The Influence of Financial Market Development on Economic Growth in BRICS Countries

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ERSA working paper 625

July 2016

Economic Research Southern Africa (ERSA) is a research programme funded by the National Treasury of South Africa.

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Charles Wait*and Tafadzwa Ruzive†

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Abstract

The debate about the influence of financial market development on economic growth has been ongoing for more than a century. Since Schumpeter (1912) wrote about the happenings on Lombard Street, right up to the economists of today, there is growing interest into how financial market development affects economic activity and hence economic growth. With economic growth gaining prominence in respect of development discourse, inquiry into the finance-growth nexus has grown rapidly. The latest advances of the finance-growth nexus show a positive relationship between financial market development and economic growth. In this regard, little research has been done globally pertaining to most recent economic developments, especially concerning the BRICS economies. This research investigates the influence of financial market development on emerging economies, BRICS and non-BRICS and to determine whether the openness of financial markets in BRICS economies contributed to higher growth trajectories compared to their non-BRICS counterparts. The research utilises the Generalised Method of Moments and an extended endogenous growth model to estimate the influence of a set of financial market indicators. The study found that higher levels of credit to the private sector and financial depth in the BRICS economies contributed to the higher levels of economic growth experienced in the BRICS compared to non-BRICs emerging economies.

Key words: Financial Market Development, Economic Growth, Brics
JEL code: O43

1 Introduction

The debate about the influence of financial market development on economic growth has been ongoing for more than a century. Since Schumpeter (1912)

*Department of Economics and Economic History, Nelson Mandela Metropolitan University, e-mail: charles.wait@nmmu.ac.za

†Department of Economics and Economic History, Nelson Mandela Metropolitan University, e-mail: tafadzwaruzive@gmail.com

wrote about the happenings on Lombard Street right up to the economists of today, there is marked interest into how financial market development affects economic activity and hence economic growth. With economic growth gaining prominence in respect of development discourse, economists have focused on how to propel economies to higher states of economic growth. Financial market development has emerged as one of the policy levers central banks and governments use to target economic growth.

Financial Market development is defined by Demirgüç-Kunt *et al.* (2009) as improvements in the size, activity, efficiency and stability of the financial system. Levine (2005) identified an effective financial system as one that embodies these five functions: (i) production of ex ante information about possible investments, (ii) monitoring of investments and implementation of corporate governance, (iii) trading, diversification, and management of risk, (iv) mobilisation and pooling of savings, and (v) exchange of goods and services. It is the aim of this study to investigate if these functions have improved and if these improvements have translated to higher economic growth in these BRICS countries

Chittedi, (2009) noted that BRICs nations reformed their financial regulations and policies to attract foreign portfolio flows and contribute to their stock market development and banking sector development. This resulted in a fundamental shift in the financial structures of these countries and capital flows from developed nations. Gries *et al.* (2008) concluded that these countries have been interested in fostering their financial development, by reducing governmental intervention in national financial sectors, privatising banks and enhancing market capitalisation. Such policies were implemented in the expectation of promoting growth through, *inter alia*, a higher mobilisation of savings or a rise in domestic and foreign investments.

BRICS have been more emphatic than their other emerging market counterparts in developing their financial markets and it remains to be seen if this translated to growth. The next section illustrates how financial market development interacts with the mechanisms for economic growth.

2 Literature Review

2.1 Schools of Economics

Financial market development and economic growth draw from a history of economic theory. Examining the schools of economic thought, The Classics, Neo-Classics and Monetarists believed in the funds mobilising nature of the financial markets and how these funds were allocated into productive activities via the market mechanism. Monetarists believe in controlling output through the regulation of money supply via the banking system. This is evident in the role that banks play in lending to the private sector, how they are coordinated by the central bank and the control central banks have over liquidity in an economy. (King & Levine 1993b) The Keynesians separated investment from financial markets and attributed its levels and nature to "animal spirits". It

is clear that the Classical school laid the economic foundations for the institution of financial market mechanisms affecting savings and investment in an economy. This is important as it will serve as a framework with which the whole analysis of the influence of financial market development on economic growth will proceed. Given this economic background, there is a need examine the stakeholders present in financial markets. The following section provides an investigation into who are the stakeholders in these markets and an evaluation of their interactions in mobilising savings and allocating capital in a functional economy.

2.2 The role of financial intermediaries in financial markets

In an open economy with free markets, financial intermediaries perform the function of connecting lender savers to borrower spenders (Gurley & Shaw 1955). Howells (2007) defined a financial intermediary's role as: "To create assets for savers and liabilities for borrowers which are more attractive to each than would be the case if the parties had to deal with each other directly." The function of financial intermediaries in an economy is to channel funds from lender savers who have managed to save from their income to borrower spenders who wish to spend more than their income can allow. The financial system is complex in structure and function throughout the world. It includes many different types of institutions: banks, insurance companies, mutual funds, stock and bond markets (Mishkin 2005)

2.3 Information asymmetry and funds mobilisation

This complexity in structure and function of financial markets relates mainly to mitigating the effects of transaction costs and information asymmetries that inhibit the allocation of mobilised funds in an economy. Direct means of financing are often fraught with high costs and less transparency in respect of information, making indirect means more favourable. State contingent contracts become the easiest way with which direct funding can be made available to entrepreneurs who need them. In the light of the effect of information asymmetry on the lending process it is crucial that financial intermediaries step in to smooth the lack of trust that exists between borrowers and lenders and thus open up flows of funds to spur economic growth. Functional financial intermediaries enable funds mobilisation through reduced transaction costs and ameliorated information asymmetry leading to greater volumes of capital being allocated than would have been the case had the process taken place directly. With this in mind it becomes necessary to investigate how financial intermediaries influence economic growth; this topic will be discussed in the following section.

