AN ANALYSIS OF ECONOMIC COMPLEXITY AND SELECTED MACROECONOMIC INDICATORS IN SELECTED SSA AND BRICS COUNTRIES: PANEL DATA ANALYSIS

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DECLARATION

I declare that the dissertation titled "**AN ANALYSIS OF ECONOMIC COMPLEXITY AND SELECTED MACROECONOMIC INDICATORS IN SELECTED SSA AND BRICS COUNTRIES: PANEL DATA ANALYSIS"** is my own work and that all the sources that I have used or quoted have been indicated and acknowledged by means of complete references and that this work has not been submitted before for any other degree at any other institution.

Full names	**Date**
Sehludi Brian Molele	2022/03/21

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Psalm 3:6.

'In all your ways submit to him,
and he will make your paths straight'

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ABSTRACT

This study investigated the relationship between economic complexity and the three macroeconomic variables in a comparative setting between selected Sub-Saharan African (SSA) and BRICS countries. Economic complexity as a development index reveals how sophisticated a country is as shown by its exports structure through the Product Complexity Index (PCI) and Economic Complexity Index (ECI). The three macroeconomic variables are gross domestic product per capita (GDP per capita), current account and fixed investment (gross fixed capita formation) for the period 1994 to 2018.The first three set study objectives were investigated on whether there exists a short and long-run relationship through a Panel Autoregressive Distributed Lag (PARDL). The the fourth objective was to test for causality through a standard Granger causality, and fifth, to forecast the macroeconomic variables for the foreseeable future utilising the Impulse Response Function (IRF) and the variance decomposition techniques, these are complementary techniques. The last two objectives were to draw a comparative analysis upon the findings, and to relate on the product complexities and economic landscape in the selected SSA and BRICS. Reporting on the ECI-GDP per capita nexus, the PARDL estimates revealed a positive and significant association between ECI and GDP per capita in both the selected SSA and BRICS in the long-run. There was no Granger causal effect between ECI and GDP per capita for both set of countries. The concern was in relation to forecasting GDP per capita due to a shock in ECI. The selected SSA GDP per capita response to a shock in ECI was neutral when adopting the IRF technique, and the variance decomposition also revealed small estimates in both the short and long-run, below 1%. In the BRICS economies, there was a meaningful positive reaction from a shock in ECI when deploying the IRF technique, while the variance decomposition had a 3% response in the long run when seen through the variance decomposition.

On the current account-ECI relationship, the PARDL estimates exposed that there was a positive and significant impact from ECI on the current account in both the groups in the long-run significant while short-run results were insignificant. Granger causality could not detect any causal effect between ECI and current account in the selected SSA, while in the BRICS countries there was a unidirectional causal effect from ECI to current account. When forecasting the current account, the selected SSA reacted negatively to a shock in

ECI seen through the IRF, and the variance decomposition also revealed a small reaction in any period. In the BRICS case, current account's response was a positive and explosive reaction from a shock in ECI when applying the IRF technique. The VD revealed a higher change in current account was explained by a shock in ECI. On the ECI-Fixed Investment, the PARDL estimates showed that there was a long-run positive and significant effect between ECI and fixed investment in bothgroups. However, the Granger causal results revealed no presence of causality in the selected SSA, while there was causal unidirectional effect from ECI to fixed investment. The IRF technique revealed a negative fixed investment reaction from a shock in ECI, and the variance decomposition results revealed a small reaction in fixed investment in the selected SSA. In the BRICS case, there was a positive and explosive fixed investment emanating from a shock in ECI. Utilising the variance decomposition fixed investment in BRICS was explained by innovative shocks in ECI in the long run.

On the last two objectives, comparatively the selected SSA countries are disadvantaged as they are concentrated in negative ECI as seen in the descriptive statistics, reflecting that they are still much less developed. This tells us that they are less industrialised as compared to the BRICS nations who are better off. These selected SSA economies are not developed enough as compared to the BRICS nations. The SSA region needs to learn from the leading BRICS countries by creating a conducive environment for a better development of innovation that improves the domestic value chain that produces knowledge-based products for the export market. The rest of the selected SSA region should form part of economic integrations with the more developed countries that offer mutual beneficiation like South Africa to fast track the developmental of their states. There is a need to modernise the agricultural and agro-industries. The region should harness the full potential of its agricultural sector. This will create a large global market share and perhaps increase the current account outlook through trade with more efficient agro-processed products. Africa needs to scale up investment in many fronts from government to private investment to improve infrastructure, more so that the scale of needs is so much in the continent.

KEY CONCEPTS: Economic Complexity, GDP per capita, Current Account, Fixed Investment, Panel Autoregressive Distributive Lag (PARDL), Causality, Forecasting.

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ABREVIATIONS AND ACRONYMS

ACET	African Centre for Economic Transformation
ADF	Augmented Dickey-Fuller
AfCFTA	African Continental Free Trade Agreement
AfDB	African Development Bank
BRICS	Brazil, Russia, India, China and South Africa
DBSA	Development Business of Southern Africa
ECI	Economic Complexity Index
ECLAC	Economic Commission for Latin America and the Caribbean
GDPpc	Gross Domestic Products per capita
ICA	Infrastructure Consortium for Africa's
IMF	International Monetary Fund
IPS	Im, Pesaran & Shin
ITC	International Trade Centre
IRF	Impulse Response Function
JB	Jarque-Bera
LLC	Levin, Lin & Chu
MIT	Massachusetts Institute of Technology
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development
UNCTD	United Nations Conference on Trade and Development
PP	Phillips-Perron
PCI	Product Complexity Index
SSA	Sub-Saharan Africa
Stats SA	Statistics South Africa
TGTT	Technological Gap Theory of Technology
NTT	New Trade Theory
ATI	Accelerator Theory of Investment

CHAPTER 1

ORIENTATION OF THE STUDY

1.1. INTRODUCTION AND BACKGROUND

The analysis of the network of global trade properties has generated new insights into the developmental level in economies and the pattern thereof across countries (Mealy, Farmer & Teytelboym, 2018). A re-emerging concept of economic complexity gives a representation of the productive assembly rooted in the goods and services that an economy produces and exports (Hausmann & Klinger, 2006; Hidalgo & Hausmann, 2009). This is a relatively new field of research that provides a framework to investigate macroeconomic competitiveness and economic development (Zaccaria, Mishra, Cader & Pietronero, 2018). The first attempt of applying this framework to macroeconomics was proposed in a series of papers that used a network of products to investigate the development of countries (Hidalgo & Hausmann, 2009; Zaccaria *et al*., 2018). As such, reasoned that an economy that produces and exports sophisticated goods accelerates economic efficiency, signifying that economic progress is complemented by an increase in the number of activities and with the complexity that arises from the relations between them (Hidalgo & Hausmann, 2009).

Economic complexity is seen to capture the development state of economies by reflecting upon its trade. In the study context, it then becomes essential to unpack what development in relation to economic complexity mean and that is a route of transforming a country's economic structure towards the production and export of more complex products (Felipe, Kumar, Abdon & Bacate, 2012). The most complex economies in the world are Japan, Germany, and Sweden, and the least complex, Cambodia, Papua New Guinea, and Nigeria (MIT Atlas, 2018). Economic complexity is a measure of productive capabilities by indirectly looking at the mix of sophisticated products that countries export, measured in Economic Complexity Index (ECI) (Lapatinas, 2019); Hidalgo & Hausmann, 2009). Therefore, it goes to reason that a more sophisticated production output may improve developmental state of nations leading to improved macroeconomic indicators. Henceforth, the study intends to unravel this inferred relationship, between macroeconomic indicators against the ECI. Wherein the chosen macroeconomic variables are Gross Domestic Product per capita, current account and investment

The three selected macroeconomic indicators investigated are selected for diverse reasons. First, GDP per capita is selected on the premise of an implicit assumption that a country that focuses on innovation improves it's well-being and realise a decrease in level of income inequality (Hartmann, Guevara, Jara-Figueroa, Aristaran & Hidalgo, 2017; Le Caous & Huarng, 2020). The Sub-Saharan Africa (SSA) countries are still much seen to be among the lowest GDP per capita and this hindas on their development status. The second macroeconomic indicator, current account is selected on the observations of Sørensen, Estmann, Sarmento & Rand (2020) that the execution of effective export promotion policies commands an identification of high potential export markets. This then means it is premised that there exists a potential to improve upon trade captured in the current account. Lemoine & Unal-Kesenci (2004) indeed provides empirical work as saying that China's outstanding performance in trade up to the period 2004 was also because of its developmental stunts in commodities. Hence, revisiting this with a new ECI matrix for both selected SSA and BRICS was reasonable. It was relevant also given the views of Canh & Thanh (2020) that trade openness of an economy to the world and imports can bring both welfares and costs to the domestic economy. The findings thereof will address this statement of cost or benefit. Lastly, on the fixed investment inclusion, the empirical works of Yalta & Yalta (2017) provides leeway because not enough ECI-fixed investment nexus was investigated thus far. It is understood that most African countries still rely much on Foreign Direct Investment (FDI) for development. However, fixed investment induced by local development stunts such as economic complexity is still lacking. Ralarala and Ncanywa (2019) studied this fixed investment, but in the context of how fixed investment and ECI affect monetary policy lending rates.

Additionally, on the motivation for the selected macroeconomic variables, the United Nation Conference on Trade and Development (UNCTAD, 2021a) report incorporates the African Continental Free Trade Area (AfCTA) emphasises that a greater emphasis on deeper intra-regional trade (captured in the current account), cross-border investments in infrastructure (fixed investment) and the improvement of the well-being (GDP per capita) is essential in the African continent. This gives impetus to the study to adress gaps in the African literature concerning the relationship thereof. Especially on the association, impact or connection on the state of development and the relevant macroeconomic variables performance.

The findigs here will aid the African Union (2015) 2063 vision by looking at a different development index, the ECI, which infers how inovative or knowledgable or the teck-nical know-how of countries; on how this may affect the African state where macrovar-iables may be improved. This is a move away from the more traditional measures that rely on indirect determinants of innovation, such as Research & Developemt (R&D) expenditure, R&D personnel and patent applications (Kyzy, 2020). Therefore, the three selected macroeconomic variables adress one of the AU's programme and initi-ative which, through trade, aims to significantly advance growth of intra-Afria trade and use trade more effectively as an engine of growth and sustainable development. Where, at the end there is going to be an establishment of the financial institutions agreed upon timeframes and effect policy space in global trade. As such, the intercon-nectedness of the global trade brings forth a distinctive trade pattern that requires a focal study for each country to measure its competitiveness as perhaps linking to rel-evant macroeconomic indicators and development thereof.

The above added to the motivation to carry out a Sub-Saharan Africa (SSA) study, moreso a comparative study with the BRICS countries to close the existing gap be-tween the developed, the emerging and the still much underdeveloped countries of Africa. In a condensed version of Adam Smith's 'Wealth of Nations', Butler (2011) posits that the progress of an economy falls on the principle that a commerce of an advanced society takes place between the country and the towns. In a sense, the towns acquire their whole wealth from the country. Building on this notion, an idea of economic complexity upscales this to measure the strength of a nation in its production structure. To this effect, countries extract rents on the principle of spatial-technological monopoly formation experienced from privileged sources of comparative advantage (Balland & Rigby, 2017).

Additionally, the concept of product complexity is also necessary as it is through the Product Complexity Index (PCI) that essentially reveals the knowledge imbedded in the productive structure of the economy. In essence, product complexity, according to Hidalgo and Haussmann (2009), reveals the knowledge intensity of a product by con-sidering the knowledge intensity of its exporters. Additionally, this is done by observing the number of different or types of products that a country can produce, this is termed 'diversity'. While also observing the number of countries with the same ability, and this is termed ‘ubiquity’. Countries with far much innovative know-how are well placed to manufacture products and services than those with less know-how, hence the diversity of the development level of countries. As such, industrialisation is sure guaranteed when countries embrace product complexity in the type of goods produced and exported thereafter.

Recent contributions reflect those countries with high-technology and expanding in production can be found in the upper echelons of indexation (ECI); and naturally, these countries have advantage on export competitiveness too (Erkan & Yildirimci, 2015). This bodes well to investigate Sub-Saharan African (SSA) countries given that Africa is still seen much relying on raw unprocessed products though some countries like South Africa, Ethiopia and Tanzania have improved comparatively to their African peers.

Some leading emerging economies in the SSA region such as Nigeria, Botswana, Ghana and Kenya are found low in economic complexity. This impact negatively in their structural transformation (Bhorat, Steenkamp & Rooney, 2016). Furthermore, Bhorat, Rooney & Steenkamp (2019) suggests that there are disconnections on productive structure characterised by products with low levels of economic complexity, resulting into limited productive abilities. This suggests or sends a message to developing nations to realise new and unique capabilities that allow them to produce highly sophisticated value added goods and services. The study is carried out on a comparative setting to draw on differences from more developed countries in trade terms (seen in chapter two). To this end, the BRICS (Brazil, Russia, India, China and South Africa) formation, an amalgamation of contries for purposes of economic integration was chosen because they have realised tremendous growth, with an exception of South Africa in recent years. Associate countries can side-step the potential terms of trade deterioration in their trade with industrialised countries by having increased trade among themselves (Appleyard & Field, 2014). Though this is argued for regional development, it goes to reason that, given the interconnectedness of global markets, the BRICS countries integrated for global trade competitive edge too. Of contention is that South Africa, an SSA country, is also a BRICS member so that it can boost its economic trade activities and ultimately uplift its own economy (Bhorat & Steenkamp, 2018).

The economic complexity approach ventures into the interconnectedness of the existing global market and embodies the international trade data as a split system where countries are related to the merchandises or services that they ship (Mariania, Vidmer, Medo & Zhang, 2015). The fourth industrial revolution is knowledge-based high technology imbedded. As such, the type of products and services emerging from the developed countries has seen industries shape up differently. For instance, from self-service applications (Apps) in banks to self-service machines in the fast-food restaurants, and the type of technology imbedded in the modern car leaves much to be desired. Computer hardware is a product that requires specific ICT and input in physical capital, specific knowledge and intellectual skills like information technology (IT) skills (Adam, Garas & Lapatinas, 2019). This is the essence of PCI and ECI, producing and exporting products that are of high value and sophisticated. Knowledge/expertise in the country's production is then quantified to differentiate each country's developmental state (Stojkoski & Kocare, 2017).

Encapsulated in the theory of capabilities, developmental state in economies is not only a course of endlessly refining upon the production of conventional product only, but more importantly, a progression that necessitates acquiring more intricate sets of capabilities to move towards new activities linked with higher levels of yields (Hidalgo & Hausmann, 2009). The measure of product complexity then becomes how diverse the technology is, capital, labour skills, institutions, machinery, public inputs, tradable inputs, etc. It is intuitive that products that require few capabilities will be more likely produced in many countries. This is the essence of products' ubiquity (Hidalgo, 2009). Therefore, the less product ubiquity a country has, the more sophisticated and diverse products that country will produce. Gala, Rocha and Magacho (2018) further explain the distinction in non-ubiquitous products into those with high technological content and those that are highly scarce in nature. The production of, for instance airplanes, is classified as having a high technological content, while those that are naturally non-ambiguous include diamonds, a highly scare commodity in nature. Sectors which deeply depend on raw materials such as energy, horticulture and metals, manifest lower levels of complexity, while high level or high tech such as life sciences and chemicals have a high average complexity (Zaccaria, Cristelli, Kupers, Tacchella & Pietronero, 2016).

Sibanda (2021) provides a gap in literature to provide an empirical work that studies countries' development levels and trade effects and benefits in view of the AfCFTA. This will address an additional gap seen by Sikdar (2006) where the view that the development levels of the continent may be both a blessing and a curse with regard to the development agenda of AfCFTA.

It is on this basis that the focal attention of this study is to draw a comparative analysis between selected SSA and the BRICS formation. Bhorat, Rooney and Steenkamp (2019) give impetus to the study when saying that by economic complexity we refer to structural change, that is, the process of shifting from low productivity, low complex products, toward progressively high productivity, high complex products. Hence, the need to investigate this shift, whether economic complexity may have a distinct impact on some selected key macroeconomic indicators. As already aluded to, the three selected key macro-indicators are GDP per capita, current account, and Gross Fixed Capital Formation (Fixed Investment).

1.2. STATEMENT OF THE PROBLEM

The essence of this study resonates on the question, 'Why do some countries grow and others do not'? As such the two, but intertwined concepts of economic complexity and product complexity are at the core as perhaps leading to improved macroeconomic indicators. Therefore, due to the differing levels of country development, including the type of industries in respective countries, there is a level of competitiveness to be expected because of diverse economic structure in the countries. Therefore, major economic indicators may be affected, adversely so if economic agents do not properly address the issues at hand.

A prominent concern for African countries is the fewer entry points in global value chains, and increasingly challenging industrialisation (Hallward-Driemeier & Nayyar, 2018). One of the key challenges Sub-Saharan African (SSA) countries need to address is the need to undergo structural transformation in the face of young and growing labour forces. Additionally, so African nations have twin imperatives. Firstly, the need to grow' and secondly, the need to provide employment opportunities for their growing populations (Bhorat & Steenkamp, 2018). These are problems associated with some of the major macroeconomic indicators' performance (economic growth, current account balance and fixed investment) of which sophistication of goods and service exports may be seen as a catalyst to improve the macroeconomic outlook.

Bhorat, Rooney & Steenkamp, 2019 explored the relationship in three African of South Africa, Senegal and Ghana. The finding were that indeed ECI is a catalyst for growth. The fundamental issue was that the countries are much relied on raw resources. Nonetheless, there still a gap in the literature to produce further works that seek to explore other means of learning. For instance, as one of the significance, is that there's a need to forecast the variables path in line with AU's 2063 vision and bring fourth policy formulation that may better inform the Afrian countries, and in comparative to the more established economies such as BRICS. This then advocate the study as there exists a gap in literature were there is a need to reflect on the current developmental path of the African region in export termss and measure if the AU's 2063 vision is attainable against some selected macrovariables.

The connection between economic complexity and economic growth has received some attention over the years (Klinger & Hausmann, 2006; Hidalgo *et al*., 2007; Hartmann, Guevara, Jara-Figueroaa, Aristara & Hidalgo, 2016; Hallward-Driemeier & Nayyar, 2018). The notion behind this link is at the backdrop that a complex economy as seen through the diverse complex products, leading to the development of numerous, and related industries. So, it is expected that an improved growth path for developing countries will have an improved GDP per capita. Gala *et al*. (2018) state that structuralism is a dynamic process of industrialisation, a necessary condition for increasing employment, productivity and income per capita and, consequently, reducing the problem of poverty, especially in the African continent. Henceforth, the main idea behind complexity is that the higher the economic complexity of a country, the better are its conditions to promote faster growth rates (Gala *et al*., 2018). Mealy *et al*. (2018) put it bluntly that the ordering of ECI is useful in explaining variation in per capita GDP, and predicting growth suggests that different types of exports (and by extension, productive capabilities) are associated with different growth and development outcomes. GDP per capita is a measure of a nation's wellbeing or quality of life; as such, improving its performance through ECI might help alleviate the problem of poverty and unemployment, which lead to distress among the citizens of emerging countries like SSA, and even overly populated countries like China and India of the BRICS nations. In the

African region, Ncanywa, Mongale, Ralarala, Letsoalo & Molele (2021) attempted to solve the inequality problem were ECI was the predictor with some selected SSA countries. Their work focused on the Gini coefficient as the predicted measure of inequality, this study foccusses on the GDP per capita as a measure of an improved standard of living among the citizens. This ones more reflects on the gap in literature were another macro matrics is used directly influence and mitigate the inequality problem, especially in the African region.

Secondly, the link between economic complexity and current account is justified in that imports and exports are directly captured in the current account sub-account on the balance of payment (BOP). BOP account statement reflects summarily the size of the country's activity with the rest of the world taking place in any given year; and an important part of that activity is trade in goods and services, which is allocated in the current account (Appleyard & Field, 2014). As such, economic complexity is inclusively captured on the account as nations trade among each other, hence, the current account is a relevant economic macroeconomic indicator in the study. A current account imbalance (especially a deficit) has become an acknowledged indicator of undesirable macroeconomic developments and, in the case of deficits, a recognised indicator of a crisis (Raschen, 2014). The problem faced with deficit countries are the threat of solvency and liquidity crises. Solvency and liquidity in turn lead to the problem of nation's capability to attract foreign direct investment as they are seen as risky markets by potential foreign investors.

The other link between ECI and fixed investment is also reflected by literature, however, not as extensive as the other macroeconomic variables (Stojkoski & Kocare, 2017). A world investment report by the United Nations (UN) states that Gross fixed capital investment is expected to pick up significantly in emerging and developing economies; and more buoyant economic activity will help lift world trade (UNCTAD, 2018). The emphasis on trade does suggests that there is a direct link between trade and the level of infrastructure investment injection. Therefore, logically the sophistication of the exported commodity is also essential for improved trade competitiveness. As such, economic complexity is a catalyst measure. Moreover, economic complexity can extrapolate investment allocation in emerging and developing countries. Development economics identifies main drivers of long-run growth in investment in education in the presence of externalities from human capital accumulation expenditure in research and development and the openness of the economy to international trade through learning-by-exporting (Sbardella, Pugliese, Zaccaria & Scaramozzino, 2018). Infrastructure development by government is also allocated or intensified by the type of local or regional needs in that country. Fixed investment in a country is, among others, capital injection for development in infrastructure and education. African countries spend about 1.1 percent of GDP on digital investment, while advanced economies spend an average of 3.2 percent; thus, business-as-usual is not an option, as it will continue to widen the digital divide and drive the marginalisation of Africa further (Brookings Institute, 2019).

Economists have long regarded structural change, the movement of workers from lower to higher productivity employment, as essential to growth in low-income countries (Page, 2018; Bhorat & Steenkamp, 2018; Hallward-Driemeier & Nayyar, 2018). The study intends to unravel the upscaling economic challenges of SSA countries and indeed the BRICS countries. Africa's economic structure has changed very little, an action that is worrying to both policymakers and analysts (Page, 2018). In a report on global dividends of Africa's industrialisation, suboptimal macroeconomic conditions are compounded by the perpetuation of inequality within nations, especially with respect to access to the job market, to education, and to capital or investment (Monga, 2018).

The study intends to unravel the upscaling economic challenges of SSA countries, and to measure against some other key players, BRICS countries which have been in recent years among the dominant players in world economics such as China and India, hence a comparative study.

1.3. RESEARCH AIM AND OBJECTIVES

1.3.1. Research aim

The aim of the study is to analyse the relationship between economic complexity and and selected macroeconomic variables, namely, economic growth per capita, current account and fixed investment in the period 1994 to 2018 in selected Sub-Saharan countries (South Africa, Nigeria, Tanzania, Ghana, Cameroon) and BRICS (Brazil, Russia, India, China, South Africa).

1.3.2. Objectives of the study

The following objectives arise from the aim of the study in the two groups of economies (SSA & BRICS):

- To determine the association between economic growth per capita and economic complexity.
- To find the impact of economic complexity on current account.
- To estimate the effects of economic complexity on fixed investments.
- To settle any causality between economic complexity and the macroeconomic indicators.
- To forecast the macroeconomic indicators from a shock in economic complexity for the foreseeable periods.
- To draw a comparative analysis between selected SSA and BRICS with respect to the relationship of economic complexity with the chosen macroeconomic variables.

1.4. RESEARCH QUESTIONS

In undertaking this study as set out by the objectives, the study seeks to answer these key questions:

- What is the existing association between economic complexity and economic growth per capita?
- Is there an existing impact between economic complexity and current account?
- Are there existing effects between economic complexity and fixed investment?
- Is there any causality between economic complexity and the macroeconomic variables?
- What are the macroeconomic indicators response from an economic complexity shock?
- What are the underlying differences between SSA and BRICS countries?

1.5. ETHICAL CONSIDERATIONS

The study employed secondary data, protocols and ethics were followed, and all relevant references were acknowledged. This thesis does not contain other persons' data, pictures, graphs or other information, unless specifically acknowledged as being sourced from other persons. The study is also adhering to the university's plagiarism standards by ensuring that the work is run through turn-it-in, and corrections were made in accordance with accepted standards.

1.6. SIGNIFICANCE OF THE STUDY

With economic complexity a re-emerging concept of measure of economies' development, this work will add value to literature. It adds and is advocated for by advancing new and sought-after metrics to estimate the total knowledge content of an economy, and subsequently, improve relevant macroeconomic indicators for the countries concerned, particularly the selected SSA ones. This work contributes to developing literature on technological progress or innovation and growth by addressing some of the gaps in the literature. This is particularly relevant, for instance, the South African government had an agreement with Massachusetts Institutes of Technology (MIT) to run a study on economic complexity and growth progress in 2009. To this effect, according to the author, no study of this magnitude is found in literature, which measures complexity-macroeconomic analysis across SSA countries while running a comparative analysis with BRICS countries. This study does not only add to literature in a conventional way, but most certainly help policy makers who are grappling with policy formulation regarding ways to improve economic indices across the African continent. With the instituted and signed trade agreement, the African Continental Free Trade Agreement, this undertaking becomes relevant where inference is also made.

This study is significant in that it seeks to directly measure the complexity-macroeconomic indicators nexus in reply to Page (2018), as saying building complexity, and thus producing a diverse range of increasingly complex manufacturing products is a path dependent process. The path dependence theory was originally developed by economists to explain technology adoption processes and industry evolution as leading to economic progress (Smith, 1976). Additionally, this study is somewhat unique in that it uses diverse econometric methods to investigate the set objectives, that is, the economic complexity-macroeconomic indices nexus which has not been seen thus far in literature.

To this end, the study provides an empirical focus to aid the development of sound analysis in response to Signé and Johnson (2018), who argued for industrialisation and manufacturing as a source to alleviate poverty across the African continent. Upon analysis, this work helps inform further policy considerations. This is so because the possible diversity and ubiquity of products (PCI) exported thereof, may aid to reflect and advise accordingly, such as ways to attract private investment, how to accelerate manufacturing and industrial development projects and contribute to growth. This study adds to works by Ncanywa *et al*. (2021) and Yellapragada (2018). It adds to Ncanywa *et al*. (2021), where a Gini-ECI analysis to income inequality was determined. However, this study explores the GDP per capita-ECI nexus, thereby advancing on literature. It also adds to Yellapragada (2018), who gave feedback that macroeconomic stability is associated with higher economic diversification. Hence, the study delivers the matrix for economic diversification provided by ECI and PCI to develop an ECI-macroeconomic indicators stability analysis.

Additionally, Yalta and Yalts (2017) shed light on the trade competitiveness and ECI connection through term-of –trade in MENA (Middle East and North Africa). This study extends this on the actual current account outlook and ECI connection through diverse technique application. Yalta and Yalts (2017) also explored the domestic investment–ECI analysis in the said countries. Likewise, this study further adds to literature in a comparative setting. The study is in essence exploring the concept of economic diversification and development to the wellbeing of relevant macroeconomic indicators. It is a well-rounded study that seeks to reflect upon the selected SSA, and comparatively so with BRICS to draw a parallel analysis. Of significance also is the lack of literature in the comparative sense; only a handful exists (Udeogu, Roy-Mukherjee & Amakom, 2021; Bhorat *et al*. 2019; Rubbo, Picinin & Pilatt, 2021; Signé & Johnson, 2018; Stojkoski & Kocarev, 2017; Lee & Yoon, 2015; Naudé, Szirmai & Lavopa, 2013). Accordingly, only Rubbo, Picinin and Pilatt (2021) and Stojkoski and Kocarev (2017) offered a comparative analysis where the former provided a comparative analysis among some of the BRICS member countries and the latter was in the African context. Udeogu *et al*.

(2021) provided a comparative analysis among many regions and economy settings, but only utilised one statistical method of analysis.

The motivation and significance is, imperatively, to add on the argument of the Bhorat *et al*. (2019), which focuses on the 'building economic complexity in Africa'. The following critical points were made. The points argued for the long-run growth and development works that retain the view that for an arrangement of structural change and comprehensive growth to affirm itself in an economy, two key inter-linked elements were proclaimed as requirements. One, the move from a low-productivity agricultural sector to a high-productivity, export-oriented agricultural sector. Two, the development of a dynamic high-productivity manufacturing sector that is employment and export-intensive in nature is needed. It is to this end that the study undergoes an explosive and overaching run to explore a measure of sophistication and development in ECI while giving an overview on the PCI on the association, impact, and effect on GDP per capita, current account and fixed investment, respectively, to draw on the experiences comparatively.

1.7. OUTLINE OF THE STUDY

Chapter one presented the study focus through a thorough introduction and background of the intended study topic while also reflecting on the problem statement. Additionally, the research questions were detailed, and the aims and objectives of the study were well reflected upon. The rest of the chapters are stated also in the following.

To follow-on on chapter one, chapter two then offers an overview of the selected SSA and the BRICS countries accordingly. This is done through the demarcation of the selected macroeconomic variables and economic complexity, and subsequently the product complexity for each country. Therefore, chapter two provides a trend analysis for the period covered in the study. This helps understand the developmental level and standing in the global economy for all countries concerned. Chapter three then presents the theoretical and empirical literature perspective to give direction as to the work done thus. The chapter as such concludes on the work done prior in relation to the selected macroeconomic variables and economic complexity so as to draw similarities or differences. Chapter four follows and deliberates on the research methodology and the step-by-step reflection and analysis method utilised in the study to answer the set objectives. This is done while discussing the data set and subsequently the theoretical model specification. Chapter five then follows on chapter four to disseminate the empirical results in answering the set questions and objectives. The last chapter is chapter six, which gives a summation of the overall study while concluding and providing recommendations.

CHAPTER 2

MACROECONOMIC AND COMPLEXITY ANALYSIS OF THE SELECTED SSA AND BRICS ECONOMIES

2.1. INTRODUCTION

This chapter examines the economic landscape of all the countries within the two groups. The aim is to understand the economic and developmental level of each nation and what drives each economy, the challenges and policy perspective for each while interrogating all the macroeconomic indicators in the study. The chapter is divided into two main sections, the selected SSA country analysis and the BRICS analysis sections. That is, each country is allocated a section for analysis, the five SSA countries and BRIC countries, since South Africa is found in both groupings. Thereafter, a summary section to bring forth some contrast among the nine nations. The analysis starts off with South Africa leading to the SSA countries and followed by the BRIC formation. Though there are limitations on how far the study models are set due to availability of data, the country analysis will be based on recent information.

2.2. SUB-SAHARAN AFRICAN COUNTRIES

Sub-Saharan African (SSA) countries are defined as geographically the area lying south of the Sahara in the African continent. This is made up of 42 countries and the additional islands that make up the rest of Africa, but excludes the Arab countries. The selected SSA countries being studied are South Africa, Nigeria, Ghana, Tanzania and Cameroon. This is a continent endowed with natural resources, raw materials, precious metals and fertile soil. The Brookings Institutes (2020) report underpins the region's potential in that it has a collective GDP of over US$2.3 Trillion (T) and a population of 1.2B, of which the majority are below the age of 30. The latest regional development initiative to improve the region is the creation and implementation of the African Continental Free Trade Agreement (AfCFTA), which is said to substantially improve the economic outlook from intra-regional trade. This trade pact seeks to gradually remove tariffs across the African countries and allows free movement of goods and services.

2.2.1. South African Economic Landscape

South Africa as one of the selected SSA economies is a developing country, and is found in the Southern tip of the continent. The country is bordered by the likes of Zimbabwe, Mozambique, Botswana and Namibia, with Lesotho and Swaziland interlocked in the country. An upper-middle class income economy is rated the second richest in the continent behind Nigeria, and 35th in the world in Gross Domestic Product terms at $358.839 Billion as of the 2020 estimates (IMF, 2020).

2.2.1.1. GDP performance and population trajectory.

The South African economy is rated the second biggest economy in the continent with a greatly advanced economy, developed infrastructure, and as such considered one of the fastest-developing countries in the world. South Africa is considered a diverse economy with a breed of mining, financial services, manufacturing, construction, trade and tourism, among other industries. Additionally, it has an abundance of natural resources, raw material exports that include gold, diamonds, platinum, coal, and iron ore and some processed or manufactured exports like cars. It is one of the world's largest exporters of these commodities, particularly gold and platinum. This means the country is not over-reliant on a single source of revenue.

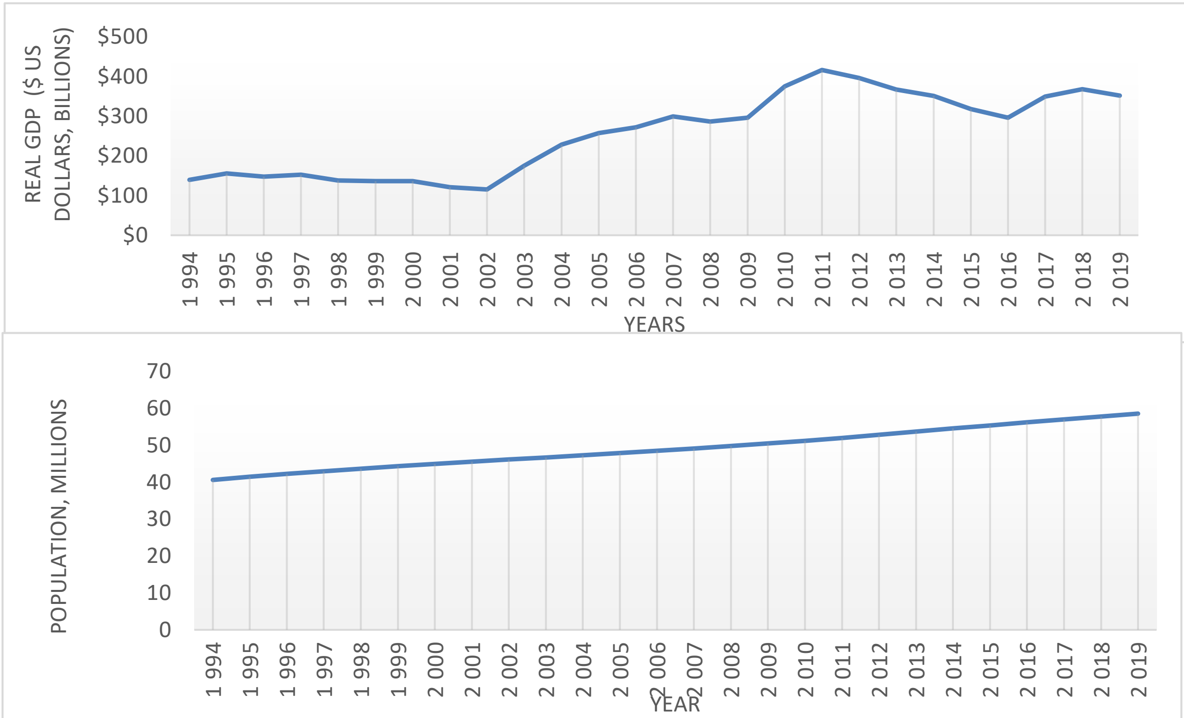

Figure 2.1: South Africa's Real GDP and Populations trends

Source: World Bank Data Bank

The country has of late had the worst economic outlook. In the past five years from 2016 it has experienced two technical recessions, that is, two consecutive periods of negative growth. Figure 2.1 shows the GDP figures narrated against the population trajectories. The South African population has been on an upward surge reaching 59, 62 million in 2020 mid-year estimates from roughly 40 million in 1994, the dawn of the democratic emancipation from the apartheid era (StatsSA, 2020a). Of course, population and the rate of economic growth have a direct link between the wellness of an economy and the standard of living. In the past as alluded already, the country realised a technical recession after experiencing consecutive quarters of negative growth rates in GDP, and development has slowed, growing its GDP by only 0.2% in 2019 (SARB, 2020).

Given the expansion in yearly population estimates, as of the first quarter of 2021, the unemployment rate figures stood at 32.6% from 32.5% in the previous 2020 fourth quarter (StatsSA, 2021). As such, although the country remains one of the leading economies in Africa, the standard of living may be compromised due to an ill performing GDP. Figure 2.2 shows the GDP per capita estimates including the percentage change. Because GDP per capita is yearly GDP divide by mid-year population estimated, it is observed as the best measure of standard of living for the population at large. The real GDP estimated in purchasing power parity at international dollar denominated reflects a much healthy upward trend for South Africa peaking just above $12 000. However, the percentage change in per capita estimated show a dire reality. Between 2014 and 2019, the standard of living has not been improving for South Africa with negative change estimates.

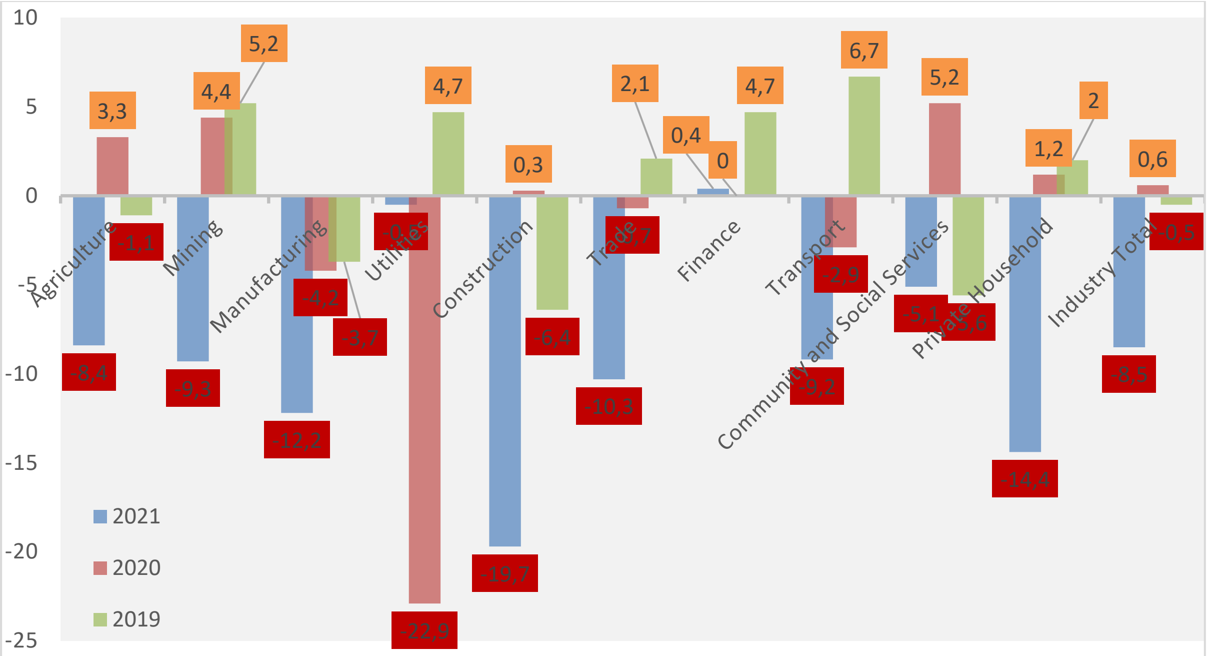

Figure 2.2: South Africa’s Industry Employment Change (year (y) – on – year % change)
Source: Statistics South Africa 2021

Figure 2.2: shows the respective South African industries employment figures as possibly explaining the country’s past industry performance as possibly explaining the impacted negative GDP per capita changes. The plot reflects the 2019, 2020 and 2021 year-on-year industry estimates. The three-year estimates from 2018 clearly show that the respective industries employment performance was deem as the sectors or industries that had to lay-off workers. The total industry employment shows that in the three-year leading into 2020, there were two periods of negative employment prospects for the country. This auger well to also reflect on the GDP per capita estimates with a bleak outlook in respect to GDP per capita changes. Over the past six years to 2019, the standard of living for the population did not improve as reflected in figure 2.3 below.

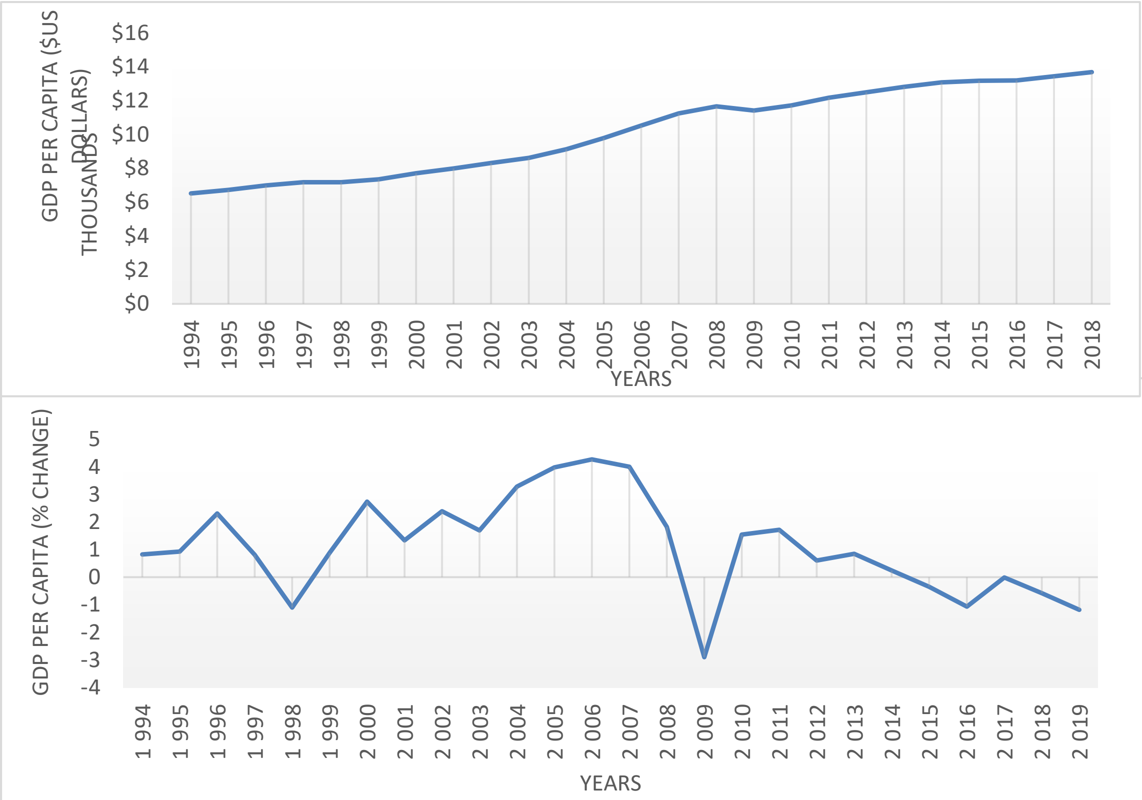

Figure 2.3: South Africa GDP per capita (Normal and percentage change)

Source: World Bank Data Bank

Figure 2.3 therefore, given the country's employment prospects in figure 2.2 is evidently showing that the standard of living has been on a decline with the negative GDP per capita. These are in culmination with the past dire economic stance that has not been developing well enough to address the growing population. The labour absorption rate bears testament standing at 42.1% between January and March of 2020 with a decline of 4.2% on a year-on-year basis from 2019 (StatSA, 2020b).

2.2.1.2. Trade Outlook and Performance

South Africa is an open economy and is often seen as the entry into Africa through its ports in Durban and Eastern Cape, good infrastructure and the four main border countries Zimbabwe, Botswana, Mozambique and Namibia, though that tittle has been challenged by other African countries like Kenya. Table 2.1 provides the top five exports destination and imports source (MIT Atlas, 2018).

