Acta
Universitatis
Danubius

ŒCONOMICA

The Relationship between Mining, Financial Development and Growth. A Case of BRICS

Kunofiwa Tsaurai[1]

Abstract: The study investigated the impact of the complementarity between mining and financial development on economic growth in BRICS (Brazil, Russia, India, China, South Africa) using the dynamic generalized methods of moments (GMM) approach with panel data ranging from 1995 to 2018. Extensive empirical research on the role of either (1) mining on economic growth or (2) financial development on economic growth have been done and it appears that their positive influence on economic growth is no longer debatable and is now a conclusive matter. What is still inconclusive is the non-linear influence (revealed by Arezki and Gylfason. 2011) of either mining or financial development on economic growth. In other words, previous research wrongly assumed that mining has a direct linear influence on economic growth, a view which this study disagrees with. The non-linearity between mining and economic growth is the basis upon which this study is hinged on. Both mining and financial development were individually found to have had a significant positive impact on economic growth in BRICS. However, the study also observed that economic growth of BRICS was enhanced by the complementarity between mining and financial development, consistent with an argument put forward by Bakwena and Bodman (2010). BRICS countries are therefore urged to concurrently develop and implement policies targeted at improving mining sector operations and financial development in order to enhance economic growth. Future studies can investigate the various channels that enhances the mining sector's influence on economic growth in BRICS.

Keywords: Mining Sector; Financial Development; Growth; BRICS; Panel Data

JEL Classification: B26

1. Introduction

This section discusses the background of the study, gaps found in the literature, contribution of the study towards literature and the structure of the rest of the paper.

[1] Full Professor, Department of Finance, Risk Management and Banking, University of South Africa, Address: P.O. Box 392, UNISA 0003, Pretoria, South Africa, Corresponding author: kunofiwa.tsaurai@gmail.com.

1.1. Background of the Study and Gaps Found in the Literature

Theoretical literature argued that mineral resources are a backbone for economic growth in any country. This view was agreed to by theorists such as Singer (1950), Arezki et al (2013), Bhagwati (1958), Kalumbu (2014), Prebisch (1950), Tilton (2012), among others. Esfahani et al (2014) and Cavalcanti et al (2011) are some of the empirical studies which concurred that mining has a long-lasting positive influence on economic growth. Other empirical research concurred that natural resources such as minerals have significant long-term positive effect on economic growth, employment creation and poverty eradication if the right environment exists or prevails (Harvey, et al. 2017; Harvey, et al. 2010; Olakojo, 2015).

What is common is most of the studies on the influence of mining on economic growth is that they wrongly assume that the relationship between the two variables follow a linear format. Few studies such as Arezki and Gylfason (2011) and Bakwena and Bodman (2010) noted that the relationship between mining (natural resources) and economic growth follow a non-linear pattern. What is still not yet agreed is a list of variables which enhances mining's ability to influence economic growth. It is the basis upon which this study investigated the effect of a complementarity between mining and financial development on economic growth in BRICS, in line with Bakwena and Bodman (2010) recommendation.

What is also clear in the existing empirical literature on the subject matter is that endogeneity issues and the dynamic characteristics of economic growth data were ignored. That is wrong because the econometric function which describes economic growth and its explanatory variables suffers from endogeneity problem, consistent with Rahman et al (2019). The fact that economic growth is affected by its own lag, consistent with Rahman et al (2019, p. 570) has not been given any attention in the literature on the influence of mining and economic growth. To the best of the author's knowledge, no empirical study on the relationship between mining, financial development and economic growth within the BRICS context. This study seeks to address all these gaps in the literature.

1.2. Contribution of the Study

In conclusion, Bakwena and Bodman (2010) noted that future studies should examine the influence of financial development as a channel through which natural resources influence economic growth in development countries. This study seeks to address their suggestion by investigating the economic growth influence of the complementarity between mining and financial development in BRICS countries. The author is not aware of any prior empirical research that investigated the impact of the complementarity between mining and financial development on economic growth, let alone using BRICS as a unit of analysis. In other words, this study is the first of its kind to investigate such a phenomenon, more so in the context of BRICS. This study also addresses the endogeneity problem and the dynamic nature of the

economic growth data, something totally ignored in previous similar empirical research on the subject matter.

1.3. Structure of the Paper

The remaining part of the paper is structured as follows: Section 2 focuses on the theoretical literature on the impact of mining on economic growth. Section 3 discusses the influence of mining on economic growth from an empirical literature point of view. Section 4 focuses on the literature that describes the relationship between financial development and economic growth. The impact of financial development on the mining sector is discussed in Section 5. Section 6 discusses the research methodology, data analysis and results interpretation. Section 7 summarizes the study, discusses policy implications and suggests future research.