2.4 Financial Sector Reforms and Financial Market Development in BRICS Countries

Financial market development is defined as improvements in the size, activity, efficiency and stability of the financial system and is always expected after periods of financial sector depression as reforms. In their study, King and Levine (1993a; 1993b) demonstrated that financial-sector reforms in five developing countries that had experienced financial-sector reforms were widely associated with increases in their measures of financial development. Lynch (1996) noted that "As initial liberalisation leads to positive real interest rates, only projects with positive real returns are undertaken. Positive real interest rates stimulate greater financial saving, significantly increasing monetisation of the economy, and financial intermediation." Financial sector reforms will result in positive movements in the measures of financial development that are discussed below.

The indicators of financial development were obtained from King and Levine (1993a; 1993b). The first variable is *DEPTH*, a proxy for the overall size of the formal financial intermediary sector, measured as the ratio of liquid liabilities of the financial sector to GDP. The second indicator is *BANK*, the ratio of deposit-money bank domestic assets to deposit-money bank assets plus central-bank domestic assets. King and Levine (1993a; 1993b) introduced this variable to emphasise the risk-sharing and information services stressed in their theory that banks are most likely to provide. The third variable is PRIVY in this research; the ratio of claims on the nonfinancial private sector to GDP, which indicates the share of credit funnelled through the financial system to the private sector.

For instance, bank lending to firms has generally appeared first, followed by stock and bond markets, and finally credit and insurance markets catering to households (Pagano 1993). This justifies the focus on bank lending as it is a fundamental form of financial intermediation unlike stock and bond markets which have highly unrepresentative proportions in countries being studied. The focus is on identifying trends in financial market development indicators and seeing how they affect economic growth. Below are illustrated the diagrams that show the trends in the respective developments in financial markets in the emerging economies vs those for the BRICS.

Figure 2.3 shows the trend for BRICS versus non-BRICS averages for the credit to private sector ratio as a percentage of GDP. The trend over the observation period shows increases in the rate of private sector credit to GDP in the BRICS economies. The non-BRICS economies have higher averages of credit to private sector as a percentage than the BRICS economies. However, the ratios remain constant over the observation period; increasing ratios relate to how much banks increase lending to the private sector, implying an increase in the size of the intermediaries sector in an economy. This indicator is denoted as PRIVY in this treatise.

Financial depth provides a measure of the size of the financial system relative to the size of the economy. It will be denoted by DEPTH in the treatise. The BRICS economies experienced increasing depth through the observation period

though the non-BRICS economies increased the amount of M2 to GDP as the decade progressed. The greater depth of the BRICS economies is associated with the long gestation periods of projects that spur economic growth.

Figure 2.5 indicates that the BRICS economies had more bank assets in the economy compared to non-BRICS countries throughout the duration of the observation period. This implies that banks were more involved in the financial system in BRICS economies than their non-BRICs counterparts. The trend in financial market development denoted here shows that the BRICS economies have more bank intermediation than non-BRICS economies and are also funnelling more funds to productive private sector projects other financial market intermediaries in the economy, the central bank concluded.

2.5 Summary

From the empirical literature it is clear that a variety of indicators of financial sector development have been regressed against real GDP growth, capital accumulation and productivity enhancements. The methods that have been utilised began from three stage least squares, onto Vector Error correction models to Vector Auto regressive models. The underlying theory that was being tested remained that of the endogenous growth models and this had been done on numerous sets of countries around the world with a wide variety of results. The most robust econometric methodologies applied to date for panel data analyses were the generalised method of moments which could account for the endogeniety of physical capital accumulation to economic growth as Spiegel *et al.* (2001), and Lopez and Spiegel (2002) have demonstrated, creating a precedent for further investigation for the growth finance nexus along the same line of thought.

3 Methodology

3.1 Econometric Methodology

The econometric tool that is applied here is panel data analysis through the generalised method of moments, as described by Loayza *et al.* (2000), Spiegel and Ben-Habib (2001) and Levine (1997).The intuition in this method is to circumvent the simultaneity bias that is induced by the co-determination of physical capital accumulation and income in time series. If this aspect is not treated for, estimation with OLS will produce estimates that are biased upward. This upward bias is due to the unaccounted effects of the direction of causality between income and physical capital accumulation. Besides simultaneity bias GMM enables full information to be distilled from the data.

The system GMM, entails estimating a levels equation, preferably in logarithms, because this will enable the coefficients to be obtained as elasticities. Differenced lags of the dependent variable and the weak exogenous variables are then utilised to estimate the equation in a two stage fashion. Usually labour

and capital are defined as weakly exogenous or endogenous in the generalised method of moments estimations of production functions (Spiegel & Benhabib (2000).