Table 2.1: South Africa's Top Exports and Imports Partners

Exports Destination		Imports Source	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. United States of America	($8.21B	1. China	$15.6B
2. India	($8B)	2. Germany	$7.23B
3. United Kingdom	($7.97B	3. United States	$5.49B
4. Germany	($7.05B)	4. Saudi Arabia	$3.89B

Source: MIT Atlas of Economic Complexity

To this effect, recent current account figures show that the country has performed better than expected. The country's 2020 imports and exports of goods amplified in the 4th quarter as trade's unrelenting recovery (SARB, 2021). However, the report further alludes to the fact that trade surplus narrowed rather slightly from R450.9 billion in the 3rd quarter of 2020 to R425.2 billion in the 4th quarter. Figure 2.4 as such reflects South Africa's current account, the credit items. From 1994 to 2002 these items had a neutral trend, and afterwards had an upward trajectory to 2008 with a huge decline in the year 2009 before peaking up in 2011. From 2012 the country has seen tremendous negative outlook in its income items trajectory.

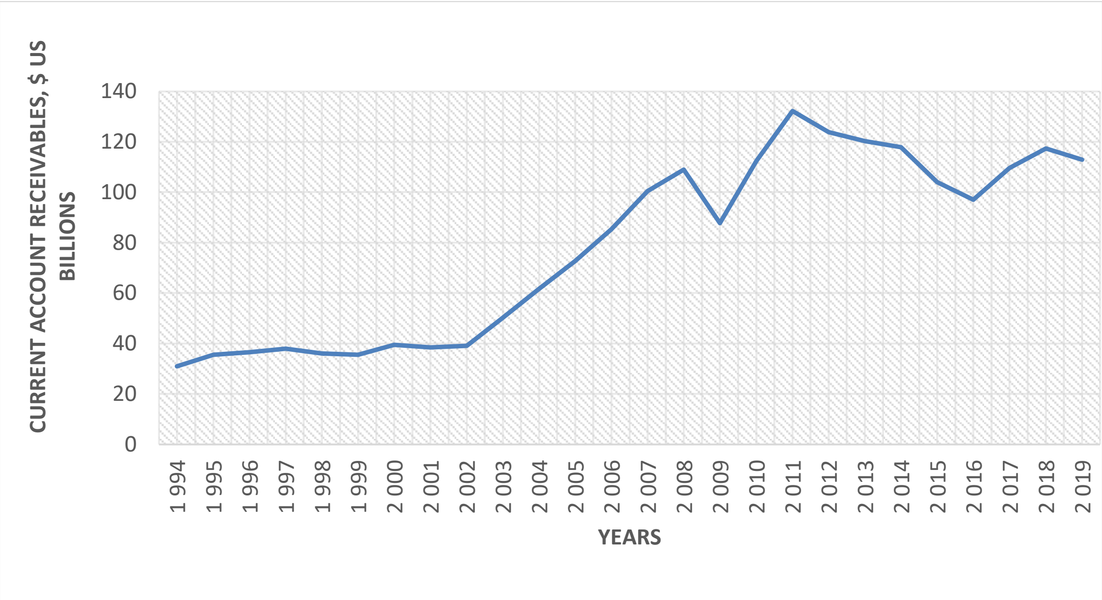

Figure 2.4: South Africa Current Account (Income items, credit)
Source: World Bank Data Bank

It then becomes imperative to measure or gage the payment items of the current account as captured in figure 2.5 below. The debit outlook of the current account seem to follow the same trajectory as the credit items. However, from the year 2011 to 2016, the payment items (debits) seem to peak above the income items (credits), suggesting that the country realised trade deficits in those years.

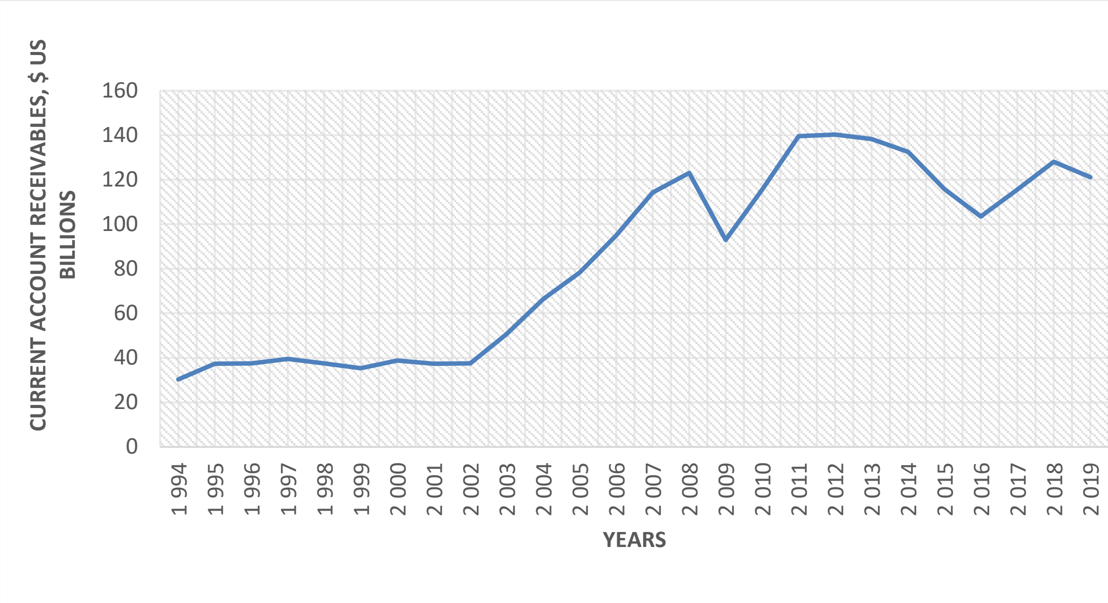

Figure 2.5: South Africa Current Account (Payment items, debits)
Source: World Bank Data Bank

Figure 2.6 puts the South African current account in perspective in that there is a clear ill performance in the balance of payment through its sub-account. The outlook in the account has not been good for the country with trade deficit observed from 1994 to 2002 and realised a brief surplus in 2003 to 2007. The country has since realised trade deficits from 2007 to 2019, which of course culminates in the problems already emphasised in the study. One other significant downside of persistent current account deficits is that it manifests in less foreign exchange captured and has a bearing on the domestic currency. However, Prinesha Naidoo of Bloomberg indicates positive analysis in saying that on the upside, trade surplus improved to R102.5 billion from a revised R44 Billion in the 3rd quarter, leading into September as the value of exports amplified whereas imports dropped 2.6% from the 2nd quarter of 2020 (Fin24, 2020). As such given the past historical threat to the current account, South Africa still finds itself well enough to rebound from the past grave performances as the 2021 estimates.

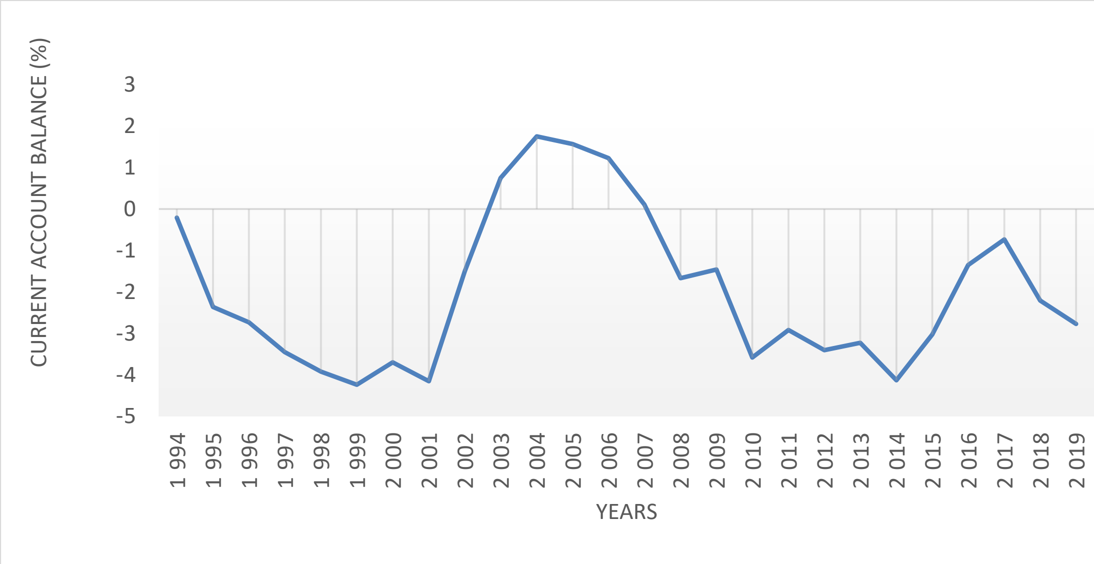

Figure 2.6: South Africa Current Account balance (1994 – 2019)
Source: World Bank Data Bank

In the country, June trade highlights that South Africa's trade fortunes reflects an improved estimate; this may continue internally as consumer demands for foreign goods regain momentum and begin to narrow and realise some surplus (Business Maverick, 2021).

2.2.1.3. Investment performance

This section provides an analysis of all matters concerning investment, however, with more focus on real fixed investment or gross fixed capital formation along with some insides on foreign direct investment. With regards to the real fixed investment, Moody's Analytics (2021) provides the recent investment estimates below in figure 2.7. The real investment figures are narrated both in real estimates (denominated in domestic currency) against the percentage change for the period Q1 of 2018 to 2021 Q1. As it stands, the economy realised the biggest negative percentage change in real investment in Q2 of 2020 at -20.18%. Thereafter the performance improves in three subsequent quarters to 2021Q1 with gradual positive percentage change. Prior to 2020Q1, real fixed investment has nonetheless had a negative performance on a quarter-on-quarter basis with 2019Q2 and 2019Q3 have realised positive percentage change.

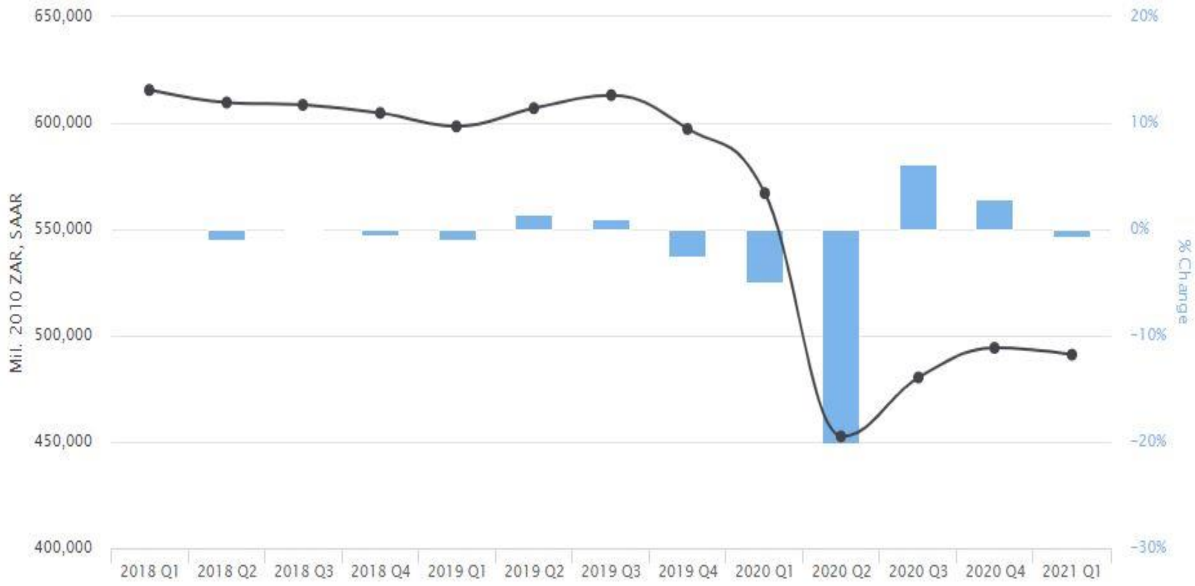

Figure 2.7: South Africa's current Real Fixed Investment (2018Q1 – 2021Q1)
Source: Moody's Analytics (2021)

It then becomes imperative to analyse the trajectory in real fixed investment in the study period from 1994 to 2018. Figure 2.8 shows the real fixed investment course over the years. The most significant investment growth was between 2002 to 2011 with a minor decline in 2008 and 2009. Afterwards, there is a major decline in real fixed investment over the years to 2019 with minor grounds made in 2016 to 2017.

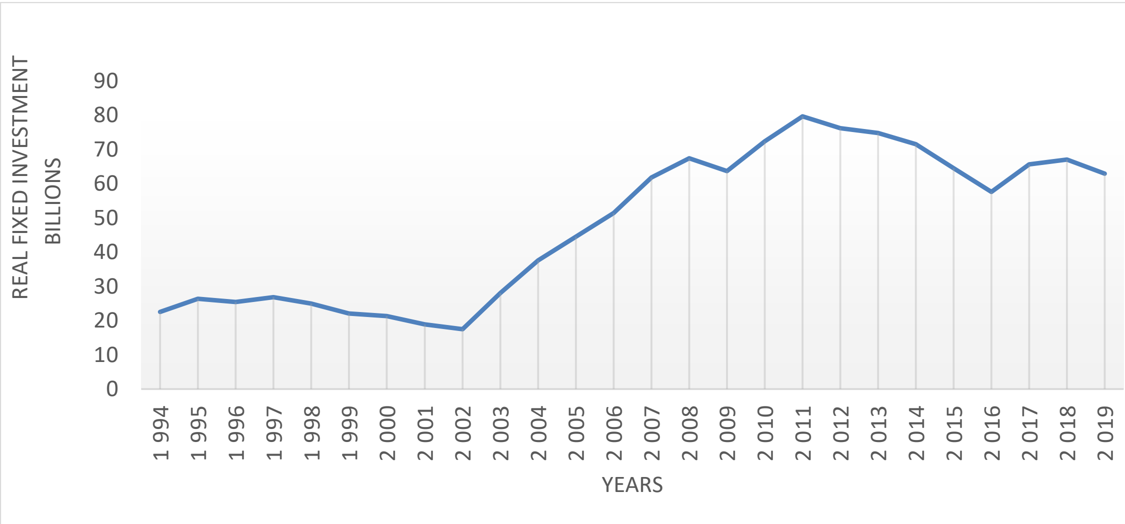

Figure 2.8: South Africa's historical Real Fixed Investment (1994 – 2019)
Source: World Bank Data Bank

Given that the country received negative investment grades by three ratings agencies means real fixed investment need to be augmented rather than looking outward for investment. The SARB 2020/21 annual report submits concerns in that Moody's Investors Service lowered the country's local and foreign currency credit score to sub-investment in 2020, which worsened capital outflows (SARB, 2021). The concerns to this effect were that the cost of government borrowing, the bond yields that is, rushed to unmaintainable levels, and was accompanied by a rand depreciation of 22% against the US dollar between February and April 2020. It then becomes also imperative to visualise the foreign direct investment historical trends as reflected in figure 2.9.

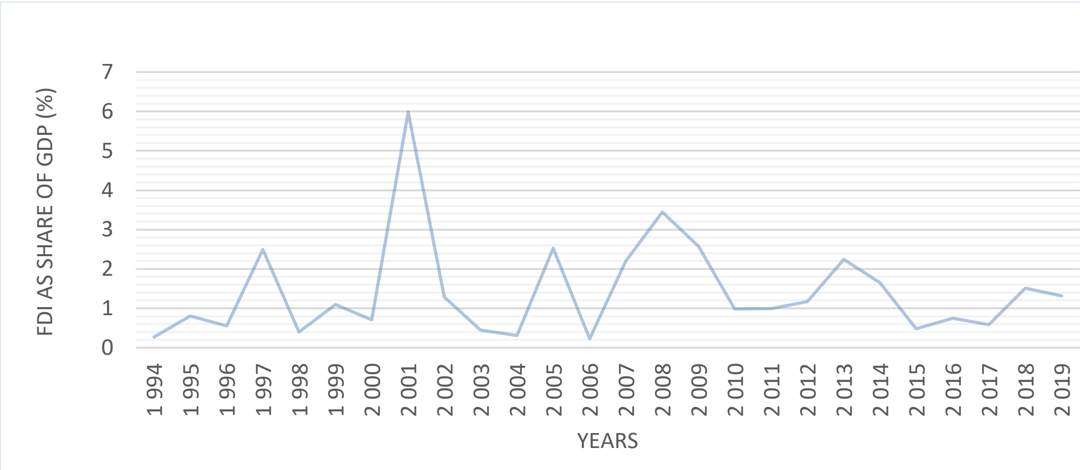

Figure 2.9: South Africa's FDI Inflows (%GDP Share)
Source: World Bank Data Bank

The country's highest FDI inflows were seen in 2001, which was twenty years ago at 6% share of the GDP. Another noticeable peak was in 2008 at over 3%, with a decline to just 1% share in 2010. The 2008 to 2010 and neutralised until 2012 was due to the global financial crisis that emanated in the United States of America in 2008. As it stands, the average FDI as a share of GDP has averaged well below 2%. This trend has exacerbated the president, President Cyril Ramaphosa to launch a local and international investment drive to promote the country as a viable investment destination. Thus far the aggregate investment pledges by local and international investors secured since the inception of the conference in 2018 stands at R773.6-billion, including the 2017 pledges by companies and the likes, as narrated by Business Maverick contributor Ray Mahlaka (Business Maverick, 2020).

2.2.1.4. Economic Complexity, product complexity and trade dynamics

The main economic indicator understudy as perhaps leading to the progress of the selected macroeconomic variables is economic complexity, which is approved to be the proxy for developmental state of economies. This section is as such meant to interrogate the current state of the developmental stance of South Africa and of course the respective selected SSA countries and the BRICs countries in the sections to follow. Figure 2.10 below shows the ECI, the index measure of exports sophistication for the country. The work of Bhorat *et al*. (2019) and the Atlas of economic complexity from both Harvard (2018) and MIT (2017) form the crux of this analysis for all selected countries as this is still a fairly re-emerging concept with limited information.

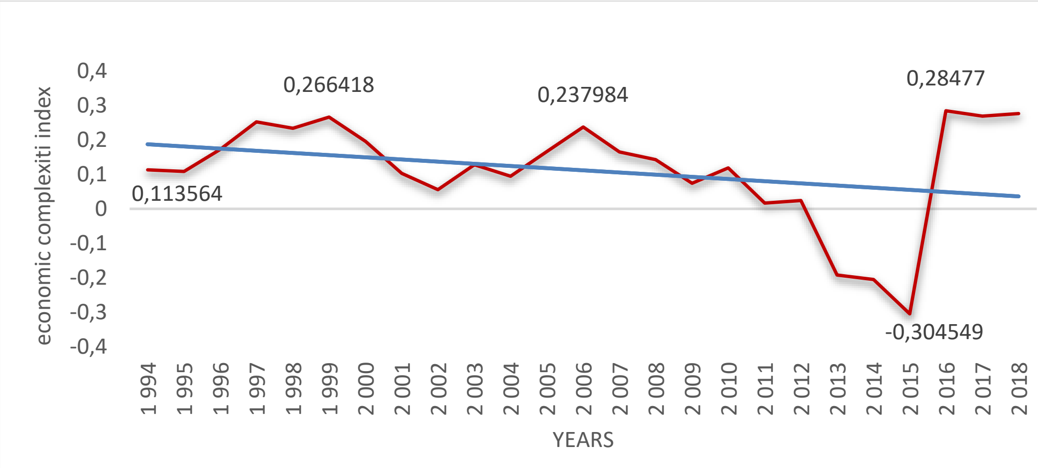

Figure 2.10: South Africa's Economic Complexity Index (1994 – 2018)
Source: Atlas of Economic Complexity (MIT, 2018)

The study, as shall be observed in chapter 4, adopts the ECI as calculated by the MIT atlas (2018) as opposed to the Harvard Atlas (2019) because the MIT has better ECI estimates across the countries. The MIT ranks South Africa at 47 while the Harvard atlas ranks it at 63 across 133 countries. Nevertheless, their respective reports produce similar findings in their analysis. Figure 2.10 clearly reflects that the country's ECI has been on a decline down from an index of 0.26 in 1999 to -0.304 in 2015. Some grounds were made in 2017 to 2018 reaching in 0.284 index, its highest peak. It is argued that the country's economy has become less complex, deteriorating positions in the ECI rank and the worsening complexity has been determined by a lack of diversification of exports (Harvard Atlas, 2019). The country should be placed to take lead of many opportunities to diversify its production using its existing know-how. South Africa nonetheless is the highest placed country in SSA (Bhorat *et al*., 2019).

Figure 2.11 then proceeds to summarily provide the country's export basket and to reflect on the export mix. The Harvard Atlas (2019) estimates show that minerals make the bulk of the export with gold (13.22%), platinum (7.51%), iron ore and concentrates

(5.96%), coal (3.7%) and the likes of manganese (2.22%), diamonds (3.93%) and petroleum oil, refined with respective percentage. Other major exports include cars (5.36%), which are assembled in the country. Travel and tourism is also a noteworthy service with 8.56%.

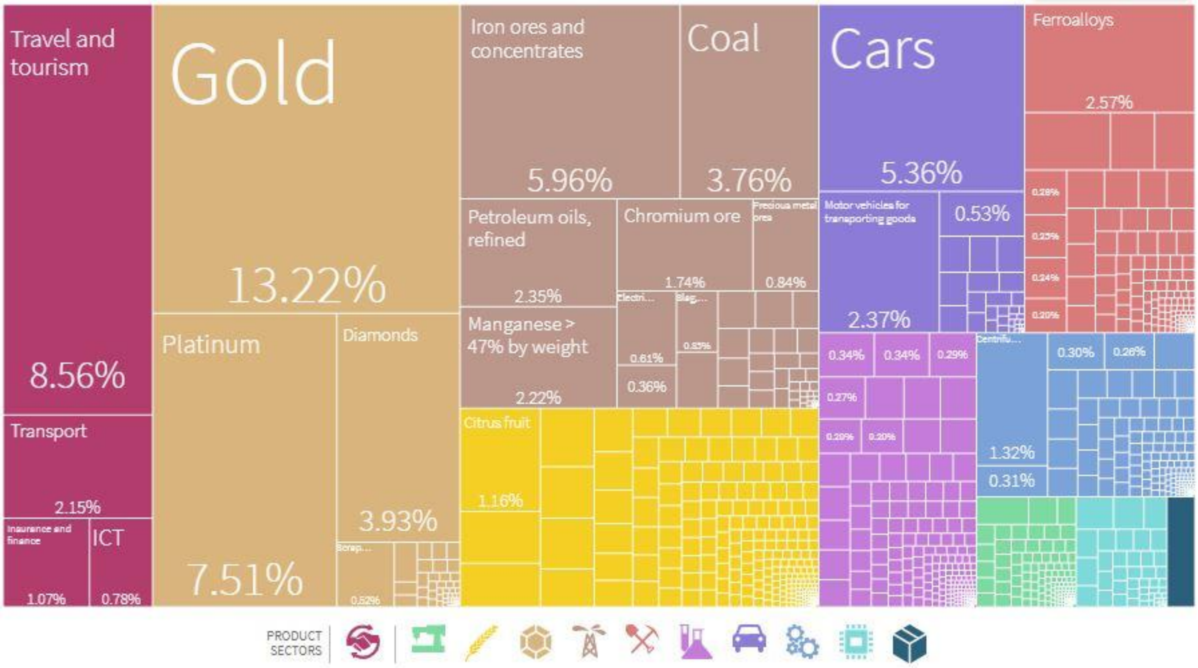

Figure 2.11: South Africa's Export Basket (2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

Figure 2.12 proceeds to submit the trade basket in the period 1994 – 2019 performance encompassing ECI and related products PCI ranking. South Africa is seen to be marginally sophisticated through the likes of cars and platinum as main exports with a higher PCI. However, much of the exports basket are still less complex such as gold, iron ores, diamonds and coal as less complex or raw export resources. These also make the highest share of the country's share of exports.

Figure 2.12 shows the complexity of products that were exported against less complex products. Some of the less or low complexity exports products were gold (-2.24), coal (-1.33), citrus fruits (-1.34), manganese (-2.1) and chromium ore (-2.95) among many others. Some of the exports products with a favourable PCI were platinum (1024), cars (1.05), parts of motors (1.2), pump and liquids (1.31) among many others.

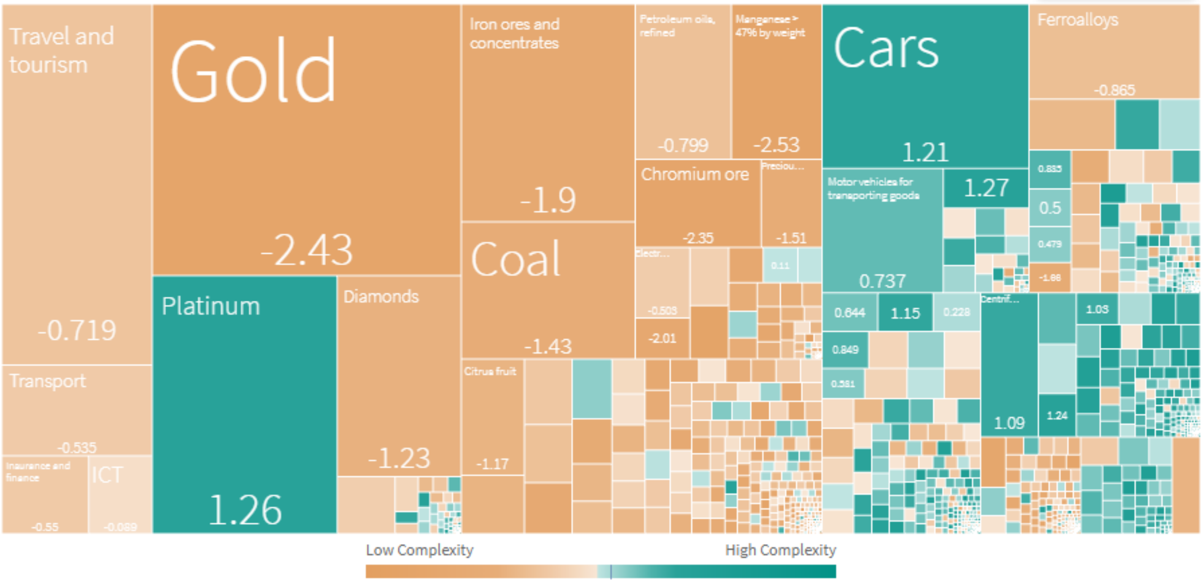

Figure 2.12: South Africa's Exports Basket and product complexity Index (PCI)
Source: Harvard Atlas Economic Complexity Lab (2019)

South Africa has made some grounds in expanding on more complex products for both consumption and the exports market. Figure 2.13 reflects on these new products added since 2003. It is postulated that economic growth is driven by diversification into new products that are incrementally more complex. To this effect, the country has added 9 new products since 2003. These products contributed $5 in income per capita in 2018 (Harvard Atlas, 2019). These new few diversified products are said to have had a substantial growth in income. Moreover, it is reflected, as a drawback, that there is an arrangement of structural transformation wherein the manufacturing sector does not stretch to its full potential, with labour and other resources channelling resources from low-productivity agriculture to relatively unproductive services instead (Whitehead & Bhorat, 2021).

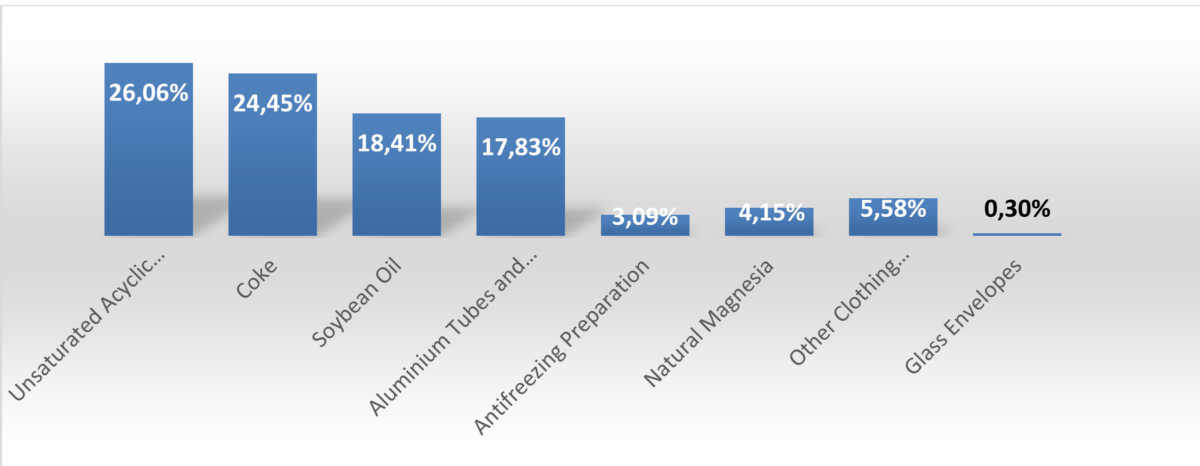

Figure: 2.13: South Africa's New Product diversification
Source: Harvard Atlas Economic Complexity Lab (2019)

The last analysis is in respect to the global share of the export market as representing the global presence of South Africa. Therefore, figure 2.14 reflects South Africa's market share per sector exports. According to the atlas, only the stone sector had a meaningful share of the global market share by sector at 4.04%. The rest of the sectors were below 1% of the global market with electronics ranking the lowest at 0.07% as at 2019 world market share.

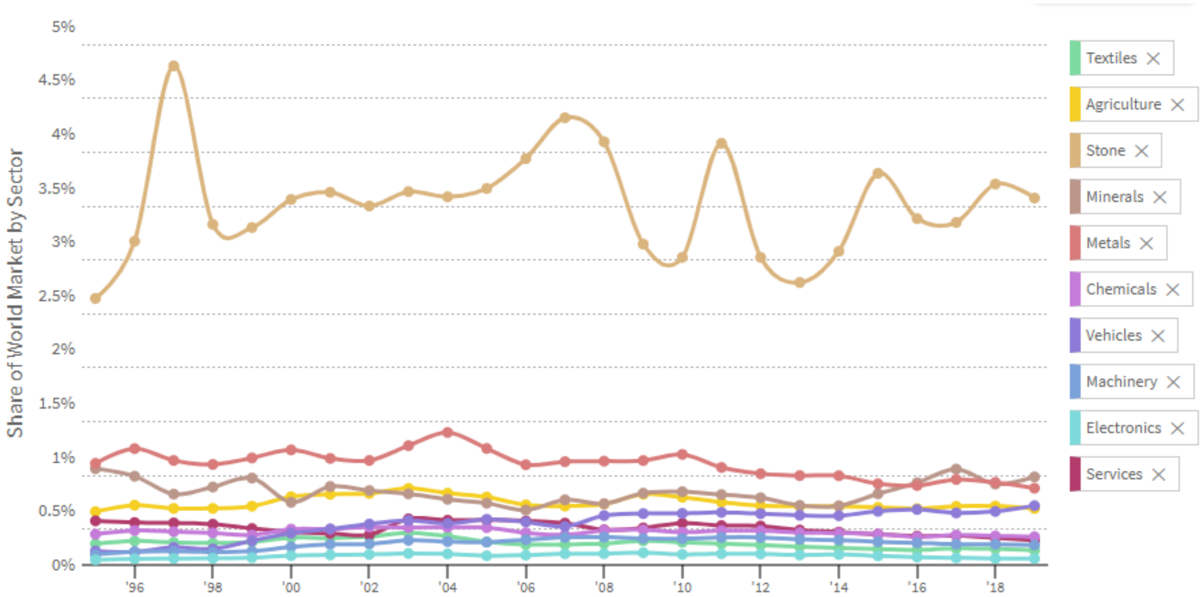

Figure 2.14: South Africa's World Export Market share (1996 – 2019)

Source: Harvard Atlas Economic Complexity Lab (2019)

Much is still left to be said in future writing about South Africa's economic complexity outlook or prospects. For practicality purposes, the information given is enough to give one a small but significant bird's eye view of the country's developmental level in respect to the export market.

2.2.1.5. Policy perspective and challenges

Given the study at hand, the policy perspective explored here is in relation to the Industrial Policy Action Plan (IPAP) under the stewardship of Minister Dr Rob Davis (Member of Parliament) in the Department of Trade and Investment (DTI, 2020). The IPAP policy is also themed 'Radical Economic Transformation'. This is a 2018/19 – 2020/21 plan aligned to advance economic sector development, employment creation and to encompass an infrastructure development cluster programme.

The following are the key objectives of the IPAP (2018/19 – 2020/21), which is also amalgamated with the National Development Plan vision 2030.

- The embodying objective is to enhance the productive capabilities of the South African economy. This means that the industrial policy targets to upturn the economy's ability to produce more complex and high value-added products with superior efficacy. As such, to produce more value using less resources.
- Transforming the ethnically or racially tilted ownership, management and employment contour of the economy. The emphasis is that the harmony between industrial policy and transformation should be clear. The notion is that if a product or commodity is imported, then building a transformed supply chain is hindered.

The minister submits the following matters as key observations critical in the future success in domestic industrial strategy:

- Basic economic service delivery

Basic service delivery needs to be in place for there to be effective industrial policy. A widely accepted notion is that the institutional failure that derives from prevalent corruption and rent-seeking in key State Owned Companies (SOCs) must be rooted out.

- Institutional coordination

It is inferred that policy cohesion and programme alignment are a prerequisite for industrial intervention. This is on the backdrop that industrial policy needs to be aligned across the respective government departments, not some of the departments.

- Industrial policy in the global context

This key observation emphasises that policies need to continually adapt to developments in every industrial sector. Reasoned on the backdrop that industrial policy is by its nature an iterative progression, that is, the construction of industrial capabilities is a step-by-step practice. It is not possible for an economy to master highly advanced and complex industrial capabilities if basic and intermediate capabilities are not in place.

- Partnership with the private sector

One of the key principles that government is drawing on is to form conditional collaborative partnerships with private sector companies that show substantial commitment to invest in areas that are aligned with policy objectives. Industrial policy is ultimately about promoting investment by the private sector in new industrial capabilities.

On the overall, there are challenges that are observed as hindering the progress of the economy holistically, and the current state of things. A Helara Research hub indicates the following challenges facing the country (Heinisch, 2019). The country is faced with some major fiscal challenges. The findings indicated that since 2008, government debt has surged from 26% to 52% of GDP; the debt has doubled. Additionally, there has been an increase in government spending by nearly 4 percentage points of GDP to 30%. On the other hand, the income side of budget revenues have only amplified by 1 percentage point of GDP.

Government spending is accounted wages, followed by debt interest payments. To this end, it was proposed in the 2020 Medium Term Budget Policy Statement (MTBPS) to freeze wages in the next three subsequent years to provision fiscal consolidation (National Treasury, 2020). This of course was met with resistance from labour unions. Additionally, given that the expenditure cuts are across the board, this may hinder on the investment side, the gross fixed capital formation side which is meant to advance infrastructure for improving business means. Lastly, Fitch Solutions agency submits that the country has high labour costs, inflexible labour market, prevalent industrial strikes, and high crime levels that weigh up on the country's appeal as an investment destination (Fitch Solutions, 2020)

2.2.2. Nigeria Economic Landscape

The second selected SSA country is Nigeria located in the Western part of the continent. The country is a lower-middle-income country and holds the position of the richest nation in the continent valued at just under $450 billion in nominal GDP driven by finance, transport, infrastructure, tourism, and an abundance of crude oil. Nigeria is the 27th in the world and borders Chad, Cameroon, Benin and Niger, while it shares maritime borders with Ghana, São Tomé and Príncipe, and Equatorial Guinea.

2.2.2.1. GDP Performance and population trajectory

The World Bank reports that Nigeria’s GDP has over the past fourteen years from 2000 to 2014 grew by 7% on a year-on-year basis, which was one of the fastest rates in the African continent (World Bank, 2020a). However, in the same report, it is also reflected that the GDP growth rates have slowed to 2% in recent years as a result of political instability, socioeconomic factors, oil and production shocks. This is quite evident when observing the GDP path in figure 2.15.

On the other hand, as reflected in the same figure 2.15, the population trend has been rising over the years. As such, this West African economy, which has a population of over 200 million people, makes up an indispensable share of the African economy. To this end, the ever expanding population and GDP estimates have a critical alteration in the standard of living as already made clear above (South Africa).

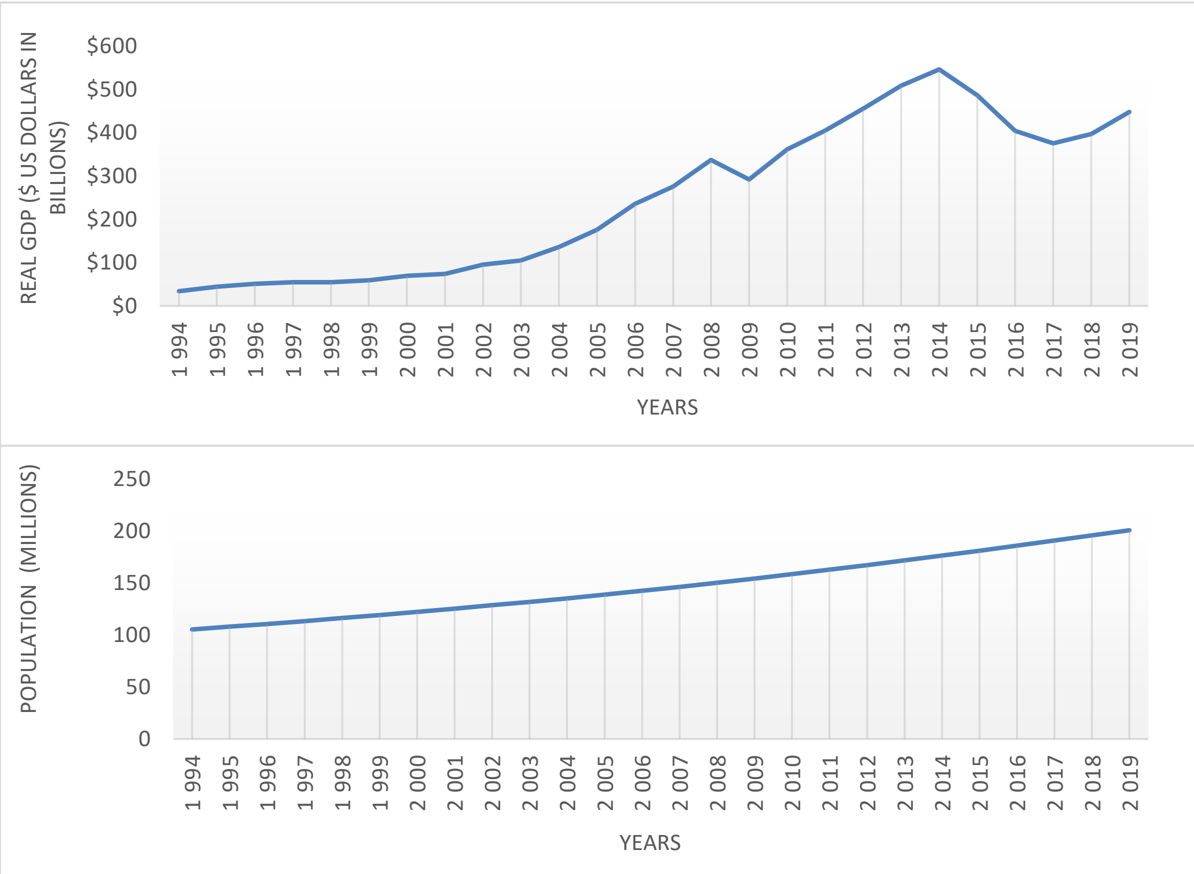

Figure 2.15: Nigeria Real GDP and Populations trends
Source: World Bank Data Bank

It is also foreseen that the enormous population have aided to drive Nigeria as the largest consumer retailer in the continent, and the digitally aware residents have contributed to the country's fast growing tech sector (World Bank, 2020).

Figure 2.16 further puts forward the Nigerian economy and its population estimates by stating its GDP per capita and the percentage change from year to year. As reflected above, the per capita estimates also show that the standard of living was improving over the years with a dent in the year 2014 onwards. Furthermore, the percentage change also reveals that there was a visual negative impact with a negative percentage change in the per capita GDP on a year on year basis from 2015 to 2019. This shows that the standard of living diminished at respective rates.

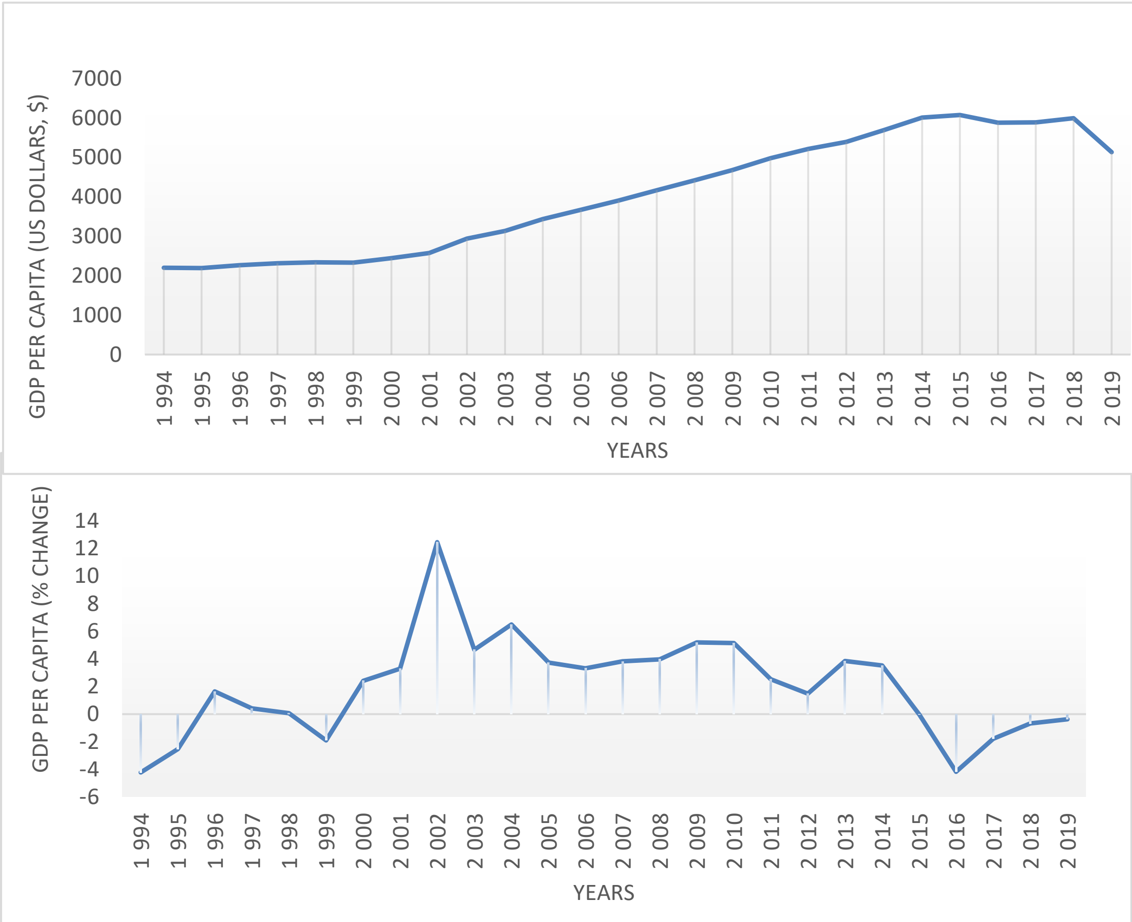

Figure 2.16: Nigeria’s GDP per capita (Real and percentage change)
Source: World Bank Data Bank

In recent times, the Nigerian’s National Bureau of Statistics (NBS) reflects that GDP grew by 0.11% on a year-on-year basis in 2020 real terms in the fourth quarter of representing the first positive quarterly growth in the last three quarters (NBS, 2021). A brief analysis of the Nigerian economy’s sector performance is that the country is said to be over-reliant on its oil production in the export market, while the rest of the sectors play secondary importance to the GDP share.