2. Mining and Economic Growth –Theoretical Literature

Consistent with Singer (1950) and Prebisch (1950), the Prebisch-Singer hypothesis argues that a country that heavily relies on primary commodity exports such as minerals experience a rapid economic growth phase during the time when world commodity prices surge. The same hypothesis noted that the fall in prices and demand of the commodities in international markets lead to economic instability in that country, triggered by balance of trade deficit. Arezki et al (2013) supported the Prebisch-Singer hypothesis whilst a study done by Tilton (2012) contradicted the hypothesis. Contradicting the Prebisch-Singer hypothesis, Kaodor (1987) noted that a rise in prices of natural resource commodities is inflationary in nature hence impeding economic growth.

The immiserizing growth hypothesis developed by Bhagwati (1958) argued that economic growth of a country which over-depend on mineral commodity exports gets negatively affected by fluctuations in the international prices of the commodities especially if the terms of trade deteriorates. The scenario occurs if earlier growth triggered by a rise in commodity price increase is less than the extent of deterioration of the terms of trade.

A slight modification of the Prebisch-Singer hypothesis was done by Kalumbu (2014) who argued that countries which heavily depend on natural resources such as minerals experience negative economic growth when the natural resources depletes and begin experiencing balance of trade deficit.

The founder of the resource curse hypothesis known as Sachs and Warner (1995) noted that mineral commodity booms have a long run negative influence on the growth of the economy. Empirical research done by van der Ploeg (2011), Gylfason (2001) and Gylfason and Zoega (2006) produced results which tacitly supported the resource curse hypothesis. On the contrary, empirical studies by Cavalcanti et al

(2011) and Esfahani et al (2014) found out that abundance of natural commodities is actually a blessing and not a curse to the economic prosperity of country.

According to Olakojo (2015), a rise in world commodity prices negatively affects economic growth of a country which is a net importer of the commodities (minerals). On the contrary, economic growth of a net exporter of commodities tends to increase in response to a rise in in world commodity prices especially if there exists investment expenditure by local firms, high levels of domestic consumption of domestic goods in the economy (Olakojo, 2015, pp. 11).

3. Mining and Economic Growth –Empirical Literature

Table 1. Empirical Literature on the Influence of Mining on Economic Growth

Author	Country/Countries of study	Period	Methodology	Results
Cavalcanti et al (2015)	Persian Gulf countries	1970 to 2007	Generalised methods of moments (GMM)	Increase in prices of commodities led to positive economic growth whereas the volatility of commodity prices resulted in the negative impact on economic growth in Persian Gulf countries.
Nazlioglu and Soytas (2012)	United States (US)	Monthly data from January 1980 to February 2010	Panel co-integration and causality analysis	World commodity prices influenced the prices of agricultural commodities and economic growth
Collier and Goderis (2012)	Global sample of countries	1963 to 2008.	Vector autoregressive (VAR) and panel error correction model	In both the long and short run, an increase in the commodity prices had a significant positive effect on growth and output.
Dick et al (1983)	Kenya, Ivory Coast and Colombia.	1993-2014	Time series data analysis	Abundant foreign currency reserves needed to be available in order to offset negative economic growth triggered by the volatility of commodity prices.
Arezki and Gylfason (2011)	158 global countries	1970 and 2007.	Panel data analysis	Fluctuations in commodity prices had a positive impact on

				economic growth in democratized countries.
Browne and Cronin (2010)	United States of America	U.S quarterly data from first quarter of 1959 to fourth quarter of 2008	Vector autoregressive (VAR) framework	The rise in commodity prices triggered an upward movement in inflation, which in turn negatively affected economic growth in the United States of America.
Medina (2010)	8 Latin American commodity exporting countries	From first quarter of 1975 to fourth quarter of 2008	Panel data analysis	The increase in commodity prices led to over-expenditure and pushed inflation levels up during the period under study
Doroodian and Boyd (2003)	United States of America	1981 to 2001	Time series data analysis	Stable economies which consistently records positive economic growth do not get affected by temporary increase or fluctuations in commodity prices in international markets
Camacho and Perez-Quiros (2014)	Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela	14-year period	Panel data analysis	The business cycle regime that country is in was found to be the major determinant of the extent to which commodity prices influence economic growth across all the countries studied.
Dehn (2000)	113 developing countries	1957 to 1997	Panel data analysis	In the long run, commodity price shocks negatively influenced GDP per capita regardless of the economic policy types implemented by the government. In the short run, commodity price shocks had a positive effect on economic growth. The same study noted that volatility of commodity prices had a