Jose Lopez utilising DEPTH, BANK and PIVYY in a difference, noted a problem that arises with indicators in growth regressions is their tendency to be endogenous with current income levels and investment rates as discussed by Greenwood in Jovanovich (1990). To address the endogeneity issue he utilised the beginning of period values as indicators of financial development. He also noted that the extent of development of financial markets in anticipation of future investment and growth, may cause simultaneity bias in the analysis.

To address this possibility, the system GMM methodology of Blundell and Bond (1998) is used. This methodology builds upon the differenced GMM estimation method of Holtz-Eakin *et al.* (1988) and Arellano and Bond (1991) that was used in several panel studies, such as that of Benhabib and Spiegel (2000) or in another instance the system GMM method of Blundell and Bond (1998) as in Levine *et al.* (2000), where both studies found a positive relationship between growth and financial economic development.

Following Spiegel and Benhabib (2000), the procedure adopted for estimation will involve regressing one indicator of financial development at a time and then putting them altogether at once to see if the remain significant as ancillary variables that can affect the level of GDP. A BRICS dummy variable will be utilised to check if there is any financial development initiative occurring in the BRICS but not anywhere else in the sample.

3.2 GMM as an Estimation Technique

GMM was popularised by Hansen (1982) as a method to estimate moment based estimators that could not be written down mathematically. The foundational intuition of the Method of moments is the starting point of GMM estimation, where this method is based on the idea of estimating a population moment by utilising a corresponding sample moment. A moment is a statistical attribute of a population or sample data generating process. Typical moments are the mean, variance, peakedness and kurtosis of a given data generation process.

The vector L of moment conditions that the true parameters of β should satisfy may be written as follows:

$$E[m(y_t, \beta)] = 0 \tag{E3.5}$$

Where y_t a vector of variables is observed at time t and β is the unique value of a set of parameters that makes the expectation equal to zero. Equation (3.5) should usually satisfy orthogonality conditions between a set of instrumental variables Z_t and the residuals of the equation, $u_t(\beta) = u(y_t, X_t, \beta)$ as follows:

$$E[Z_t \mu_t(\beta)] = 0 \tag{E3.6}$$

Where: X_t refers to a set of explanatory variables observed at time t. By replacing the moment conditions in equation (3.5) by its sample analogue, the

following traditional MOM estimator is obtained:

$$\frac{1}{T}Z'u_t(\beta) = 0m_t(\beta) = \frac{1}{T}\Sigma_{t=1}^{T} Z_t u_t(\beta) = \tag{1}$$

Where: T is the sample size. The MOM can only yield an exact solution to this equation if the number of L of moment conditions is equal to K number of parameter estimates.

The general case that exists however is that where there are more moment conditions than the number of unknown parameters; (L>K). Under such conditions, the alternative approach to deal with the over-identified system is the GMM. The GMM procedure is an extension of the traditional MOM approach able to deal with the case where there are more estimating equations than parameters to be estimated (Mittlehammer *et al.* 2000). Although there is generally no exact solution of an over-identified system, GMM is deemed to reformulate the problem by choosing a β that makes the sample moment as close to zero as possible.

To compute this beta the following quadratic function is utilised:

$$J(\beta, \hat{W}_T) = Tm_t(\beta)'\hat{W}_T^{-1}m_t(\beta) \tag{2}$$

$$= \frac{1}{T}u(\beta)'Z\hat{W}_T^{-1^1}Z'u(\beta) \tag{3}$$

Where: W_T is an (mxm) weighting matrix which minimises the weighted distance between the theoretical and actual values. At this stage it's worth mentioning that GMM produces consistent estimates with any positive weighting matrix. For instance Mittlehammer *et al.* (2000) maintained that the GMM approach defines an entire family of consistent and asymptotically normally distributed estimators as a function of the weighting matrix. Another benefit arises in the presence of hetero-scedastic errors in that GMM is asymptotically more efficient than its special cases for instance Two-Stage Least Squares.

Moment conditions that will be minimised in the analysis will be of the form:

$$\begin{gathered}\Sigma(LogY_{it} - LogA_{it} - \alpha LogK_{it} - \beta LogL_{it} - \gamma LogH_{it} - \\ \varphi_1 LogTC_{it} - \varphi_2 OP_{it} - \varphi_3 RD_{it} - \varphi_4 GE_{it} - \varphi_5 DEBT_{it} - \theta_2 X_{it} - \\ \delta DBRICS_{it} - \tau(DBRICS_{it} * X_{it})Z_{t-1}) = 0\end{gathered} \tag{E3.10}$$

Up to

$$\begin{gathered}\Sigma(LogY_{it} - LogA_{it} - \alpha LogK_{it} - \beta LogL_{it} - \gamma LogH_{it} - \\ \varphi_1 LogTC_{it} - \varphi_2 OP_{it} -_3 RD_{it} - \varphi_4 GE_{it} - \varphi_5 DEBT_{it} - \\ \theta_2 X_{it} - \delta DBRICS_{it} - \tau(DBRICS_{it} * X_{it})Z_{t-n}) = 0\end{gathered} \tag{E3.11}$$

All these are orthogonal conditions which can be simplified to yield approximations of the parameter estimates that will minimise the difference from zero

for the given moments. Z_{t-n} is a matrix of instruments that has lags running from time t up to time n.