Estimates are that the non-oil sector growth realised a 1.69% growth in real terms in Quarter 4 of 2020, which is 2.26% slower than the recorded in the corresponding quarter of 2019, but nonetheless recovered from the -2.51% growth rate recorded in the previous quarter (NBS, 2021). The bureau further states that the growth rate in the non-oil sector grew –1.25% in 2020 compared to 2.06% in 2019. The non-oil sectors include the likes of telecommunications and broadcasting, agriculture, real estate and manufacturing (Food, Beverage & Tobacco), mining and quarrying (Quarrying and other Minerals), and construction, accounting for positive GDP in 2020. In 2020, the non-oil sector's contribution to the GDP share was 91.84% in real GDP terms, which was greater than the 91.22% documented in 2019 (NBS, 2021).

2.2.2.2. Trade Outlook and Performance

The Nigerian trade or export economy is mainly driven by petroleum (crude oil, refined, and gas), while other noticeable exports include cocoa beans, rough woods, chemicals, vehicles and aircraft parts. Table 2.2 provides Nigeria's top exports destination and top imports origin. With the United States and the rest of the countries providing the dollar and pounds with the exception of India, it plays a significant role in strengthening the Nigerian currency with much needed currency boost.

Table 2.2: Nigeria's Exports Destination and Imports Origin

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. India	$8.25B	1. China	$9.6B
2. The United States	$6.68B	2. Belgium-Luxembourg	$3.03B
3. Spain	$4.54B	3. Netherlands	$2.83B)
4. France	$2.81B	4. South Korea	$2.18B)
5. Netherlands	$2.3B	5. The United States	$2.04B

Source: Atlas of Economic Complexity (MIT, 2018)

A World Bank overview report on the macroeconomic conditions is more challenging today (2020) than it was in 2015 to 2016, when oil prices fell abruptly and the country experienced its first recession in 25 years (World Bank, 2020). The below analysis in figure 2.17 summarily reflects on the previous performance in the current account credit items. In 2017 the country had an affirmative trade balance of $12.7B in net exports. This is paralleled against the trade balance in 1995 when Nigeria still had a positive trade balance of $6.96B in net exports (MIT Atlas, 2018). The 2018 to 2019 figures seem to uphold the World Bank pronouncement in that there is an awkward drop or decline in the current account receivables.

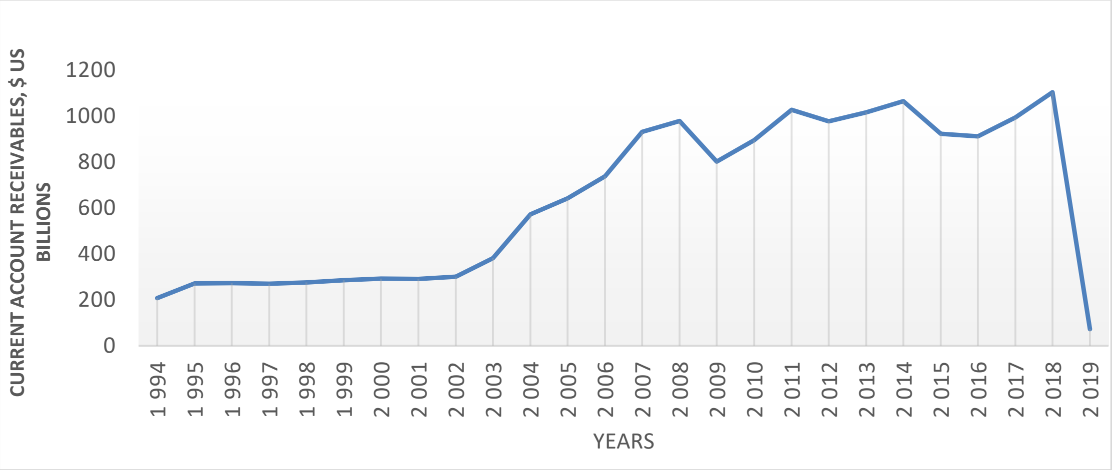

Figure 2.17: Nigeria's Current Account (Income items, credits)
Source: World Bank Data Bank

On the other hand, the debit items in the current account as depicted in figure 2.18 below show that there exists a similar trend as the debit items. However, from 2014 to 2017, there seems to be a positive surplus account with a much more convex shape in the items trend. In recent times, there was a much improved outlook in the current account oulook because of the steadiness in crude oil price and the steady opening up of the economy which has led to enhanced economic activities in the 3rd quarter of 2020 (World Bank, 2021a).

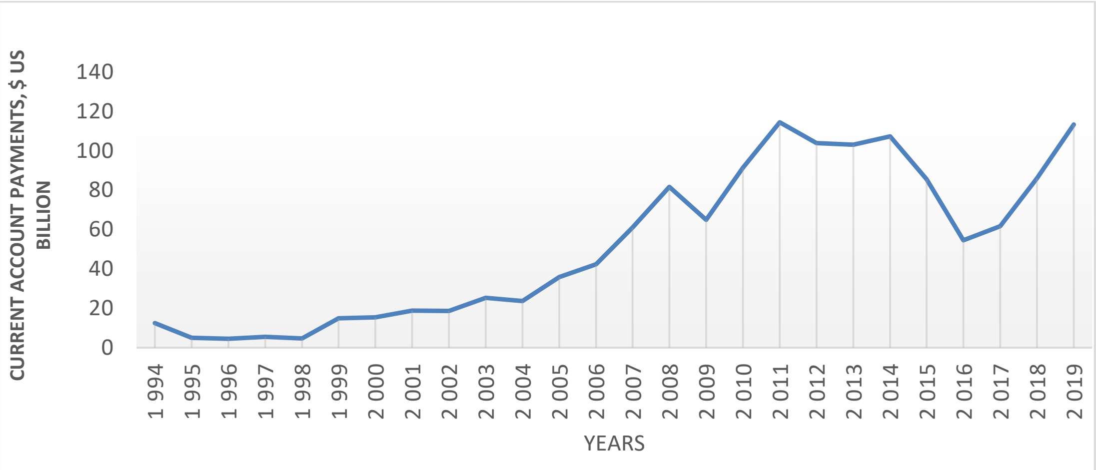

Figure 2.18: Nigeria’s Current Account (Debit Items)
Source: World Bank Data Bank

Furthermore, to put the Nigerian current account in context, a perfect picture on the account’s performance in recent times to the current 2021 year is brought forth by the

Central Bank of Nigeria. In the last quarter of 2016 and well into the 2nd quarter of 2018, there was a current account surplus. From the 3rd quarter of 2018 to the 4th quarter of 2020 there was current account deficit. To this end, Nigeria logged a current account deficit of $5264.53 Million in the 4th quarter of 2020 (Central Bank of Nigeria, 2021).

2.2.2.3. Investment performance

The following reflects the 2020Q2 total investment inflows which is tied to foreign exchange challenges, amongst other elements. FDI inflows stood at US$1.3B in 2020Q2. This is seen as the worst inward FDI since 2017Q1, and represents a decline of 79% in comparison to the $6B in 2019Q2. It was additionally stated that the momentous weakening in FDI was owing to economic uncertainty.

A Santander (2020) FDI outlook accounts some of Nigeria FDI past performances as enacted from the United Nations Conference on Trade and Development (UNCTAD) reporting in Table 2.3. The submission was that the country has attracted robust inflows from American companies, comprising corporations like Facebook and Uber, as well as the likes of Meltwater Group. China has, likewise invested significantly in Nigeria, primarily in the textile industry, automotive and aerospace industries. The submission is also that in respect to inward FDI, there was an upsurge in FDI to $6.401 Million, then down to $3.299 million in 2019. The interesting part is that the number of Greenfields investments went up to 76 projects in 2019 from 36 in 2017. This shows that the country may be seen a good investment destination, as opposed to South Africa as of recent. The aggregate FDI stock was appraised at USD 98,6B in 2019. The main investing countries in Nigeria include the United States of America, China, United Kingdom, the Netherlands and France (Santander, 2020).

Table 2.3: Nigeria's FDI Inflow Performance

Foreign Direct Investment	**2017**	**2018**	**2019**
FDI Inward Flow (million USD)	3,813	6,401	3,299
FDI Stock (million USD)	88,917	95,318	98,618
Number of Greenfield Investments*	36	57	76
Value of Greenfield Investments (million USD)	4,841	7,954	10,196

Source: UNCTAD - Latest available data

Note: * A form of FDI where a parent company starts a new venture in a foreign country by constructing new operational facilities from the ground up.

Another investment measure is the real fixed investment in terms of gross fixed capital formation. These are investment made by the country and locally by private individuals and corporations to investment in the local economy. Figure 2.20 shows the investment performance for Nigeria as perhaps augmenting or augmented by the FDI inflows.

Figure 2.19: Nigeria's Real Fixed Investment Performance (1994 – 2019)
Source: World Bank Data Bank

Figure 2.19 shows the investment made in improving the country's infrastructure either in new plants built or machinery. The country has over the years invested in itself as seen by the upward trajectory, with the only dent in the 2015 to 2017. This may be on the backdrop that the country aims to diversify or expand its economy away from petroleum by building a viable manufacturing sector, which facilitates integration into universal value chains in order to boost productivity.

The recent merging of trade, industry and investment under the ambit of the Federal Ministry of Industry, Trade and Investment reflects Nigeria's intention to effectively coordinate between these three key areas to improve its trading and investment environment ((Santander, 2020). Perhaps the initiation to diversify the economic structure might improve the country's ECI outlook as shall be seen in subsection 2.2.2.4.

2.2.2.4. Economic Complexity, product complexity and trade dynamics

Out of the 133 countries ranked by the MIT and the Harvard atlas of economic complexity laboratory, Nigeria was ranked last as the very least complex or diversified exporter of goods and services. A further analysis is that in the past ten years prior, Nigeria's economy has become less complex, falling 3 positions in the ECI index (Harvard Atlas, 2018). To exacerbate the ECI outlook is the fact that 90% of the export market share is purely on the petroleum products (crude and gas). Figure 2.20 paints a better picture of the Nigerian export basket with non-oil sectors contributing minimally.

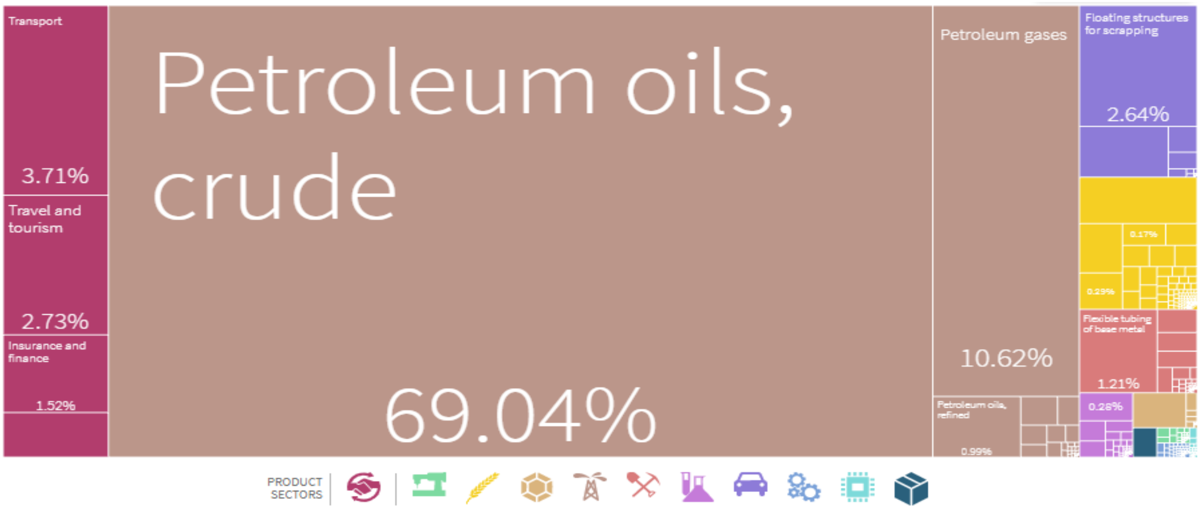

Figure 2.20: Nigeria's Sector export share
Source: Harvard Atlas Economic Complexity Lab (2019)

Even more, worsening the Nigerian ECI rating, the non-oil exports waned by 9.1% annually in the past five years, dropping below the world average growth (MIT Atlas, 2018). The MIT Atlas further gives the PCI of the petroleum oil at -2.83 and the petroleum gas at -2.08, which explains the low rank of Nigeria because these two products together represents 90% of the export share.

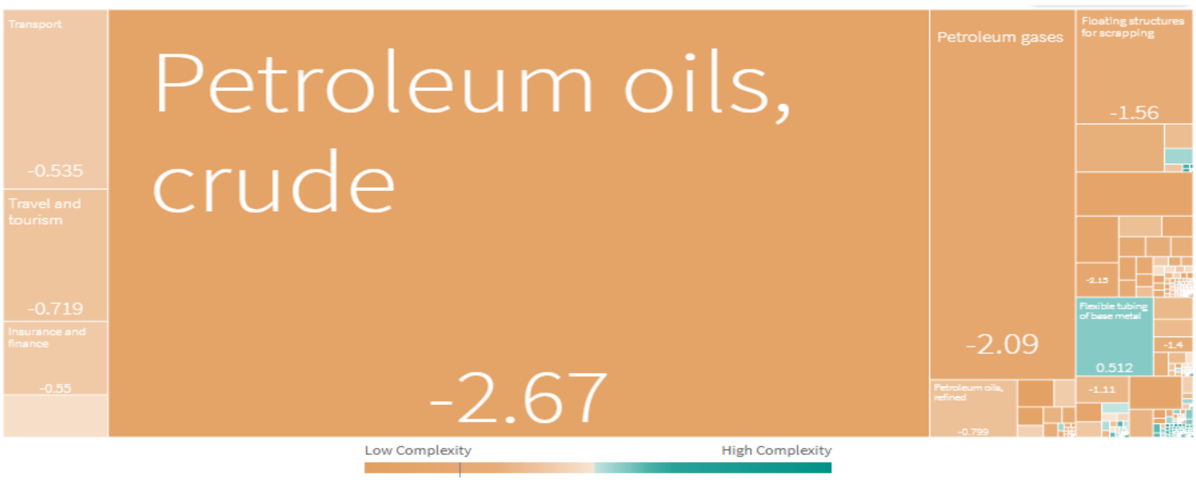

Figure 2.21: Nigeria’s Exports Basket and product complexity Index (PCI)
Source: Harvard Atlas Economic Complexity Lab (2019)

The figure below therefore gives a clear understanding of why the Nigerian ECI is very low with the depiction of the historical export sophistication index given in figure 2.21. From 1994 to 2018, Nigerian exports have been unsophisticated, and lacking any technological advances as seen by the below zero index.

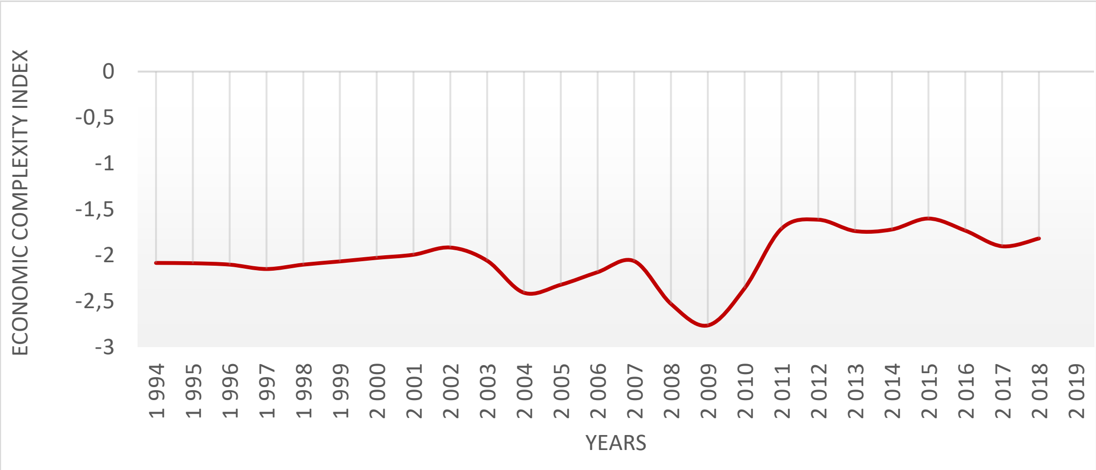

Figure 2.22: Nigeria's Economic Complexity Index (1994 – 2018)
Source: Harvard Atlas Economic Complexity Lab (2019)

The last presented Nigerian ECI summary provides the Nigerian industry global export share in figure 2.23. Much like South Africa, the Nigerian share of the global export market in any sector or industry is quite small. The highest share of the global market was the mineral sector, which stood at just over 2.8% of the world export share. The rest of the sectors had well below 0.2% share.

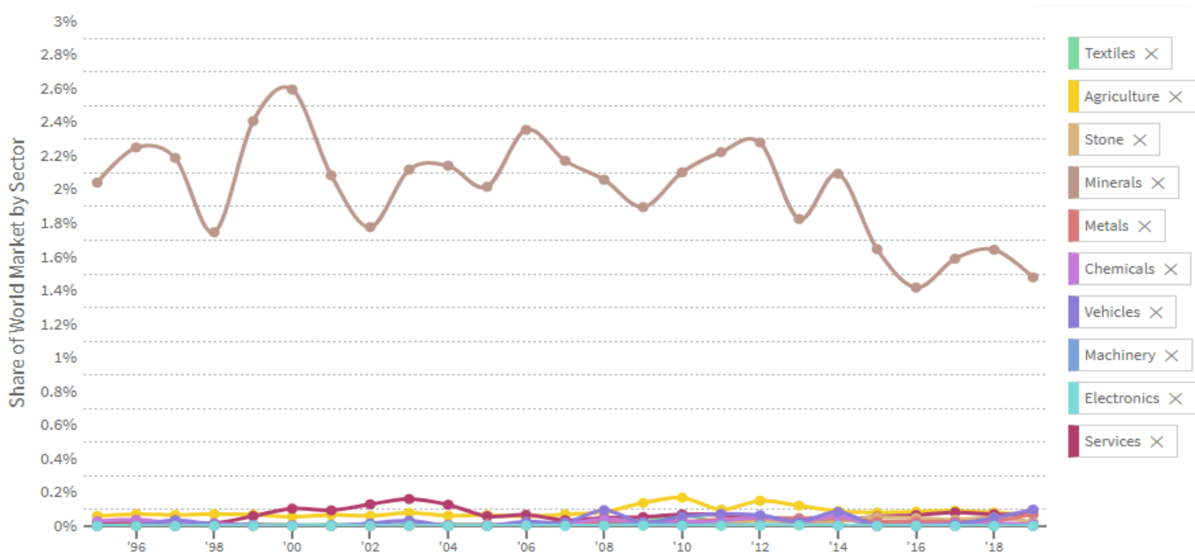

Figure 2.23: Nigeria's World Export Market share (1996 – 2019)

Source: Harvard Atlas Economic Complexity Lab (2019)

Unlike South Africa, Nigeria has not up till now begun the traditional process of economic structural transformation. By the end of 2018, this necessary process and a key foundation of economic growth and the progression transfer of economic activity from low to high productivity industries or sectors were required (Havard Atlas, 2018).

2.2.2.5. Policy perspective and challenges

Nigeria has reacted to some of the past economic recessions by setting in motion a number of reforms and initiatives to enhance its development prospects (UNCTAD, 2019), with the main recession being the 2015 to 2017 economic crises, that is, and the waning of oil prices that surged and led to a severe deficiency of foreign currency, and the 2012 to 2014 GDP crisis. As such, the following relevant policy recommendations were initiated as reflected in the Investment Policy Review (IPR) from the UNCTAD (2019) report:

- Providing competitive support to investor

An impediment with respect to regulatory framework was highlighted as that emanating from areas such as taxation, technological transfers and the labour market.

- Developing infrastructure, skills and linkages

The IPR endorsed refining the physical infrastructure, particularly with regards to electricity. This IRP called for rehabilitating or developing further the energy grid before enchanting investment promotion for the sector. This support is initiated through further investment in infrastructure development and modernisation in innovation, while encouraging the adaptation of free zones based on the efficiency of infrastructure and facilitation of business services. This speaks to the promotion of fixed investment, that is, gross fixed capital formation.

With this in mind, there are some challenges that hinder progress and are seen as critical.

- The poorly developed transport system in Nigeria, coupled with energy infrastructure, especially lack of electricity, which then exacerbates high operating costs.
- The over 90% export revenue from oil and gas is seen as a challenge with market volatility living the economy vulnerable to prices.

- The last main challenge is the presence of extremists group Boko Haram operating in the North-East of Nigeria, which results in security concerns, or lack of thereof.

At a glance, Nigeria is a member of the African Continental Free Trade Agreement (AfCFTA), and as such, is placing itself among a group of economies involved in a multi-country trade agreement. The Nigeria Investment Promotion Commission (NIPC) affirms that the AfCFTA is expected to support and expand the country's inter-trade portfolio, lift competitiveness and upturn GDP (NIPC, 2020).

2.2.3. Ghana Economic Landscape

The third selected country is Ghana, which is located in the West of Africa, and has a diverse and rich economy worth $67,077B in GDP. The World Bank (2020) reports that the country is ranked 71st in the world and 9th in Africa as per GDP estimates, while it is considered a lower-middle income economy with a population of just over 30 million people. The country was the first in the SSA to obtain independence from colonialism, and the first to half extreme poverty, one of the millennial development goals as stipulated in the United Nations. The country is bordered by Cote d'Ivoire, Burkina Faso and Togo by land, and by sea it is bordered by Benin and Nigeria.

2.2.3.1. *GDP Performance and population trajectory*

Ghana is well resourced with an abundance of natural resources that aid to advance an economic boom. The World Bank (2021c) reports the following on the economic front. The country's economy contracted in the 2nd and 3rd quarter of 2020 by 3.2 and 1%, respectively, which culminated in a recession, for the first time in 38 years. Additionally, a modest growth rates of 1.1% for the year 2020 was still observed on the back of the 1st quarter performance of 4.9% growth in 2019.

Figure 2.24 gives an overall picture of the GDP performance for the stated period of study prior to the pandemic along with the population growth trajectory. It clearly reflects that Ghana had neutral growth rate from 1994 to 2005 with GDP moderately at an average of $10B, and had a growth spat onwards into 2015. From 2012 to 2013, we observe a noteworthy growth trajectory while moderately trending upwards to just about $67B in 2019. The population figure was ever increasing at a moderate pace from around 16 million to the current 30.5 million. Once more, living standards are then observed in figure 2.24, the GDP per capita and percentage change estimates thereof.

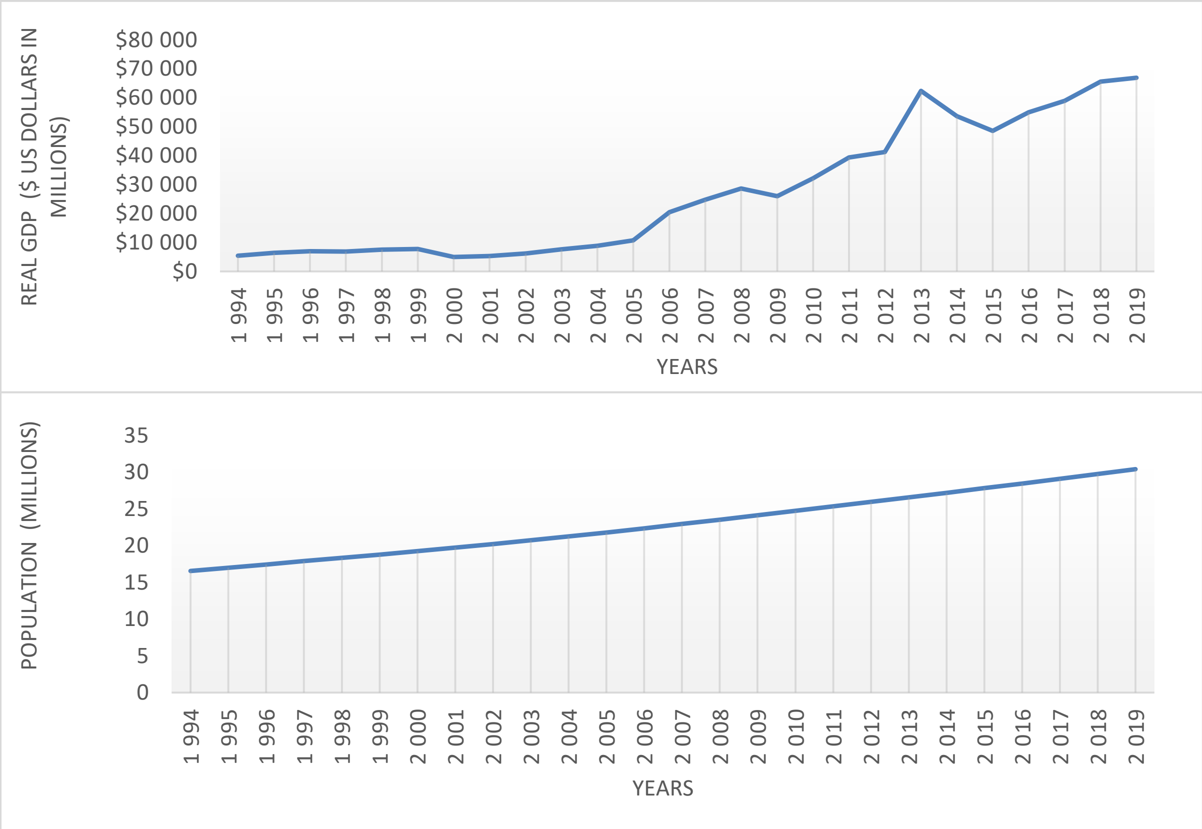

Figure 2.24: Ghana's Real GDP and Populations trends
Source: World Bank Data Bank

Figure 2.25 shows a rather positive outcome in the GDP per capita estimates over the years to 2019. The gradual increase in population figures seem to meet a gradual increase in GDP as reflected above. This has meant that the GDP per capita estimates were healthy enough with the positive GDP per capita percentage change in the positive also. The GDP per capita had an incline of over $4500 in 2019 up from just $1500 in 1994. In recent estimates for 2020, the country's GDP per capita was $5,652. Given that the Ghanaian economy is seen to be prosperous, it became imperative to investigate the relevant economic sectors that are aiding the trajectory of the GDP performance thus far.

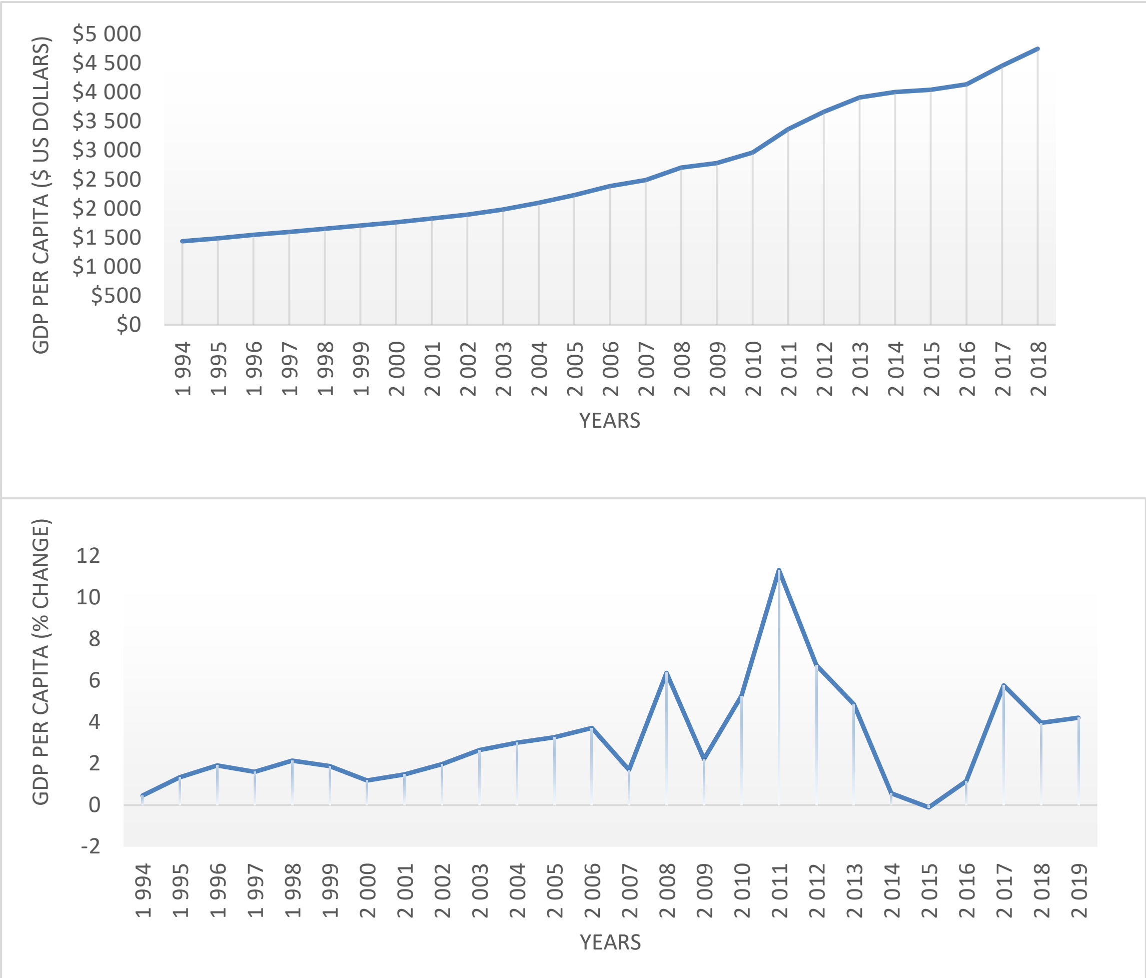

Figure 2.25: Ghana's GDP per capita (Real and percentage change)

Source: World Bank Data Bank

It is observed through the Ghana Statistical Services (GSS, 2021) reporting in figure 2.25 that the agricultural, industrial and service sectors had a meaningful growth rates, the value added to the GDD over the years with the industry contributing the most from 4th quarter of 2015 to just about 2019 when services was the most contributor to the GDP in 2019. As a share of the GDP services sector contributed to about 48%, the industry are around 34%, and the agricultural sector contributed around 18% as a share of GDP in 2019 (GSS, 2021). Of contentious to the current state of the pandemic on the national welfare is low growth in 2020, tied with escalating population growth, which has pressed real per capita incomes 1% lesser than in 2019 (World Bank, 2021b)

On the overall, the Ghanaian economy seems to be performing well, with only the current pandemic having some minor dent like any other country. With 0.4 growth rate in GDP in the 4th quarter of 2020, the country is well placed to continue its positive GDP trajectory (World Bank, 2021b)

2.2.3.2. Trade Outlook and Performance

The Ghanaian economy exports is driven mainly by gold , crude petroleum, cocoa beans, cocoa paste and coconuts, brazil nuts, and cashews, while its top imports include cars, delivery trucks, refined petroleum, rice and non-fillet frozen fish. Gold is the country's main export. This is followed by petroleum, and together, they make up 50% of the country's foreign exchange. Other major exports include cocoa beans, timber and gold. Table 2.4 provides Ghana's top export destination and imports origin. China and India remain some of the most featured exports destination and imports origin with respective trade values. An SSA country features in fourth place for the first time in South Africa as the fourth most export destination for Ghana thus far.

Table 2.4: Ghana's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. India	$5.09B	1. China	$3.08B
2. China	$1.9B	2. the United States	$1.1B
3. Switzerland	$1.84B	3. India	$660M
4. South Africa	$918M	4. Belgium-Luxembourg	$637M)
5. Netherlands	$$911M	5. the United Kingdom	$587M

Source: MIT Atlas of Economic Complexity (2018)

The two subsequent figures reflect on the current account credit and debit items and the balance, respectively. While the GDP prospects were positive, the current account, however, seem to be operating in the red, where the current account credit items like exports were seen to be below the debit items like imports as seen in figure 2.26. This suggests that the country had been operating on the deficit side of the balance.

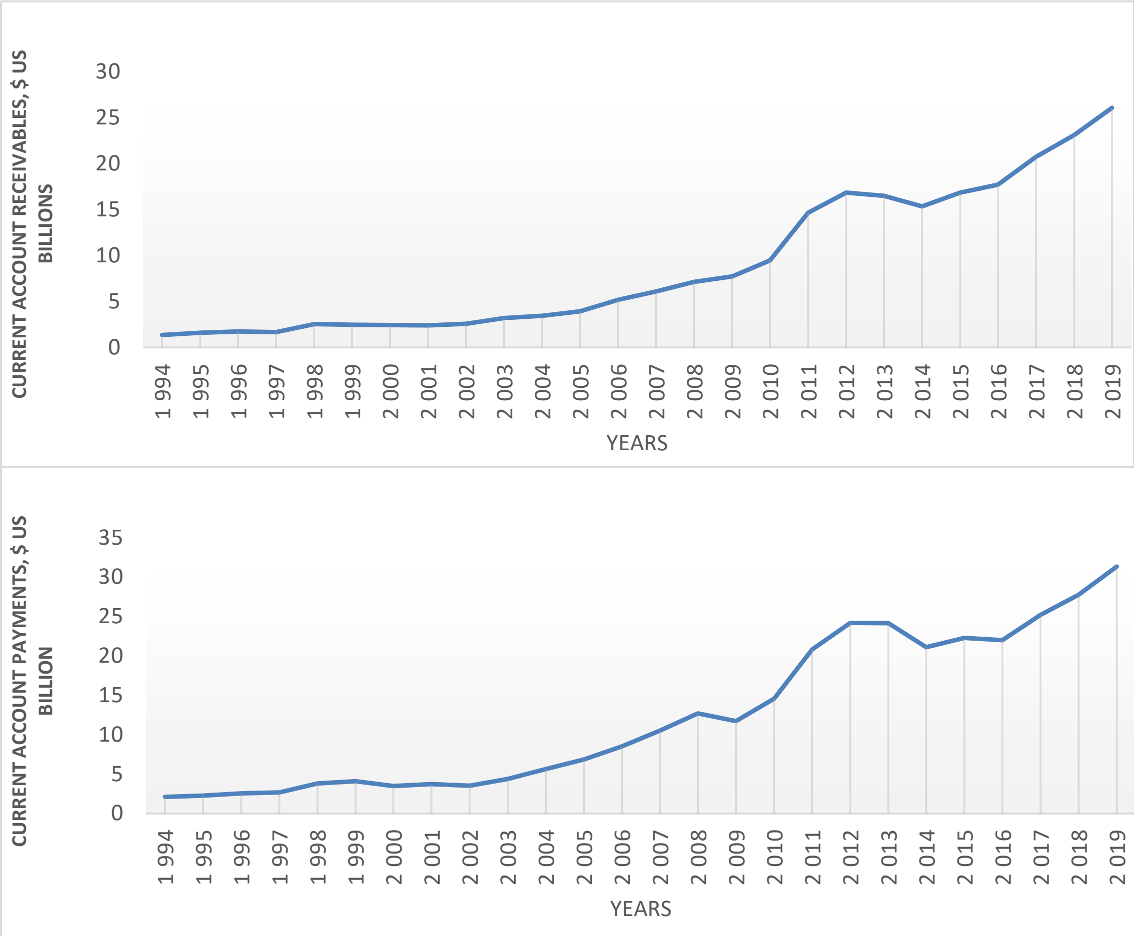

Figure 2.26: Ghana's Current Account Credit and Debit Items (1994 – 2019)

Source: World Bank Data Bank

Figure 2.27 provides evidence that the Ghanaian current account has indeed been operating on a trade deficit over the years. The only surplus realised was in 2003, with a marginal current account surplus of below 1% change.

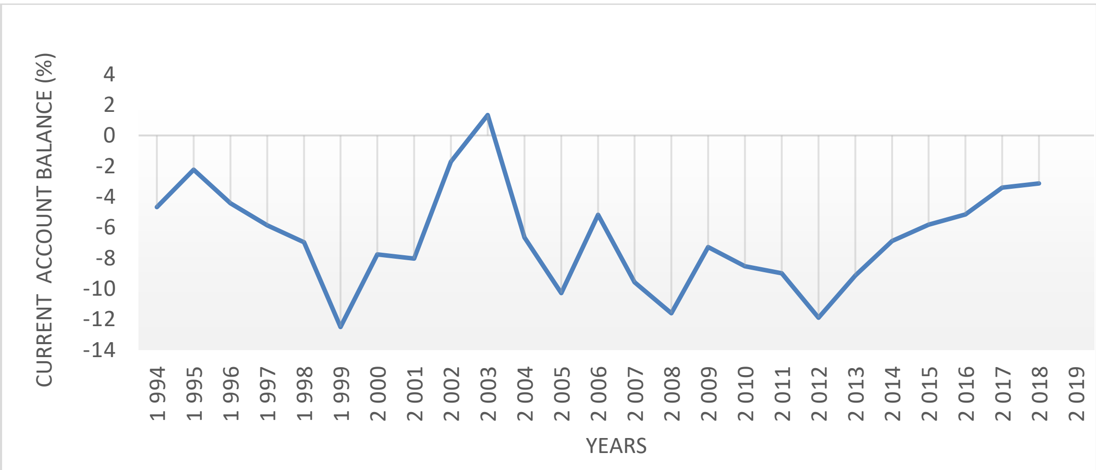

Figure 2.27: Ghana's Current Account Balance (1994 – 2019)

Source: World Bank Data Bank

The Ghanaian current is facing a deficit predicament wherein all the associated problems are realised. Unless the financial account side of the balance of payment account performs substantially well to mitigate the deficits, the country may face liquidity concerns.

2.2.3.3. *Investment performance*

Ghana is said to have attracted foreign investment due to its overall positive business environment, and experienced economic growth of just over 6% in the last two years prior to 2018 (IMF, 2020). As already alluded to above, services contributes to around 50% of the Ghanaian GDP, while employing nearly 30% of the labour force. Industry's contribution is at just under 25% share of GDP, followed by agriculture (GSS, 2021). In an overview of Ghana, the World Bank, through its program in Ghana, submits that it has injected $3.26B worth in credits and grants over 29 projects (World Bank, 2021). As such the following financing by the World Bank is submitted:

- Of the total financing, 90% is from International Development Association (IDA), where at the national level, the contribution was worth $2.713 billion, the regional contribution was $210 million, and the remainder of 10% was sourced from a trust fund in specific sector worth $337 million.
- The projects portfolio had a balanced range over all the sectors with the largest investments in education at 14%, finance and competitiveness at 16%, and urban resilience at 9%.
- All other sector financing ranged from 2-8%.

Additionally, the Ghanaian government and incorporating the private sector has had some investment into developing the infrastructure needed for production purposes.

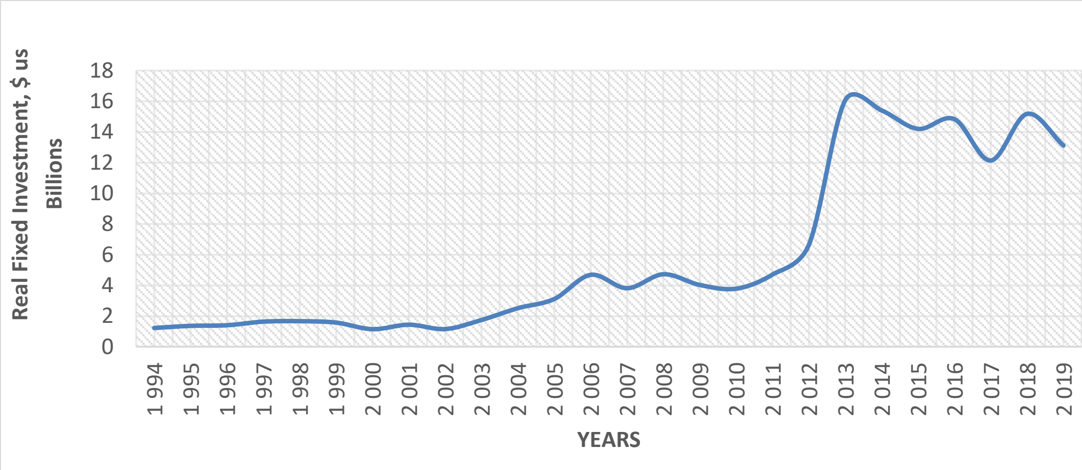

Figure 2.28: Ghana's Real Fixed Investment performance (1994 – 2019)
Source: World Bank Data Bank

Figure 2.28 narrates the real fixed investment performance. Thus far, it has the lowest investment estimates compared to South Africa and Nigeria, perhaps the size of respective countries gives credence to the figures stated. As at 2019, fixed investment was below $14 Billion.

2.2.3.4. Economic Complexity, product complexity and trade dynamics

According to the MIT Atlas, Ghana is ranked 103rd and as the most complex country in the ECI ranking, and it is inferred that compared to the last ten years prior to 2017, Ghana's economy has developed and is more complex, improving two positions in the ECI ranking (MIT Atlas, 2018). Ghana is also said to be well positioned to gain from few opportunities to expand its production using its existing know-how much like South Africa. However, the country is also said to be slightly less complex than anticipated for its income level. To this end, its economy is estimated to grow much slowly.

Figure 2.29 proceeds to summarily provide the country's export basket, to reflect on the export mix and the percentage share of each sector or product. The Harvard Atlas (2019) assessments show that gold (24.09%) and petroleum oil, crude (14.52%) have the largest share of the export basket, with services through travel and tourism (5.71%) and ICT (5.64%) being third and fourth most contributors, respectively.

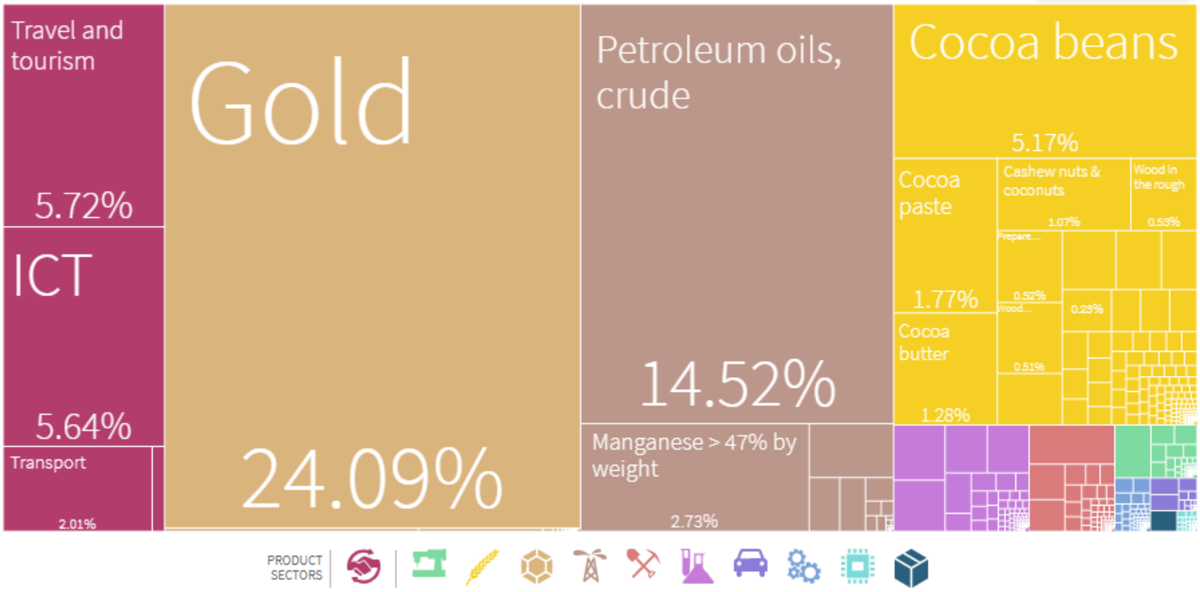

Figure 2.29: Ghana's Sector export share

Source: Harvard Atlas Economic Complexity Lab (2019)

In view of the exports destination and the country's exports basket narrated in the latter sections, figure 2.30 continues to also affirm the complex nature (PCI) of exports basket as leading to the country's ECI in figure 2.30. The figure suggests that Ghana's exports basket are mainly in moderate and low complexity products such as gold stone and minerals.