23

				negligible impact on economic growth in developing countries studied.
Addison and Ghoshray (2014)	Sub-Saharan African countries	1960 and 2010	VAR framework	In Sub-Saharan African countries, commodity price shocks had a deleterious effect on economic growth
Emara et al (2015)	Developing countries	1980 to 2010	Panel data analysis	In developing nations which are endowed with natural resources, economic growth did not significantly benefit from commodity price increase if its governance index was low. In general, an increase in commodity prices triggered significant positive influence on economic growth in developing countries during the period under study
Hua (1998)	22 industrial economies	1970 to 1993	Error correction (ECM) approaches	Increase in commodity prices was associated with volatile exchange rates, interest rates and inflation during the period under study

Source: Author Compilation

4. Impact of Financial Development on Economic Growth

Levine (1997) presented a theoretical framework showing how financial development affects economic growth. In summary, Levine (1997) noted that financial markets enhance economic growth through their ability to mobilise savings, efficiently allocate resources, facilitates risk management, exert corporate control and provide liquidity to enable ease of trading of goods and services.

According to Diamond and Dybvig (1983), the financial sector enables investors to have access to high return investment opportunities which normally are illiquid through pooling their liquidity risk. The view was supported by Pagano (1993) whose study noted that individuals are allowed to participate in unit trusts thus promoting diversification and risk sharing. This function of the financial sector enables the pooling together of more funds and channeling them towards economic growth of the country. Liquidity that is provided by the financial sector allows some of the financial assets (national certificates of deposits, shares, bankers' acceptances) to be used as collateral security to allow productive firms and or projects to access funds (Levine, 1997; Osinubi, 1998).

Moreover, Schumpeter (1911) argued that financial sector is able to efficiently allocate resources to firms that are better place to meaningfully contribute towards economic growth through technological innovation and innovative products manufacturing. The same author argued that financial sector facilitates economic growth through risk diversification, savings pooling and efficiently allocating them to the sectors of the economy which are productive. Shaw (1973), McKinnon (1973), Goldsmith (1969) and Townsend (1983) agreed that information costs reduction, savings mobilization, risk management services, loan provision transaction costs reduction and efficient allocation of available financial resources to more productive projects are different ways through which economic growth is enhanced by financial sector development.

5. The Influence of Financial Development on the Mining Sector

Bakwena and Bodman (2010) noted that financial sector development enhances mining activities in the following ways: (1) It allows mining firms to easily access finance to purchase heavy equipment normally required for extraction activities in mining (2) It enables mining firms to list on local stock exchanges hence enabling mining firms to raise capital from the primary markets through selling shares, (3) listing mining firms enables them to access liquidity as and when they require it for their activities and (4) the financial sector enables mining companies to convert their expected export proceeds to liquidity through the discounting of letters of credit and or bankers' acceptance, (5) financial sector helps the mining sector by providing research based information on relevant international commodity markets and (6) providing risk management financial products for the mining sector. The study therefore expects that the complementarity between mining and financial development enhances economic growth, not only in BRICS but in any economic grouping.

6. Research Methodology

This section has five sub-sections, namely data and its sources, general model specification, econometric model specification, pre-estimation diagnostics and lastly main data analysis, results presentation and interpretation.

6.1. Data and its Sources

Using BRICS (Brazil, Russia, India, China, South Africa) as a unit of analysis, this research employed the dynamic generalized methods of moments (GMM) econometric estimation technique. Panel data used ranges from 1995 to 2018. Whilst economic growth is the dependent variable, the independent variables used include mining, foreign direct investment, inflation, financial development, trade openness

and savings. International Financial Statistics databases, Global Financial Indicators, United Nations Development Programme reports and World Bank Indicators are the reputable international public databases from which secondary data used was extracted.

6.2. General Model Specification

In line with similar empirical research done by Emara et al (2015) and Addison and Ghoshray (2014), the economic growth function is presented as follows:

GROWTH=f (MIN, FIN, FDI, OPEN, INFL, SAV)   (1)

Where GROWTH, MIN, FIN, FDI, OPEN, INFL and SAV represents economic growth, mining, financial development, foreign direct investment, trade openness, inflation and savings respectively.