The estimation of growth regressions was done using the generalised method of moments (GMM) to account for the endogeniety of physical-capital accumulation. This accounts for the fact that economic growth influences past values of growth concurrently, as well as being influenced by past values of itself. To untangle the dual causality, an estimator is applied, which accommodates the bi-causality between economic growth and physical-capital accumulation by weighting the error terms of the equation with instruments that alternatively explain the phenomenon in question.

This methodology has been used in a number of panel growth regressions, including Caselli *et al.* (1996) and Easterly et al (1997), applying techniques advanced by Holtz-Eakin *et al.* (1988) and Arellano and Bond (1991). Essentially, consistency of estimators under GMM requires the assumption that all factors except physical-capital accumulation are strictly exogenous, while physical-capital is only weakly exogenous. For example, for equation (1) we require $E(\Delta k_{it} e_{is}) = 0$ for all $s > t$ which is the moment condition that the estimation of this production function is built upon. The instruments (the weighting matrix) are by exception defined by the aforementioned moment condition.

3.2.1 Specification tests for GMM

The validity of instruments used in the regressions was tested by first testing for second order serial correlation in the residuals and then conducting the Sargan test of the over-identifying restrictions suggested by Arellano and Bond (1991). The logic of the test is that under the null hypothesis that the over-identifying restrictions are valid, the Sargan statistic is distributed as a $\chi^2(p-k)$, where k is the number of estimated coefficients and p is the instrument rank. To ensure that there is no serial correlation in the model the residual is run and tested for second order auto-correlation if it is in differences, and first order correlation if it is a levels equation of which the one in this treatise is.

3.3 Summary

Spiegel (2001) also found a positive role for financial development in enhancing economic growth using the Arellano-Bond methodology. In addition, Spiegel found that the growth experience of a sub-sample of APEC countries were more sensitive to financial development than the overall world sample of countries. This additional sensitivity arose both in enhancing the rates of physical capital accumulation and enhancements in total factor productivity growth. In the theoretical framework below, this analysis will examine the relationship between financial development and economic growth for BRICS countries by extending the work of Benhabib and Spiegel (2000) to utilising a Blundell-Bond system GMM method.

4 Regression Results

4.1 Data Sources and Analysis

4.1.1 Data descriptions and sources

A summarised description of data and sources are presented in Table i.

4.1.2 Data Transformations

To make the variables easier to work with, GDP, Capital Stock, Labour, Educational attainment and technological change have been transformed to logs so that they can enter a Cobb-Douglas type of production function. The rest of the variables are either in ratio or percentage form which makes them stationary and easier to interpret.

4.1.3 Data description

The descriptions of the various variables utilised in the regressions are given in Table 4.2 below. The Table is created by using Eviews 7. These are descriptions of the time series that have been used in the analysis.

4.2 Presentation of Results

The table below shows results from the regressions run to investigate the link between financial market development and economic growth.

Dependent variable log (GDP)

4.3 Interpretation of Results

4.3.1 Base model

Although it is common practice to regress economic growth on an array of potential determinants as shown in Table 4.1 the usefulness of this approach has increasingly been questioned by a number of empirical studies (Sala-i-Martin 1997 and Levine & Renelt 1992). Bosworth and Collins (2003) stated that it is necessary to focus only on a core set of variables of interest and evaluate the importance of other variables conditional on inclusion of the core set. As such, analyses in this chapter mainly focused on the link between financial market development and economic growth. The base model is an extended Cobb-Douglas function with ancillary variables and financial market development indicators. The coefficients for K, L and H are therefore elasticities in respect of capital, labour and educational attainment respectively. The elasticity for capital is 0.57, implying that a one unit increase in the log of the capital stock will yield 0.57 increase in the log of GDP. This elasticity for labour is 0.27 and has the same interpretation. Human capital with a coefficient of -0.002 implies that a year's increase in the average educational attainment of the population will yield negative 0.002 percentage shift in GDP.

The results from the econometric analysis of the determinants of economic output show that domestic capital, stocks, labour and bank assets relative to total financial assets have a positive and statistically significant impact on economic output while government consumption and openness have a significantly negative impact on growth. The negative coefficient on changes in government consumption suggests that government was pursuing a counter-cyclical fiscal policy by increasing consumption in response to lower growth and reducing it in response to higher growth. The coefficient for the debt-to-GDP ratio shows that for every percentage point increase in the debt-to-GDP ratio the growth rate of per capita income falls by 0.06 per cent. In a log model, coefficients for variables in ratio or percentage form translate into percentage increases in the logged dependent variable. The results are also consistent with Barro's (1999:3) findings that growth is inversely related to government consumption.

Openness to trade has a coefficient of -0.0002 implying that a percentage increase in openness to trade reduces GDP by 0.0002 log units or 0.04%. A percentage increase in gross national debt will decrease GDP by 0.06 log units or 0.14% percent. The results for BANK are significant at 0.002 log units or 0.05%, PRIVY AND DEPTH are insignificant at 0.0003 and 0.0009 respectively. Implying that movements in BANK assets are crucial in explaining movements in GDP, in the dataset, a 1% increase in the BANK ratio increases GDP by 0.46%. The BRICS coefficient of -0.94, is significant and implies that BRICS countries as a block, have lower intercept coefficients than non-BRICS countries. BRICS economies start about one log unit of GDP behind non-BRICS economies at the starting point of the analysis. The data suggest that BRICS economies overtook non-BRICS economies in terms of growth in the time period of the analyses (2000-2011).