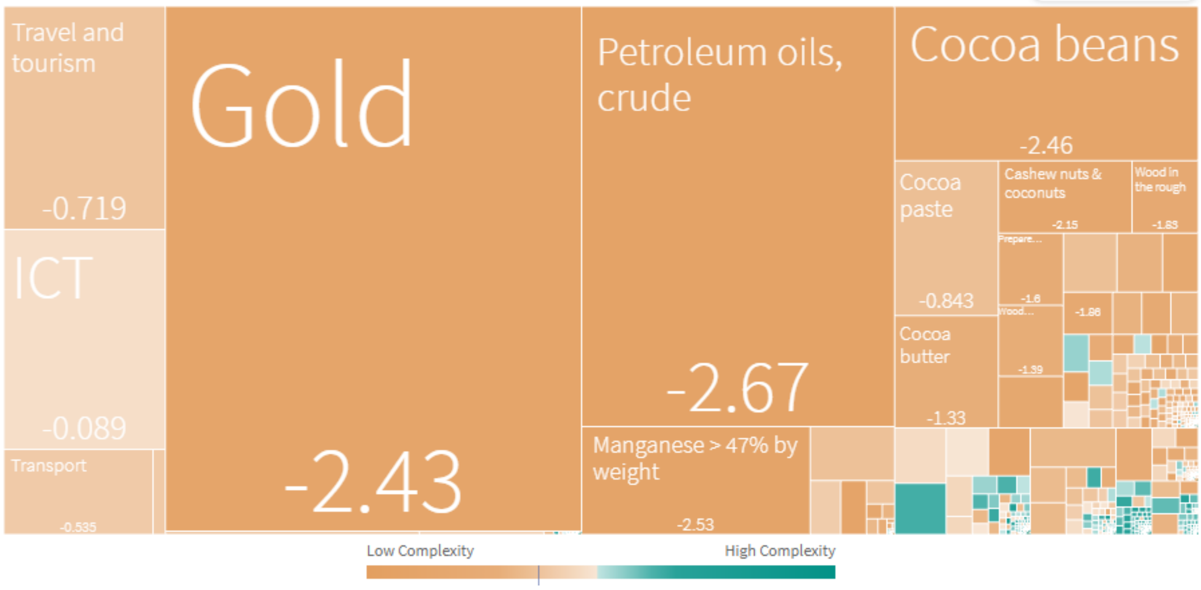

Figure 2.30: Ghana's Exports Basket and complexity index

Source: Harvard Atlas Economic Complexity Lab (2019)

Figure 2.31 provides a trend analysis of the ECI performance to reflect the country's level of sophistication given the products it exports. Because of the products that it exports as reflected in figure 2.29, which are of course lacking in process as most are unprocessed minerals, the economy is therefore not diversified. This may help explain the negative current account realised in the section above. It exports unsophisticated and therefore less durable goods as opposed to finished durable goods that it imports. This has led to the low complexity index and subsequent ranking.

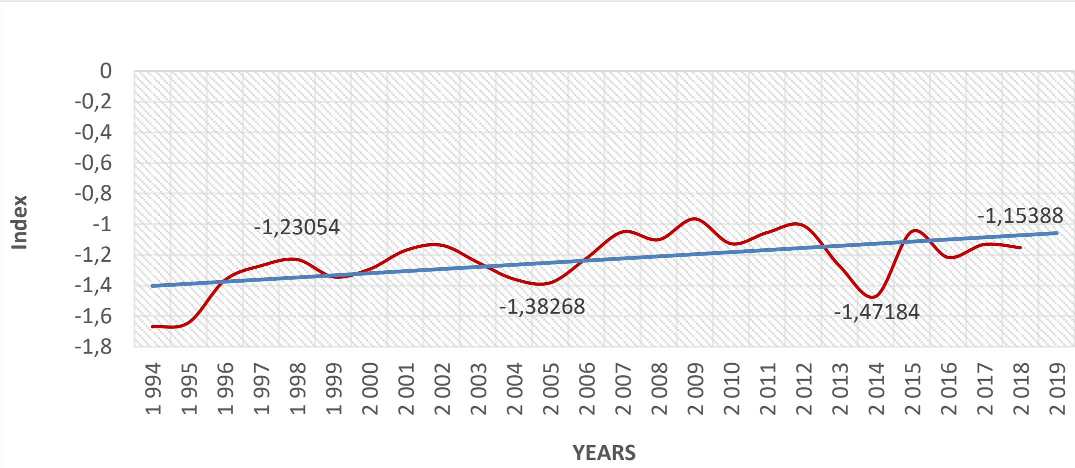

Figure 2.31: Ghana's ECI Trend (1994 - 2018)
Source: MIT Atlas Economic Complexity Lab (2018)

From figure 2.32, Ghana's world exports market share is rather not a positive one. The world share is even lesser than the South African and Nigerian. The best performing sector was stone at 0.76%, which is below any acceptable standards. Global market share in textile exports in Ghana has stagnated over the previous decade; electronics and machinery have yet to take-off, limiting its income growth (MIT Atlas, 2018).

Ghana has not yet started the traditional process of structural transformation. As a key source of economic growth, this process reallocates economic activity from low to high productivity sectors. It broadly moves activities out of agriculture into textiles, followed by electronics and/or machinery manufacturing. Global market share in textile exports in Ghana has stagnated over the previous decade; electronics and machinery have yet to take-off, limiting its income growth.

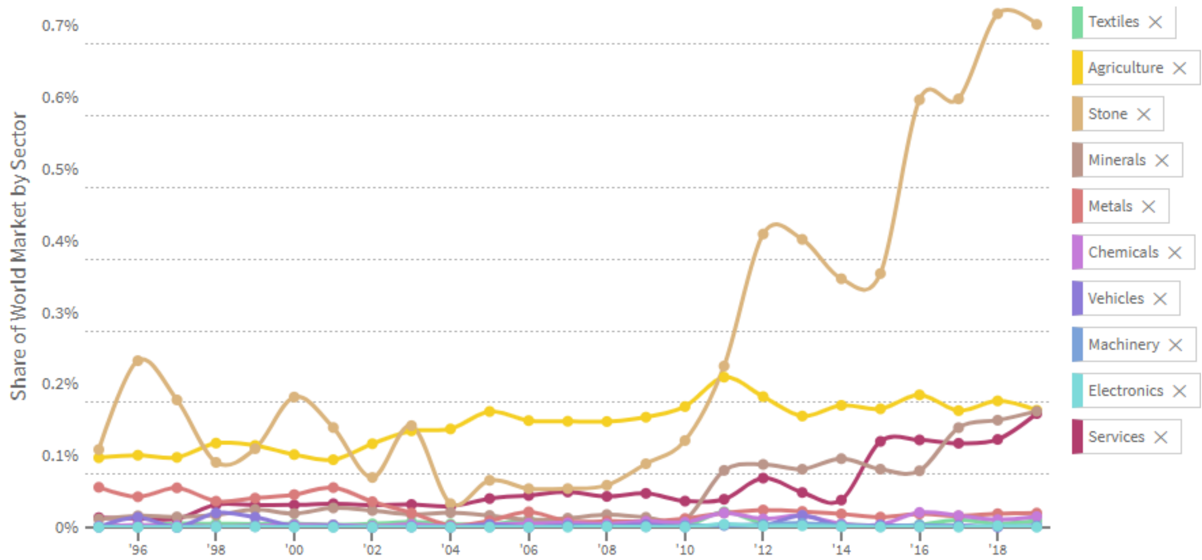

Figure 2.32: Ghana's World Export Market share (8994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

Ghana's export growth in the past five years has been driven by stone. Ghana's growth in Stone has not been by good luck, by simply concentrating in a growing global sector. Rather, export growth in stone has been driven by expanding its global market share.

2.2.3.4. *Policy perspective and challenges*

In its industrial policy (2020) report, Ghana confirms that the manufacturing sector has not replied well to the numerous economic and trade policy reforms followed over the past ten years. Firms in the manufacturing sector have faced substantial challenges in the form of amplified rivalry in the domestic and export markets. The industrial policy forwards the following set objectives against the prescription in relation to agro-based local raw materials, non-agro-based local raw materials, imported raw materials, and plant, machinery and equipment, among other measures (Industrial Policy, 2020):

- Agro-based Local Raw Materials

The policy objective in this regard seeks to ensure that raw materials are produced locally with competitive prices in relation to quality and quantity for local manufacturing. The followed prescription was that government will reassure intensified and/or expanded hectareages of nominated agro-based raw resources such as oil palm, cassava, cocoa, cotton, sorghum, among others. To this end, government ensures supporting the backing of best agronomic guidelines and best practice benchmarks.

- Non-Agro-based Local Raw Materials

The policy context in this regard entails localising sources of supply as production and supply are reasoned to be inadequate and unreliable. This is set against the policy objective of harnessing and fully utilising the mineral deposit available in Ghana to support rapid industrial development. The government then provides a policy prescription that says it will be encouraging extensive exploitation of local mineral deposits such as Kaolin, clay, iron ore, aluminium, oil and natural gas, among others. In addition, the government is to entice investments into non-agro raw material sector.

- Imported Raw Materials

The acknowledgement is that most local industries rely on importation of raw manufacturing material, and these imports are costly. The challenge was then to seek access to competitively priced raw resources seen as essential for safeguarding unceasing production. The government has three policy prescription to this effect. One, the state to reassure the setting up of batches by stocking critical imported raw materials or resources in customs bonded warehouse by the private sector. Two, to support industry groups and negotiate sympathetic port levies and cost of shipping. And lastly, government to remain improving the handling of facilities and the ports' turn-around times.

- Plant, Machinery and Equipment

The policy context is on deployment of modern technology, seen as essential to determine the competitiveness of the country's industry. This is on the basis that Ghana's industrial plants and machinery are mostly aged and obsolete, hindering efficiency of manufacturing operations. Therefore, there was an undertaking to guarantee the implementation of new technology and the placement of advanced plant and machinery in industries. In this regard, the policy prescription is threefold. First, Ghana should inspire financial institutions to support and back-up the re-tooling of respective industries. Secondly, the state should reassure the placement of advanced plant and machinery in industry. And lastly, the Ghanaian government needs to expedite the setting up of CGPU (Capital Goods Production Units) and production of focussed niche or functional engineering sub-units and intermediates.

In view of the above stated policy perspective and prescriptions from the Ghanaian government, there still exist challenges that may hamper the progress like any other country. According to a BTI country report (2020), it was alluded that "Efficiency in policy implementation is hampered by a relatively inefficient and bloated administrative system with serious challenges in expertise and dedication." The report goes further to report on key developmental index leading to a better country outlook with a defective democracy index of 7.85, economic transformation that is limited at 5.57, and the governance index at 6.26, which raises some optimism about the country. Ghana is also a member of the AfCFTA. This may auger well for its trade development, leading to relevant macroeconomic indicators improvement like the current account balance.

2.2.4. Tanzania Economic Landscape

The fourth selected SSA country is Tanzania, which was rated the 10th richest country in Africa based on the GDP estimates of 62.224B in 2019. The country is considered a lower-middle mixed income economy with GDP per capita estimates as at 2019 at $2950. It is known also for its national parks, the Kilimanjaro as the top tourism attraction. The country borders the Democratic Republic of the Congo, Kenya, Mozambique, Uganda, Zambia, Burundi and Malawi by land, and Comoros and the Seychelles by sea.

2.2.4.1. *GDP Performance and population trajectory*

According to the MIT Atlas (2018), Tanzania ranks as the 120th richest economy in the world in GDP per capita out of 133 countries. Bank of Tanzania (2021) monthly report reflects that the economy (GDP) has grown on a year on year basis by 14.9%, 9.6%, 8.7% and 8.4% in the fourth year period from 2016 to 2019, respectively. Figure 2.33 gives impetus to these estimates as it clearly reveals an upward trajectory in GDP accompanied by an upward movement in the population growth, reaching just above 58 million people in 2019. The World Bank (2020) reports that the country's economy is principally grounded on agriculture, which contributes nearly 25% to GDP, and employs half of the workforce. The bank further substantiates that the industries are a developing constituent of the economy, and are responsible for nearly 30% of GDP, that is, mining, manufacturing, construction, electricity, natural gas and water supply.

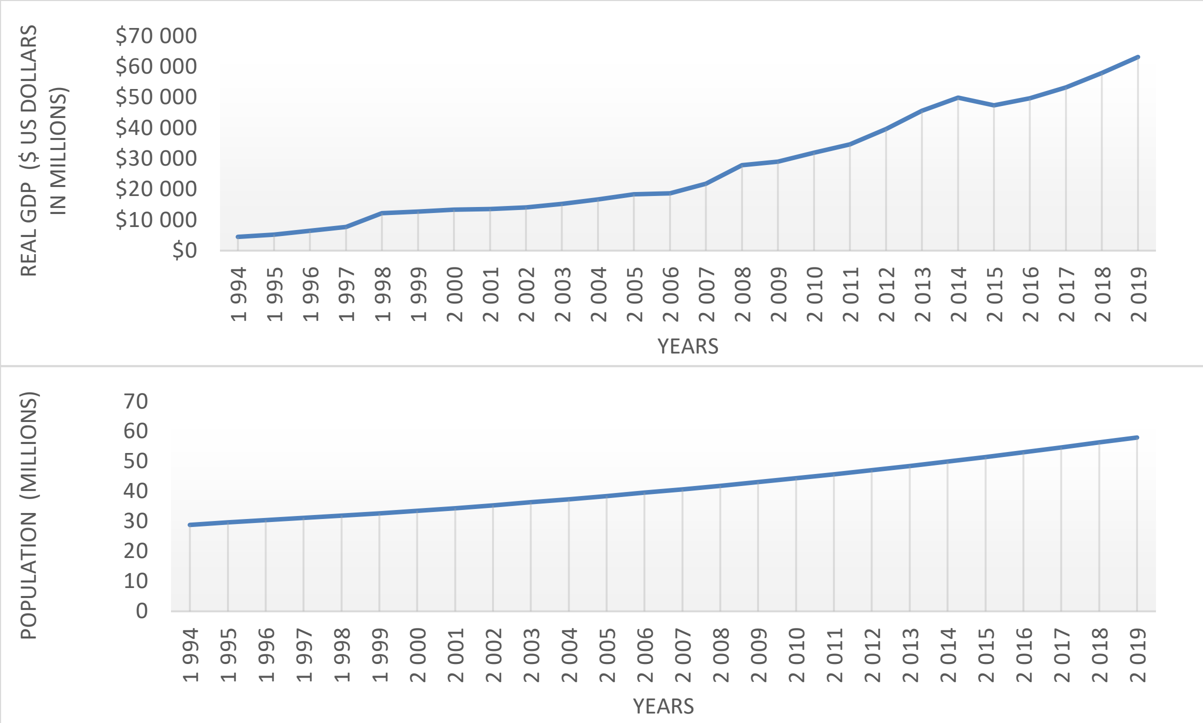

Figure 2.33: Tanzania's Real GDP and Populations trends (1994 – 2019)
Source: World Bank Data Bank

As revealed in figure 2.33 above, figure 2.34 below reflects on the living standards through its per capita GDP and the percentage change thereof. The country has had an upward trajectory in GDP per capita of $1,060 ($3,240 PPP) in 2018. It is estimated that GDP per capita growth has averaged 3.3% over the past five years, above regional averages. Given that it has the same population estimates as South Africa, one may conclude that South African people enjoy a much more up scaled standards of living as reflected above.

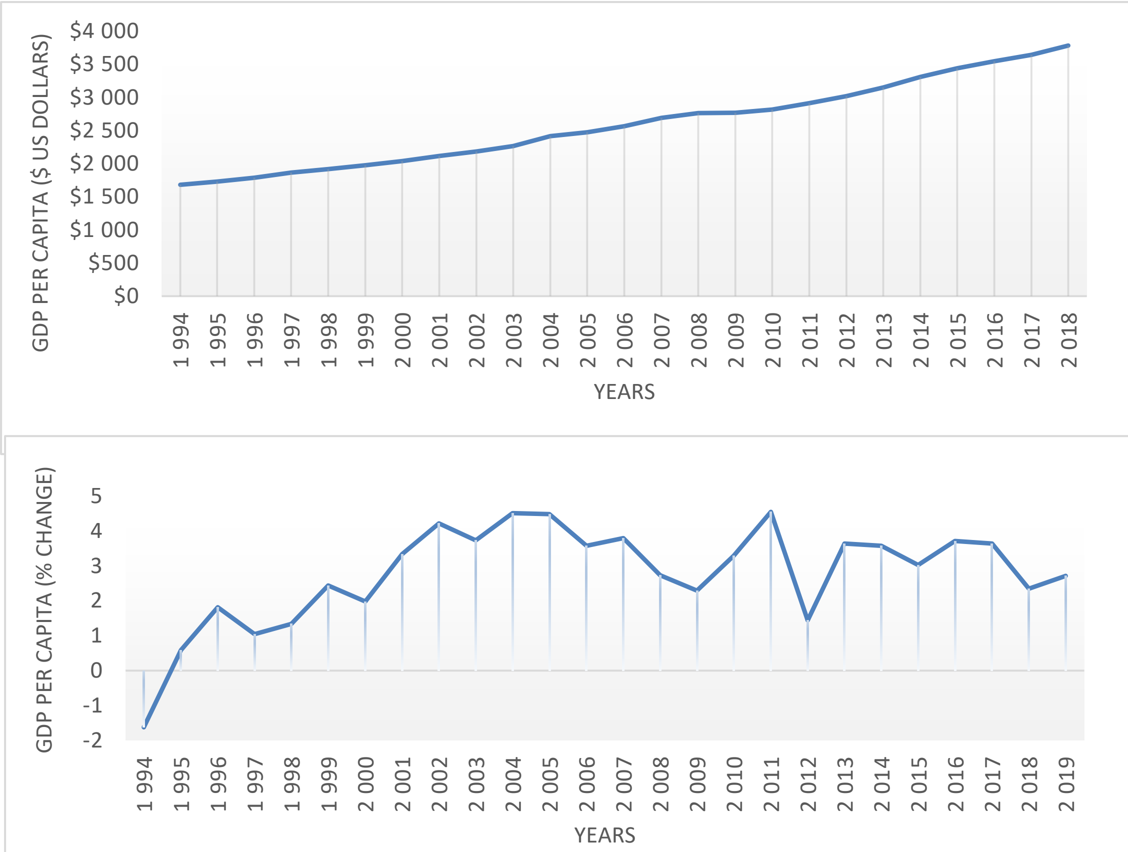

Figure 2.34: Tanzania’s GDP per capita (Real and percentage change)
Source: World Bank Data Bank

In its annual report, the Bank of Tanzania affirmed that it was reassuring to note that, the country continued to be one of the fastest rising economies in the SSA region, with real GDP growth of 7.0 percent in 2019, and reasonable inflation averaging 3.5% in 2019/20 (Bank of Tanzania, 2019/20). The World Bank also suggests that the Tanzanian economic outlook was that of a relatively high economic growth in recent years with medium-term outlook seen to be positive supported by large infrastructure spending (World Bank, 2020).

2.2.4.2. Trade Outlook and Performance

The Tanzanian economic outlook as projected had a positive performance and outlook. The Balance of Payments (BOP) had a surplus owing to the contraction in current account deficit as reported that in the 2019/20 financial year, the current account deficit was equal to 1.4% of GDP compared to 3.5% in the previous year on the back of an upsurge in the value of goods export and a drop in import bill (Bank of Tanzania, 2019/20). The country’s top exports include natural resources like Gold at $1.55B, Coconuts, Brazil Nuts, and Cashews at $612M, Raw Tobacco at $344M, Coffee at

$160M and Fish Fillets at $157M. While its top imports are Refined Petroleum at $1.36B, Packaged Medicaments at $335M, Palm Oil at $261M), Wheat at $176M and Cars $154M. Table 2.5 provides a summary of the top exports destination and imports origin.

Table 2.5: Tanzania's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. India	$1.11B	1. China	$3.08B
2. South Africa	$709M	2. United States	$1.1B
3. China	$329M	3. India	$660M
4. Vietnam	$314M)	4. Belgium-Luxembourg	$637M
5. Switzerland	$275M	5. United Kingdom	$587M

Source: MIT Atlas of Economic Complexity (2018)

The current outlook with respect to external performance was a little dire given the pandemic facing the entire world. The external sector displayed unassertive performance, and the current account deficit broadened to $1,557.7 million from a deficit of $1,137.8 million in the same period in 2020, explained by lower services receipts, particularly travel during the year ending May 2021 (Bank of Tanzania, 2021). Figure 2.35 below goes on to provide the overall current account from the perspective of debits and credit outlook. Both sub-accounts show a similar trajectory in the Tanzanian current account performance. The debit side of the current account seem to be trending above the credit items, reflecting that there were more payments than receipts in the stated period of 1994 to 2019.

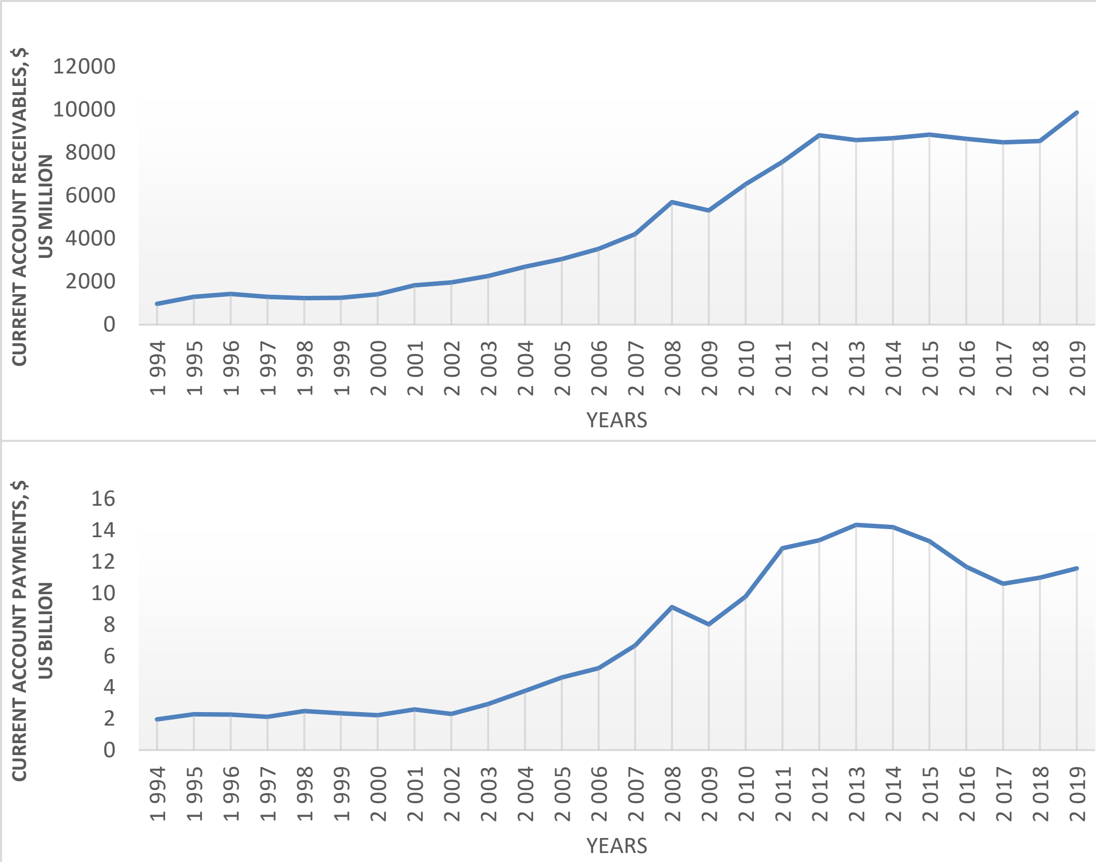

Figure 2.35: Tanzania's Current Account Credit and Debit Items (1994 – 2019)

Source: World Bank Data Bank

Figure 2.36 proceeds to give a bird's eye view of the current performance in year-on-year percentage change. Indeed, the current account realised negative prospect on a year-on-year basis from 1991 to 2019. The year 2002 is recorded as the almost best year performance nearing neutrality in both credit and debit payments. Nevertheless, in the 2019/20 reporting, the import bill lessened to $9,812.4 million from $10,321.3 million in 2018/19, accompanied by declining goods and services (Bank of Tanzania, 2020).

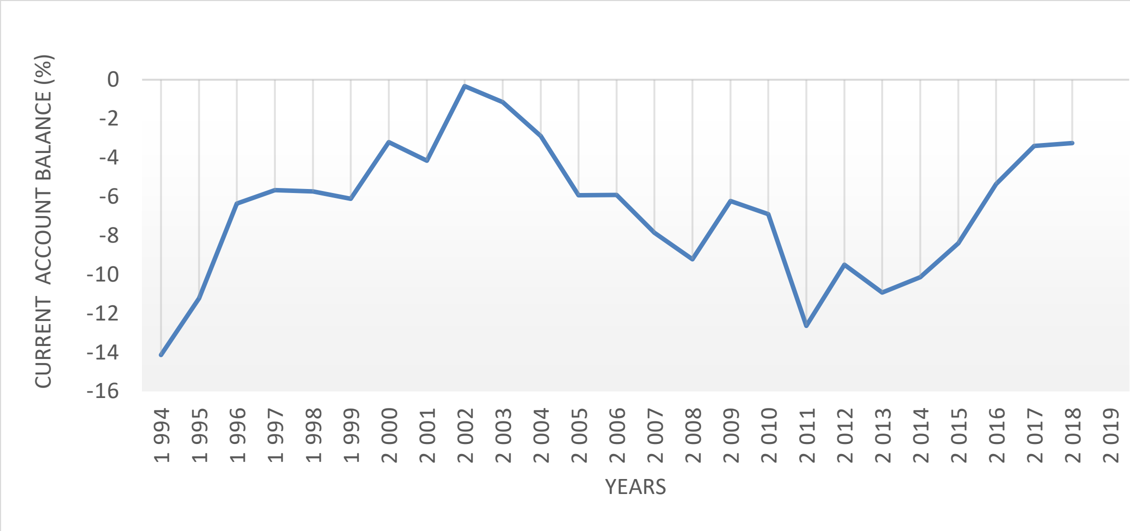

Figure 2.36: Tanzania's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

It was interesting to find that from the Bank of Tanzania year-end reporting, the top exports market in percentage terms was South Africa, India, United Arab Emirates, Switzerland and Vietnam, while the top imports share were China, India, United Arab Emirates, Japan and South Africa. With South Africa featuring in both imports and exports share reflects well in that there is evidence of intra-trade among these two SSA nations.

2.2.4.3. Investment performance

The United Republic of Tanzania has adopted Government of Tanzania (GoT) policies, which raises questions about short- and medium-term prospects for FDI, and foster a more perplexing business environment. Tanzania is ranked 141 out of 190 countries on the World Bank's "Doing Business" rankings, the lowest among its East African peers after nearly a decade of double-digit growth. Additionally, Tanzania has its own public enterprises or State Owned Entities (SOE's), and they do not contest in the same terms and circumstances as private enterprises because they have access to state subsidies and other benefits.

SOEs are active in the power, communications, rail, telecommunications, insurance, aviation, and port sectors, which report and are led by a board (World Bank, 2020). Typically, a presidential appointee chairs the board, which usually includes private sector representatives. SOEs are not subjected to hard budget constraints, and do not discriminate against or unfairly burden foreigners, though they do have access to sovereign credit guarantees. Figure 2.37 provides the country's effort to improve the conditions and status in which public and private entities operate. In the stated period of 1994 to 2018, the government has had an increasing rate of fixed investment injection into the economy to improve infrastructure and the likes for ease of doing business.

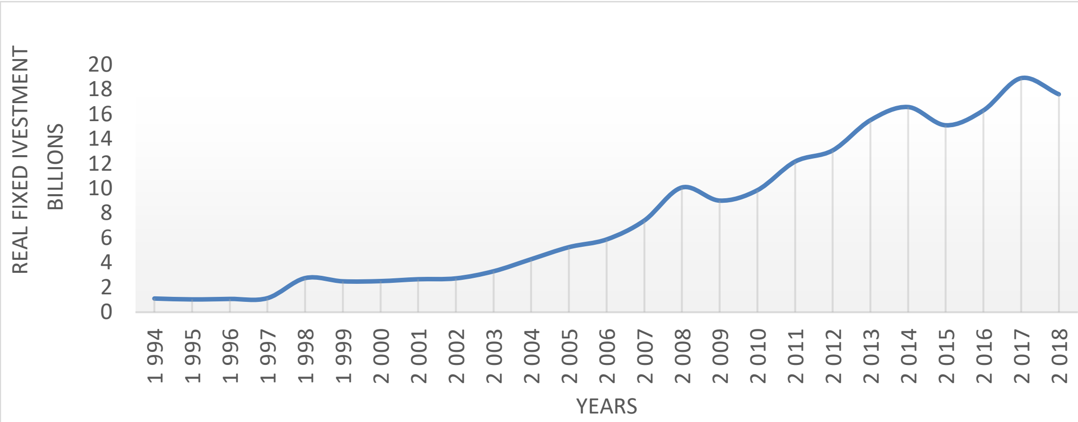

Figure 2.37: Tanzania's Real Fixed Investment performance (1994 – 2019)

Source: World Bank Data Bank

To this end, the Tanzania Investment Centre (TIC) has been instituted to proposition a package of investment benefits and inducements to both foreign and domestic investors without performance requests (World Bank, 2020). Furthermore, the least amount or capital investment of $500,000 if foreign owned or $100,000 if locally owned is required. This indicates that the country is positioning itself as an investment destination.

2.2.4.4. Economic Complexity, product complexity and trade dynamics

Tanzania is ranked the 68th most complex country in ECI according the MIT Atlas. Nonetheless, the Atlas shows that the country has become more complex compared to a decade prior, improving 28 places in the ECI ranking. Tanzania's improving complexity has been driven by diversifying its exports. As reflected in section 2.2.4.2 above, figure iii proceeds to reflect the share of exports. It is more of the traditional natural unprocessed commodities that form the base of the large share exports like gold (21063%) and cashew nuts and coconuts (7.97%).

Figure 2.38 summarises and provides the country's export basket, reflects on the export mix and the percentage share of each sector or product. The Harvard Atlas (2019) valuation shows that the services through travel and tourism (34, 25%) and the transport sector (17.83%) form the catalyst to the export share of the country followed by gold (14.24%). Other sectors and subsequent products seem to form a smaller share of the export basket. This reveals the dependence of Tanzania on a few sectors in the economy.

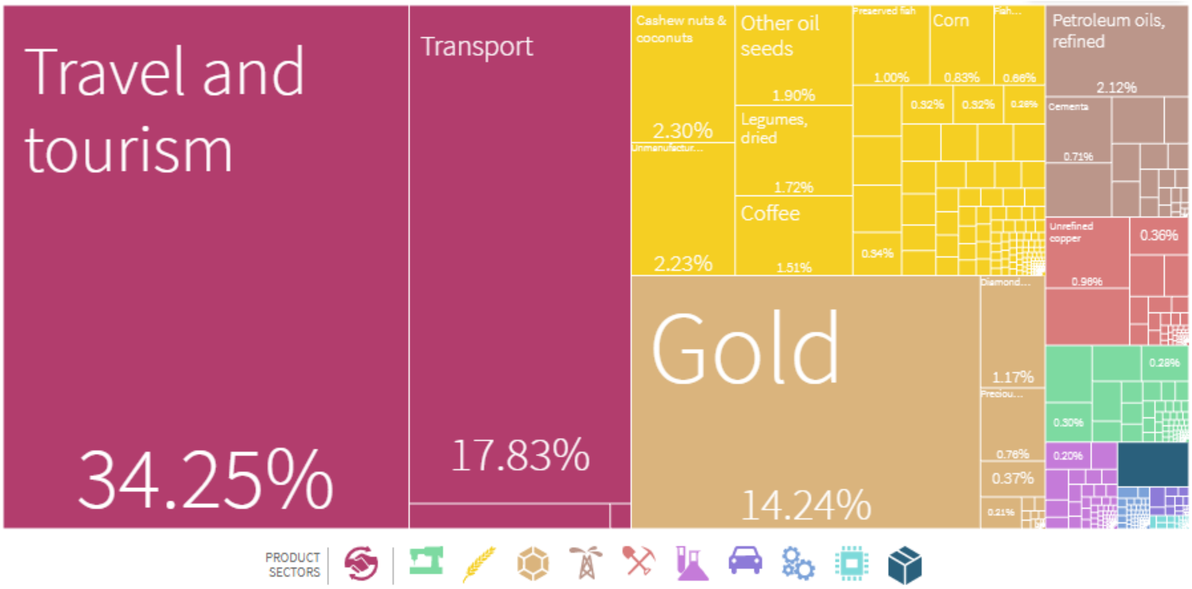

Figure 2.38: Tanzania's Sector export share
Source: Harvard Atlas Economic Complexity Lab (2019)

It is on this basis that we proceed to reflect on how complex the Tanzanian export baskets are. From figure 2.39, there is a clear reflection that the complexity of the exports goods is much less in the negatives with gold at -2.24 and cashew nuts and coconuts at -1.97, with coffee and unrefined copper, among others. The country is over-reliant on natural products.

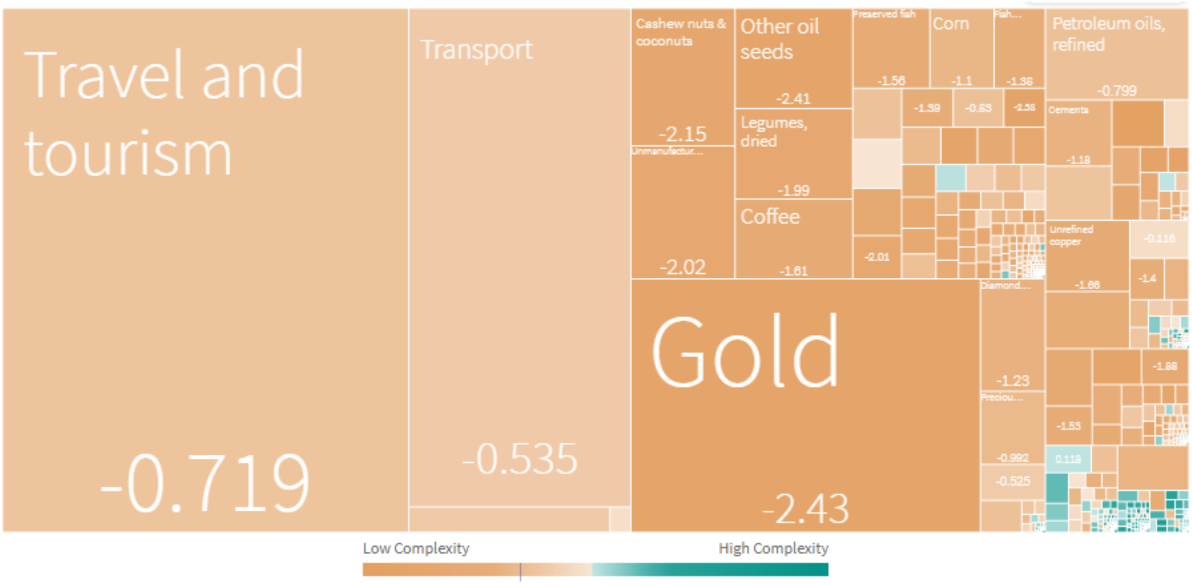

Figure 2.39: Tanzania’s Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

Even though the country has improved in ECI to 68 in the last ten years, it is acknowledged that it has not yet started the traditional process of structural transformation. Which like any other countr is argued to be a key source of economic growth. Tanzania's export dynamic in the past five years was driven by stone. Disturbingly, exports in stone collapsed. As a consequence, economic growth in Tanzania has been hindered by concentrating in a declining sector of global exports (MIT Atlas, 2018).

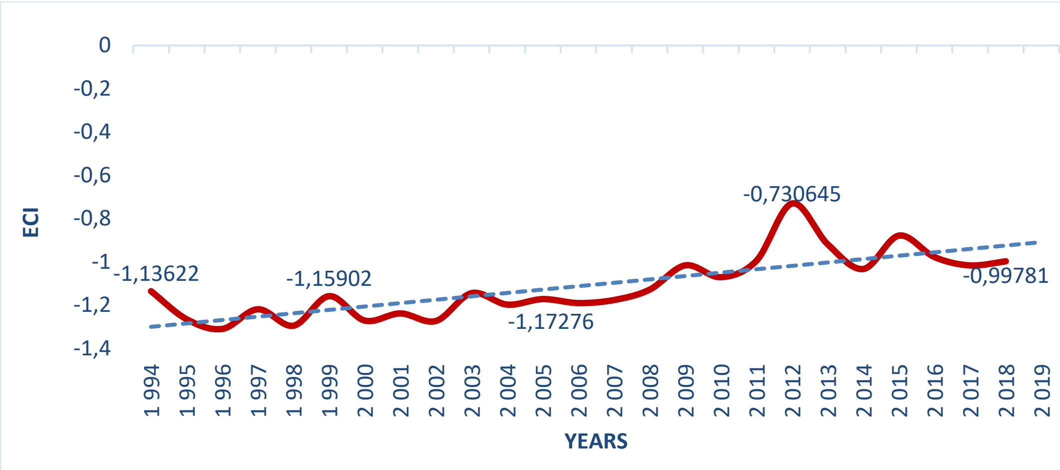

Figure 2.40: Tanzania’s ECI Trend (1994 - 2018)
Source: MIT Atlas Economic Complexity Lab (2018)

Figure 2.40 clearly shows the unsophisticated nature of the Tanzanian exports market. The trend line was below the zero mean from -1.4 in 1994 to -0.8 in 2018. This goes to indicate that the country is still lacking in the technical know-how and less developed in nature in its procuctive capacity.

Figure 2.41 reflects upon the country’s share of the world market. It is expected that Tanzania may not be a substantial player given the developmntal stands. The stone sector had a mere below 0.22% of the world export share, and it is the country’s highest export component. The country needs to upscale its productive capacity to be of significance in the future.

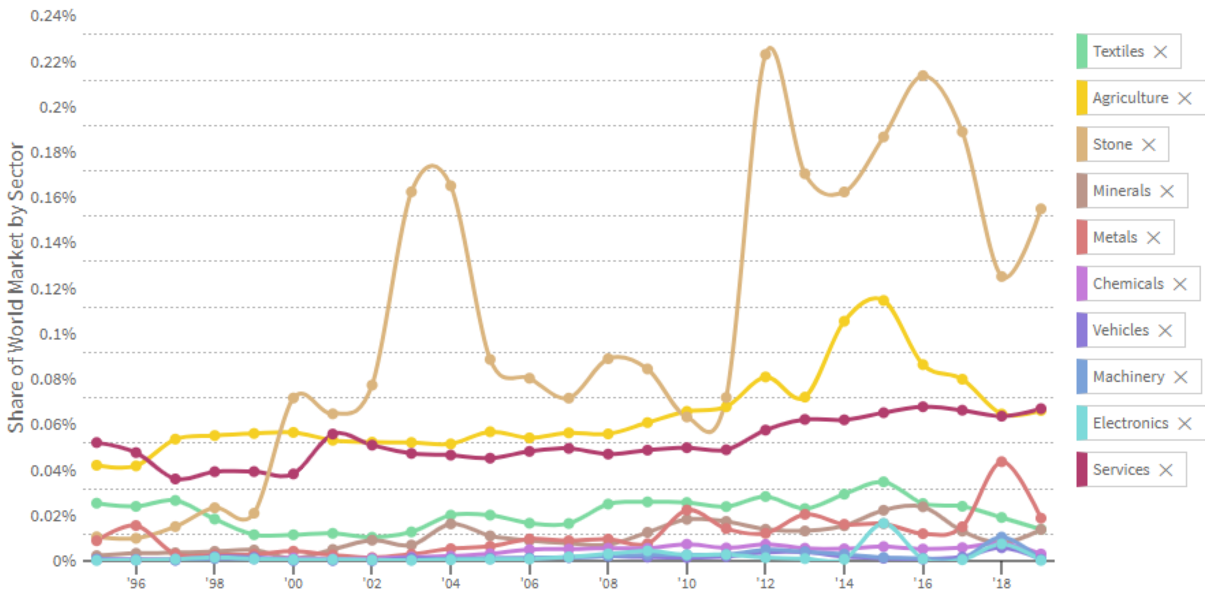

Figure 2.41: Tanzania's World Export Market share (9994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

The Tanzanian government has effected the export portal, which has thus far attracted millions of visitors to reflect on the country's import and exports potential to influence trade with the country, or perhaps improve on its world market share.

2.2.4.5. Policy perspective and challenges

Tanzania has explored and effected policies to improve its economic outlook through relevant bodies. The country, through its Export Processing Zones Authority (EPZA), has instituted and is also in charge of the Tanzania's Export Processing Zones (EPZs) and Special Economic Zones (SEZs). EPZA's central objective is to shape and encourage export-led economic development by offering investment incentives and enabling services (IMF, 2018). Moreover, there are other set bodies like the Zanzibar Investment Promotion Agency (ZIPA) and the Zanzibar Free Economic Zones Authority (ZAFREZA), who offer the following incentives for doing business in Tanzania (IMF, 2018):

- Exemption from payment of taxes and duties for machinery, equipment, heavy duty vehicles, building and construction materials, and any other goods of capital nature to be used for purposes of development of the Free Economic Zone infrastructure;

- Exemption from payment of corporate tax for an initial period of ten years and thereafter a corporate tax shall be charged at the rate specified in the Income Tax Act;
- Access to competitive, modern and reliable services available within the Free Economic Zones;
- Exemption from payment of withholding tax on rent, dividends and interests for the first ten years; and
- Exemption from payment of all taxes and levies imposed by the Local Government Authorities for products produced in the Free Economic Zones for a period of ten years.

The above stated are not exhaustive, but are rather some of the set enticing local investment incentives for potential investors according to special A, B and C grading. In 2017, Tanzania approved new regulations in the mining sector that allow the government to renegotiate mining contracts, partially nationalise mining companies, introduce higher royalties, enforce local beneficiation of minerals and bring in strict local-content requirements. These have impacted on investors' ‘perceptions’ of the investment environment, but the government is collaborating with domestic and foreign investors. This was the one challenge facing the country, to incentivise investors to invest in the country (IMF, 2018).

2.2.5. Cameroon Economic Landscape

The last selected SSA country is Cameroon, a central African state, which was rated the 15th richest country in Africa based on the GDP estimates of $38,760 Billion as at 2021. Like most African countries, the country is well endowed with rich natural resources and minerals, including oil and gas, mineral ores, and high-value species of timber, and agricultural products such as cotton, coffee, maize, cocoa and cassava. Unlike most African states with reserve banks, Cameroon is an affiliate member of the Bank of Central African States (BEAC); a central bank that serves six central African states which form the economic and monetary community of central Africa, which include Central African Republic, Chad, Equatorial Guinea, Gabon and the Republic of the Congo. The country is considered a lower-middle income economy with GDP per capita estimates as at 2020 of $1,469.91. The country borders Congo, Chad, Central Africa Republic and Gabon by land, while Nigeria and Equatorial Guinea borders by sea.

2.2.5.1. GDP Performance and population trajectory

The African Development Bank (AfDB) submits that of the selected SSA, Cameroon's economy was the most challenged economically in 2020. Additionally, the prevalence of regional security and political crises and world oil prices decline where stated as the other factors impacting adversely the economy (AfDB, 2021). This has led to real GDP contraction of 2.4% in 2020 as compared to 3.7% in 2019, the AfDB reports. Much like South Africa, BEAC took measures to support the respective member countries' economies, where interest rate was reduced by 25 basis points from 3.50% to 3.25% in March 2020.