Majority of earlier empirical research work on the subject matter preferred to use similar independent variables, namely Nazlioglu and Soytas (2012), Arezki and Gylfason (2011), Camacho and Perez-Quiros (2014) and Cavalcanti et al (2015).

6.3. Econometric model specification

In econometric terms, equation 1 is transformed into equation 2.

$$GROWTH_{it} = \beta_0 + \beta_1 MIN_{it} + \beta_2 FIN_{it} + \beta_3 (MIN_{it}.FIN_{it}) + \beta_4 X_{it} + \mu + \varepsilon \quad (2)$$

Where μ represents the time invariant and unobserved country specific effect β_0 stands for the intercept term whilst ε is the error term. X_{it} is the vector of independent variables. Time and country is respectively represented by t and i subscripts.

Gross domestic product per capita, mineral rents (% of GDP), domestic credit by financial sector to GDP, net foreign direct investment (% of GDP), total trade (% of GDP), inflation consumer prices (annual %) and gross domestic savings (% of GDP) were the proxies used to measure economic growth, mining, financial development, foreign direct investment, trade openness, inflation and savings respectively. A significant positive co-efficient (β_3) means that the mining and financial development complement each other in enhancing economic growth in BRICS.

6.4. The Influence of Control Variables on Economic Growth

This section discussed how each control variable influences economic growth, from a theoretical point of view (summarized in Table 2).

Table 2. Theory Intuition and Expected Sign(s)

Variable	Theory intuition	Source	Expected sign
FDI	Romer (1986) argued FDI brings in along with it human capital development, new skills, new technology and technical know-how, aspects which are key inputs into the production process and economic growth of any country.	Romer (1986)	+
OPEN	According to Baltagi et al (2009), imports are essential for economic growth because they enable local firms and industries to access high quality inputs, resources and implements that are necessary for the proper functioning of the economy. Exports are also necessary for the proper functioning and growth of the economy because they bring in foreign currency. Baltagi et al (2009) also argued that trade openness can have a negative effect on economic growth especially because it exposes the economy to any international shocks that may occur.	Baltagi et al (2009)	+/-
INFL	According to Mallik and Chowdhury (2001), high inflation discourages the savings mobilisation efforts, contributes to the depreciation of the domestic currency and makes imports very expensive thereby negatively affecting economic growth efforts.	Mallik and Chowdhury (2001)	-
SAV	Savings can be invested in sectors of the economy which are productive thereby enhancing economic growth (McKinnon. 1973). The same author also noted that savings provides liquidity thereby lubricating the economy.	McKinnon (1973)	+

Source: Author's Compilation

6.5. Pre-estimation Diagnostics

This section presents and discusses the correlation results and trend analysis of key variables of BRICS.

Table 3. Correlation Results

	GROWTH	MIN	FIN	FDI	OPEN	INFL	SAV
GROWTH	1.00						
MIN	0.0327***	1.00					
FIN	0.4379***	0.0012***	1.00				
FDI	0.5129***	0.0318**	0.0271***	1.00			
OPEN	0.3719***	0.0127**	0.0087	0.0719**	1.00		
INFL	-0.4193***	-0.3418*	-0.1372	-0.1121	0.0005	1.00	
SAV	0.0034***	0.0018	0.0381**	0.0418	0.0278	-0.0455	1.00

Note: ***/**/* denotes statistical significance at the 1%/5%/10% level respectively.
Source: Author compilation from E-Views

The maximum correlation is between financial development and economic growth which is 43.79%. This is evidence that there is no multi-collinearity problem among all the variables used in this study, consistent with Stead (1996). As already observed in the literature, Table 2 shows the existence of a significant positive relationship between (1) mining and economic growth, (2) financial development and economic growth, (3) foreign direct investment and economic growth, (4) trade openness and economic growth and (5) savings and economic growth. In line with existing literature on inflation-growth nexus, a significant negative relationship was observed between inflation and economic growth (see Table 3).

Trend analysis (1995-2018) for key variables in the study such as economic growth, mining and financial development variables in BRICS is presented in Table 4.