4.3.2 Indicator specific models

The indicator specific models utilise a simple but intuitive extension of the Least Squares Dummy Variable (LSDV) models. Their interpretation is explained in Gujarati (2004:645). The two crucial coefficients are the financial development indicator and the BRICS coefficient. Both of these coefficients would have to be significant and their interpretation will be the same as in the base model. The particular interactive variable now determines the slope coefficient in respect of the BRICS dummy variable and if positive and significant shows a higher growth trajectory for the BRICS countries in the case of the analyses.

4.3.3 Bank model

The BANK model has a focus on the activities of banks in emerging markets, mainly focussing on the composition of their assets to the total financial assets in the economy. This measure of financial development has to do with the extent of banks in economic activities. The assumption is that the more assets banks bring to financial markets, the more involved they are in screening, intermediation and surveillance activities as a percentage of all banking activity in the country, the

more they are likely to funnel funds that will spur economic growth in the country. The model shows significant capital and labour elasticities. Also of note is the positive elasticity for education. Gross national debt has a negative and significant impact on GDP and so has technology.

The BANK coefficient is -0.002 and insignificant. The BRICS dummy has a negative and significant coefficient the BRICSBANK interactive variable has a significant but positive coefficient of 0.01 which implies a percentage increase in bank activities grows GDP by 2.32 % faster in BRICS economies compared to non-BRICS economies, all things being equal. However, due to the fact that the BANK coefficient is insignificant, the BANK variable does not affect economic activity in this selected dataset. Overall the emerging market economies portray conformity to Neo-Classical principles in their behaviour. Looking at the backdrop of these emerging market economies the level of bank involvement as a percentage of total financial intermediation in the BRICS economies has led to faster economic growth.

4.3.4 Privy Model

The PRIVY model focuses on funds that are channelled from financial markets to private sector firms. The assumption underlying the involvement of private sector credit flows in this analysis is that the more funds are fun channelled to the private sector the bigger the financial markets are perceived to be. Capital, labour and educational attainment have positive and significant elasticities. Gross national debt and technology both have a negative and significant coefficient. PRIVY the indicator for private sector credit flows has a negative and significant coefficient and so does the BRICS dummy. The interactive dummy is positive and significant at 0.01, implying that BRICS economies grow 2.32% faster than non-BRICS economies due to the volumes of credit that flow to the private sector, all things being equal. These results are consistent with findings in literature on cross-country growth analyses that found a positive effect of credit to private sector on growth (Levine *et al.* 2000).

4.3.5 Depth model

The DEPTH model has to do with the amount of liquidity that is in an economy. The rationale for the inclusion of depth is that the deeper the financial markets are the more people will invest in long term gestation projects since change of ownership is not difficult or does not entail getting a haircut on ones investment as one exits a long term gestation project. The model has significant elasticities for capital, labour and education. Gross national debt has a negative and significant coefficient. DEPTH and BRICS independently have negative and significant coefficients but the interactive term of BRICSDEPTH has a coefficient of 0.05 implying that the depth in BRICS countries makes them grow at about 13% faster than non-BRICS economies, all things being equal.

4.4 Robustness Checks

The models all have significant J-statistics which imply that the instruments that have been utilised correctly over-identify the equation by creating a covariance matrix that minimises the betas or coefficients that are being estimated. The residuals of all the models portray second order correlation which is consistent with GMM models that are estimated with time series that are not in levels (logarithms and percentages in this model) (Spiegel & Benhabib 2001). The second stage of the regression involved the estimation of the impact of external capital flows on investment volatility. Findings from the estimation results are presented in Table 3. The diagnostic tests for the GMM-IV specification indicate that the model is well specified. The new residuals for the GMM-IV specification are, at times, auto-correlated of order 1, but not auto-correlated of order 2. The Sargan test results also confirm the validity of the over-identifying restrictions and use of the instruments.

5 Conclusion

In summary, based on the literature survey it was expected that a positive relationship extending from financial market development indicators to economic growth would be obtained. The econometric analysis found that a 1% increase in financial market depth causes BRICs economies to grow 13% faster than non-BRICS economies. A 1% increase in credit extended to the private sector causes BRICS economies to grow 2.32% faster than their non- BRICS counterparts. More financially open markets can accelerate growth for developing or emerging economies; an increase in the assets of banks compared to the total assets of the financial sector including the central bank, does not cause BRICS economies to grow faster than non-BRICS economies.

