0.012)
Sdev ^b	-0.000 (- 1.15)	-0.000 (-1.00)	-0.000 (-0.86)	-0.000 (-0.91)	-0.000 (-0.76)	-0.000 (-1.15)	-0.000 (-1.06)
Growth ₋₁			0.196 (2.13)		0.175 (1.66)		0.145 (1.33)
F test	12.22	10.37	10.02	10.72	9.04	5.98	5.06
F* test		19.71	8.09	12.70	5.57	14.65	7.00
R ²		0.50	0.63	0.41	0.64	0.41	0.47
Wald test				701.07	725.23	454.83	495.03
Hausman				2.76	3.02	2.93	2.21

t-test values in parentheses

*, **, *** indicate significance at the 10%, 5% and 1% levels

^b indicates those variables whose differenced values were used

Columns one and two give the static estimates of *Findev* on *Growth* using POLS and FE estimators respectively. For the POLS (1), *Findev* has the expected positive sign, and is statistically significant. *Inf*; *GovDebt*; *Inv*; and *XConst* all have coefficients with the expected signs, but *XConst* and *GovDebt* are not statistically significant, and *SDev* does not have the expected sign and is not statistically significant. These results being from our benchmark model are already quite good, an indication that our overall model is a good one.

For the FE estimator (2), all the variables (except *SDev*) are economically viable (have the expected signs). *Findev*'s coefficient of 0.867 shows that for every one percent increase in *Findev*, *Growth* will increase by 0.087%. When testing for the validity of fixed effects (or poolability), from the f-statistic of 19.71 we conclude that fixed effects are valid

and (significant) and therefore the BRICs countries are heterogeneous and should not be pooled. Looking at the f-statistic of 10.37 (greater than the critical value of $2.42((N - 1)(NT - N - K))$) we conclude that the overall model is also statistically significant.

For the dynamic FE estimator (3), all the variables are economically viable (again with the exception of *SDev*), although *Findev* is not entirely statistically significant. The f-statistic of 8.09 also shows the presence of fixed effects. For the overall model, the f-statistic of 10.02 (greater than the critical value of 2.42) shows that the model is statistically significant.

Furthermore, after testing for endogeneity using the Hausman Specification Test, and with the critical value of $\chi^2(6) = 12.59$, which is greater than the test statistics of 2.76; 3.02; 2.93 and 2.21, we reject the null hypothesis of exogeneity, therefore we go on further to use the FE-IV estimator, both in static (4 and 6) and dynamic (5 and 7) models. *Findev* is economically viable in all the models and statistically significant in both the models where *Open* is used as an instrument, showing that indeed financial development has an important role in generating economic growth in a country. For every one percent increase in *Findev*, *Growth* will also increase by 0.33% in the static specification (5) and 0.30% in the dynamic specification (7). In addition, in the first stage regressions, the F test is statistically significant and *Findev*₋₁ as well as *Open* present the expected positive (and statistically significant) impact of *Findev*. This goes to further prove that both the lag of financial development and trade openness are a good instruments for financial development, and that by being open to trade, a country's financial development will improve, and thus also improving economic growth prospects.

All the controls are economically viable as well (with the exception of *SDev*), although some are not wholly significant this time. This proves that indeed good institutions (as encompassed in the inflation rates (*Infl*); the amount of government debt (*GovDebt*); and constraints on the executive (*XConst*), with high levels two former representing poor macroeconomic environments) and a stable macroeconomic environment are a necessary condition for growth. *Inv* continues to be economically viable and highly significant statistically throughout our numerous regressions, indicating that high levels of investment are conducive to growth.

Conclusion

In this paper we investigate the impact that financial development has in boosting economic growth in the BRICS a group of fast growing emerging economies. This investigation is based on panel time-series analysis, and the results, which by large are robust to a range of alternative techniques, suggesting that indeed financial development plays a crucial role in promoting economic activity, and thus generating economic growth for these countries. These results are in line with what literature predicts, as well as the empirical investigations of those such as Beck and Levine (2004).

More robust results are obtained in this study by making use of the panel time-series technique, which does not average data over time, but allows for variation over time. Principal component analysis is also made use of, thus going further to deal with model uncertainty that can result in growth regressions, thereby providing more robust estimates that are also more informative. The results of this study go further to show that for finance to really benefit a country, there must be macroeconomic stability and those institutions that ensure stability, for example, central bank independence, which amongst others helps towards achieving low inflation rates (a cautionary tale being that of Zimbabwe and its hyperinflation).

Future work from this could involve the investigation of the those market imperfections that are present in both the financial intermediaries as well as markets of the BRICS, as literature shows that it is these imperfections that hinders the mechanism through which financial development is translated into growth. Then the next step would be looking into ways of solving this problem, i.e. minimising these imperfections.

In conclusion, financial development (both bank and market development) is found to play a significant role in promoting economic growth in the BRICS. The empirical results in this paper are in line with expectations, confirming that the emerging economies of the BRICS are benefiting from their finance sectors.

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