To this end, the country's GDP trajectory is reflected below in figure 2.42 to observe its performance prior to the current world pandemic against its population growth. Current population estimates put the country at just over 27 million, which is a 2.56% increase from 2020. As at 2019, real GDP stood at $39.1 Billion and the trend line reflects a steady upwards course. On the other hand, the population figures have expanded over the years from 1994 to 2019. This of course has a direct effect on the population's living standards given the rate of output as read through the GDP figures.

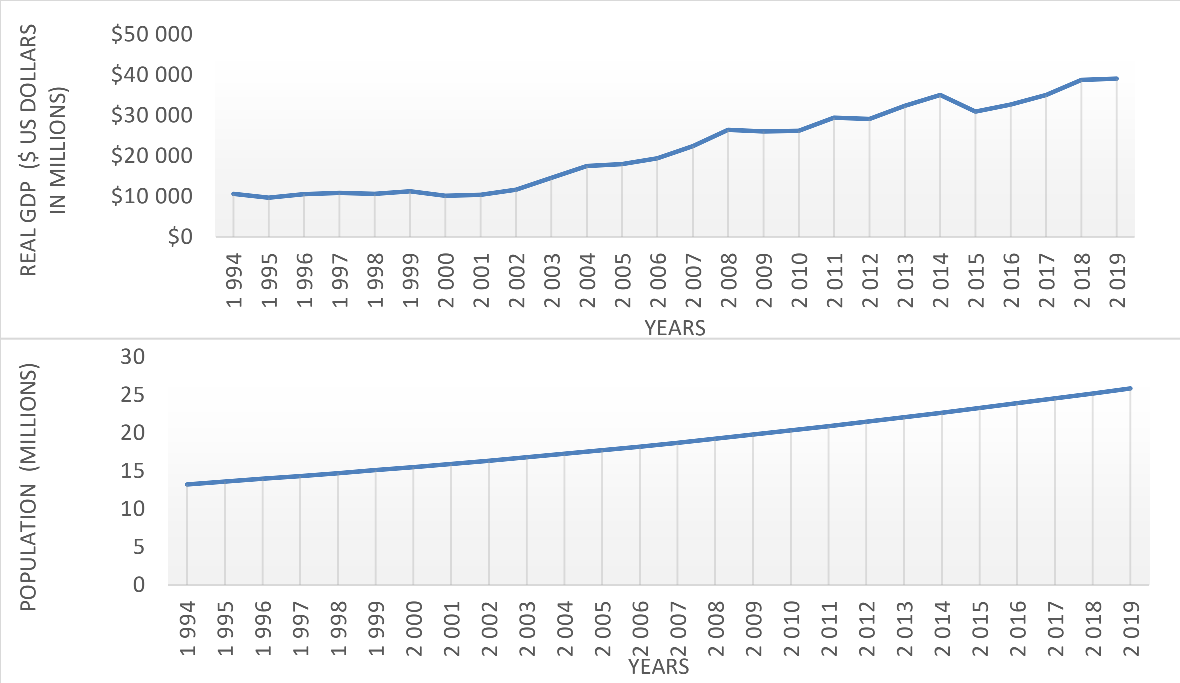

Figure 2.42: Cameroon's Real GDP and Populations trends

Source: World Bank Data Bank

To add to the country's woes, Cameroon's over-indebtedness is seen as challenging because of the need to provision economic recovery this year (2021), and to carry out the major structuring projects proposed in its new national development strategy for 2020 to 2030 (AfDB, 2021).

However, previous measures taken might help mitigate the debt problem, the adoption of a three year economic disaster plan, a financing cost of about US$ 825 million (2% of GDP), and a debt relief plan from lenders (IMF, 2020). This will surely help provide proof to the deteriorated living standards. Figure 2.43 shows the GDP per capita and the changes thereof prior. On a positive note, the GDP per capita (PPP) has an upward trend, and shows a positive percentage change on a year-on-year basis from across the study period with the exception of the years 2005 and 2009.

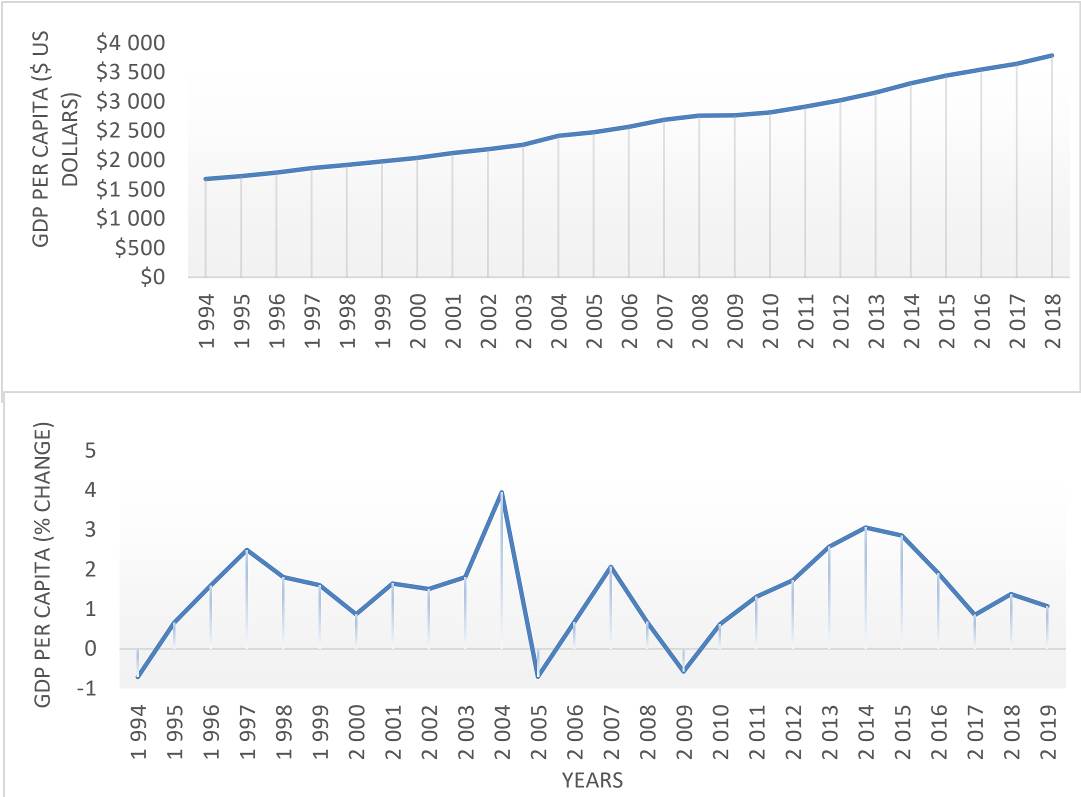

Figure 2.43: Cameroon's GDP per capita (Real and percentage change)

Source: World Bank Data Bank

The policy response given the current status and the internal dilemma stated above were addressed with a monetary easing measures approved by the BEAC. Authorities adopted a reviewed budget with a larger deficit to provide accommodative stabilisers and crisis-related emergency spending (IMF, 2020). It was envisioned that as the crises subsides, fiscal adjustment will be desirable to strengthen domestic revenue mobilisation and spending while shielding social expenditures. Given Cameroon's overall high risk of debt distress, the authorities continue to commit to a zero limit on non-concessional external borrowing (IMF, 2020).

2.2.5.2. Trade Outlook and Performance

On the trade front, Cameroon's main export includes crude petroleum at $1.34B, sawn wood at $616M, Cocoa Beans at $492M, Bananas at $306M and Rough Wood ($219M) using the 1992 while its imports were Refined Petroleum at $396M, Special Purpose Ships at $351M, Rice at $304M, Crude Petroleum at $220M and Packaged Medicaments at $195M. Table 2.6 goes further and show the country's top export destination and import origin. It is of interest that the country has its border countries Nigeria and Republic of Congo among the top import origin. This augurs well for the region as the countries are member countries of the AfCFTA, which is meant to improve trade in Africa, while China has it spots among other countries as one of the exports destinations.

Table 2.6: Cameroon's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. France	$559M	1. China	$1.06B
2. China	$488M	2. France	$548M
3. Italy	$392M	3. Republic of the Congo	$441M
4. Belgium-Luxembourg	$359M	4. Thailand	$275M
5. the Netherlands	$356M	5. Nigeria	$253M

Source: MIT Atlas of Economic Complexity (2018)

As already above economic challenges emanating from the social and security unrest, Cameroon has placed measures to improve its Terms of Trade (TOT). Along with its Central African Economic and Monetary Community (CEMAC) partners, Cameroon has had to put fiscal modification measures in place to adjust to the terms of trade shock and re-establish macroeconomic stability and assurance in the common currency (World Bank, 2021). This is meant to improve trade in the region.

Foreign exchange regulations were effected on the 1st of March 2019, which made it promising to upsurge the country's foreign exchange reserves, which were meant to cover 7.5 of imports in 2020 as compared to 6.3 months at the end of 2019 (IMF, 2021). Current account deficit increased to 5.2% of GDP in 2020, compared with 3.1% in 2019 due to the decline in oil exports and remittances, as further reported by the IMF. According to figure 2.44, the current account outlook prior to the yar 2020 and the exacerbated security concerns in the region still maintain a dire outlook. The debit and the credit performance show that the payments figures were above the payments marginally across the time span from 1994 to 2019.

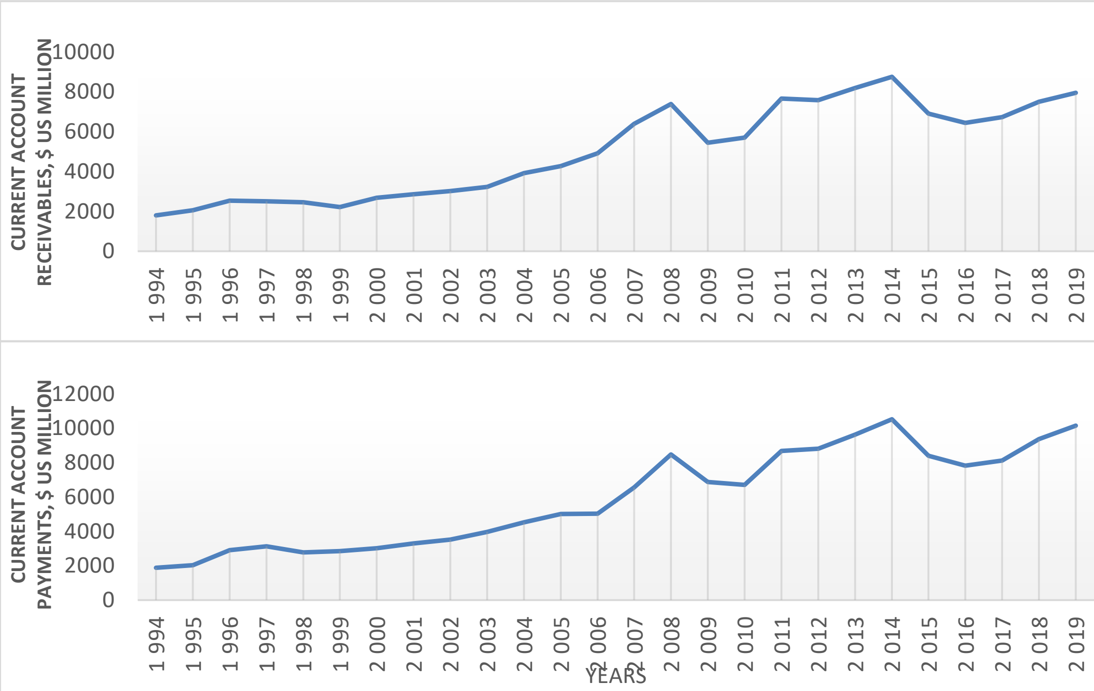

Figure 2.44: Cameroon's Current Account Credit and Debit Items (1994 – 2019)

Source: World Bank Data Bank

Additionally, figure 2.45 affirms the rather blemish economic outlook with the percentage change in the current account having a negative stand across the time-span with only 2006 and 2007 showing a positive percentage change. This figure shows that while the current pandemic concerns stand as affecting economies and the region, Cameroon was not performing well.

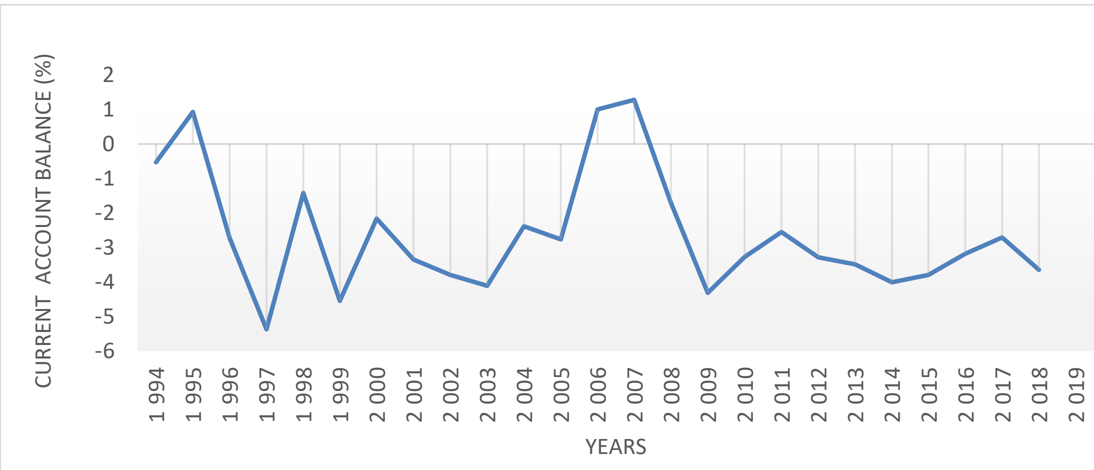

Figure 2.45: Cameroon's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

In 2020 the current account decreased to – 322.2 Billion from – 991. 897 Billion. These were expected as the IMF stated that the deficit, including official grants, was expected to widen to 6 percent of GDP in 2020, about 0.3 percentage point larger than projected (Trading Economics, 2021; IMF, 2020). The worsening trade balance was on the back of a weaker domestic outlook, while imports did decline in the non-oil sectors, adding to the economic woes though there were some improvements in the largest export commodity, oil.

2.2.5.3. Investment performance

The country's security concerns as expected because of its regional context make Cameroon a risky investment destination. To this end, even the country may not be investing in itself. Additionally, Cameroon suffers from weak governance, which hinders on its developmental needs and ability to entice investment. The World Bank doing business report shows that the country ranks 152 out of 180 countries in the 2018 transparency international corruption perceptions index and 166 out of 190 economies (World Bank, 2021d). Nonetheless, through its IDA programme, the World Bank has made the following funds available for the country to improve its agricultural competitiveness:

- The agriculture investment and market development project worth $100 million and $25 million in IFC funds. These funds are meant to change the low-productivity, subsistence-oriented cassava, maize, and sorghum subsectors into commercially-oriented and competitive value chains in four agro-ecological zones; and
- The livestock development project which is worth $100 million that aims to develop productivity, market access and the livelihoods of small livestock farmers in target agro-ecological zones, in particular pastoralists in the far north.

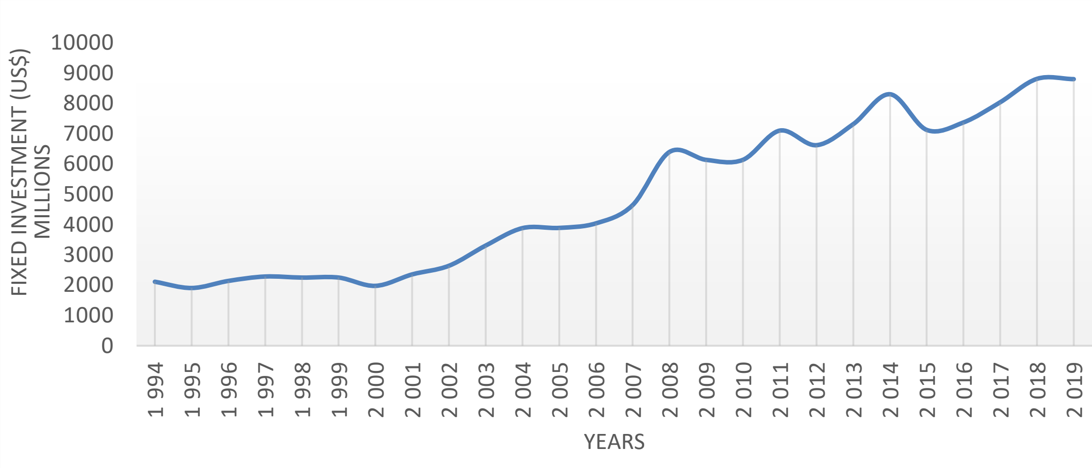

Figure 2.46: Cameroon's Real Fixed Investment performance (1994 – 2019)

Source: World Bank Data Bank

Given the above challenging sentiments and the economic outlook, the country is in fact trying to improve its infrastructure as seen in figure 2.46. There is evidence of an upward trend in investment, which suggests that the country realised some improvements in infrastructure initiated in the stated period.

2.2.5.4. Economic Complexity, product complexity and trade dynamics

Cameroon is classified as a lower-middle-income nation ranked as the 112th richest economy per capita out of 133 studied while it is ranked the 129th most complex in ECI ranking (MIT Atlas, 2018). The Atlas findings also go further to reflect that compared to ten years prior, Cameroon's economy has become less complex, deteriorating twenty positions in the ECI ranking as a result of lack of diversity. The country is set to position itself to take advantage of some opportunities to diversify its production using its existing resources.

Figure 2.47 reveals that Tanzania sector exports share and the petroleum oil, crude has a 26.15% of exports share, followed by the transport and service sector with travel and tourism at 13.13% and 12.79%, respectively, and cocoa beans (8%) and gold (5.67%) followed.

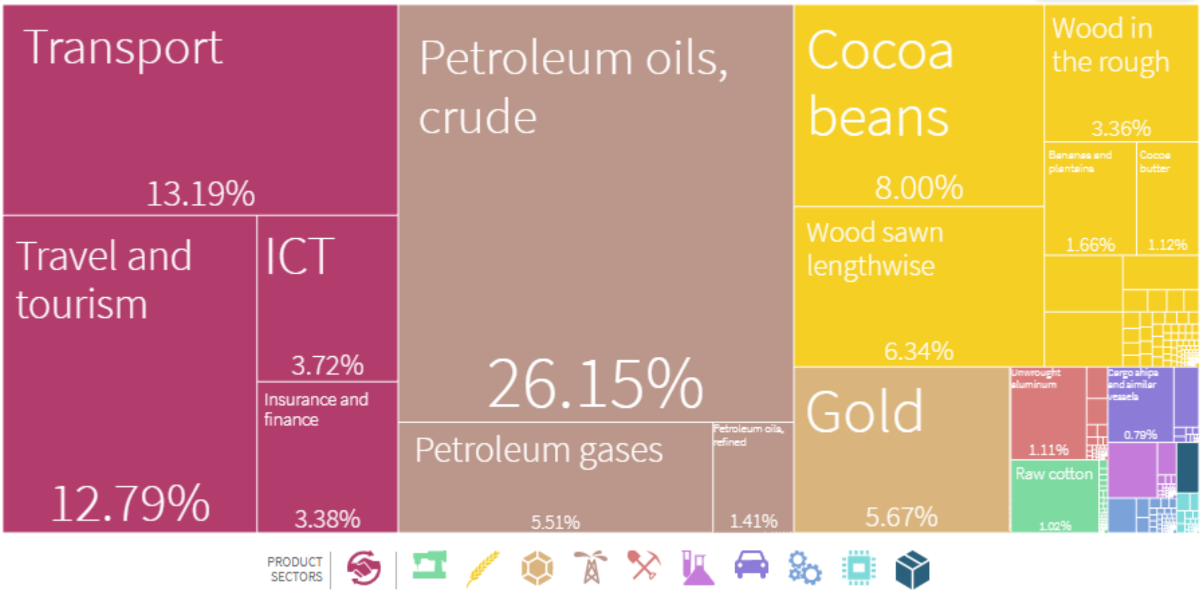

Figure 2.47: Cameroon's Sector export share

Source: Harvard Atlas Economic Complexity Lab (2019)

Figure 2.48 proceeds to reflect the export basket that also goes on to reflect the complexity (PCI) associated with each export, giving credence to the 129th position. The results indeed reveal that the large if not the entire export basket has a negative complexity index with very minimal complex products. The results are expected because section 2.2.5.2 submits that the large share of the exports was indeed a natural resource of raw and unprocessed in nature. Figure 2.47 also affirms the same.

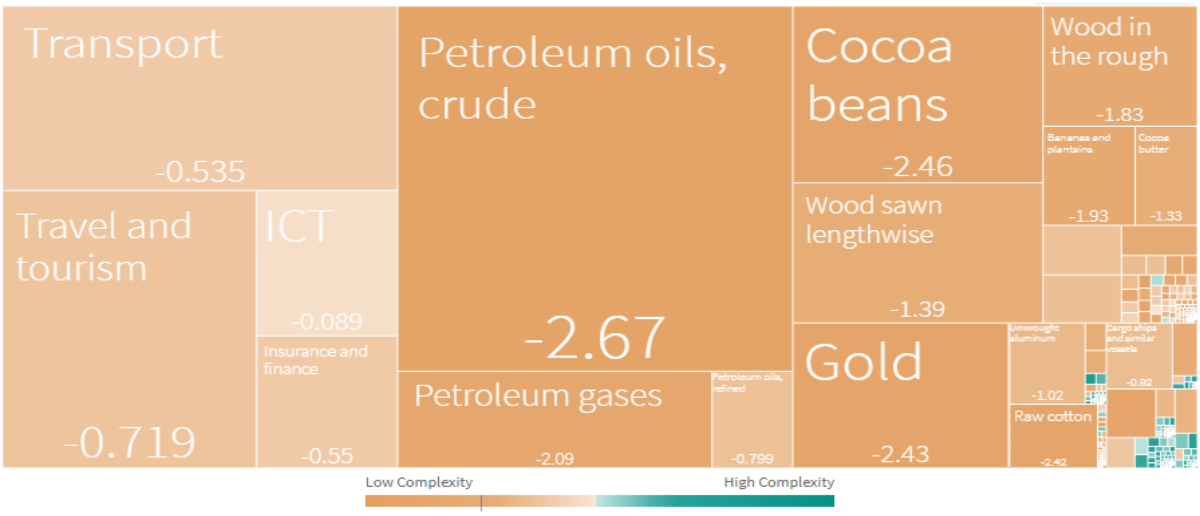

Figure 2.48: Cameroon’s Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

Nonetheless, the Harvard Atlas (2019) reports that the country has realised a disturbing arrangement of export growth, with the largest support to export growth coming from modest and low complexity products, particularly wood and cocoa products. Indeed, leading commodity exports are in low complexity products, minerals and agriculture. This is given evidence in the country's complexity index, a less developed country in figure 2.49 below.

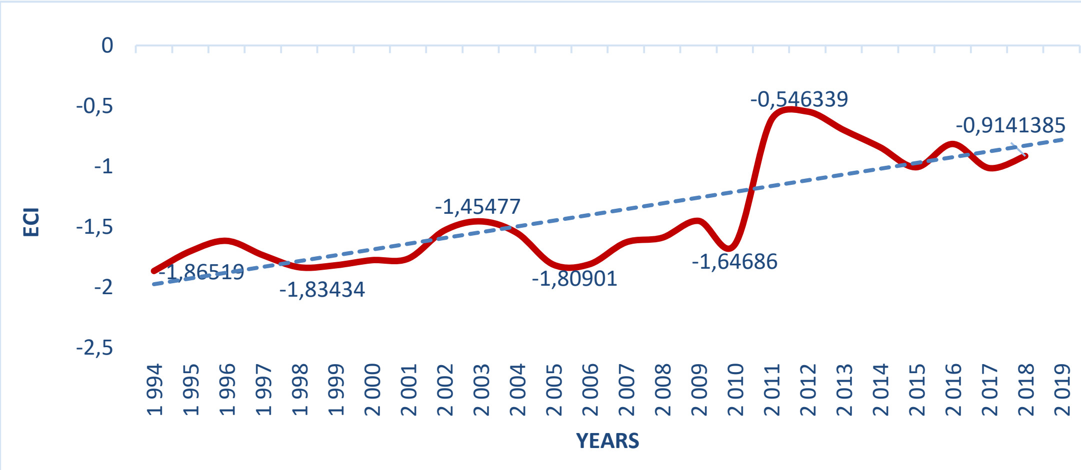

Figure 2.49: Cameroon's ECI Trend (1994 - 2018)

Source: MIT Atlas Economic Complexity Lab (2018)

Cameroon's ECI is trading well below the required level, and is as such, a less developed country. The country lacks the knowledge required to produce a more complex nature of goods and services. Cameroon's ECI was at – 2 in 1994 and improved to – 9.914 in 2018.

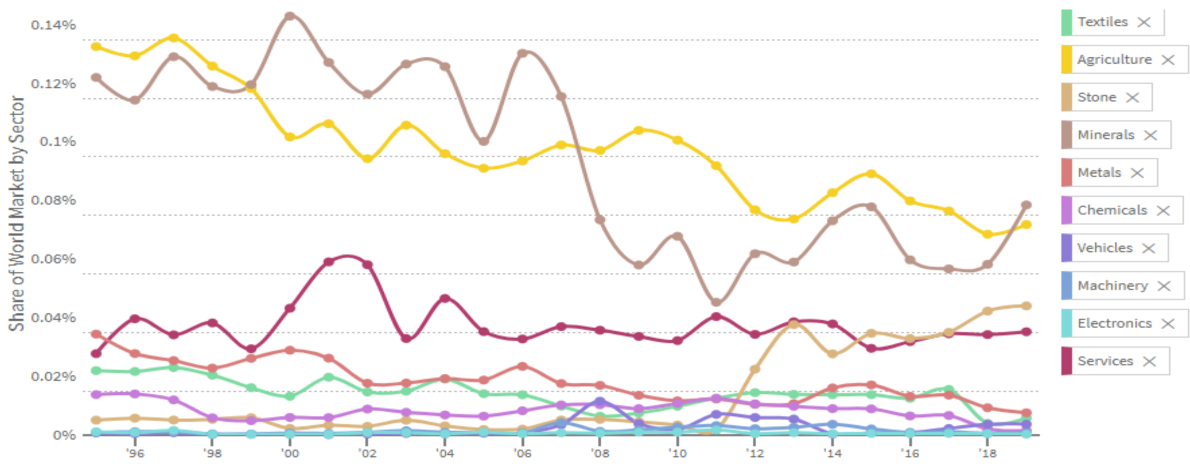

Figure 2.50: Cameroon's World Export Market share (10994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

The given analysis that the country has deteriorated into in the last decade with regards to export sophistication is given impetus by figure 2.50 above. The highest export commodity, agricultural products and minerals have diminished over the years as a share of world export in the last decade, moving from 0.14% to less than 0.08% between 1996 and 2019.

The Harvard Atlas (2019), however, still gives a positive feedback on the current (as at the last ATLAS update) ECI trajectory in saying that Cameroon has added four new products since 2003. These products contributed $14 in income per capita in 2019. But the country has not diversified well enough into new products to back income growth.

2.2.5.5. Policy perspective and challenges

The IMF 2021 report on Africa gives a more nuance policy recommendation of addressing challenges engulfing African countries which is more relevant for Cameroon, and Nigeria as border countries. There is a need to strengthen the region and multinational solidarity to enable collective and sustained economic recovery to safeguard gains in the fight against the pandemic and of course regional security concerns (IMF, 2021). The country needs to be more self-reliant as opposed to borrowing funds for development purposes. As such, there is a need to improve upon its fixed investment, internal investment, that is. This is on the back of a country proven to be among the most indebted poor countries. Although Cameroon has significantly reduced its public debt in 2006, it has lost grounds since then taking more substantial debts (AfDB, 2021).

2.3. BRICS COUNTRIES

BRICS is an economic alliance acronym of five countries across four continents, that is, Brazil (South America), Russia (Asia and Europe), India and China from Asia, and South Africa (Africa). While this formation was incepted in 2006, South Africa joined this important bloc of emerging economies in 2010 to complete the BRICS. Among other benefits, BRICS members are founded on collective strength in economic issues of interest, topical global issues such as Sustainable Development Goals (SDGs), food and energy security, trade and tax, information and communication technology, customs cooperation, industries and innovation (Swain, 2018).

This bloc has also formed the New Development Bank (NDB) and the Contingency Reserve Arrangement (CRA). The NDB is promoted as an alternative to the World Bank, while the CRA is an alternative to the IMF. The NDB is mainly oriented on financing infrastructure and sustainable development of emerging economies. A contributor in Time publication reflects on the size of BRICS having a collective area of 39,746,220 km2 of land and a projected aggregate population of 3.21 billion, which represents a 41.53% of the world population (Bremmer, 2017). This reflects the market power these economies hold. The rest of the BRICS members are each given attention with the exception of South Africa as already done above as SSA country.

2.3.1. Brazil Economic Landscape

Brazil is positioned as the 9th biggest economy in the world and the biggest in its region of South America, with US$1.84 trillion 2019 GDP estimates. The country's economy is diversified well into gamut from heavy industries, such as aircraft and automotive production to mineral and energy resource extraction. Like the SSA counterpart, it too has a hefty agricultural sector hence a major exporter of coffee and soy beans. In recent times, the country is said to have emerged from a serious economic downturn in 2017, while suffering from a series of high-level corruption scandals (CIA World Factbook, 2020a). The factbook goes on to state that, even so, faced with these events, Brazil established a sequence of major economic reforms envisioned to harness public spending and debt, while investing in energy infrastructure, lower barriers to foreign investment, and improved labour market conditions.

2.3.1.1. GDP Performance and population trajectory

Much like the world at large, Brazil laboured through its sincere economic downturn in recent memory in the first half of 2020. While the economy observed a resurgence of sorts in the second half of 2020, the blemishes of an overwhelmed economy are visible (Barua & Samaddar, 2021). In 2021, the economy sustained its repossession path in the first quarter, though at a much slower pace compared to the preceding two quarters (Q3 and Q4 of 2020). However, in the second quarter of 2020 real GDP grew by a mere 1.2% on a q-on-q basis as a results of an world economic downturn.

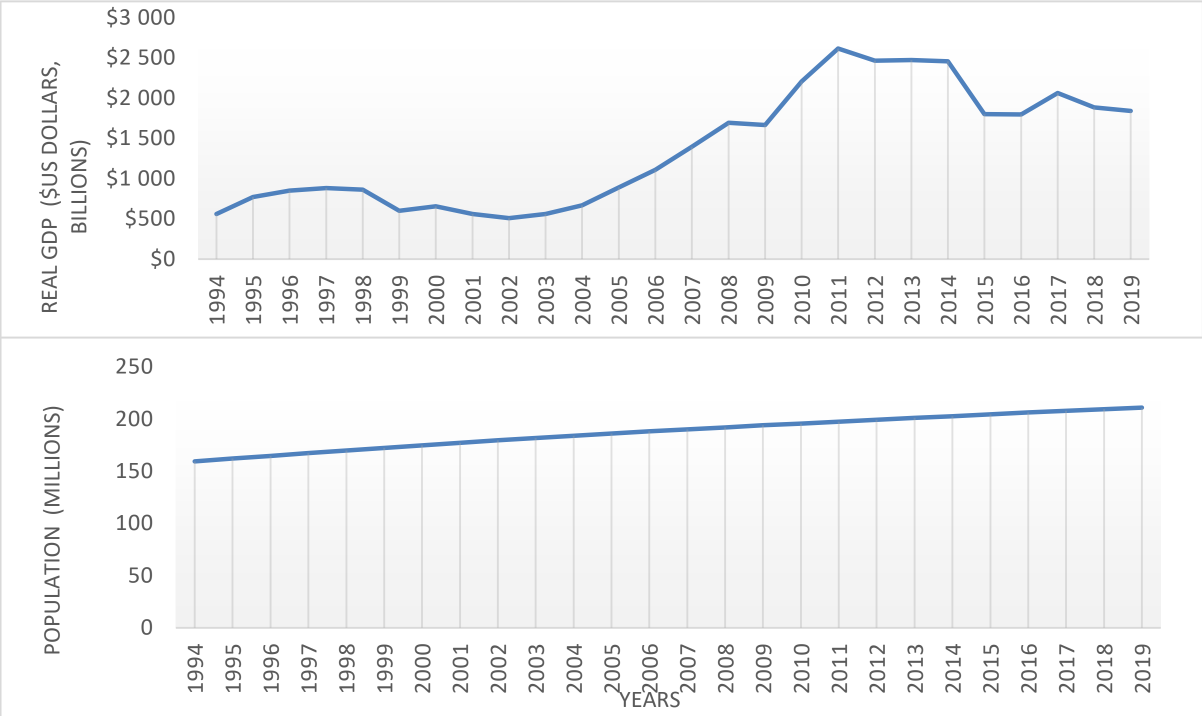

Figure 2.51: Brazil's Real GDP and Populations trends

Source: World Bank Data Bank

Figure 2.51 shows the population records as expanding over the years from just above 150 million in 1994 to over 209 million in 2019. The country is the third most populated among the BRICS behind China and India. The GDP estimates trended upwards from 1994 to 2011 thereafter stabilised with a peak in 2014 before a mild downward trend to 2019. Given the current pandemic, it is reported that 2020 is marked a primary hindrance to policymakers' determinations over the prior years to steer the economy back to a path of strong growth last witnessed in 2014Q1 (Barua & Samaddar, 2021).

Brazil is an upper-middle-income country, and ranked the 57th richest economy in per capita terms out of 133 at $15,388 PPP as at 2019 (Harvard Atlas, 2019). To this effect, figure 2.52 goes on to reflect on the trajectory over the years and the percentage change estimates. The submission was that the GDP per capita growth averaged -1.3% over the past five years, leading to 2019, which was below the regional averages. Therefore, the standard of living has deteriorated in the past couple of years for Brazil given its population.

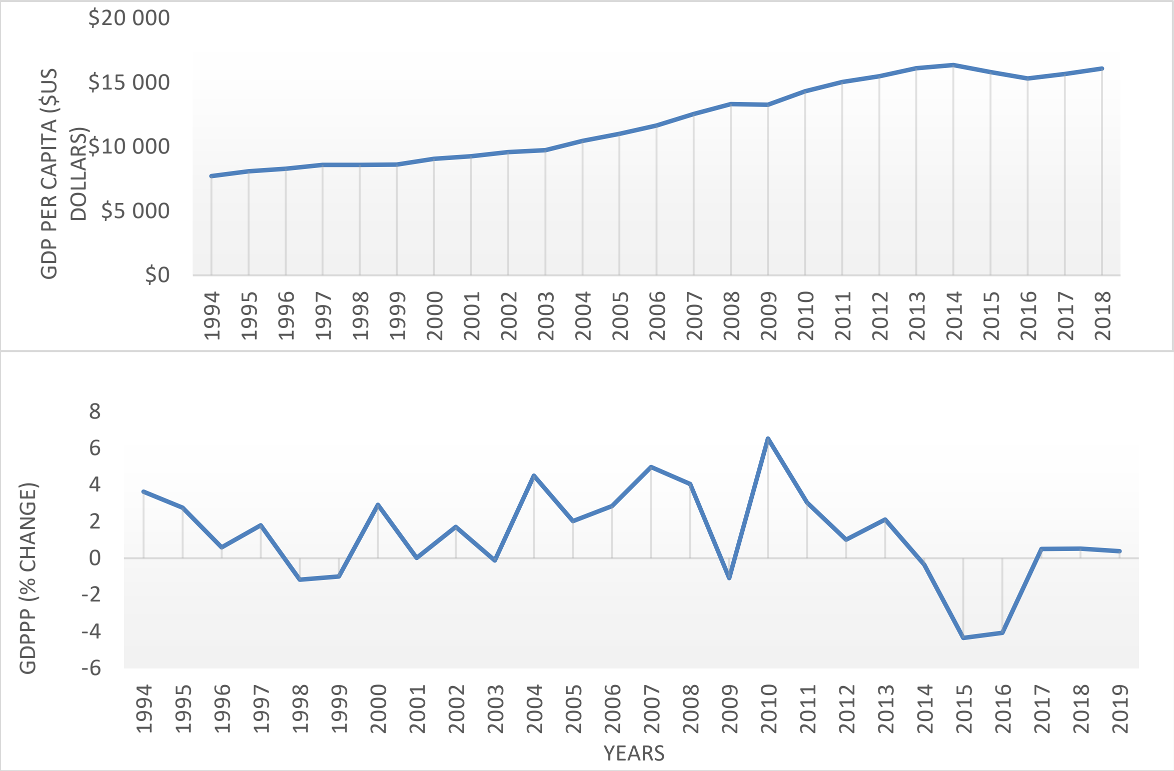

Figure 2.52: Brazil's GDP per capita (Real and percentage change)

Source: World Bank Data Bank

To safeguard the most susceptible people, the Brazilian government advanced a large, timely bound fiscal stimulus package focused on social assistance. The cost of this package was estimated at US$156.8 billion, or 11.4 percent of GDP in 2020 (World Bank, 2021e). The bank says that the large fiscal stimulus restricted the annual contraction in 2020 to 4.1 percent.

2.3.1.2. Trade Outlook and Performance

In 2020, Brazil's current account balance was US$-12.5B. Nonetheless, the country's current account balance has fluctuated considerably in recent years (Knoema, 2021). It was further described that the balance tended to decrease throughout from 2001 to 2020. In the trade front, Brazil has a number of exports destined for the world market, where its top exports include soybeans worth $25.9b, iron ore at $20.1b, crude petroleum at $17.4b, raw sugar at $11.4b and cars at $6.78b. The top imports were refined petroleum at $11.4b, vehicle parts at $5.1b, packaged medicaments at $3.1b, integrated circuits at $3.03b and cars at $3b.

Table 2.7 provides a view of exports destination and import origin. China continues to feature as the most ventured export and imports market, with the United States as the second most international market, while Germany and Argentina too hold firm in both markets.

Table 2.7: Brazil's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. China	$48B	1.China	$27B
2. United States	$25.1B	2. United States	$20.4B
3. Argentina	$17.8B	3. Argentina	$9.3B
4. Netherlands	$7.57B	4. Germany	$9.3B
5. Germany	$6.18B	5. South Korea	$5.39B

Source: MIT Atlas of Economic Complexity (2018)

Figure 2.53 below reflects the current account performance prior to the pandemic, and as already alluded to, there were more payments to the international markets than the country received. The trend line of both payments and receivables follow a similar pattern, but with the debit side trending higher. In 2019, the Economic Commission for Latin America and the Caribbean (ECLAC) report that the current account deficit rose to 3.0% of GDP, compared with 2.2% in 2018. However, the sentiments were that it was mainly funded by FDI income amounting to US$ 60.8B (ECLAC, 2019).

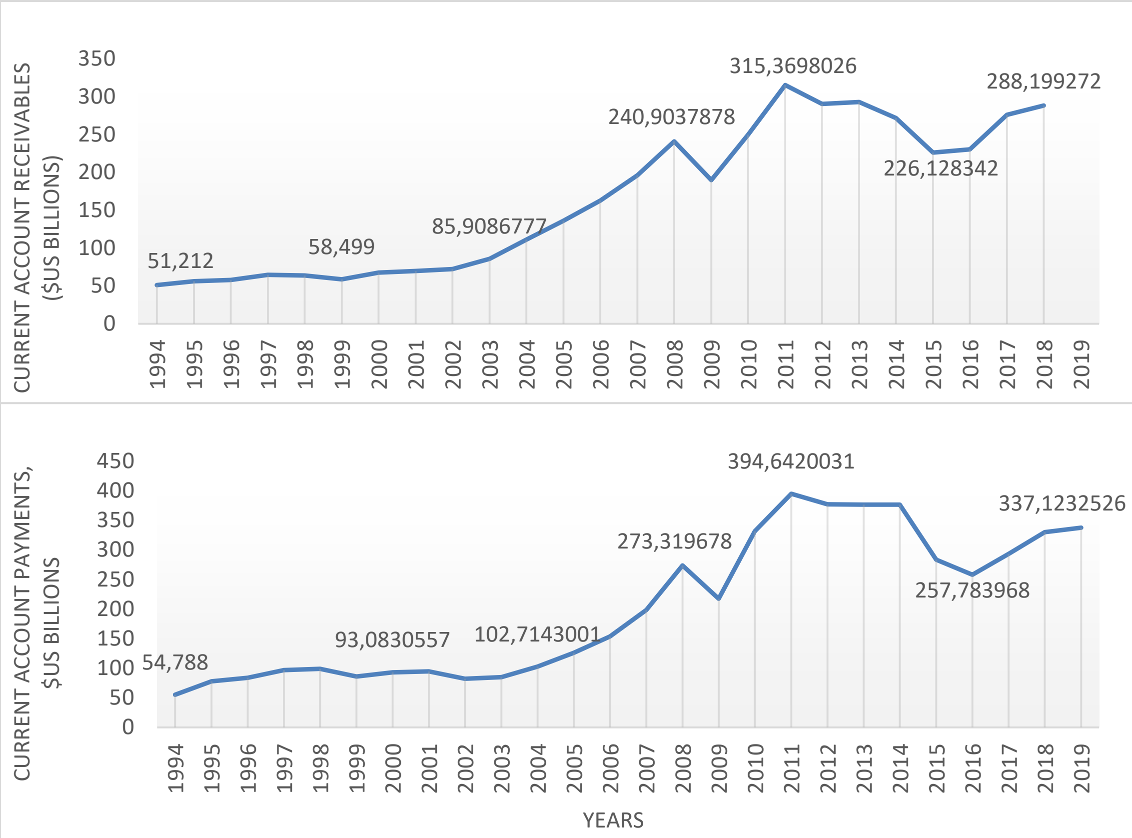

Figure 2.53: Brazil's Current Account Credit and Debit Items (1994 – 2019)
Source: World Bank Data Bank

Figure 2.54 gives a bird's eye view of the current state of the Brazilian current account balance, and as reported, the only surplus period were the year 2003 to 2007, while the rest of the timespan were deficits. The ECLAC further reports the following measures taken by relevant Brazilian entities in mitigating the dire economic outlook:

- In 2019, monetary policy initiated a reduction of the benchmark interest rate, the Selic fell to 5.0% and it is the lowest level seen in 50 years in nominal terms;
- Owing to the above rate cuts, personal loans ascended by 8.9% subsequently, thereby contributing to the improvement in household consumption, although corporate loans declined by 3.1%; and
- Extensive negotiations among the Common Market of the South (MERCOSUR), the European Union and the European Free Trade Association were clinched in 2019. These are expected to give stimulus to trade between Brazil and regional member countries, permitting special access to the Brazil's commodities and manufactured products.

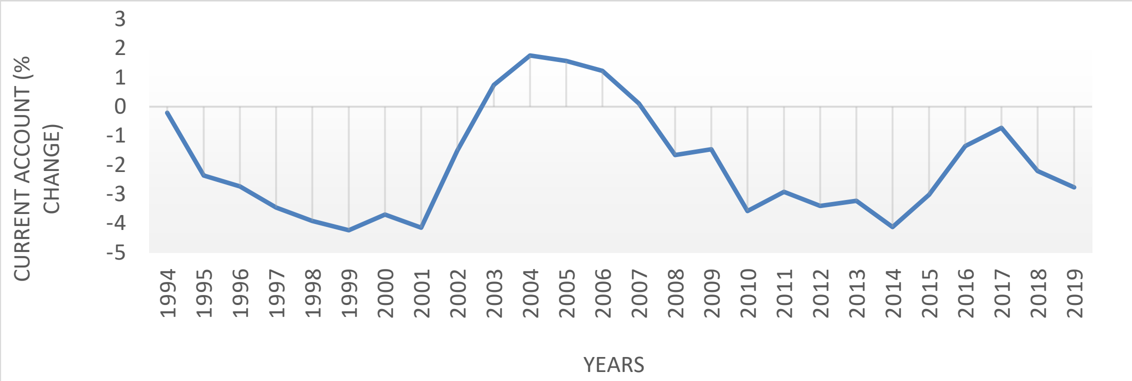

Figure 2.54: Brazil's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

The above measures were taken in response to the challenging economic downturns. The World Bank (2021e) reports that uncertainties on macroeconomic policy structure, particularly in the fiscal area, thus calling for strong fiscal consolidation and the acceptance of structural reforms in 2021, once the economic downturn is under controlled, reported the World Bank.