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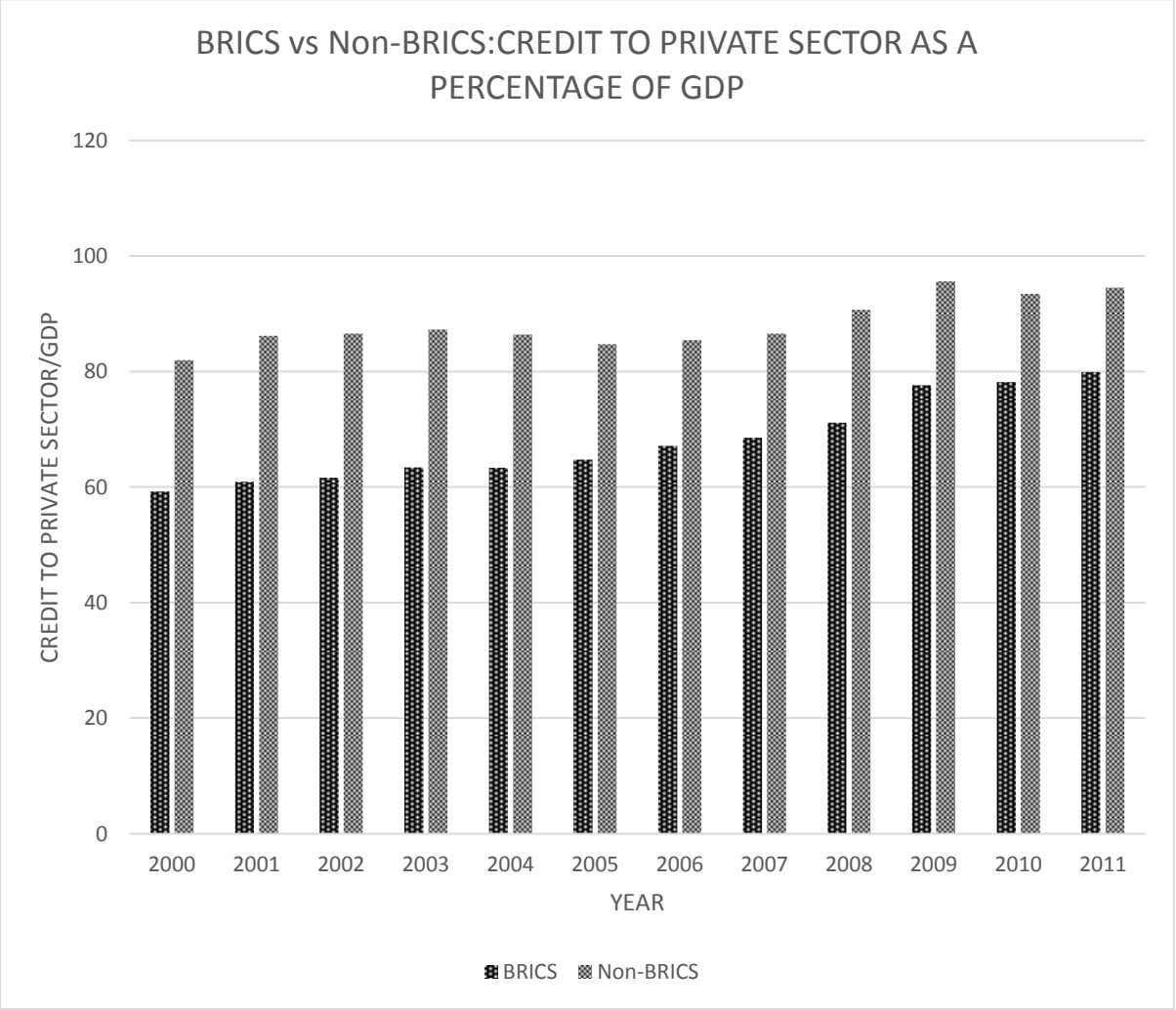
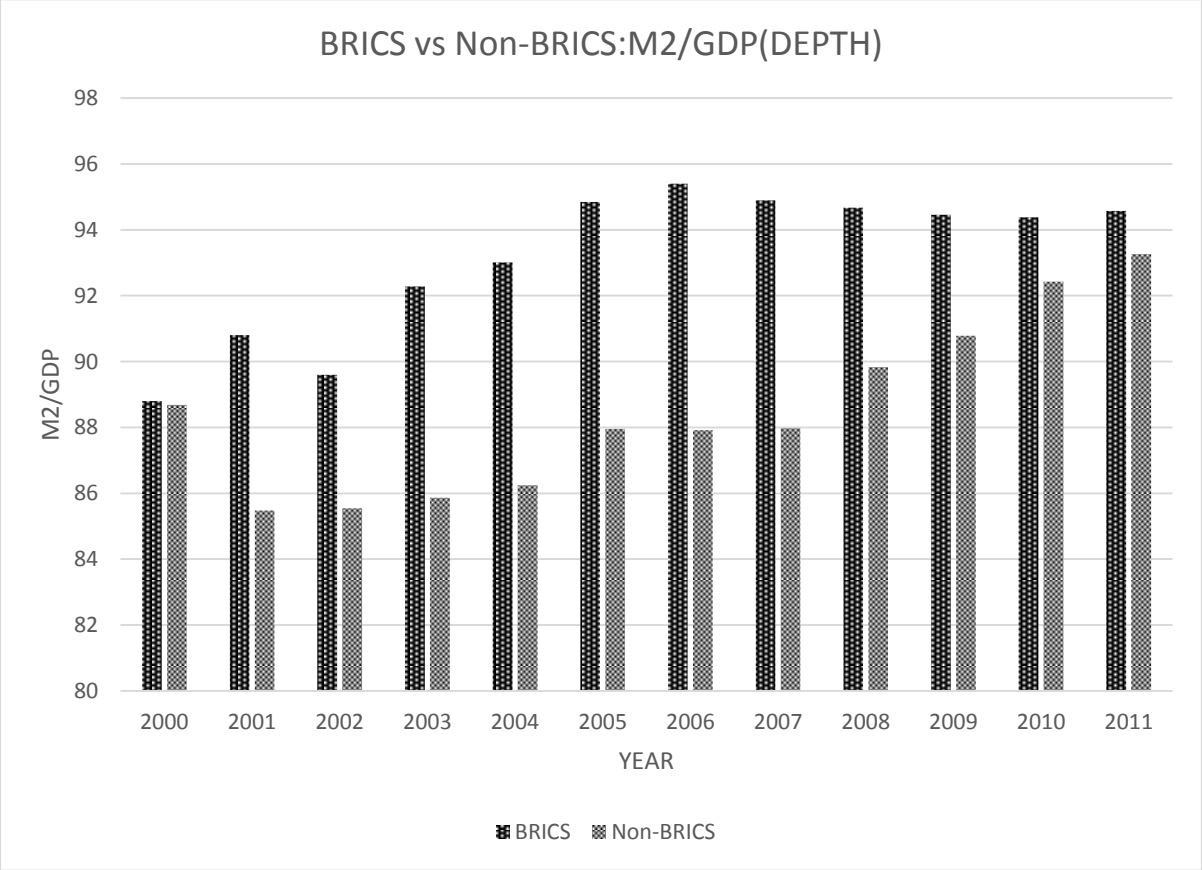
Figure i: BRICS vs Non-BRICS: Credit to private sector as a percentage of GDP