Table 4. Economic Growth, Mining and Financial Development Trends in BRICS (1995-2018)

Countries	GDP per capita	Mineral rights (% of GDP)	Domestic credit by financial sector (% of GDP)
Brazil	7 166.08	1.53	61.81
Russia	7 202.08	0.83	30.53
India	1 003.58	0.75	46.59
China	3 730.99	0.78	109.17
South Africa	5 157.39	1.98	167.67
Overall Mean	**4 852.02**	**1.18**	**83.15**

Source: Author's own compilation

Brazil (US$7 166.08), Russia (US$7 202.08) and South Africa (US$5 157.39) had their GDP per capita greater than the overall mean GDP per capita of US$4 852.02 whilst India and China's mean GDP per capita were less than the overall mean GDP per capita value. Brazil, Russia and India are outliers because their mean GDP per

capita values deviated from the mean GDP per capita value (US$4 852.02) by a very wide margin. Countries whose mean mineral rights (% of GDP) were lower than the overall mean mineral rights value of 1.18% of GDP are Russia, India and China whilst Brazil and South Africa's mean mineral rights (% of GDP) were higher than the overall mean mineral rights value. Considering the deviation between mean mineral rights of each BRICS country and the overall mean mineral rights for all country studied, outliers include India, China and South Africa. Brazil, Russia and India are the BRICS nations whose mean domestic credit by financial sector (% of GDP) were lower than the overall mean domestic credit by financial sector of 83.15% of GDP. China and South Africa's mean domestic credit by financial sector were higher than the overall mean domestic credit by financial sector value of 83.15% of GDP. Russia, India and South Africa are outliers in this case because their mean domestic credit by financial sector (% of GD) deviated from the overall mean domestic credit by financial sector of 83.15% of GDP by quite a substantial margin. Before data analysis procedures could take place, all the variables used in the study were converted into natural logarithms in order to decisively do away from problems associated with outliers, multi-collinearity and data that does not follow a normal distribution pattern, consistent with Aye and Edoja (2017). The latter also noted that transforming data into natural logarithms before data analysis helps to avoid spurious results.

6.6. Panel Unit Root Tests

Levin, Lin and Chu (2002), Im, Pesaran and Shin (2003), Augmented Dicky Fuller (ADF) Fisher Chi Square and PP Fisher Chi Square tests were used to determine whether the data was stationary or not, stable or unstable, volatile or non-volatile.

Table 5. Panel Root Tests – Individual Intercept

	Level				First difference			
	LLC	IPS	ADF	PP	LLC	IPS	ADF	PP
LGROWTH	1.3312	4.1730	8.1239	7.1293	-5.1298**	-5.8821**	91.9219**	101.2183*
LMIN	-2.17***	-1.82**	62.82***	88.12***	-10.18***	-10.54***	150.83***	403.18***
LFIN	-2.72***	-1.73***	56.04**	98.28***	-11.83***	-12.63***	202.18***	523.73*
LFDI	-4.99***	-4.83***	101.25***	141.63**	-10.14***	-11.32***	202.16***	951.03**
LOPEN	-1.66	0.99	30.12	62.82**	-8.91***	-9.38***	165.26***	361.05***
LINFL	-3.92***	-2.73***	66.92***	113.16**	-11.02***	-12.82***	194.02***	672.05**
LSAV	-1.23*	-1.45*	39.92**	55.92***	-7.92***	-8.12***	133.18***	493.02**

Note: LLC, IPS, ADF and PP stands for Levin, Lin and Chu; Im, Pesaran and Shin; ADF Fisher Chi Square and PP Fisher Chi Square tests respectively. *, ** and *** denote 1%, 5% and 10% levels of significance, respectively.

Source: Author's compilation - E-Views figures

The null hypothesis is that variables are stationary whilst the alternative hypothesis is that variables are non-stationary. At level, not all the variables' probability values were significant. This means that not every variable was stationary at level. On the contrary, the probability values of all the variables used in the study were significant at first difference hence the null hypothesis which says that variables are stationary is not rejected.

6.7. Panel Co-Integration Tests

The existence of a long run relationship between and among the variables was tested using Kao (1999) panel co-integration procedure, in line with other empirical studies such as Okoroa and Chinweoke (2013). Odhiambo (2014) noted that if the variables used are co-integrated, it means that there is a long run relationship between and or among the variables studied.

Table 6. Results of Kao Co-Integration Tests

Series	ADF t-statistic
GROWTH MIN DCF FDI OPEN INFL SAV	-2.0005***
GROWTH MIN SMC FDI OPEN INFL SAV	-4.5431***
GROWTH MIN DPD FDI OPEN INFL SAV	-3.2295***

Source: Author Compilation

Where DCF stands for domestic credit by financial sector (% of GDP), SMC represents stock market capitalization (% of GDP) whilst DPD is outstanding domestic private debt securities (% of GDP). In all the three economic growth functions using different measures of financial development, the variables were found to be co-integrated (long run relationship among the variables used was established). The results of both panel unit root and co-integration tests allowed main data analysis (causality analysis) to happen, in line with Guisan (2014).