2.3.1.3. *Investment performance*

Following on from the above government actions to protect the economy, investment undertakings were encouraged and taken as alleviating the economic downturn conundrum. As already alluded to above, that it was fixed investment, that is, gross fixed capital formation that aided the mild recovery in the 4th quarter of 2020 as it expanded from the previous periods. Because of this, overall, with the third successive quarter of growth in fixed investment, real GDP in the first quarter was almost back to end-2019 levels (Barua & Samaddar, 2021). This goes to reflect that government's initiative through fixed investment may be a key stimulus needed in economies

It then became an imperative undertaking to reflect on past government efforts to improve the economic outlook through fixed investment. Figure 2.55 shows the investment trajectory over the years prior to 2020. Government capital injections waned in the period 1994 to 2003, and thereafter exploded just above US$500B in 2011. Thereafter, the capital injection had a downward trend to just below US$300B in 2019.

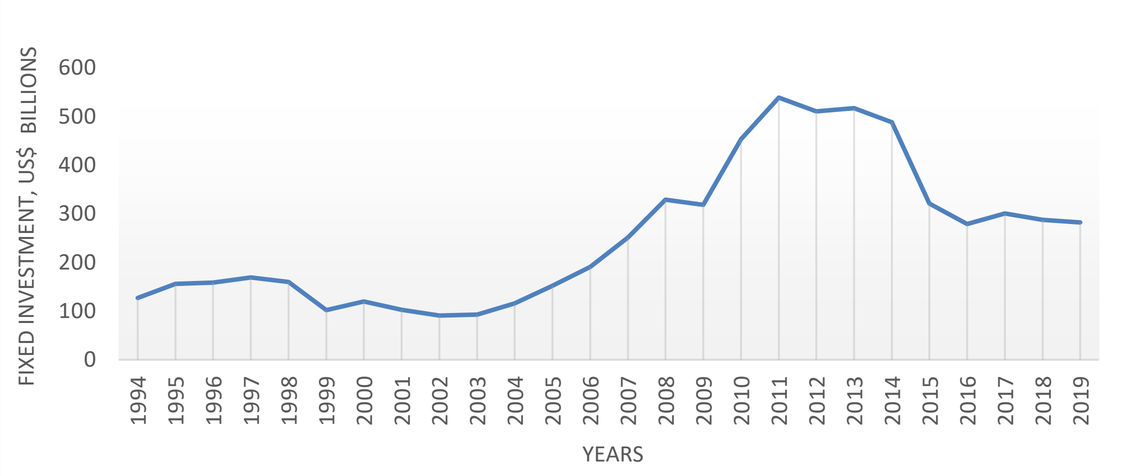

Figure 2.55: Brazil's Real Fixed Investment performance (1994 – 2019)

Source: World Bank Data Bank

While Brazil has made strides to develop and invest in itself, FDI still remains a critical indicator of progress. The IMF reported that the United States was the second largest single-country stockholder of FDI representing 19% of all FDI in the country at US$108 billion, which was only behind Netherlands' at 23% with US$131 billion in 2018 (US Department of State, 2021). The Brazilian Government's private investment priorities were in infrastructure and energy sectors during 2018 and 2019, and its promotion strategy was highlighted to be in the automobile manufacturing, renewable energy, life sciences, oil and gas, and infrastructure sectors.

2.3.1.4. Economic Complexity, product complexity and trade dynamics

Brazil is positioned or ranked as the 37th according to the MIT Atlas (2018) and 53rd according to the Harvard Atlas (2019) most complex country in ECI ranking. Much like the selected SSA countries, the MIT Atlas (2018) submits that compared to ten years prior, Brazil's economy has worsened in ECI terms, falling four positions driven by a lack of diversification of exports. However, the country was still expected to take advantage of many opportunities to diversify its production by employing existing know-how. Additionally, the MIT Atlas study suggests that growth projections were foreseen at 2.3% annual growth rate in the next decade to 2028.

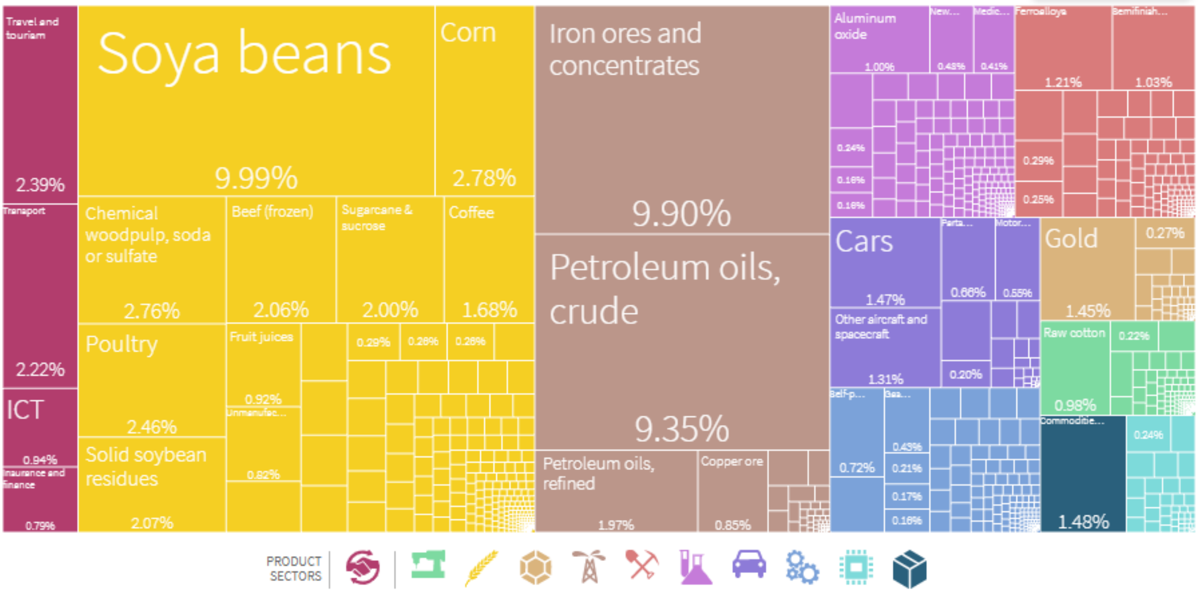

Figure 2.56: Brazil's Sector export share
Source: Harvard Atlas Economic Complexity Lab (2019)

It was seen that Brazil was trading at a deficit in the current account. Non-oil exports declined by 1.6% annually over the past five years, which was observed to be lower than the global average, while imports totalled USD $251B in 2018 left Brazil with a trade deficit in commodities traded (Harvard Atlas, 2019). As such, figure 2.ii shows a picture that most exports were in the natural or unprocessed exports. However, compared to the selected SSA, the basket is somewhat diversified with no single commodity taking a large share of exports with soya beans, petroleum oil, crude, and iron ore and concentrates claiming just about 10 % of the basket each in figure 2.55.

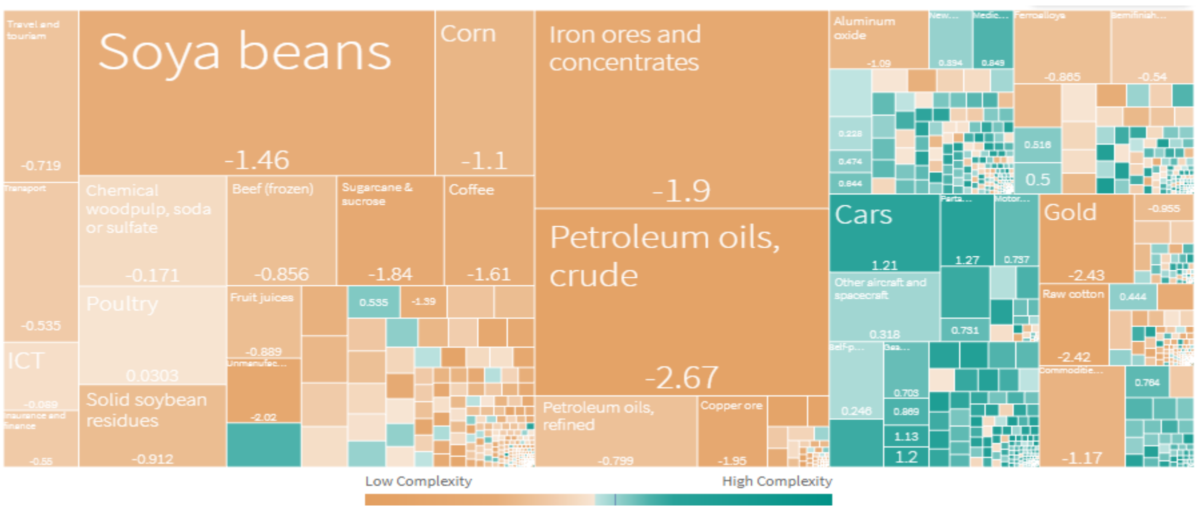

Figure 2.57: Brazil's Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

In addition, figure 2.57 goes further to reflect on the PCI of each exported commodities. The large share of the exports were less sophisticated, the likes of soya beans at -1.48 and crude oil at -2.83. However, there are some complex exports like cars at 1.05; and unlike the selected SSA, Brazil has a number of moderate complex commodities as seen by the blue shades like mineral fuels, oils and waxes and cereals products. The challenge is that the complex commodities form a smaller share of the exports basket with the exception of cars.

Figure 2.58 summarily provides Brazil's ECI. Indeed the Brazilian ECI reflects the PCI in the exported product. The country's ECI has been declining from 1994 up to 2014. Thereafter in 2018 there were substantial gains made and the trend was now a moderate positive ECI at 0.608.

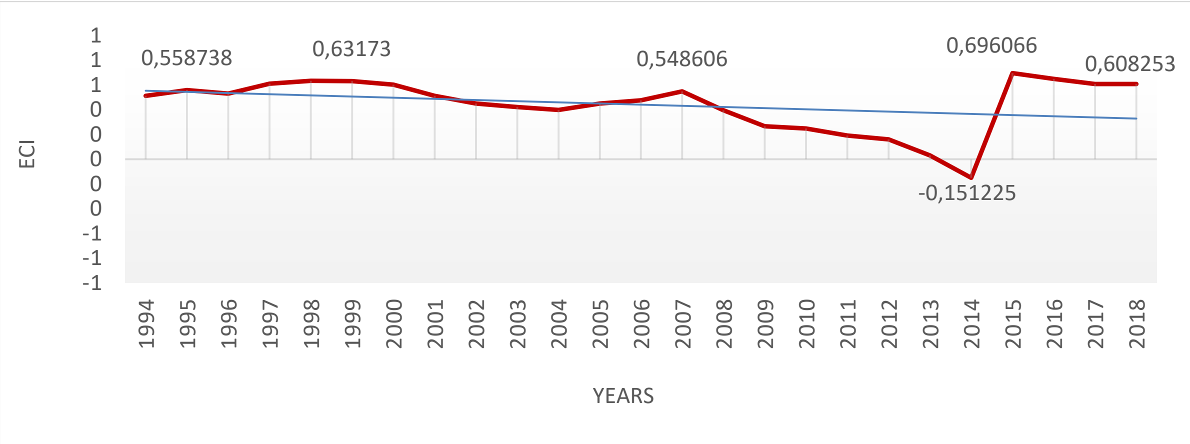

Figure 2.58: Brazil's ECI Trend (1994 - 2018)

Source: MIT Atlas Economic Complexity Lab (2018)

The above submission beckons the question of how competitive Brazil is in the international export market. Figure 2.59 illustrates that Brazil's major exports in world market share was textile, while minerals have had a moderate upsurge. However, the Harvard Atlas lab study suggests that the global market share in textile exports stagnated over the past decade; while electronics and machinery were still to take-off in Brazil (Harvard Atlas, 2019). This then limits potential income growth for the country with services exports driving the export dynamic even though it too has fallen.

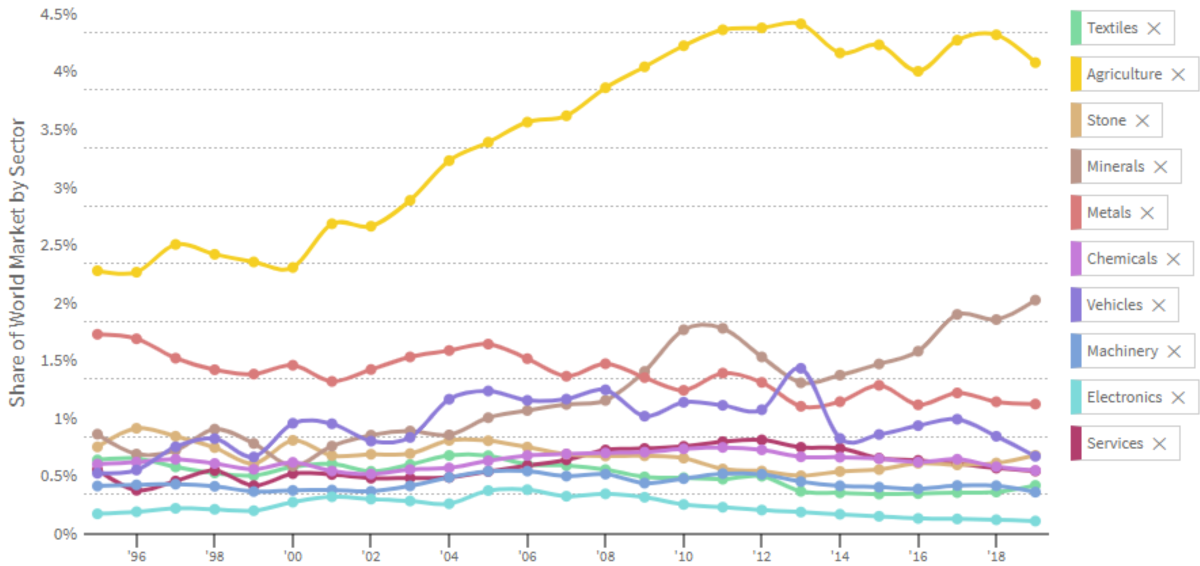

Figure 2.59: Brazil's World Export Market share (11994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

Brazil added eight new products since 2003, and these products were said to have added $3 in income per capita in 2019 (Harvard, 2019). However, the stand is that these are too few goods to add a significant income growth of which the value addition to exports was $647 million. Some of the new products added was copper ore, which contributed 79.44% of the new exports value, bovine at 16.49%, and nickel bars, wire at 1.27% as the highest contributors.

2.3.1.5. Policy perspective and challenges

Brazil has a more detailed trade plan of action or policy mission to advance the country, and this also involves the Small to Medium Enterprises (SME's). Brazil has acknowledged its potential to proliferate present exports regionally to Asia, Europe and well into Africa. The International Trade Centre (ITC) confirms that there is possible avenue to increase the current exports of motor cars and aeroplanes to these regions (ITC, 2021). The ICT echoes the following challenges in relation to Brazilian firms or SME's:

- They struggle in producing audited financial statements, universal quality certificates and licensing in foreign technologies.
- The leading performance breach between small and big firms lies in having managerial experience and certification in international quality.

Additionally, with respect to investment drive, Brazil is focussed on transport infrastructure, energy, aeronautics, and other technology-intensive sectors as well as in education and research. To this effect, ITC endures to coordinate its work in Brazil through the country's foremost trade support institutions and aims to work both at the national and state levels, giving more priority to the SME integration into regional and global value chains.

The Ministry of Economy for Brazil, under the special secretariat for productivity, employment and competitiveness, has some programmes aimed at business internationalisation. The programmes aim to internationalise start-ups through capacity-building and business missions to foreign markets (OECD, 2020).

2.3.2. Russia Economic Landscape

Russia is placed as the 11th biggest economy globally according to GDP estimates at US$1.7 trillion, and had a 1.3% growth in 2019, with a 5-year compound annual growth of 0.8%, while its GDP per capita stood at $29,181 per capita as at 2019. The country is said to have moved toward a more market-based economy over the past 30 years since the fall of the Soviet Union, though government ownership of and intervention in business is still common (CIA World Factbook, 2020b).

Russia is also among the leading exporter of oil and gas, as well as other minerals and metals which are highly sensitive to fluctuations in world commodity prices. The country is situated in both Asia and Europe bordered by fourteen countries including China, Azerbaijan, Estonia, Kazakhstan, Finland, Belarus, Georgia, North Korea, Latvia, Poland, Ukraine, Lithuania, Mongolia and Norway.

2.3.2.1. *GDP Performance and population trajectory*

The Focus Economists (2020) reports on the Russian economy an economic downturn, that the economic situation appeared to improve somewhat in Q3 after a sharp GDP decline rate in a decade in Q2. Additionally, in Q3, activities fell at a much softer pace than Q2's average, reinforced by a steady rescue from the critical industrial sector, as manufacturing companies' continual capacity revamps, offsetting the sliding mining output partly.

The Bank of Russia (2021) reports on the economy that it has maintained an upward trend between May and June, owing to a fast growth of corporate and retail lending. To this effect, the economy rebounded in Q2 of 2021, while industries concentrated on consumer and investment demand reached new growth strides. Figure 2.60 below presents the pre-2020 economic status to gauge the economic and standard of living projections narrated against the GDP and population growth. The Russian economy stood at 144.4 million people as at 2019, and the trend also suggests that the population has been declining in the stated period.

The population stood at just below 150 million in 1994. On the other hand, the GDP trended upward from 2003 with a mild downturn between 2008 and 2009. This may have been as a result of the financial crisis. Afterwards, there was a brief uptrend from 2010 to 2014 with moderate stability in the growth trajectory to 2019. Given that the population estimates trended downwards, it may suggest that the standard of living may have been maintained with no major adverse impact in GDP per capita.

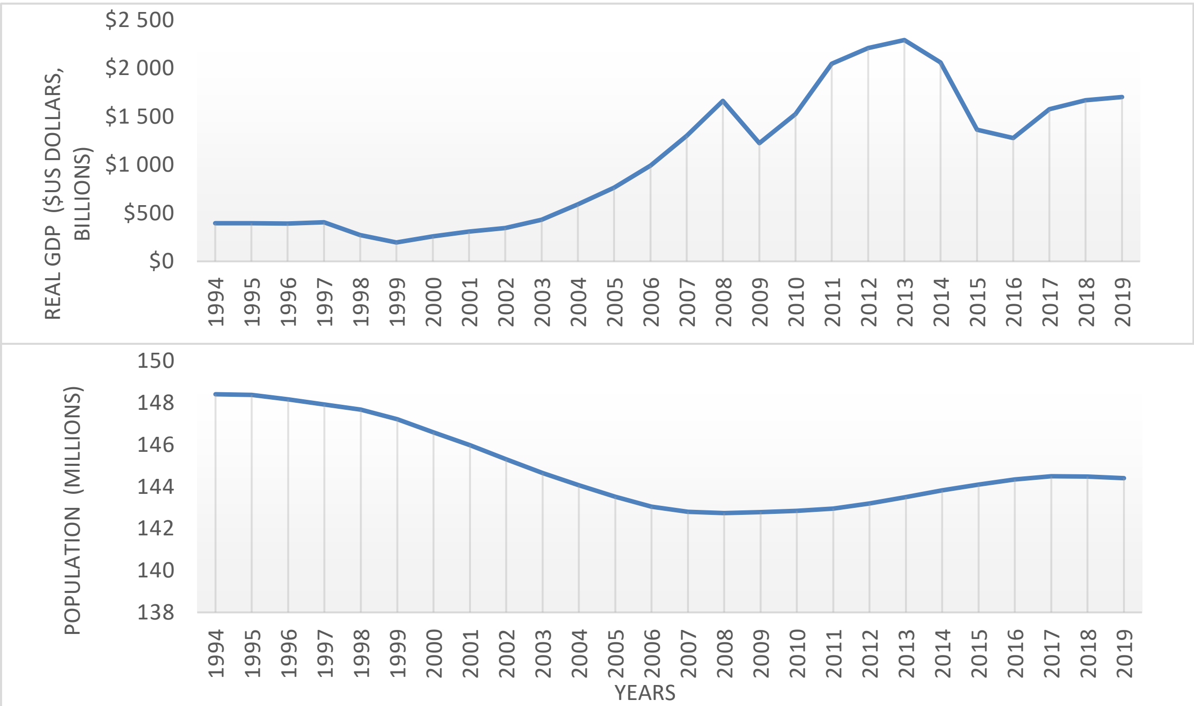

Figure 2.60: Russia’s Real GDP and Populations trends
Source: World Bank Data Bank

Figure 2.61 too gives a more prescise measure of standard of living per capita GDP. There apears to have been a decline in the well being of the Russians given the slide decline per capita GDP estimates. This reflects the dire economic effects realised in 2020, and the percentage change too was declining prior.

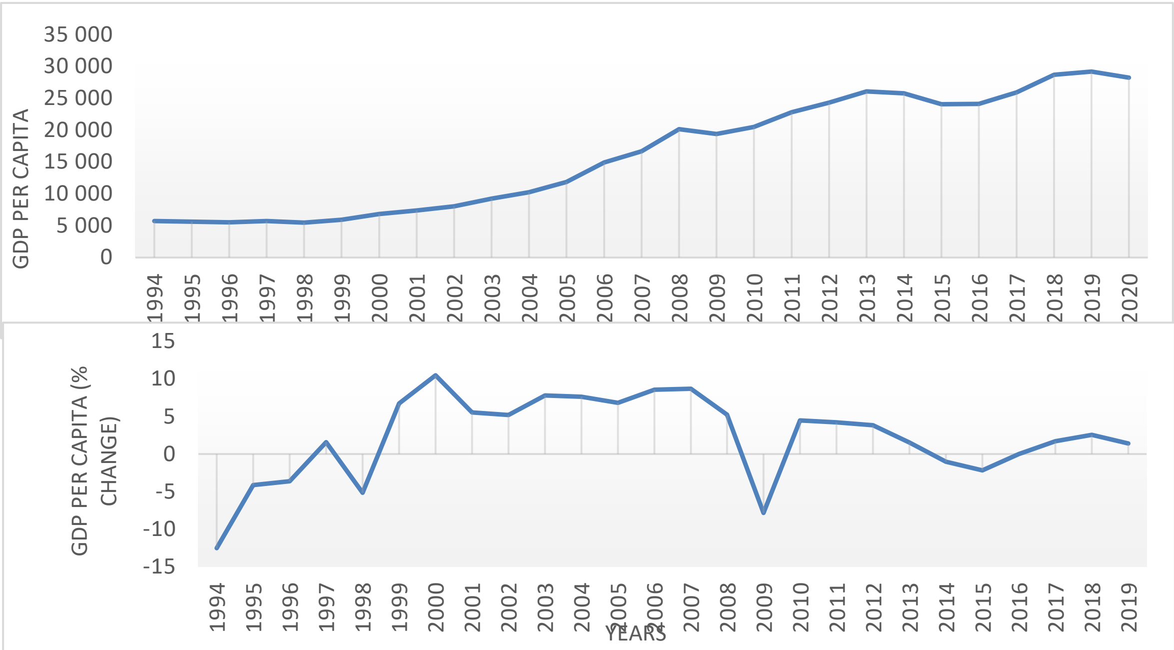

Figure 2.61: Russia's GDP per capita (Real and percentage change)

Source: World Bank Data Bank

Even the year 2021 economic performance was still lacklustre given the measures to protect the economy. The Bank of Russia (2021) July reports confirms that the second quarter saw economic growth at a slower pace compared to the first quarter due also to the consumer services sector adversely affected. However, other sectors of the economy like manufacturing were improving.Additionally, per capita disposable income for 2020 in the last three quarters was lower by 7.9%, 5.3% and 1.7%, respectively, than in the previous 2019 year (World Bank, 2021). A further analysis was that the drop in GDP per capita income appears to not have excessively affected poor households.

2.3.2.2. Trade Outlook and Performance

The MIT Atlas (2018) confirms that Russia is the 14th major export economy in the world. While its top export were crude petroleum at US$96.6B, Refined Petroleum at US$58.4B, petroleum gas at US$19.8B, coal at US$16.1B and Wheat at US$7.93B. On the debit side of the current account, top imports were packaged medicaments at US$8.23B, cars at US$7.69B, vehicles at US$7.44B, broadcasting equipment at

US$7.04B and planes, helicopters, and/or spacecraft at US$6.33B. Table 2.7 provides a summary of Russia's export destination and imports origin. Of interest is that there exists a mutual trade relations between Russia and its BRICS partner China as both export and import from one another, and Germany, Belarus and the United States feature in both markets.

Table 2.7: Russia's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. China	$39.1B	1. China	$43.8B
2. Netherlands	$27.7B	2. Germany	$27.2B
3. Germany	$19.9B	3. Belarus	$12.5B
4. Belarus	$18.5B	4. United States	$10.9B
5. United States	$15.4B	5. Italy	$9.2B

Source: MIT Atlas of Economic Complexity (2018)

In 2021, there was a current account surplus expansion (y-on-y) to US$19.9B in the 2nd quarter of 2021 from US$1.6B (Bank of Russia, 2021). The key factor behind this improvement was a rise in commodity prices with faster rate of merchandise exports amid the recovery of external demand. The bank, however, reported that oil and gas exports made negative contributions to export performance as compared to pre-pandemic levels.

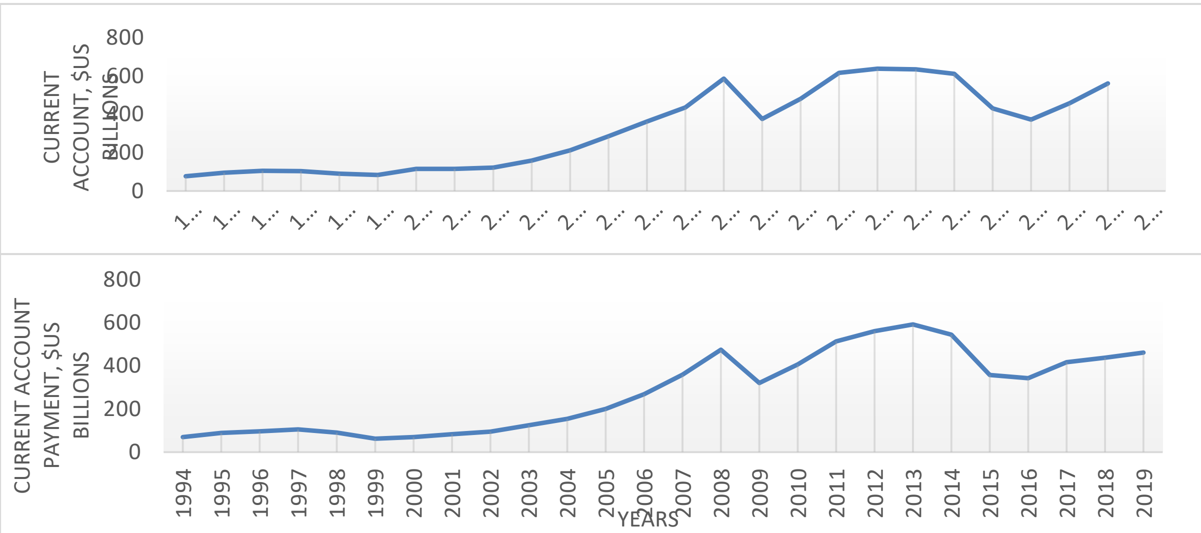

Figure 2.62: Russia's Current Account Credit and Debit Items (1994 – 2019)
Source: World Bank Data Bank

Figure 2.62 goes on to reflect the pre-pandemic's current account performance. It appears that the trade pattern in export and import market follows a similar trajectory in debits and credits side. However, the export seem to be more than the imports marginally so. Indeed from figure 2.63, there exists a current account surplus across the years with a positive percentage change across the specified period to 2019. Focus Economics (2020) explains that Russia's current account archives consistent surplus trade chiefly owing to commodity exports such as crude oil and natural gas. From 2010 to 2014, Russia's average current account surplus was US$ 66.8B, reaching a peak of US$ 98.8B in 2011.

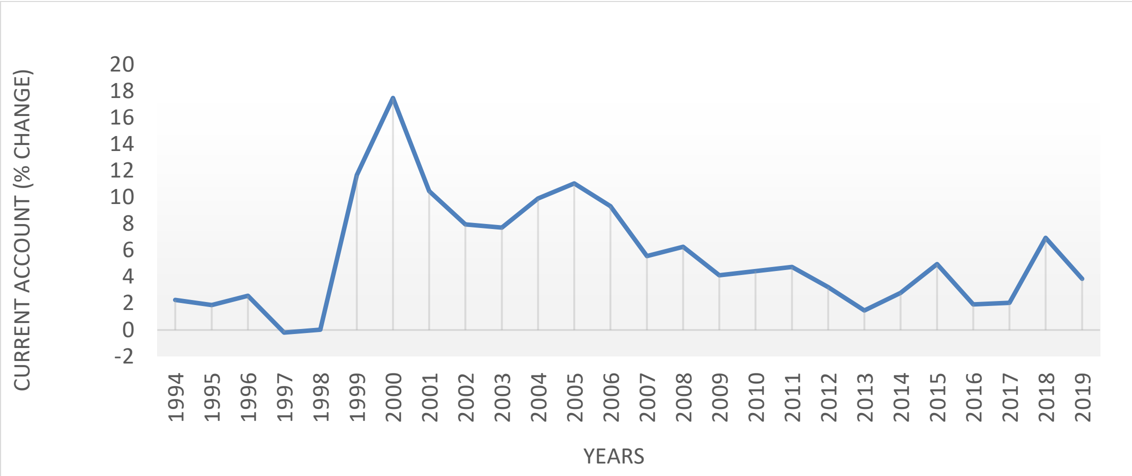

Figure 2.63: Russia's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

Given that globally the pandemic has exacerbated economic performance adversely, Russia's exports of gas and petroleum might once more add to its economic recovery. The forecasts reveal that a gradual increase in oil prices is expected to thrust up the current account balance in 2021 – 2022 (World Bank, 2021), while net capital outflow is expected to stay moderate, helped by relatively strong macro-fundamentals and accumulated macro-fiscal buffers.

2.3.2.3. *Investment performance*

The Bank of Russia (2021) as reflected above on the economy and the recuperation of the economy was on the back of fixed capital investment and household consumption among other macroeconomic indicators. Fixed capital formation suggests that the Russian government undertook much needed capital injection or investment projects when it was most needed. Figure 2.64 then proceeds to reflect on the efforts made by the Russian government in investing in itself. Over the years, Russia has had a significant gross fixed capital investment in the economy as can be noted that there was a sound capital injection from 1994 to 2004. The highest capital injection was in 2013 at just over US$500B.

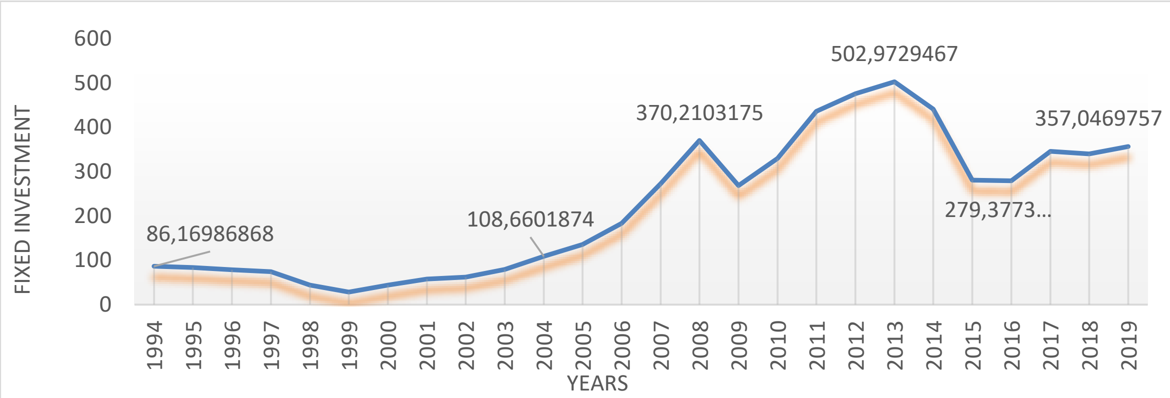

Figure 2.64: Russia's Real Fixed Investment performance (1994 – 2019)

Source: World Bank Data Bank

Additionally, Russia has some important partners such as the World Bank Group, which aid the country to bring knowledge and financial resources to benefit other countries around the world. The following are some of the projects between the government of Russia and the World Bank (World Band, 2021d):

- Since 2007, Russia has guaranteed US$896 million to IDA's;
- Russia has also funded US$279 million across 24 administered trust funds in the provision of education, SME's (small and medium-sized enterprise) development, and other development range in countries across Europe and Central Asia (ECA), Africa and the Middle East.
- The latest pledges include US$9M to the ECA Regional Public Finance Management (ECA PFM) Trust Fund programme and $3 million to the Public Expenditure Management and Peer-Assisted Learning programme (PEMPAL) in October 2019.

2.3.2.4. Economic Complexity, product complexity and trade dynamics

The MIT Atlas (2017) places Russia as the 27th most complex economy, while the Harvard Atlas (2018) positions the country at 52 in ECI. Further analysis, and in contradiction with the above analysed countries, Russia's economy has actually become more complex, improving 10 positions in the last decade by diversifying its exports. The country is said to be well placed to realise gains of a moderate number of prospects to diversify its production by means of its current knowhow. Table 2.63 shows the exports basket of the country. Russia's major exports basket were in petroleum oil products, with crude oil constituting 25.03%, while refined oil was 14.36% and petroleum gas at 4.99%.

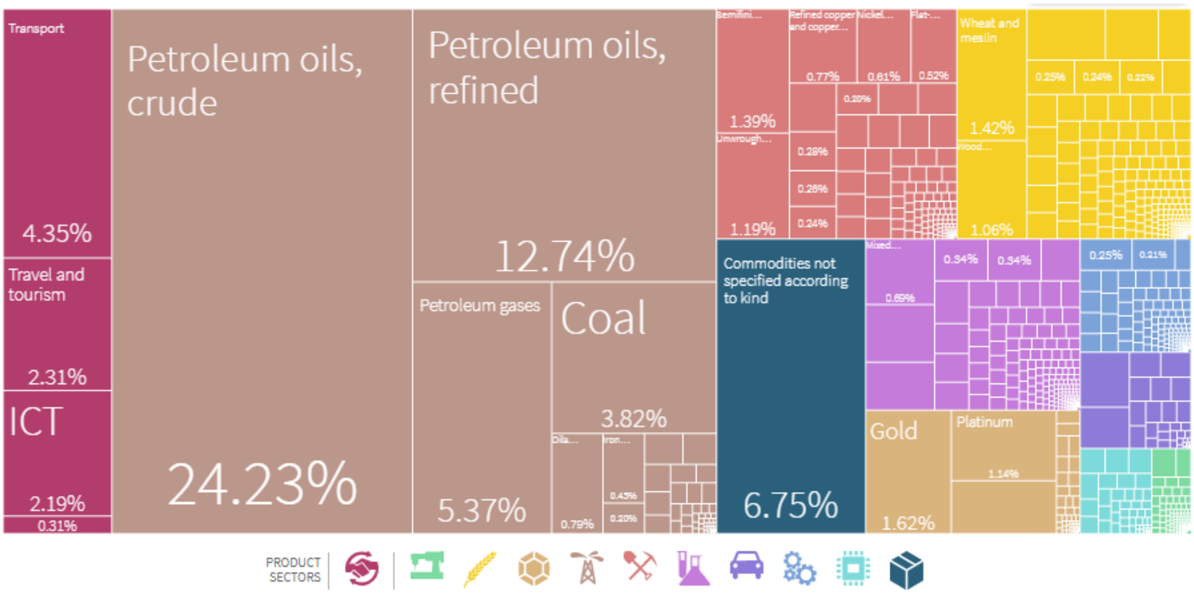

Figure 2.65: Russia's Sector export share

Source: Harvard Atlas Economic Complexity Lab (2019)

Next is to reflect on the PCI in the exports basket, thereby giving credence to the said ECI position. Table 2.66, therefore, gives a reflection of such product with the Harvard Atlas (2018) presenting that Russia has seen a fixed outline of export growth, with the main input to export growth emanating from modest complexity products, predominantly precious metals, stones and wood products. The overreliance on petroleum, which constitute a large share of exports, might hinder the ECI outlook for the country.

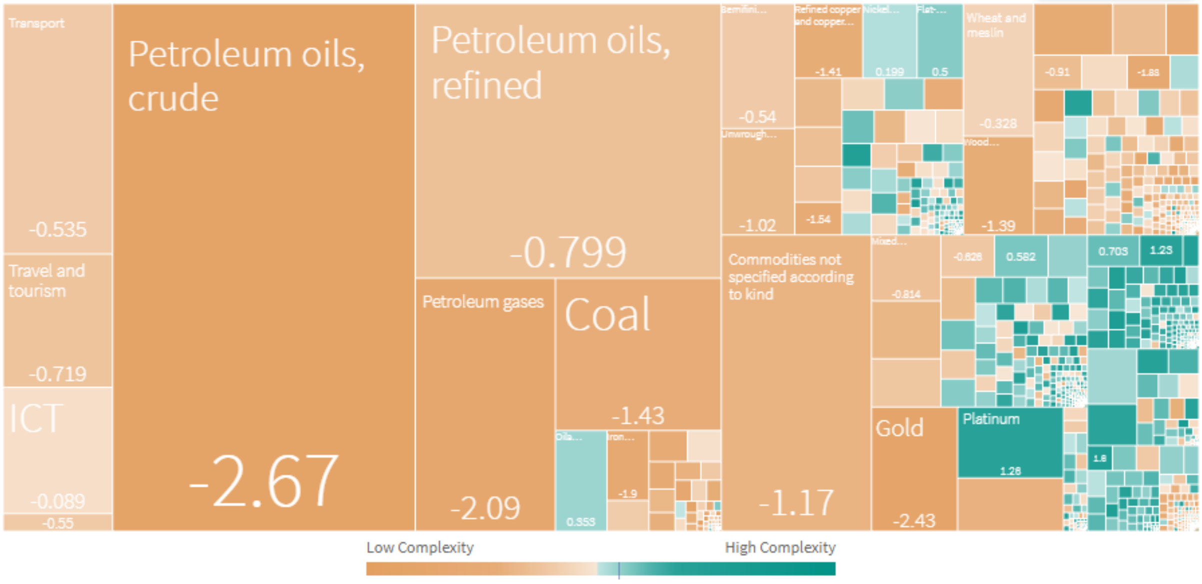

Figure 2.66: Russia's Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

Figure 2.65 then plots the Russian ECI over the years given the above submissions. The country's ECI is seen here to be moderate improving in the last 5 years to 2018. The improvement was significant enough to cover the lost grounds between 2007 and 2014.

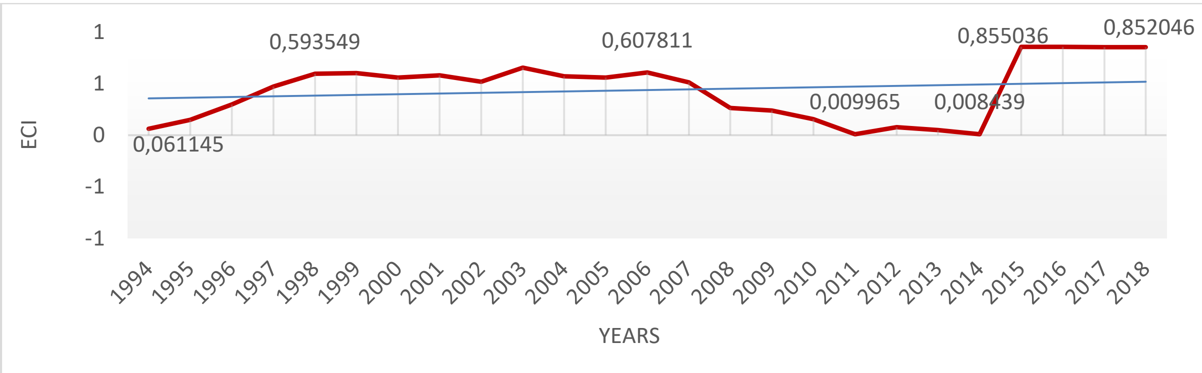

Figure 2.67: Russia's ECI Trend (1994 - 2018)
Source: MIT Atlas Economic Complexity Lab (2018)

As of 2020, the Harvard Atlas (2020) proclaimed that Russia had not started the traditional course of structural transformation. This is a key source of growth of economies. The process moves economic actions from low to high productivity sectors. Figure

2.66 then places Russian share of global market in context. The textile exports in Russia has remained the same as a share of world exports market over the past 10 years. Additionally, Russia's highest export sector was in the stone and mineral sectors; while electronics and machinery hover around the mean of zero, suggesting that these two sectors are still to take-off in Russia. Hence this was reasoned as limiting income growth.

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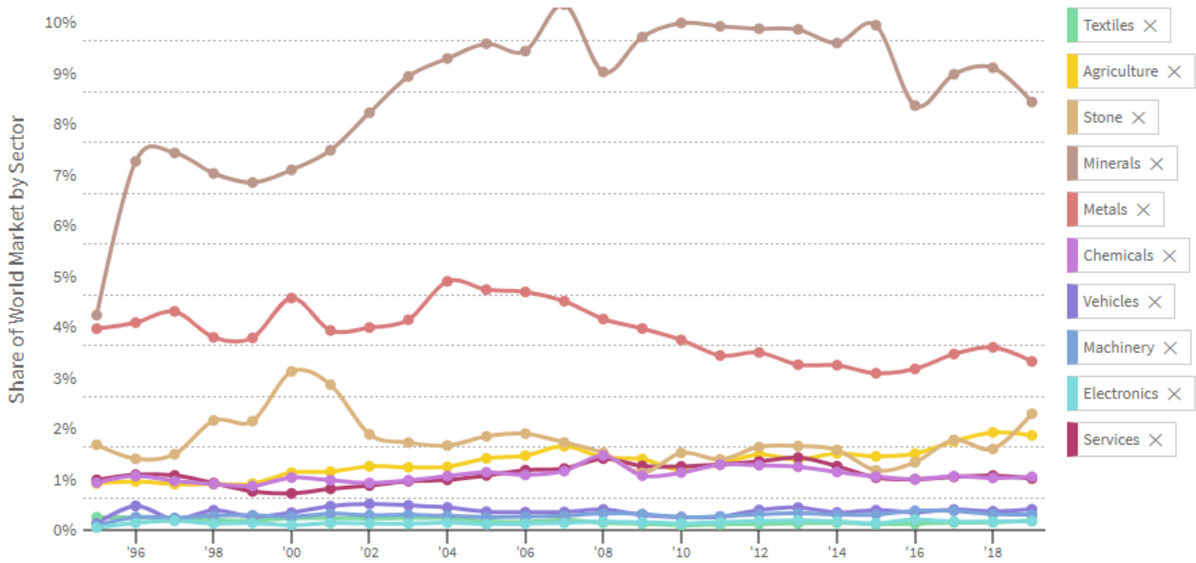


Figure 2.68 Russia's World Export Market share (12994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

Even so, since 2003, the Harvard Atlas (2020) states that the country has actually added 18 new products into its export basket share. This of course drives economic growth when countries diversify into new products that are substantially complex. The only concern was that the product expansion was not enough to contribute well into income growth. This is reasoned on the basis that although a sufficient number of new products were added in the export basket, it was at too small a volume to fund a considerable income growth.