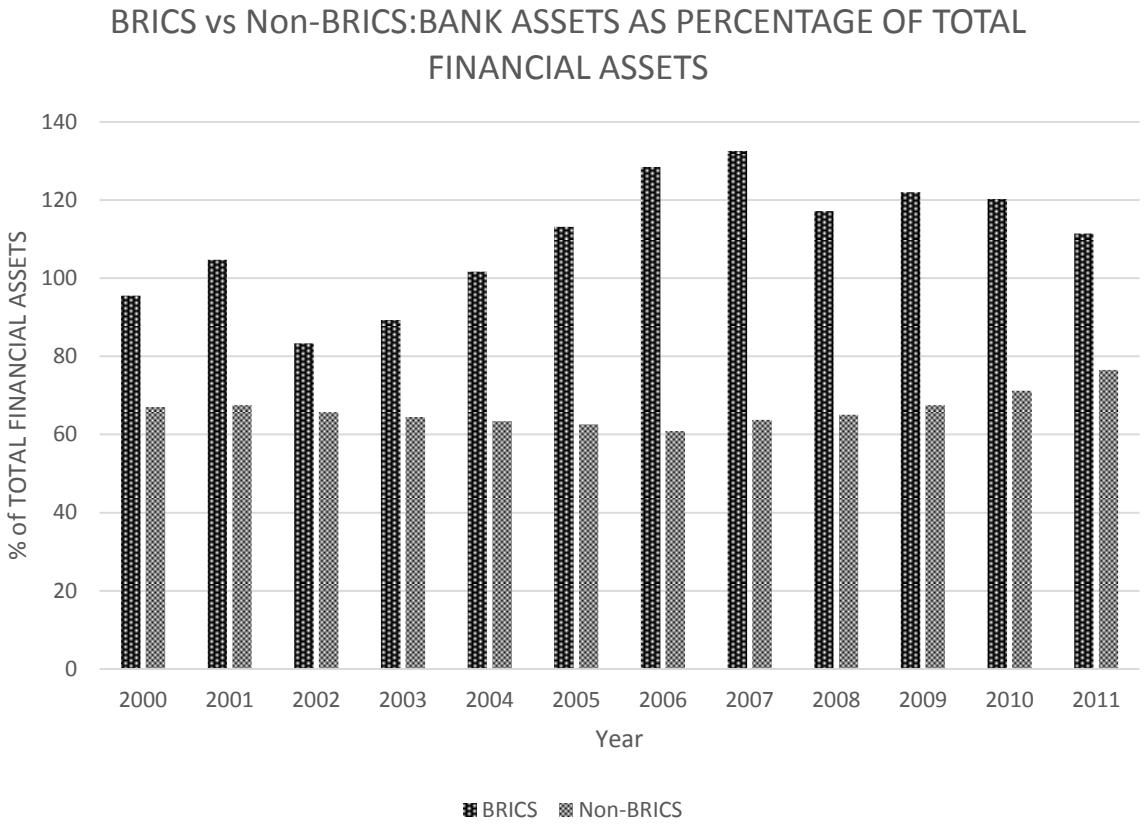
Source: Researcher's calculations based on WEF data

Figure ii: BRICS vs Non-BRICS: Money supply as a percentage of GDP



Source: Researcher's calculations based on WEF data

Figure iii: BRICS vs Non-BRICS: Bank assets as a percentage of total financial assets