6.8. Main Data Analysis, Results Presentation and Interpretation

The dynamic GMM results of the economic growth function are presented in Table 7.

Table 7. Dynamic Generalised Methods of Moments (GMM) Results

	Model 1	Model 2	Model 3
GROWTH$_{i,t-1}$	0.2347***	0.0479***	0.3409***
MIN	0.2885**	0.0006**	0.2387**
FIN	0.3421*	0.2412*	0.0045**
MIN.FIN	0.4005***	0.3338***	0.0126***
FDI	0.0005***	0.1133***	0.0896**
OPEN	0.0543*	0.3720	0.0045**
INFL	-0.0056	-0.2228*	-0.0077*
SAV	0.3352*	0.0056*	0.1437*
Adjusted R-squared	0.76	0.71	0.77
J-statistic	317	317	317
Prob(J-statistic)	0.00	0.00	0.00

***, ** and * denote 1%, 5% and 10% levels of significance, respectively.
Source: Author's compilation from E-Views

Model 1 used domestic credit by financial sector (% of GDP), model 2 employed stock market capitalization ratio whilst outstanding domestic private debt securities to GDP was used in model 3 as measures of financial development.

Across all the three models, economic growth was found to have been positively and significantly influenced by its own lag, in line with Rahman et al (2019), whose study revealed that earlier economic growth had a significant positive influence on current economic growth in South Asia.

Mining sector was found to have had a significant positive impact on economic growth, consistent with earlier empirical studies such as Prebisch (1950) and Singer (1950) whose studies argued that countries which relies heavily on primary commodity exports like minerals experience a significant positive economic growth during the time when world commodity prices increase.

Financial development also had a significant positive effect on economic growth in all the three models. The results resonate with authors such as Levine (1997), McKinnon (1973), Shaw (1973), Townsend (1983) and Goldsmith (1969) whose studies argued that financial development improves economic growth through efficient resource allocation in the economy, mobilizing savings, exerting corporate control in the economy, liquidity provision to enable ease of trading of goods and services and facilitating risk management.

The study revealed that the complementarity between mining sector and financial development had a significant positive influence on economic growth in BRICS group of nations, consistent with researchers such as Bakwena and Bodman (2010). What is more striking is that the co-efficient size of the complementarity variable is larger than the co-efficient size of either mining or financial development variable.

Such a result means that complementarity between mining and financial development enhanced economic growth in BRICS countries, in line with Bakwena and Bodman (2010) whose research argued that financial development could be a channel through which natural resources enhances economic growth especially in developing economies.

Foreign direct investment was found to have had a significant positive effect on economic growth in BRICS nations across all the three models, consistent with earlier researchers such as Romer (1986) who argued that that FDI brings in along with it human capital development, new skills, new technology and technical know-how, aspects which are key inputs into the production process and economic growth of any country.

Trade openness had a significant positive impact on economic growth in BRICS under models 1 and 3 whilst trade openness was found to have had a non-significant positive influence on economic growth in BRICS under model 2. These results on trade openness led growth hypothesis resonate with authors such as Baltagi et al (2009) whose study argued that high levels of trade openness enables a country to export its goods and services, brings in foreign currency that would have long term positive impact on economic growth.

In line with researchers such as Mallik and Chowdhury (2001), this study found out that inflation had a significant negative influence on economic growth across all the three models in BRICS countries. Economic growth was also found to have been positively and significantly influenced by savings, results which resonate with authors such as McKinnon (1973) who argued that savings increases the quantity and value of investment that goes into the productive sectors of the economy.

7. Summary, Policy Implications and Suggested Future Research

The study investigated the impact of the complementarity between mining and financial development on economic growth in BRICS using the dynamic GMM approach with panel data ranging from 1995 to 2018. Extensive empirical research on the role of either (1) mining on economic growth or (2) financial development on economic growth have been done and it appears that their positive influence on economic growth is no longer debatable and is now a conclusive matter. What is still inconclusive is the non-linear influence (revealed by Arezki and Gylfason. 2011) of either mining or financial development on economic growth. Both mining and financial development were individually found to have had a significant positive impact on economic growth in BRICS. However, the study also observed that economic growth of BRICS was enhanced by the complementarity between mining and financial development, consistent with an argument put forward by Bakwena and Bodman (2010). BRICS countries are therefore urged to concurrently develop

and implement policies targeted at improving mining sector operations and financial development in order to enhance economic growth. Future studies can investigate the various channels that enhances the mining sector's influence on economic growth in BRICS.