2.3.2.5. Policy perspective and challenges

From the Focussed Economist (2020) perspective, Russia's longer-term economic growth prospects depend on national projects as the foremost tool for the acceleration of long-term potential growth through infrastructure development, promoting economic diversification, raising total factor productivity through digitalisation, and enhancing human capital. However, the main challenge to this was on the efforts to reduce the state's economic footprint, which is levelling the playing field for the private sector, improving governance, and particularly SOE's. As such, the Russian government has taken steps to stimulate private investment.

In August 2019, the Russian government formed the Special Investment Contracts, (SPIC) which aimed to increase long-term private investment in high-technology projects, and introduce advanced technology for local content in manufacturing products. The Ministry of Industry and Trade has extended the SPIC term to 20 years, conditional on the extent of investment (World Bank, 2021).

2.3.3. India Economic Landscape

India is considered a lower-middle class and the 5th biggest economy in the world, with GDP figures of US$2.87T in 2019, which was 4% higher than in 2018. As a result of its huge population, India has the lowest per-capita GDP in the top 25 biggest economies in the world (World Bank, 2020). It is also reported that India's economy is a blend of old-fashioned village farming and handcrafts alongside a thriving modern industry and automated agriculture.

The World Bank (2020) also affirms that India is a major exporter of technology services and business outsourcing, and the service sector makes up a large share of its economic output. India is bordered by Afghanistan, Bangladesh, China, Nepal and Pakistan by land; and Indonesia, Sri Lanka, Maldives and Thailand by sea.

2.3.3.1. *GDP Performance and population trajectory*

Much like most economies reflected thus far, India also fell victim to the economic downturn due to the current pandemic. The Asian Development Bank (2021) reports that there was a – 8% drop in GDP figures in 2020 as compared to 2019. This resulted in a drop in India's world GDP ranking to 6th from the 5th position in 2020. However, the country made some gains from government interventions to boost the economy. The government provided a spending boost to growth together with private investments and goods exports in sub-sectors such as engineering goods, chemical products and pharmaceuticals in the last quarter of 2020 (Majumdar, 2021).

As the norm, the pre-pandemic analysis to 2019 is reflected in figure 2.67. One major factor that hinders the GDP per capita is the population numbers in India. As of 2019, the population stood at just under 1,400B residents. This means that the standard of living is severely affected even though the GDP has been on an upward trajectory.

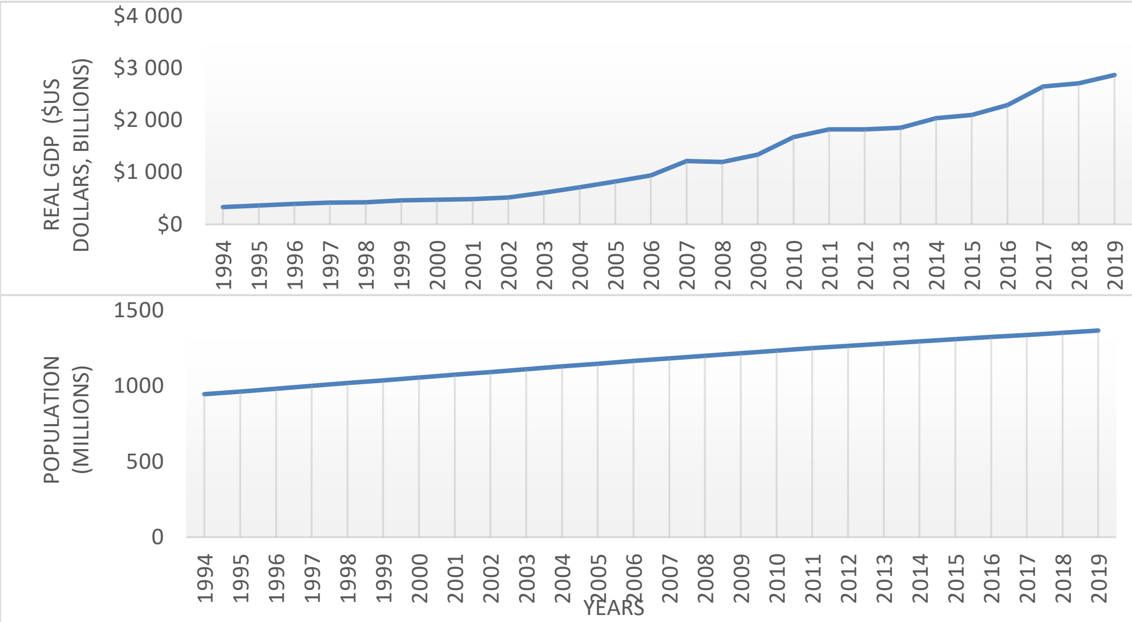


Figure 2.69: India's Real GDP and Populations trends

Source: World Bank Data Bank

Figure 2.68 reflects on the GDP per capita estimates and indeed India's economy affirms the healthy upwards trajectory. However, it is the lowest among the BRICS nations and is better than the rest of the selected SSA countries with the exception of South Africa. In the pre-pandemic years, India was among the world's fastest-growing economies, lifting millions from poverty. However, in the 1st quarter of 2019, growth slowed to a six-year low, with consumption and investment losing pace owing to weak, especially rural, income growth, coupled with stress in the non-bank financial sector, and corporate and environmental regulatory ambiguity (IMF, 2019). To this end, given its population, the Indian economy needs to expand upon through sector expansions, and to expand the positive percentage in GDP per capita reflected in figure 2.68.

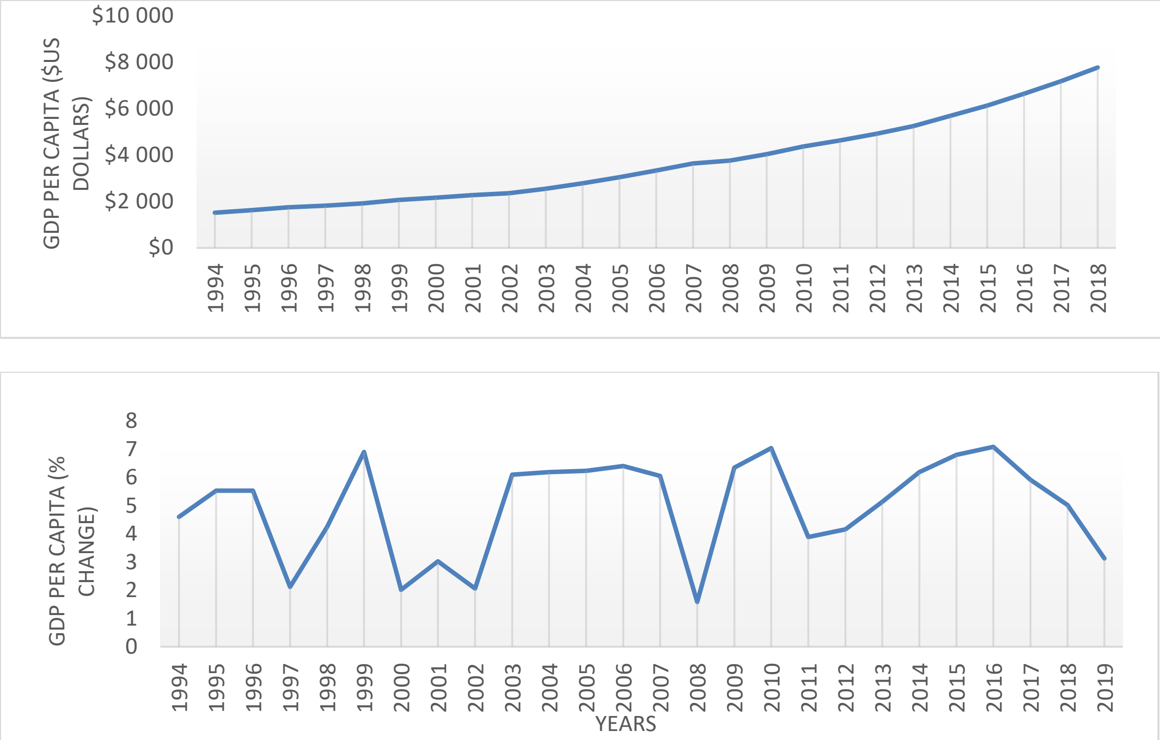


Figure 2.70: India's GDP per capita (Real and percentage change)
Source: World Bank Data Bank

The Indian government, through the reserve bank, took some monetary and fiscal policy measures to upkeep vulnerable firms and households, magnify service delivery and mitigate the severe effect of the crisis on the economy (World Bank, 2021f). This has asserted other relevant organisations to be optimistic on the economic outlook. The ADB has projected on the economy for the financial year 2022 upgraded to 7.5% from the previous 7% due to measurs taken to alleviate economic distress (ADB, 2021).

2.3.3.2. *Trade Outlook and Performance*

According to the MIT Atlas (2018), India was considered the 17th largest export economy in the world. Some of its top exports include refined petroleum at US$30.2B, diamonds at US$26.5B, packaged medicaments at US$13.2B, jewellery at US$8.66B and rice at US$7.05B. Top commodity imports were crude petroleum at US$74.7B, gold at US$39B, diamonds at US$20.7B, coal briquettes at US$19.4B and petroleum gas at US$12.2B. Table 2.9 offers a summary of India's export destination and imports origin. It is reflected that there exists a mutual trade relations between India and its BRICS partner, China as both export and import from one another, and the United States and the UAE featuring in both markets.

Table 2.9: India's Top Exports and Imports Partners

Exports Destination		Imports Origin	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. United States	$44.3B	1.China	$68.8B
2. United Arab Emirates (UAE)	$28B	2. United States	$22.8B
3. China	($14.8B	3. United Arab Emirates (UAE)	$22.1B
4. Hong Kong	($12.7B	4. Switzerland	$20.9B
5. Germany	($9.9B	5. Saudi Arabia	$19.4B

Source: MIT Atlas of Economic Complexity (2018)

Bank of India (2021) August monthly reports that on the export and import of commodities, there were some positive grounds made with exports performing better given the pandemic. However, India's current account has over the years had a lacklustre outlook. The Indian Macro Analyst (IMA, 2020) gave figures and reported that in the last 11 years to 2020, the current account as a share of GDP has been declining with negative percentage change. Figure 2.69 shows both the debit and credit side of the current account in the stated period from 1994 to 2019. There exists evidence of the payment side trending higher than the receivables.

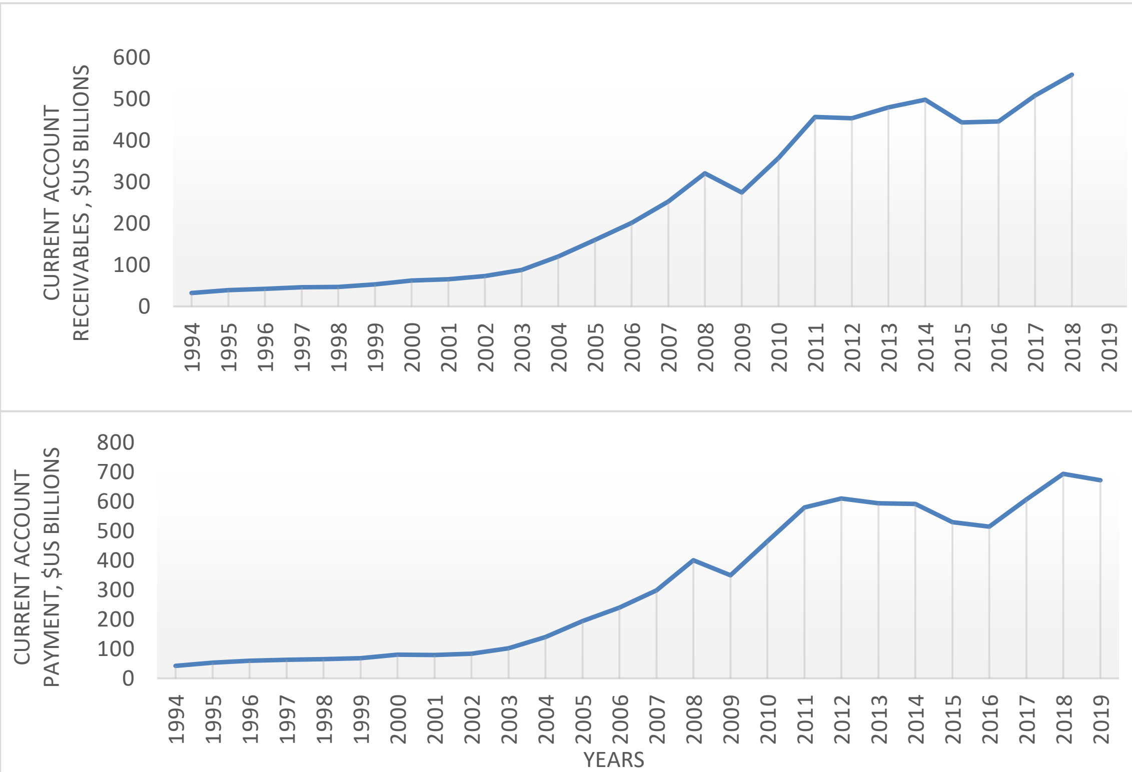


Figure 2.71: India's Current Account Credit and Debit Items (1994 – 2019)
Source: World Bank Data Bank

Figure 2.70 presents a much clearer picture of the current account status in the Indian economy. In the set period, only the years 2002 and 2003 had positive percentage change of the current account to the overall economy, with the rest of the years having payments above the receivables. As such, the Indian current account is operating with a deficit balance to this end. The Reserve Bank of India (RBI, 2021) reports that dome of the factors to the current ill-performance of the economy is due to the overall service activity declining as a result of deceleration in construction and trade, hotels, transport, communication and services related to broadcasting.

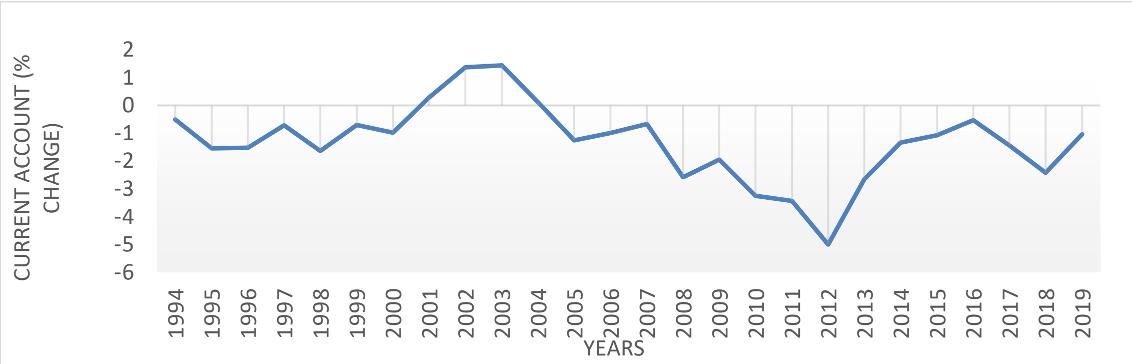


Figure 2.72: India's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

From 2014 to 2020, it is reported that trade deficit and the income sub-accounts were responsible for the current account deficit. The RBI (2021) proceeds to reflect that the current account deficit has narrowed to - 0.9% in 2020 from - 2.1% in 2019. The analysis may be that the reduced deficit may be due to the disruption in the global value chain as a results of the pandemic. Nonetheless, the Indian current account has and is still operating at a deficit.

2.3.3.3. *Investment performance*

In the investment front, as already expected, the government and indeed the private sector's efforts on the economy were impacted by the pandemic. The Reserve Bank of India (2021) reports the following with regards to fixed investment:

- The rate of gross domestic investment in the economy, that is, the ratio of GCF to GDP declined to 32.2 per cent in 2018-19, in the pre-pandemic period.
- In the 2019-20 estimates, fundamental indicators reflect to investment having faded further. The ratio of GFCF to GDP weakened to 29.8% in 2019-20 from 31.9% in 2018-19 on account of waning confidence in the business sector.

- The construction activity too endured subdued performance in 2019- 20 as large inventory overhang tied with stressed liquidity circumstances reserved new launches.
- Pouring into the narrowing in GFCF during 2019-20 was the fall in investment in machinery and equipment, as apparent in both imports and production of capital goods.

Figure 2.71 reflects on the country's fixed investment trajectory prior to the pandemic. There exists evidence of a gradual uptrend in the capital injection for improvement purposes. However, given different reports submission, it appears that it is still not adequate enough given the large size of the population. In the 2020 Q1 estimates, fixed investment growth picked up to 10.9% from 2.6% in Q4 of 2019 (Focus Economics, 2021).

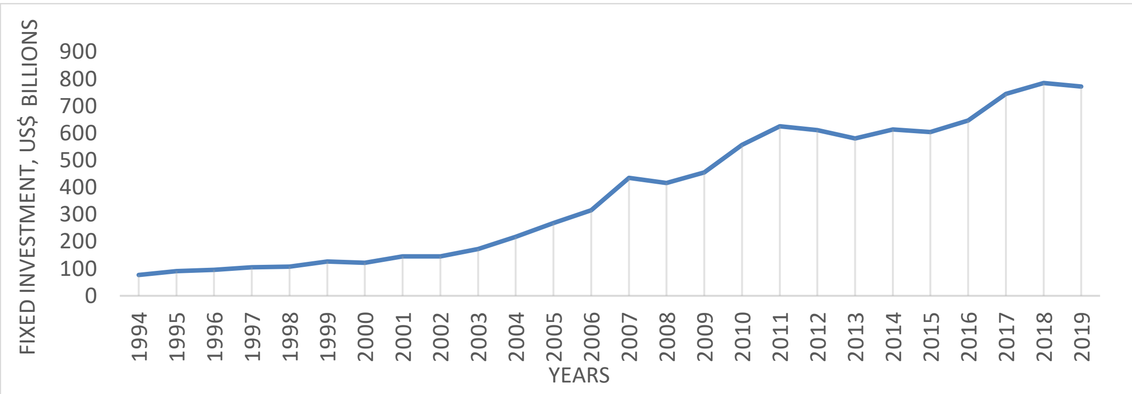


Figure 2.71: India's Real Fixed Investment performance (1994 – 2019)
Source: World Bank Data Bank

The Indian corporate tax system reform of September 2019 has not yet expanded its traction in improving capital expenditure (RBI, India, 2021). To this end, FDI has been seen to augment the economy. The Bank further reflects that FDI remained the principal source of outward financing, as in both gross and net terms. FDI flows in 2019-20 were well above their respective levels in 2018-19 despite a slowdown in the global economy and growing global investment concerns due to disruptions in supply chains. India was able to sustain the pace of FDI in 2019-20 and was the 9th largest recipient country globally in 2019.

2.3.3.4. Economic Complexity, product complexity and trade dynamics

According to the MIT Atlas (2017), India ranks as the 45th most complex economy, while the Harvard Atlas (2018) places the country at 43rd position in ECI, which is a more coherent placement compared to Russia and Brazil. Much like Russia, India is also said to be well positioned to take advantage of many opportunities to diversify the country's production employing present know-how. The Harvard Atlas (2018) went further to project on the growth trajectory to 2028. To this end, the growth lab foresees a 5.1% annual rate over the next decade, and was in the top echelons of the 133 countries investigated globally.

Figure 2.72 then proceeds to give a summative view of the expanded export basket. India seems not to be overly reliant on one export sector or commodity. Rather, it has a diverse export basket, which means the country may not be susceptible to price fluctuations due to one or a few export commodities. Unlike the selected SSA countries and the analysed BRICS nations thus far, petroleum only accounts for 8.78% of India's export basket.

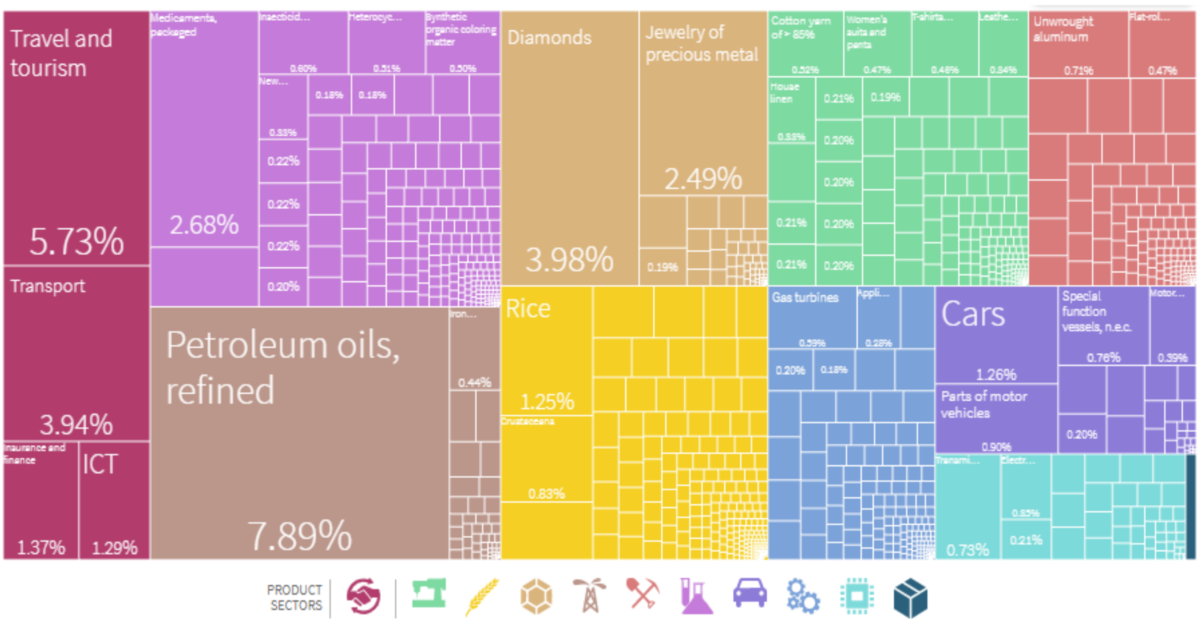


Figure 2.74: India's Sector export share
Source: Harvard Atlas Economic Complexity Lab (2019)

We then proceed to reflect on the PCI of the respective Indian export basket in figure 2.73. With India, there seems to be prevalence of more complex products, with cars as the most significant. The Harvard Atlas (2018) affirms that India has seen an auspicious arrangement of export growth, with the major support to export growth coming from moderate and high complexity products and services, predominantly travel and tourism, and industrial machinery products.

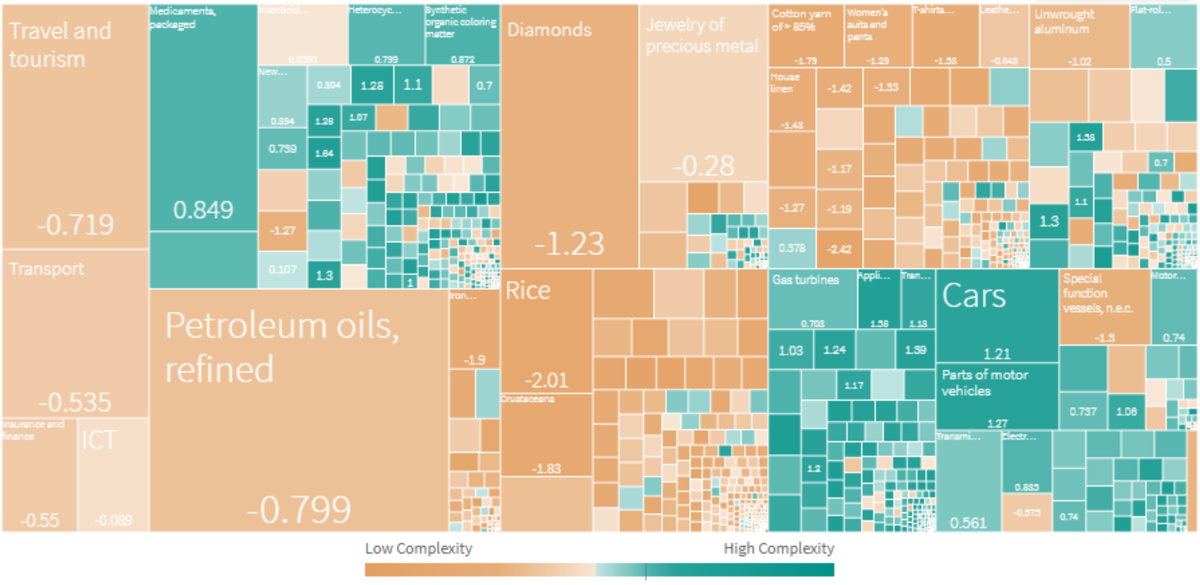


Figure 2.75: India's Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

However, the Indian ECI trajectory seems to be more consistent, unlike the above three BRICS ECI'S as reflected in figure 2.74. The highest ECI year was 0.3598, which suggests a moderate product complexity.

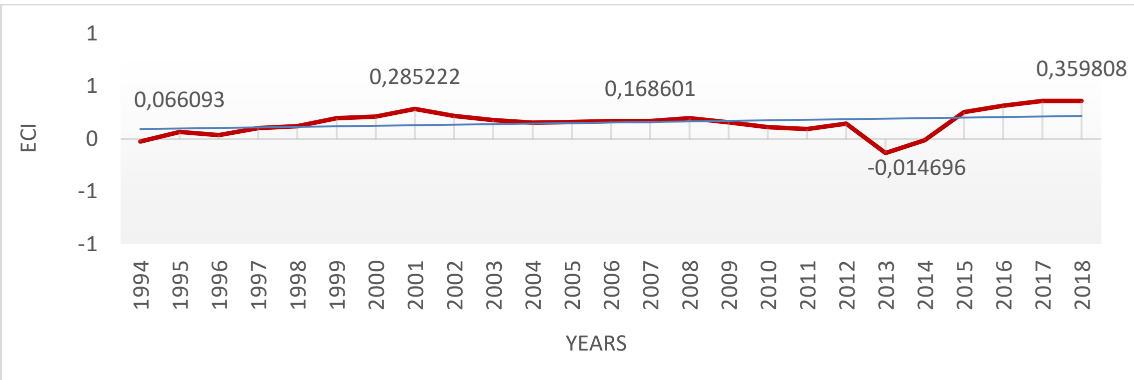


Figure 2.76: India's ECI Trend (1994 - 2018)

Source: MIT Atlas Economic Complexity Lab (2018)

Much like Russia, the Harvard Atlas (2019) too affirms that India has not as yet started the traditional route of structural transformation. Nonetheless, as also revealed in figure 2.75, India's export growth in the past 5 years has been driven by services. The country has also, broadly, moved activities out of agriculture into textiles, trailed by electronics and/or machinery manufacturing, while stone export embodies India's largest export market over the years covered.

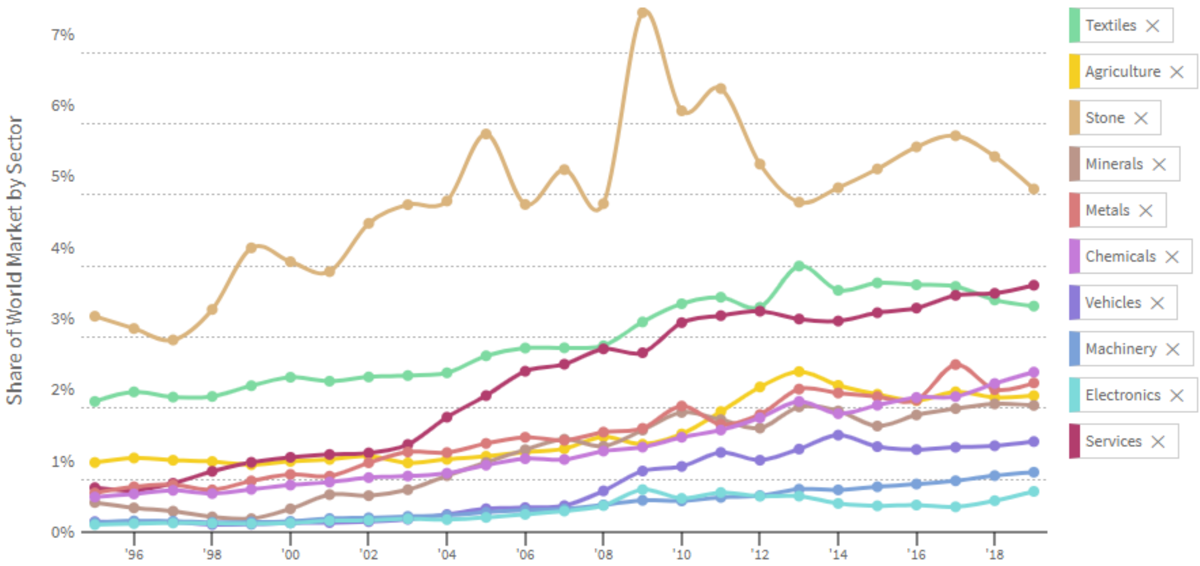


Figure 2.77: India's World Export Market share (13994 – 2019)
Source: Harvard Atlas Economic Complexity Lab (2019)

The Harvard Atlas (2018) further states that India, much like Russia, has had an addition of 22 new products since 2003. Moreover, these products subsidised US$3 in income per capita in 2018. The contradiction is that while Russia added 18 more products, it had a better income expansion than India with half as much addition to the income per capita with 6 more new products than Russia. This suggests that Russia had a more complex additions, or else the export volume was higher in Russia comparatively. The IMA (2020) sums-up the Indian exports status by saying:

- India has accomplished much in exporting services, but exports of goods have trailed in the last ten years;
- Additionally, it has diversified its exports since the 1990s, both geographically and commodity-wise;
- The share of technology-intensive goods, including engineering and petroleum products, has risen over the years;
- The country has progressively found its way into new evolving markets where its share of export to emerging nations has surpassed that of advanced economies;
- Off concern was that despite some improvements, India endures a lower percentage contribution in total world export at 2%.

- The promotion of trade through lessening of logistics costs.
- Invigorating India's missions abroad towards promoting trade, tourism, technology and investment goals.
- The practise of public procurement in promoting local value addition and manufacturing.

2.3.3.5. Policy perspective and challenges

The understanding in the Indian context is that there exists much growth potential. The country currently is required to cherry-pick promising industries and products with the uppermost demand in highest importing countries and mount operative export policies to enable growth (IMA, 2020). The Indian government has taken a number of measures to promote exports cause and the ease of trading environment through various infrastructural and functional simplifications for businesses in an initiative termed 'make in India' launched in 2014. The following are policies effected in the 'India first in trade policy' to improve the export potential (Ministry of Commerce and Industry, 2021):

- To reduce non-essential imports and endorse domestic manufacturing. Among other undertakings, one of the key ones was on the anti-dumping front with a noteworthy impact with cases in 2019 - 20 and 2020 - 21 to defend domestic industries from biased trade practices of the trading partners. Other measures include import monitoring systems in the steel sector brought in 2019. Additionally, stricter enforcements in the rules of origin on preferential imports, and review of Free Trade Agreements' initiated to correct the imbalances.
- To promote agricultural exports and double-up farmers' Income.
- The Development of districts as export hubs. This is executed through the District Export Promotion Committees (DEPC) formed to evaluate existing export activities, the potential and gaps, and to prepare or implement action plans to methodically in order to encourage exports through stakeholders.
- The championing of services sector initiative for promotion and diversification of the services sector.
- Special Economic Zones (SEZ) reforms to attract investment and exports promotions. The SEZ amendment Bill 2019 enables an entity to set up a SEZ unit that includes Trusts. This is expected to aid investments and to generate new exports

and job opportunities. Investments of US$1.1 B was proposed since the promulgation in 2020.

2.3.4. China Economic Landscape

The last BRICS country analysed is China, an upper-middle-income country and the world's second economy in current nominal GDP terms at US$14.34T, but the largest in terms of the PPP measure. The annual growth rate of the Chinese economy (6.1%) is consistently more than that of the United States of America, and is expected to become the largest economy in the next years to come (World Bank, 2020). The overview is also that the country has progressively opened its economy in the past four decades, leading to vast improvement in economic development and living standards. The current outlook is also on the back of an industrial policy that encouraged domestic manufacturing, which has made China the world's number one exporter. Geographically, China is bordered on land by Afghanistan, Bhutan, Hong Kong, India, Kazakhstan, Kyrgyzstan, Laos, Macau, Mongolia, Nepal, Pakistan, North Korea, Tajikistan, Vietnam and Russia; and by sea it is bordered by Brunei, Indonesia, Japan, South Korea, Malaysia, the Philippines and Taiwan by sea.

2.3.4.1. *GDP Performance and population trajectory*

The World Bank (2021g) affirms that China was the only major country to achieve positive growths rate in 2020 at 2.3% real GDP growth. In the same report, the Bank (2021g) further submits the following critical facts about the success of its economy.

- China opened up and reformed its economy since 1978, and GDP growth has since averaged almost 10% a year, while more than 800 million citizens were lifted out of poverty.

- China's high growth is based on resource-intensive manufacturing, exports and low-paid or cheap labour which has largely stretched its limits and led to economic, social and environmental imbalances.

Figure 2.76 gives a bird's view of the Chinese GDP trajectory and the population figure. Much like the Indian population, China too has quite a significant large population at over 1.4 Billion people. The GDP figures show a positive upward trend even though it may affect the GDP per capita and the living standards adversely. China is also faced with a roughly significant challenge of a rapidly aging population and a stark environmental degradation (CIA World Factbook, 2020c).

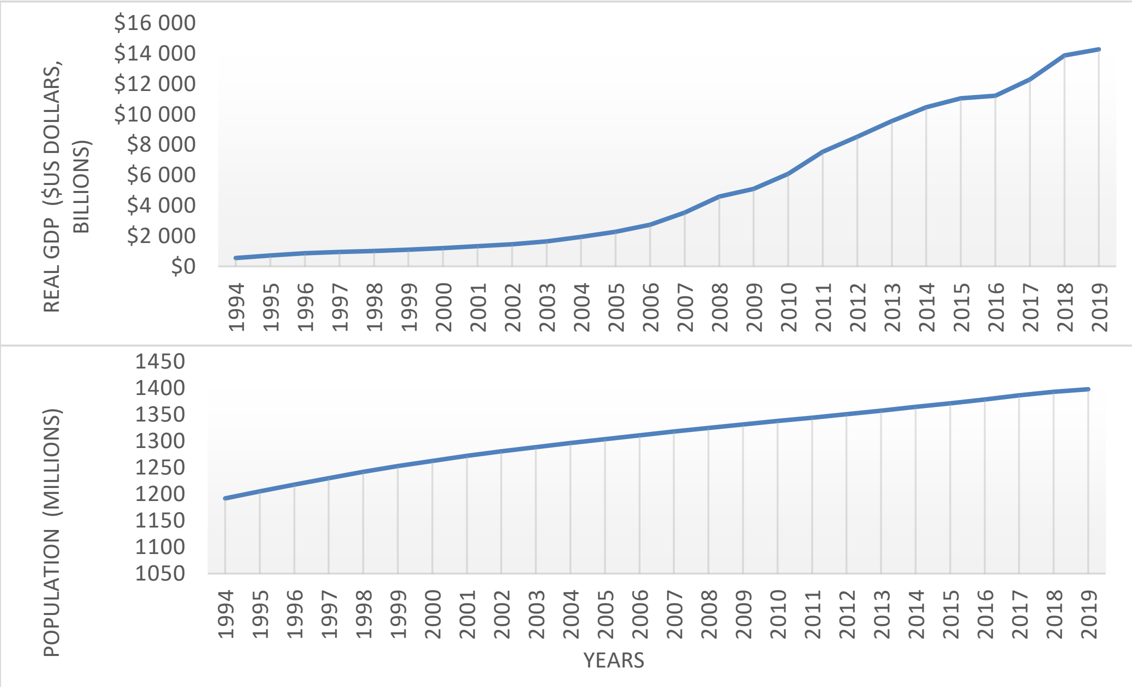


Figure 2.76: China's Real GDP and Populations trends
Source: World Bank Data Bank

The IMF (2021) reports also sustain China's growth performance when forecasting the 2021 and 2022 rate at 8.1% and 5.6%, respectively. Nonetheless, figure 2.77 shows the GDP per capita performance and the percentage change thereof. The GDP per capita trajectory reflects an upward trajectory, suggesting the findings of World Bank's view that most of the Chinese population were taken out of poverty. Of concern is the percentage change that has been declining over the past decade from 2009 to 2019. The task going onward is to find new drivers of growth and an aging Chinese population (World Bank, 2021g).

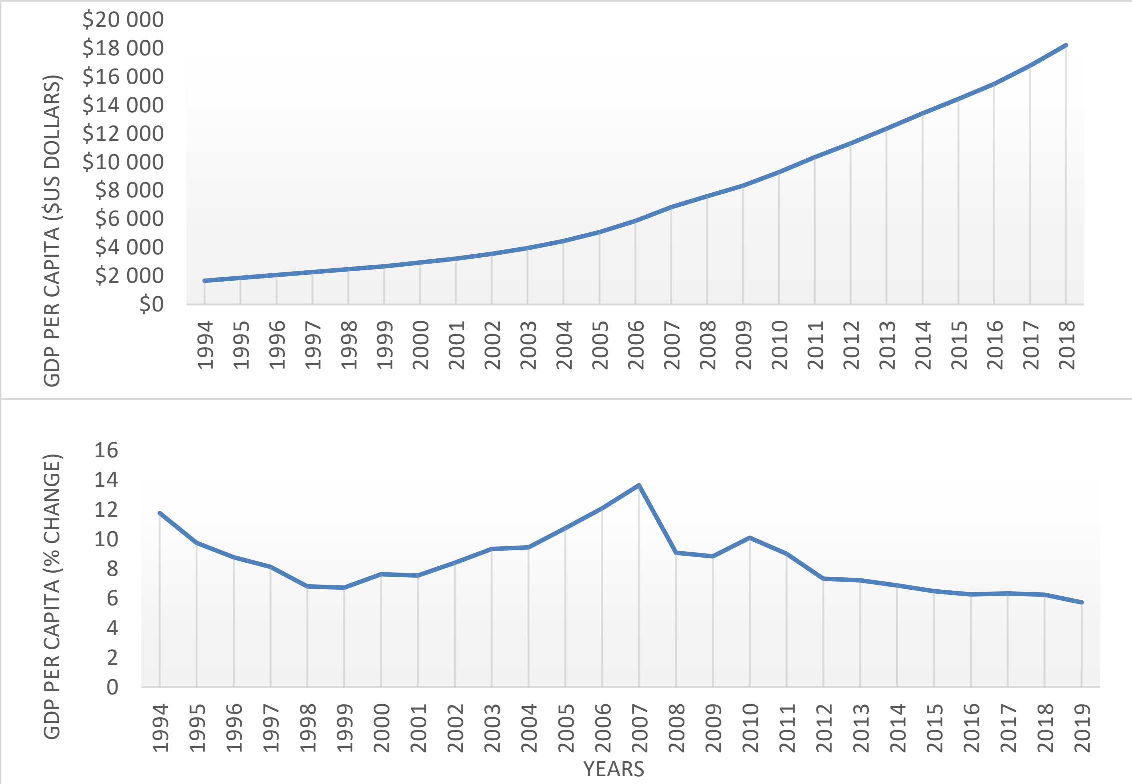


Figure 2.79: China's GDP per capita (Real and percentage change)

Source: World Bank Data Bank

Of the analysed economies to this end China holds the strongest economic stunts and forecasts. This is not surprising, given that it is the second largest economy and only second to the US in exports performance. Its vast population requires that it should focus on new growth paths and act on its aging population; which it has by adopting a two child policy instead of the one child policy which was meant to restrict population growth.

2.3.4.2. Trade Outlook and Performance

As already alluded to above, China is the world's leading exporter with great volume in merchandise goods and services. According to the MIT Atlas (2018), the country's top exports were broadcasting equipment at $231B, computers at $146B, office machine parts at $90.8B, integrated circuits at $80.1B and telephones at $62B. China's top imports were integrated circuits at $207B, crude petroleum at $144B, iron ore at $59B, cars at $46.8B and gold at $40.3B. Table 2.29 shows China's top exports destination and import origin. China has the number one economy as its most export market with a value of $476B to the United States, while it is 4th most import market at

$133B. Therefore, it goes without saying that China has a huge trade surplus on the leading economy; which the US has had issues with over the years.

The US has initiated tariffs over the years to alter the trade structure with China even though US companies continue to trade with China. As of 2021, the US has more than $300B worth of Chinese imports under tariff, from electronics to footwear and clothing, bicycles and pet foods; nonetheless U.S. retailers are still electing to absorb the cost and squeezing their profit (Bloomberg, 2021). China has Germany, South Korea and Japan as the other major economies in both export and import markets.

Table 2.10: China's Top Exports and Imports Partners

Exports Destination		**Imports Origin**	
Country	**Value ($USD)**	**Country**	**Value ($USD)**
1. United States	$476B	1. Other Asia	$151B
2. Hong Kong	$255B	2. South Korea	$149B
3. Japan	$157B	3. Japan	$136B
4. Germany	$109B	4. United States	$133B
5. South Korea	$98.1B	5. Germany	$95B

Source: MIT Atlas of Economic Complexity (2018)

The Chinese current account is expected to operate in the surplus range given its status as the world leading exporter. Figure 2.78 therefore shows the current account receivables, and indeed there exists an upward trajectory of income. This shows that merchandise trade and other credit items' performance were at a healthy state at nearly US$3 trillion rand. In comparison to the leading economy, China's 2020 current account surplus stood at 2.1% and the US at 3.1% of economic output (Reuters, 2021). This was amidst the pandemic that shows the resilience of the Chinese economy.

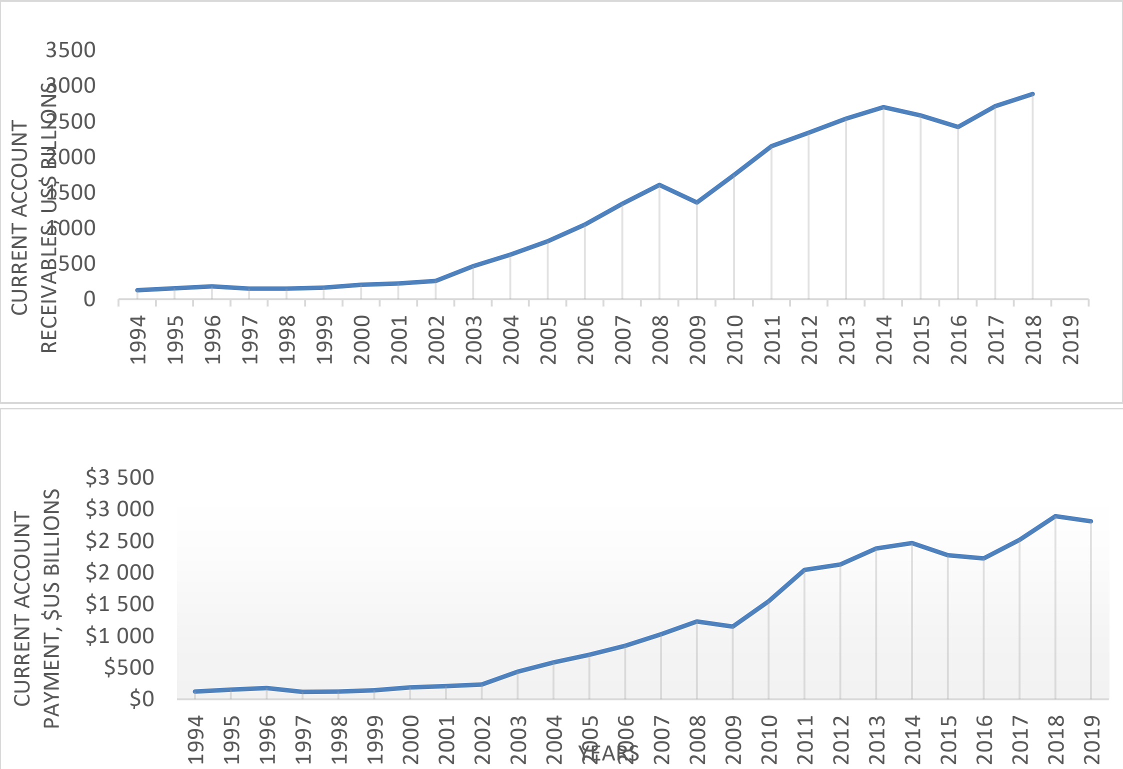


Figure 2.80: China's Current Account Credit and Debit Items (1994 – 2019)
Source: World Bank Data Bank

The pre-pandemic current account status too reflects well of its performance as depicted in figure 2.78. The largest percentage growth spat was seen in 2006, 2007 and 2008 at an average of 9%, while the lowest realised growth rate was in 2018 at an almost neutral growth change of 0%. Since 2019, the Chinese current account has been performing well. With the exception of 2020 Q1, the Chinese current account has been operating at a surplus to 2021Q2 (Trading Economics, 2021). This is on the back of the services account recording a US$2.52B surplus, reflecting an increase in freight proceeds, among other sub-account improvements in 2021Q2 (CBC, 2021).