Source: Researcher's calculations based on WEF data

Table i: Table i: Data description and sources

Variable	Symbol	Source	Measure
GDP	Y	Penn World tables 8.0	Gross domestic product at consumption levels
Capital Stock	K	Penn World tables 8.0	Stock of machinery and infrastructure utilised in production of goods and services
Labour	L	Penn World tables 8.0	Number of people employed in a given country in a given year
Educational Achievement	H	Penn World tables 8.0	Average number of years of educational attainment
Technological Advancement	TC	World Bank Database 2014	Number of cell phone connections per 1000
Debt	DEBT	World Economic Forum database	Gross national debt to GDP ratio
Openness	OP	World Economic Forum database	Exports +Imports/GDP
Government Expenditure	GE	World Economic Forum database	Government expenditure/GDP
Research and Development	RD	World Bank Database 2014	Research and development expenditure/GDP
Bank	BANK	World Bank Database 2014	Bank assets/(Central Bank Assets + Bank Assets)
Privy	PRIVY	World Bank Database 2014	Credit to private sector/GDP
Depth	DEPTH	World Bank Database 2014	M2/GDP
Gross Fixed Capital Formation	GFCF	World Bank Database 2014	Sum of all improvement in infrastructure, capital equipment and machinery to do business in a given year
DBRICS	DBRICS	Dummy variable	1 if BRICS,0 if otherwise

Table ii: Time series analysis

Variable	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis	Jarque-Bera	Probability
Y	1.19E+12	4.58E+11	1.04E+13	1.28E+11	1.82E+12	3.091414	13.04894	1113.668	0
K	3.77E+12	1.57E+12	4.53E+13	3.29E+11	6.57E+12	3.962363	20.45491	2939.802	0
L	1.04E+08	26689635	7.84E+08	2020546	1.98E+08	2.514369	8.031244	404.813	0
H	2.554339	2.597946	3.244556	1.747066	0.387872	-0.040309	2.275251	4.254079	0.11919
TC	66.47597	64.02441	215.5038	0.343205	46.13253	0.516925	2.643288	9.568701	0.00836
DEBT	53.86581	47.1875	137.512	2.956	26.47551	0.161376	2.708184	1.514601	0.468931
OP	107.9844	59.10387	447.0576	18.03959	110.6156	1.859565	5.176013	148.5356	0
GE	27.56079	26.542	51.806	11.953	8.883436	0.520409	2.572989	10.12511	0.006329
RD	0.950384	0.72282	4.52323	0.04756	1.002768	2.236967	7.747189	340.4151	0
BANK	68.80701	49.40162	202.12	10.49303	47.24929	0.520054	1.997685	16.69169	0.000237
PRIVY	81.95126	59.5006	313.6654	17.36075	60.6066	1.820288	6.669629	213.7598	0
DEPTH	89.95446	95.02998	101.6567	62.70788	10.23788	-0.944551	2.494363	30.59501	0
GFCF	1.45E+11	5.12E+10	1.90E+12	1.33E+10	2.75E+11	4.182369	22.19756	3508.12	0

Table iii: Results of Regressions

Variable	Coefficient BASE MODEL	Coefficient BANK MODEL	Coefficient PRIVY MODEL	Coefficient DEPTH MODEL
C	7.101996 *** (2.273098)	5.224699 *** (2.922997)	7.389367 ** (3.366359)	3.610824 (2.392399)
LOG(K)	0.573272 *** (0.116606)	0.302576 ** (0.143438)	0.261767 *** (0.067327)	0.35564 *** (0.107517)
LOG(L)	0.272981 * (0.139231)	0.676102 *** (0.152503)	0.643097 *** (0.139865)	0.753227 *** (0.075645)
LOG(H)	-0.025912 (1.399919)	3.31463 ** (1.409784)	3.028132 ** (1.205095)	1.82155 * (1.031487)
DEBT	-0.059138 *** (0.044398)	-0.005131 *** (0.00089)	-0.005739 *** (0.000967)	-0.0036664 *** (0.000751)
LOG(TC)	-0.004488 (0.000899)	-0.147932 *** (0.052337)	-0.143097 *** (0.045327)	-0.059058 (0.044112)
OP	-0.00132 ** (0.000601)	0.000145 (0.000436)	-0.000301 (0.000396)	0.000222 (0.000447)
GE	0.001316 (0.088003)	0.001163 (0.003453)	-0.003491 (0.002779)	-0.000846 (0.003465)
RD	-0.006048 (0.000745)	0.040636 (0.096294)	-0.04338 (0.10837)	0.073867 (0.094697)
BANK	0.002182 *** (0.000606)	-0.002435 (0.001863)		
PRIVY	0.000347 (0.001274)		-0.00105 * (0.000598)	
DEPTH	-0.000915 (0.001274)			-0.003728 *** (0.001288)
DBRICS	-0.948691 * (0.471778)	-1.955935 *** (0.322799)	-2.085742 *** (0.48616)	-6.424299 *** (1.080993)
BANK *DBRICS		0.010547 *** (0.003827)		
PRIVY*DBRICS			0.014336 *** (0.000893)	
DEPTH *DBRICS				0.053234 *** (0.010922)
Sargan Statistic	35.89366	17.37720**	17.56097**	22.27493***
AR(1)	0.0000	0.0000	0.0000	0.0000
AR(2)	0.54563	0.2703	0.4311	0.1144

Note: *** significance at 1%, ** significance at 5%, * significance at 1% and Figures in parenthesis are p- values. All regressions were regressed using Δy_{it}, Δk_{it} and Δl_{it} as instruments.