References

Addison, T. & Ghoshray, A. (2014). *Agricultural commodity price shocks and their effect on growth in Sub-Saharan Africa*. University of Bath, Department of Economics, United Kingdom.

Arezki, R. & Gylfason, T. (2011). Commodity price volatility, democracy and economic growth. *CESifo Working Paper Number*, 3619, pp. 1-20.

Arezki, R.; Hadri, K.; Loungani, P. & Rao, Y. (2013). Testing the Prebisch-Singer hypothesis since 1650: Evidence from panel techniques that allow for multiple breaks. *International Monetary Fund Paper Working Paper. Working Paper* No. 13/180, pp. 1-37.

Aye, G. C. & Edoja, P. E. (2017). Effect of economic growth on C02 emission in developing countries: Evidence from a dynamic panel threshold model. *Cogent Economics and Finance,* 5 (1), pp. 1-22.

Baltagi, B. H.; Demitriades, P. O. & Law, S. H. (2009). Financial development, openness and institutions: Evidence from panel data. *Journal of Development Economics,* 89 (2), pp. 285-296.

Bakwena, M. & Bodman. P. (2010). The Role of Financial Development in Natural Resource Abundant Economies: Does the Nature of the Resource Matter? *Botswana Journal of Economics,* 7 (11), pp. 16-31.

Bhagwati, J. (1958). Immiserizing growth: A geometrical note. *Review of Economic Studies,* 25(3), pp. 201-205.

Browne, F. & Cronin, D. (2010). Commodity prices, money and inflation. *Journal of Economics and Business,* 62(4), pp. 331-345.

Camacho, M. & Perez-Quiros, G. (2014). Commodity prices and the business cycle in Latin America: Living and dying by commodities? E*merging Markets Finance and Trade,* 50(2), pp. 110-137.

Cavalcanti, T. V. D. V.; Mohaddes, K. & Raissi, M. (2011). Growth, development and natural resources: New evidence using a heterogeneous panel analysis. *Quarterly Review of Economics and Finance,* 51(4), pp. 305-318.

Cavalcanti, T. V. D. V.; Mohaddes, K. & Raissi, M. (2015). Commodity price volatility and the sources of growth. *Journal of Applied Econometrics,* 30(6), pp. 857-873.

Collier, P. & Goderis, B. (2012). Commodity prices and growth: An empirical investigation. *European Economic Review,* 56(6), pp. 1241-1260.

Dehn, J. (2000). Commodity price uncertainty and shocks: Implications for economic growth. *Centre for the study of African Economies, Department of Economics of Economics University of Oxford*, WPS/2000-10.

Diamond, D. W. & Dybvig, P. H. (1983). Bank runs, deposit insurance and liquidity. *The Journal of Political Economy*, 91 (3), pp. 401-419.

Dick, H.; Gupta, S.; Mayer, T. & Vincent, D. (1983). The short run impact of fluctuating primary commodity prices on three developing economies: Colombia, Ivory Coast and Kenya. *World Development,* 11(5), pp. 405-416.

Doroodian, K. & Boyd, R. (2003). The linkage between oil prices shocks and economic growth with inflation in the presence of technological advances: A CGE model. *Energy Policy,* 31(10), pp. 989-1006.

Emara, N.; Simutowe, A. & Jamison, T. (2015). Commodity price changes and economic growth in developing countries. *Journal of Business and Economics,* 4 (10), pp. 1707-1712.

Esfahani, H. S.; Mohaddes, K. & Pesaran, M. H. (2014). An empirical growth model for major oil exporters. *Journal of Applied Econometrics,* 29(1), pp. 1-21.

Goldsmith, R. W. (1969). *Financial structure and development*. Yale University Press, New Haven, CT.

Guisan, M. C. (2014). World Development, 2000-2010: Production, Investment and Savings in 21 Areas of America, Africa, Asia-Pacific, Europe and Eurasia. *Regional and Sectoral Economic Studies*, 14 (2), pp. 193-211.

Gylfason, T. (2001). Natural resources, education and economic development. *European Economic Review,* 45(4-6), pp. 847-859.

Gylfason, T. & Zoega, G. (2006). Natural resources and economic growth: the role of investment. *World Economy,* 29(8), pp. 1091-1115.

Harvey, D. I.; Kellard, N. M.; Madsen, J. B. & Wohar, M. E. (2010). The Prebisch-Singer hypothesis: Four centuries of evidence, *Review of Economics and Statistics,* 92(2), pp. 367-377.

Harvey, D. I.; Kellard, N. M.; Madsen, J. B. & Wohar, M. E. (2017). Long run commodity prices, economic growth and interest rates: 17th century to the present day. *World Development,* 89, pp. 57-70.

Hua, P. (1998). On primary commodity prices: The impact of macroeconomic/Monetary shocks, *Journal of Policy Modeling,* 20(6), pp. 767-790.

Im, K. S.; Pesaran, M. H. & Shin, Y. (2003). Testing unit roots in heterogeneous panels. *Journal of Econometrics,* 115 (1), pp. 53-74.

Kalumbu, S. (2014). Terms of trade and economic growth in Namibia. *An Online International Research Journal,* 1(3), pp. 90-101.

Kaodor, N. (1987). The role of commodity prices in economic recovery, *World Development,* 15(5), pp. 551-558.

Kao, C. (1999). Spurious regression and residual-based tests for co-integration in panel data. *Journal of Econometrics*, 90 (1999), pp. 247-259.

Levine, R. (1997). Financial development and economic growth: Views and agenda. *Journal of Economic Literature*, 35 (2), pp. 688-726.

Levin, A.; Lin, C. F. & Chu, C. S. J. (2002). Unit root tests in panel data: Asymptotic and finite-sample properties. *Journal of Econometrics,* 108, (1), pp. 1-24.

Mallik, G. & Chowdhury, A. (2001). Inflation and economic growth: Evidence from four South Asian countries. *Asia-Pacific Development Journal,* 8 (1), pp. 123-135.

McKinnon, R. I. (1973). *Money and Capital in Economic Development.* The Brooklings Institution, Washington, DC.

Medina, L. (2010). The dynamic effects of commodity prices on fiscal performance in Latin America. *IMF Working Paper Number WP/10/192*.

Nazlioglu, S. & Soytas, U. (2012). Oil price, agricultural commodity prices and the dollar: A panel co-integration and causality analysis. *Energy Economics*, 34(4), pp. 1098-1104.

Odhiambo, N. M. (2014). Financial systems and economic growth in South Africa: A dynamic complementary test. *International Review of Applied Economics,* 28(1), pp. 83-101.

Okoroafor, M. O. & Chinweoke, N. (2013). Poverty and economic growth in Nigeria 1990-2011. *The Macrotheme Review*, 2 (6), pp. 105-115.

Olakojo, S. A. (2015). Export commodity prices and long run growth of primary commodities based African economies. Centre for the Study of the Economies of Africa. *Working Paper* WPS/15/02, pp. 1-23.

Osinubi, T. S. (1998). Stock Market Development and Long-run Growth in Nigeria. M.Sc. *Economics Dissertation*. University of Ibadan Nigeria.

Pagano, M. (1993). Financial markets and growth: An overview. *European Economic Review,* 37 (2-3), pp. 613-622.

Prebisch, R. (1950). The economic development of Latin America and its principal problems. *Economic Bulletin for Latin America*, 7 (1), pp. 1-22.

Rahman, M. M.; Rana, R. H. & Barua, S. (2019). The drivers of economic growth in South Asia: Evidence from a dynamic system GMM approach. *Journal of Economic Studies*, 46 (3), pp. 564-577.

Romer, P. (1986). Increasing returns and long run economic growth. *Journal of Political Economy*, 94(5), pp. 1002-1037

Sachs, J. D. & Warner, A. M. (1995). Natural resource abundance and economic growth. National Bureau of Economic Research. *Research Working Paper* No. 5398.

Schumpeter, J.A. (1911). *The Theory of Economic Development.* Harvard University Press, Cambridge, MA.

Shaw, E.S. (1973). *Financial Deepening in Economic Development*. Oxford University Press, New York, NY.

Singer, H. (1950). Comments to the terms of trade and economic development. *Review of Economics and Statistics*, 40 (1), pp. 84-89.

Stead, R. (1996). *Foundation quantitative methods for business*. Prentice Hall. England.

Tilton, J. (2012). The terms of trade debate and the policy implications for primary product producers. Division of Economics and Business Working Paper Series. *Working Paper* No. 2012-11, pp. 1-16.

Townsend, M. R. (1983). Financial structure and economic activity. *American Economic Review,* 73 (5), pp. 895-911.

Van der Ploeg, F. (2011). Natural resources: curse or blessing. *Journal of Economic Literature*, 49(2), pp. 366-420.