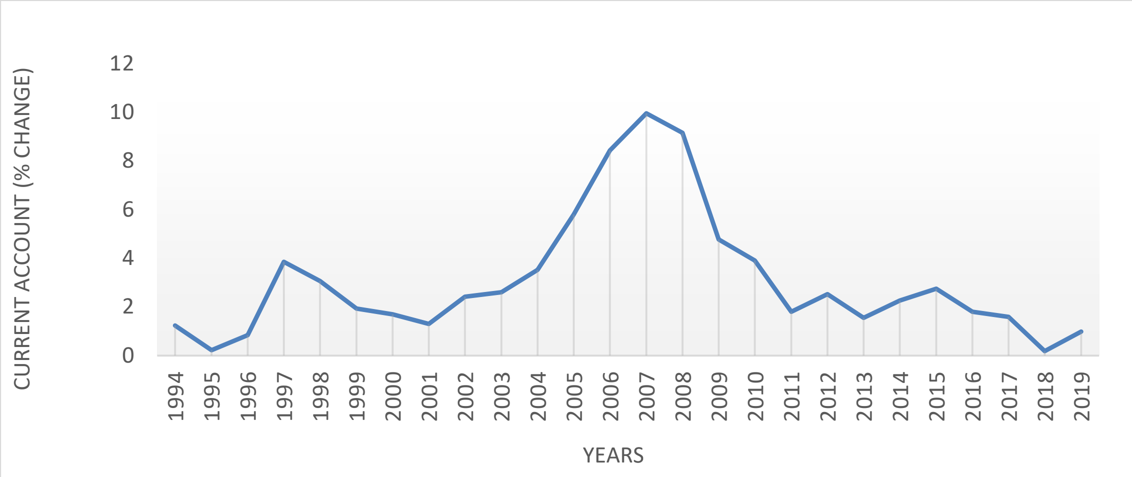


Figure 2.79: China's Current Account Balance (1994 – 2019)
Source: World Bank Data Bank

The following Chinese outlook and measures are stated as the world grapples with the current pandemic (CNBC, 2021; Business Maverick, 2021):

- The world's 2nd largest economy has largely recovered to its pre-pandemic growth ranks, compelled by a resilient export sector;
- But growth is dropping and smaller firms are bearing the effect of a surge in raw material prices.
- China to cut the cash reserves requirement rate, freeing around $154.19B in long-term liquidity to strengthen its economy.
- Nonetheless, China has gained market share apart from its progressive decoupling from the US.

In contrast to the above analysed countries and indeed the world at large, the Chinese economy was better placed and there still a sense of optimism for the future growth trajectory in trade. China's current account surplus was forecast to contract by 0.2 percentage point to 1.6% in 2021 due to decline in outbound travel, lower commodity prices, and a surge in exports (Business Maverick, 2021).

2.3.4.3. *Investment performance*

In the investment front, China has a substantial presence in investing in other countries while developing its own infrastructure. The following investment portfolio is stated by the central bank (CBC, 2021):

- A net asset increase of U$22.93B was registered in portfolio investment in the BOP;

- Of the constituents, residents' portfolio investment abroad realised a net increase of US$22.16B due to an increase in investment in overseas debt securities by insurance companies and the banking sector; and
- Non-residents' portfolio investment recorded a net decline of US$0.76B due to a reduction in local stock holdings by foreign investors.

Figure 2.80 proceeds to give a summary of China's outward FDI. The government of China has presence across the continents through diverse investment positions. The highest outward FDI or investment abroad was in 2015 and 2016, and thereafter saw some decline. Current estimates show that China's direct investment in other countries expanded by US$34.0B in Jun 2021 as compared to a growth of US$21.9B in the previous quarter (CEIC, 2021).

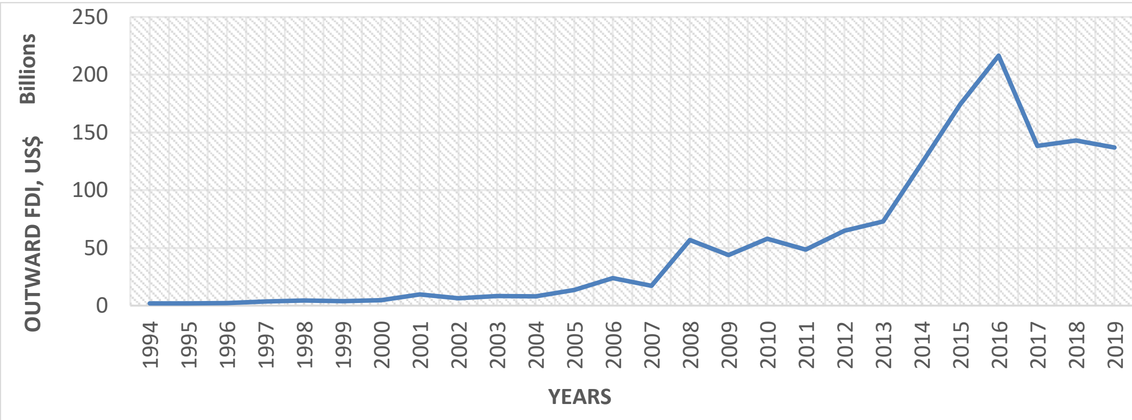


Figure 2.80: China's Outward Foreign Direct Investment (1994 – 2019)
Source: World Bank Data Bank

Amidst the current pandemic in 2020, China turned to investment spending on infrastructure projects to boost growth. The South China Morning Post (SCMP) gives of a summation of China's infrastructure development through fixed-asset investment as follows (SCMP, 2021):

- Worsening local government finances and fears of mounting public debts were possible to result in China increasingly limiting local government infrastructure projects in 2021;
- Although the top five approved infrastructure projects in 2020 are set to cost close to US$131.7B;

- China's total fixed-asset investment increased to US$8T in 2020, an increase of 2.9% compared to the previous 2019 year, subsequently, its general debt level increased to 270.1% GDP from 246.5% in 2019.

This goes to reflect on the Chinese government measures in stimulating growth through fixed investment in local infrastructure. Hence, China's business environment is well placed for private business to take advantage through a well-developed infrastructure. Figure 2.81 gives an overall outlook of the Chinese fixed investment outlook for the past years to 2019.

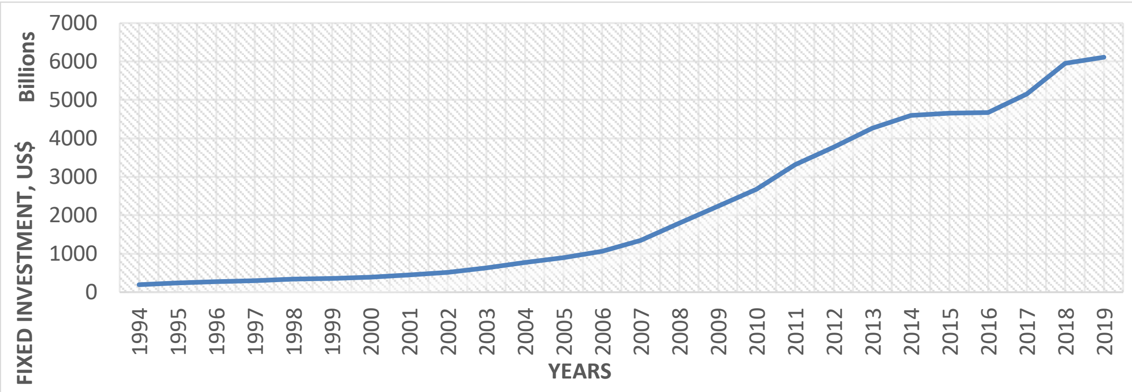


Figure 2.81: China's Real Fixed Investment performance (1994 – 2019)

Source: World Bank Data Bank

China has a well-balanced investment environment with outward FDI and local infrastructure development in fixed investment. The top five infrastructure developments include a railway system that seeks to connect the different parts of the country, and is a technologically advanced train. Lastly, to reflect on its outward investment in relation to Africa, the Infrastructure Consortium for Africa (ICA) verified a new financial commitment to African infrastructure in 2018 totalling US$ 101B to which China contributed 25% (ICA, 2018).

2.3.4.4. Economic Complexity, product complexity and trade dynamics

China is the 33rd most complex economy and the 16th most complex economy according to the MIT Atlas (2018) and Harvard Atlas (2019), respectively. The Harvard Atlas positions China much higher. This may as well reflect the more accurate stands given that it is the world leading exporter. Perhaps the country as a leading exporter was driven by diversifying exports, and is said to have improved 10 positions in the last ten decades.

Following on from section 2.3.4.2, figure 2.82 goes on to reflect on the export basket leading to the PCI thereof. The Chinese export basket is not dominated by one sector of the economy. Rather, it is split across services like ICT, textile and electronics such as computers, machinery, chemicals and metals. This makes China a well-diversified country in the export basket. In the five years leading to 2.19, exports have grown by 1.2% annually, which is still said to have had a drag on overall economic growth, representing a shrinking sector of the economy (Harvard, 2019).

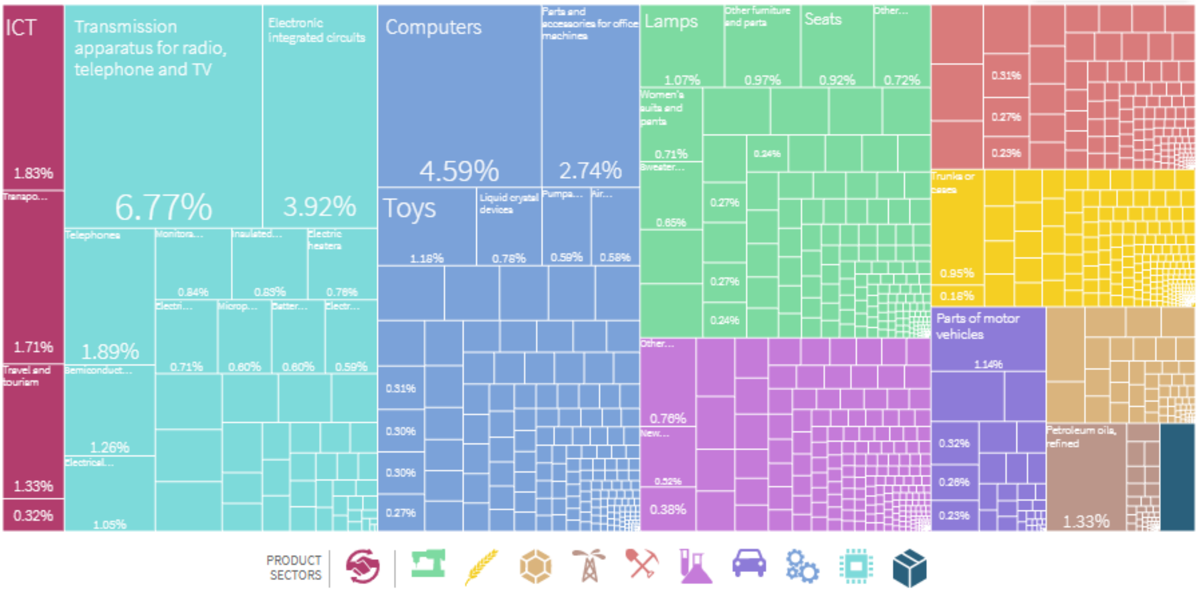


Figure 2.82: India's Sector export share

Source: Harvard Atlas Economic Complexity Lab (2019)

Following on, figure 2.83 reflects the PCI of the commodities and services in the export sector to reflect on the country's sophistication. China has the presence of more blue shaded products, which signifies the presence of more PCI products in the higher index, the likes of computers, electronics integrated circuits, parts and accessories for office machines, liquid crystal devices and parts of motor vehicles among many more. China then has more products with a tacit knowledge that goes into manufacturing them (Harvard, 2019). This then improves the Chinese rating on ECI reflecting that the country is more developed.

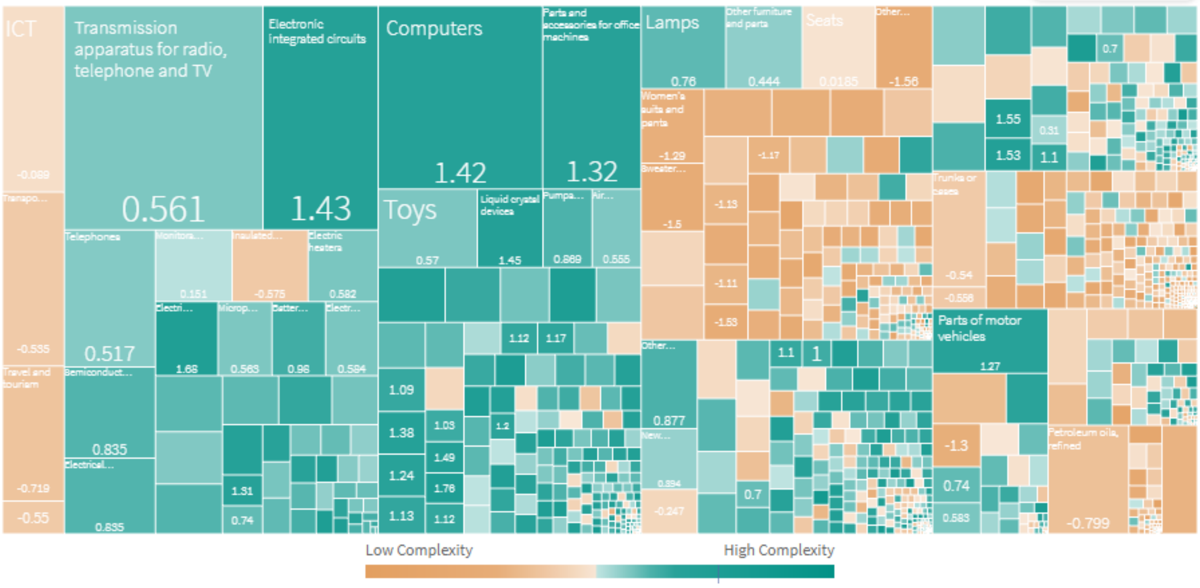


Figure 2.83: China's Exports Basket and product complexity index
Source: Harvard Atlas Economic Complexity Lab (2019)

China is well positioned in the global exports market through its well sought-after products with a higher PCI. This is reflected in figure 2.84. In 2019 China had a world export market share of 33%, 27%, 19%, 15%, 9%, 8%, 7% and 5% in textile, electronics, machinery, metals, chemicals, stone, agriculture and vehicles, respectively. The lowest export market share was metals at just over 1%. However, the Harvard Atlas (2019) submits that the world market share in machinery manufacturing has stagnated over the past ten years. Nonetheless, China remains a global export giant.

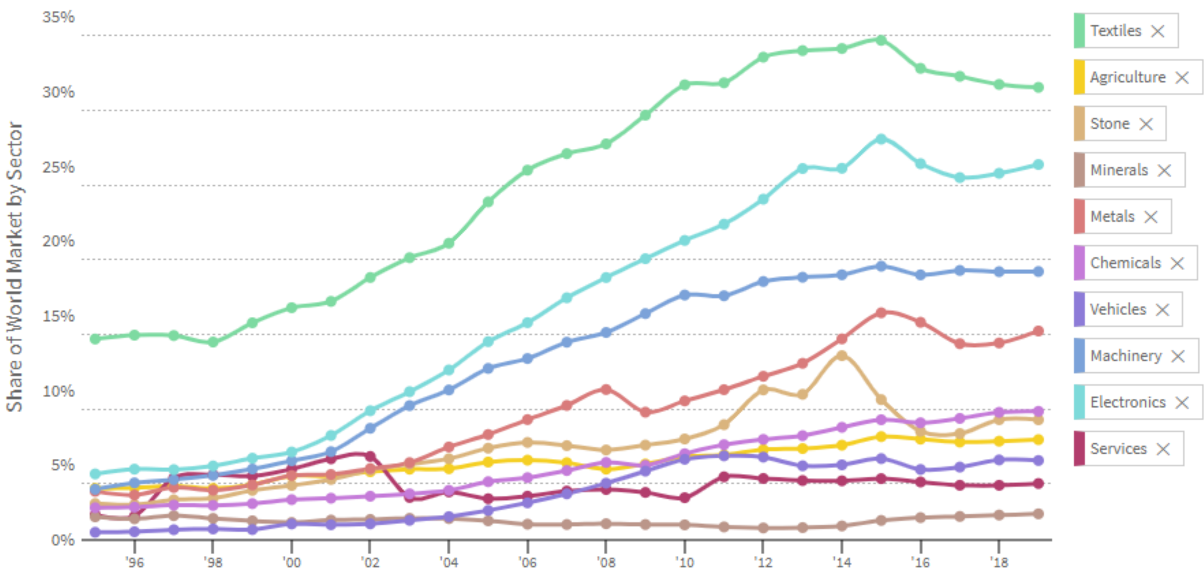


Figure 2.84: China's World Export Market share (14994 – 2019)

Source: Harvard Atlas Economic Complexity Lab (2019)

The above analysis clearly gives evidence of China's positioning in the developmental stunts through the building of structural transformation of its economy. Figure 2.85 is proof of this, with the trend line reflecting an upward trajectory in ECI. The major dent in the Chinese ECI was in 2015, and thereafter a moderate development in ECI. The Harvard Atlas (2019) goes on to reflect that China had 43 new products since 2004, while contributing $74 in 2019 in income per capita. This was possible because China diversified into plenty new products.

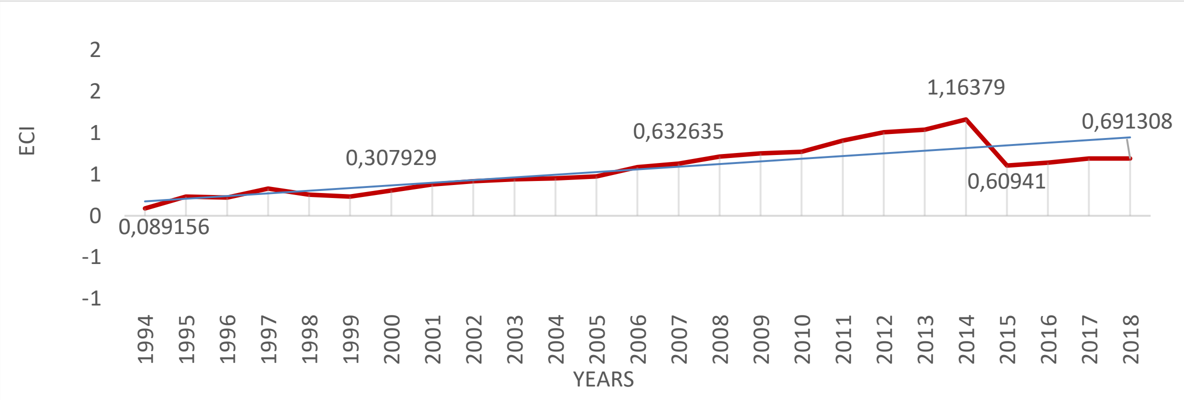


Figure 2.85: China's ECI Trend (1994 - 2018)

Source: MIT Atlas Economic Complexity Lab (2018)

China is said to have sufficient space to diversify and is called upon to leverage existing successes to enter into more complex production. The Atlas findings indicated that China's current exports show that some of the sectors have high potential for new diversification such as Industrial Machinery and Apparatuses and more.

2.3.4.5 Policy perspective and challenges

The second largest economy has had much told squabbles with its economic rival, the Unites States because of trade relations. Nonetheless, China's industrial policy is still much intact and the country has much tools that it relies on. The US's ITA (2021) identifies the following tools utilised by China to remain competitive and what it deems challenges:

- China relies on industrial policy tools such as subsidies, pressures to transfer technology, market access restrictions, and other measures to support its competitors;
- One challenge is that the policy tools undermine the ability by foreign companies to function on an equal playing grounds in the Chinese market;

- Additionally, the Chinese Communist Party's regulatory stunts over numerous economic actors in the market has significantly increased.

To this effect, the USA and China have signed the Phase One Trade Agreement in January 15th 2020 enforced in February 14th, 2020 to address the trade imbalances. To this end, China has agreed to increase US imports of goods and services in the two years to follow of not less than US$200B (ITA, 2021). This includes regulations on agreement requiring structural changes and other reforms to China's policies and practices regarding intellectual property, financial services, currency and foreign exchange, and important aspects of China's technology transfer policies. The United Nations Conference on Trade and Development (UNCTD, 2019) gives well reported figures on the trade restrictions caused by tariff impositions on either sides of the countries in figure 2.86. The imposition of tariff on each other had a detrimental impact on respective sectors of the economy and subsequently on the growth prospects of China. The report is based on 2019 trade figures while providing the 2017 figures in parenthesis.

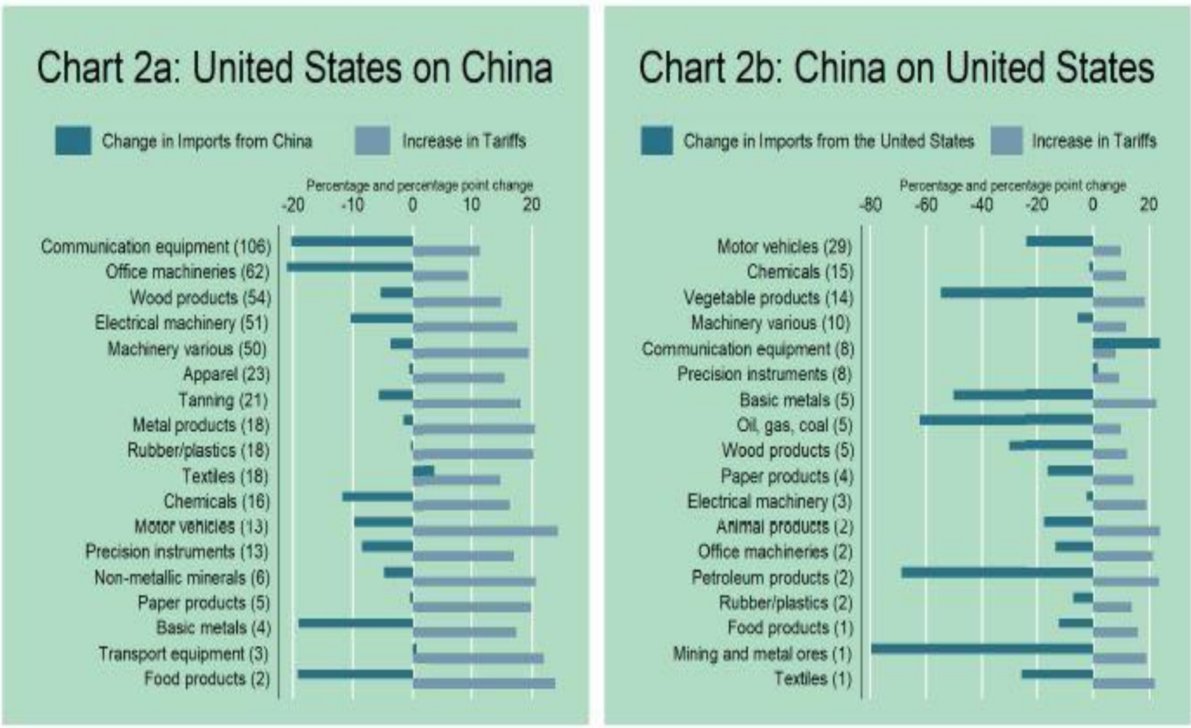


Figure 2.86: USA – China Tariff War (2019)

Source: UNCTAD Key Statistics and Trends in Trade Policy

Note: Value of imports for 2017 are in parentheses (US$ billion).

Sectors like communication equipment (US$106B), office machineries (US$62B), basic metals (US$51B), various machineries (US$50B) and apparels (US$23B) among the 18 economic sectors were adversely impacted through tariff impositions on China with a decline in Chinese imports as reflected in parentheses. The Chinese retaliated as such as reflected in the chat 2b. Hence, the two economic giants had to agree on some trade terms to improve relations and the economy.

2.4. **CONCLUSION**

The macroeconomic analysis of the selected SSA and the BRICS countries has brought forth an in-depth understanding of the developmental state of each country. The selected SSA countries are still underdeveloped. This has a detrimental effect on its people as seen on the GDP per capita outlook. South Africa is an exception as it is the highest rated African country with some know-how on its exports basket hence it has some well positioned PCI. This is of interest because South Africa is also found in the BRICS formation as the least developed. Countries like Nigeria and Cameroon are engulfed in regional instability with security concerns. This may explain why the lack-lustre development state of each.

The most developed country is China with the highest complexity index as was seen with the PCI in the exports market. As such, the country may be seen as a benchmark for the rest of the BRICS and the selected SSA to follow. China, unlike most selected SSA countries, is not reliant on raw and unprocessed commodities in the export market. Rather, it has a diverse and knowledge imbedded products and services that cut across textile, electronics, machinery, metals, chemicals, stone, agriculture and vehicles. Perhaps China's joint partner policy where Chinese companies are partners with any foreign company worked in its favour, though the policy was relaxed in 2018 to share in the profits. This means that China, through inward Greenfield's FDI, may improve on its knowledge in its workers and as such realise higher expertise and income. This bodes well for a competitve exports potential and thus the current account status, and also investment potential may be higher.

As already reflected, the selected SSA ECI's are very low and in the negatives, with the exception of South Africa. One reason is that patents registration are quite low in Africa. This is an important indicator of innovation, the number of patent registration that is. The Brookings Institute (2020) report provides figures and substantiates that in

Africa, patent registration by non-residents in Africa is higher than that by residents and is growing fast. It proceeds to affirm and posit that the significant difference between Africa and other leading nations could be an upshot of the high and unreasonable costs of patent registration. This results in Africa lagging in innovation globally. Given the population trajectory provided, the dire economic outlook may hinder the progress thereof. In the next 25 years, Africa's population will be 70% greater. By 2050, it will reach 2.4 billion, the share of African people increasing from 17%, while the population in SSA will more than double by above 1 billion in just 30 years (OECD/ACET, 2020). Add this to the fact that Sub-Saharan Africa remains one of the weak-performing regions on the ease of doing business with an average score of 51.8, well below the OECD high-income economy average of 78.4 and the global average of 63.0 (World Bank, 2020b). Henceforth, the continent still has much grounds to cover for business confidence to improve.

It is to this end that we draw the study relevance and novelty, that is, to run a comparative study underpinning one of the major economic intergrations (BRICS) and the much infant economies in development.

CHAPTER 3

LITERATURE REVIEW

3.1. INTRODUCTION

This chapter outlines theories and empirical evidence relating to the relationship between economic complexity and the three selected macroeconomic variables. The theoretical literature section touches on the underlying theories that may help explain the relationship and expected outcome among the economic complexity and chosen macroeconomic variables. The empirical literature section provide empirical works done and is set according to objectives mentioned in chapter one.

3.2. THEORETICAL LITERATURE

Macroeconomics is not a fit-all approach in modelling. Otherwise, it would be an intimidating undertaking to try to conceptualise a model that explained all interesting macroeconomic phenomena. Such a model would certainly be dense and unmanageable, making it testing to absorb the information intended for teaching a phenomenon. To this end, macroeconomists lean towards the adoption of a more diverse approach, with models often being developed with the purpose of helping to explain one specific facet of macro economy (Whelan, 2005). The first two theories relate to the nexus between complexity and GDP growth. The subsequent two theories are meant to explain the economic complexity-current account or trade relationship, while the last theory is for the economic complexity-investment nexus.

3.2.1. The Solow Growth Model

The study investigates the impact of economic complexity which is imbed in it the idea of knowledge and innovation, leading to progress of an economy. As such, technology is of significance. The Solow growth model is one such model that may help us hypothesise the relationship thereof. This is a Solow - Swan model named after Robert Solow and Trevor Swan after publishing their works on “A Contribution to the Theory of Economic Growth” (Solow, 1956).

Economic growth is the dynamic procedure amongst inputs such as capital, labour, and technology, and output, with different conditions of consumption and population integrated to assimilate changed behaviours on how to effect output (Ramanayake, 2019). With the stated factors of production, it is further acknowledged that the production in technology is the source of the economy output, and thus its total output, and perhaps answers why some economies grow faster than others (Mankiw, 2007). The following are augmented by Mankiw (2007) and Hansen and Prescott (2002) in relation to how the Solow (1956) helps to relate to growth:

- The Solow growth model shows how saving, population growth, and technological progress affect the level of an economy's output and its growth over time.
- The model also identifies some of the reasons that countries vary so widely in their standards of living.
- The model identifies reasons for income differences across countries, and also stated in a more reserved fashion in explaining growth over time.

To keep the analysis of the Solow growth model in the study specific, attention is paid to the technological factor, while not overlooking other factors like savings and consumption in the economy. This helps keep the attention in linking economic complexity and growth rate. The following Solow growth model of production function should only be applied to modern industrial economies (Hansen & Prescott, 2002):

$$Y(t) = F(K(t), A(t)L(t)) \tag{3.1}$$

Where (Y) output, (K) capital stock, (L) labour or total employability, and (A) labour effectiveness, level of technology or “knowledge” are significant model inputs. Moreover, L and A are assumed to grow exogenously. These are combined to produce output and to estimate for an aggregate production function in the economy (Ramanayake, 2019). This model of economic growth requires some underlying assumptions for further analysis. One such assumption is that production function exhibits constant returns to scale. The Cobb-Douglas function helps the analysis as given by:

$$f[K(t), L(t), A(t) = A(t)F(K(t), L(t) \tag{3.2}$$

Equation 3.2 harmonises equation 3.1 to effect the importance of technological presence in the economy. Capital stock K(t) corresponding to the quality of the machine, that is, equipment’s or structures used in production of K, the physical capital in the economy. As a result, it is used in production development of extra product.

Consider a special type of production functions in balance of the growth, that is, at aggregate level, $\mathcal{F}$ and normal production function $((t), (t), (t)$ is too general to achieve balance growth. $\mathcal{F}$, let us define different types of neutral technological progress.

$$\mathcal{F}[K(t), L(t), A(t)=A(t)F(K(t), L(t)] \quad (3.3)$$

Simply, constant retunes of the production function F implies that the technology term (t) multiplicative of another production function F. This type of technological progress is called “Hicks-neutral”. Another alternative is to have capital augmenting or Solow neutral technological progress, in that form,

$$\mathcal{F}[K(t), L(t), A(t)=F(A(t)(K(t), L(t))] \quad (3.4)$$

Simply, this is referred to as capital augmenting progress. Because a higher (t), the technological presence is equivalent to the economy having more capital, that is, a type of the technological progress. It is on this backdrop of the slow growth model that the presence of technological presence augments output levels up to the per capita level as alluded to in the works of Mixon and Sockwel (2007). The downside or disadvantage of the slow growth model is that it does not explain how technological progress could be accelerated. This is emphasised further, that the model has a technical challenge as the procedure of technological change is not inferred. This is so because Solow’s supporters fixated on the idea of savings and investment as the main feature of economic growth, instead of studying the foundations of long-run technological change (Kyzy, 2020). The attempt to address this lack was done through the Solow’s decomposition which was meant to attempt to account for growth. But it too uses the GDP growth, capital accumulation, and hours worked (Burda & Wyplosz, 2017). The fact that the Solow models is seen as an exogenous model might negate its relevance given that ECI is seen through new knowledge and innovation manifested domestically. This leads to the second school of thaught, and endowgenous growth model that may aid the link between ECI and GDP growth per capia.

3.2.2. Endogenous Growth Model

The endogenous growth model is the second theory that is also relevant in the impact of economic complexity leading to progress of an economy. The proposed endogenous growth theory originates from Abramowitz (1952) and later Lucas (1988), but much of the work is attributed to Romer (1983; 1986; 1990b; 1994; 2018). Abramowitz (1952) invoked this idea in what he saw as "central questions in the theory of growth". This theory supports the work of Smith (1776) and Ricardo (1817) word as advocates of improving economies with reference to absolute and comparative trade advantage, respectively. The endogenous theory by Romer (2018) has managed to answer the Solow (1956) drawback in that it explains how technological progress is accelerated. In projecting the driver of economic growth, the cornerstone of this model is the people and the idea that knowledge is the source of growth through the constant introduction and enhancement of production and general-purpose technologies, hence increasing returns (Daniele, 2019). Romer's (2018) endogenous growth model is developed through the "AK" growth model identified in his work (Romer, 1986):

$$Y_t = AK_t \tag{3.5}$$

and

$$K_t = sY_t - \delta K_t \tag{3.6}$$

Where 'A' represents an exogenous and constant productivity bound, and 's' an exogenous, constant investment rate, while 'K' is inferred as physical capital, but in Romer (1986), K was assumed as knowledge. Adding equation 3.5 and 3.6 gave birth to the AK model that sparked the idea of an endogenous model as:

$$g_Y \equiv \frac{Y_t}{Y_t} = sA - \delta \tag{3.7}$$

Equation 3.7 states that the growth rate of an economy is endogenously determined by fundamental factors of the economic situation. As such, a perpetual surge in investment rate 's' (which could be an investment rate in physical capital, human capital, or knowledge, depending on the interpretation of K and which was typically endogenised and in turn depended on policy) will perpetually nurture the growth rate of the economy. It was through Romer (1990) that the following were stated from the above model depictions:

- Recognises non-rivalry of ideas as central to economic growth,
- Highpoints the part of profit-maximising industrialists and imperfect competition; and
- The key "AK" linearity in the idea of production function is highly regarded.

The modern version of Romer's (2019) work answer the question of "Where does exponential growth come from?". The Romer (1990b) setup above is slightly altered, relaxing the assumption that constant research effort can generate constant exponential growth.

$$Y_t = A_t^{\sigma} L_{Yt} \quad (3.7)$$

$$\frac{A_t}{A_t} = \theta L_{At} A_t^{-\beta} \quad (3.8)$$

$$L_{Yt} + L_{At} = L_t = L_O e^{nt} \quad (3.9)$$

$$L_{At} = \bar{s} L_t \quad (3.10)$$

Equation 3.7 declares that output is made on a constant return to scale bases in the production function, alluding to labour, and increasing returns to matters and including ideas. The parameter σ allocates the production function's goods, that is, the measure of increasing return to scale. Capital is left out just to make the model simpler (Jones, 2019). Equation 3.8 is the new production function for ideas. The parameter β > 0 seizes the level at which ideas or the "proportional improvements in productivity" are getting harder to find.

It is based on equation (3.7) that economic growth refers to consumption per person ($y = \frac{Y}{L}$) as further illustrated by equation (3.11) below as:

$$y_t = A_t^{\sigma}(1 - \bar{s}) \quad (3.11)$$

The comprehension in this model is that non-rivalry is captured in equation (3.11); consumption per person is proportional to the overall stock of knowledge, A, raised to some power. This then means new ideas can raise an individual's consumption. To increase the productivity of each person in the economy, you need to give each person a computer, and you can increase the productivity of any number of people by inventing a single new idea (Jones, 2019). Romer's work, thr endogenous growth theory contrasts with neoclassical growth theories that argue that factors affecting growth are exogenous (Romer, 2018).

To draw similarities and contrasts with the Solow model, the analysis from the neoclassical theory perspective and Paul Romer's endogenous model was on the agrement that the classification of technological changes to be a key initiator of economic growth, and of course even on the per capita perspective. Both theories emphasised the need for a solid influence on a number of governments to apportion notable funds for scientific and research development, to arouse the making and diffusion of innovation (Sredojević, Cvetanović & Bošković, 2016). Contrarry to the neoclassicals, the endowgenous approach emphasised the prominence of externalities, in the form of technological spillover and research and development activities, for the creation and diffusion of innovation (Sredojević *et al*. 2016). It is the spillover of technology aspect of the endowgenous that may place the endowgenous growth as a more relevant theory given that the ECI approach to development status argues that the domestically produced goods and services results from a network of industries. The endogenous model may be relevant in today's world of the fourth industrial revolution were network science is also a key feature. This is were technological spillover is at its highest with firms or industries feeding off of each other were one output is an input in another

3.2.3. New Trade Theory

The new trade theory (NTT) is built on the fundamental framework of the Heckscher-Ohlin trade theory and in addition the theory recognise external economies and market failures as the driving force for international trade (Medin, 2014). The established concepts enclosed in latest literature of international trade has been termed the "new trade theory" pioneered by Dixit and Norman (1980), Lancaster (1980), Krugman (1979b, 1980, 1981), Helpman (1981) and Ethier (1982). The theory emerged in the early 1980s through the works of the Nobel flagship winner economist Paul Krugman and Elhanan Helpmann. In a report compiled by Royal Swidish Academy of science (2009), the theory states that the development of the NTT was motivated by failures of more traditional trade theories to explain some important aspects such as transport costs, consumer preference, economies of scale and product differentiations that affect trade. It is the characteristic of product differentiation that warrants the NTT as one of the sought-after theory relevant for the study.

Contrary to the traditional trade theories, the NTT captures the dynamics of modern-day global economy. Ahmed (2015) opines that the theory allows for the analysis of countries with similar factor endowments, technology, under monopolistic competition conditions, thereby ensuring beneficial intra-trade among nations. Moreover, the NNT incorporates four innovations in the neoclassical trade theories which are strategic behaviour and new industrial economics, market imperfection, and new growth and political economy arguments (Deraniyagala & Fine, 2000).

The new trade theories have challenged three underlying assumptions of the earlier and conventional trade models (Rangasamy, 2003). These include:

- The assumption of perfect competition which is replaced by imperfect competition.
- Constant returns (non-increasing returns) to scale which is replaced by increasing returns to scale; and
- The definition of an industry in terms of homogeneous goods which is replaced by product differentiation.

To relate the theory on trade as influenced by the knowledge presence in countries, the work of Neary (2009) explores how the assumption of increasing returns and product differentiation is a point of departure to help analyse trade in detail. Additionally, though the study analyses the country perspective, it is, however, individual firms that are producers of these commodities and services at large. It starts off with the introduction of the general-equilibrium model from Krugman's 1979 work, a simple form in the goods market:

$$Goods - market\ Equilibrium: y = kLx \quad (3.12)$$

This equation (3.12) demonstrates a situation of intra-industry trade where k denotes identical countries with n goods produced per country in equilibrium. More accurately, it tells us that the total quantity demanded comes from all households in all countries, given by the market-clearing condition for the output of each firm. As such, the total number of variations obtainable to consumers when trade is free is N = kn. This is reasoned on the basis that each country has L households supplying the only factor production (labour), a unit labour and maximises the utility function given a certain price p_i of each good. Each firm maximises profits by setting its marginal revenue given γ equal to its marginal cost. Writing the first-order condition in terms of the perceived elasticity of demand $\sigma(x)$, and dropping firm subscripts because of the symmetry assumption

$$Profit\ Maximisation\ (MR = MC): \frac{p}{w} = \frac{\sigma(x)}{\sigma(x)-1^{a}} \qquad (3.13)$$

Bearing in mind that $\sigma(x)$ relates a decrease in consumption, this suggests that higher levels of consumption permit firms to charge higher prices. Hence (3.13) is represented, for given values of k and L. The additional equilibrium situation in each sector is that profits are driven to zero by free entry and exit of firms, so price must equal average cost given by:

$$Free\ Entry\ (p = (AC): \frac{p}{w} = \frac{f}{y} + a \qquad (3.14)$$

This implies a downward-sloping relationship between output and price-wage. Prior to stating its relevance to trade, it is essential to state the following model that indicates that as a requirement, each country's Labour supply (L) must equal the demand from all domestic firms:

$$Laboour - Market\ Equilibrium\ (LME): L = n(f + ay) \qquad (3.15)$$

Equation (3.15) infers an inverse association among equilibrium firm size y and the number of firms. It was Krugman's model of infinite variety that a coherent general-equilibrium analysis of trade was made relevant, that is, enabled specialisation and large-scale production results in lower prices and a greater diversity of commodities (Neary, 2019).

$$u = \left(\sum_{i=1}^{N} x_i^{\theta}\right)^{1/\theta} \quad 0 < \theta < 1,\ \theta = \frac{\sigma-1}{\sigma} \qquad (3.16)$$

Equation (3.16) shows a special case of a monopolistic competition and trade where the sub-utility function takes a Constant Elasticity of Substitution (CES). This is a special case where only the final prediction is a greater diversity of goods consumed. A better view of the NTT is seen in contradiction to the subsequent theory below (3.2.4).

3.2.4. Technological Gap Trade Theory

Because the undertaking of research and development (R&D) is quite diverse across countries, some countries are far more technologically advanced than others as disseminating of technology is not instantaneous and complete (Cheng, 1984). This statement leads to the set theory of Technological Gap Trade Theory (the TGTT, for reference purposes). This study explores the TGTT Theory emanating from the empirical works by Luc and Soete (1981). One of their findings suggests that the TGTT may be a relevant theoretical study benchmark as saying that the role of technology as a critical variable in explaining inter-country variation in the performance of exports in large industries was significant. Some of the works can be traced to the likes of Posner (1961), Vernon (1966) and Hufbauer (1966) on the performance of trade as a result of the technological factor. The TGTT or sometimes referred to as the neotechnology theory was explicitly pronounced by Posner (1961) in terms of the factors involved in the kind of transitory trade advantage.

For a dynamic trade advantage to take place, the TGTT claim stems from technological progress, which may be defined as the material incorporation of new knowledge hitherto unknown, and only economically viable inventions are actually adopted (Borkakoti, 1998). Additionally, Borkakoti (1998) thought it analytically necessary to differentiate between two simple arrangements of technological progress, which are:

- Process technological progress or process innovation, which implies the usual inward shift of the production function. This simply depicts the cost-reducing effect of process innovation; and
- Product technological progress or product innovation, which suggests that innovation implies the expansion of the characteristics of the product.

To substantiate the above technological progress, the two early neoclassical theories by Smith (1776) and Ricardo (1817) come to play to augment the TGTT, that is, the absolute advantage and the comparative advantage, respectively. Comparative advantage relates to a concept of process innovation takes place, signifying that the same product is produced but at a comparatively lower cost. On the other hand, absolute advantage is the appropriate theory if product innovation occurs, that is, an improved product or a new product, which is not available in the rest of the world, is produced. It is on the basis of the latter, product innovation, that economic complexity becomes relevant in leading economies through sophisticated trade of products or even services.

To explore a mathematical approach or modelling the work of Luc and Soete (1981) is brought to the fore, a simple but yet revealing the relevance of the TGTT model. They focused on R&D and the number of patents in respective countries as a measure of technological know-how. This study focusses on ECI as a measure of technological advances in relating to trade performance. Trade analysis was dealt exclusively with inter-industry variations in trade flows; and some measure of export performance by commodity X_j was regressed in a country i setting for some 'input requirements' by commodity(E_j).

For each country i the subsequent equation is stated as:

$$X_{ij} = a_i + b_i E_j \qquad (3.17)$$

With the focus on explaining trade flows for particular commodities across country industries and with each industry j, it was now estimated by employing the following equation:

$$X_{ij} = a_i + b_j E_i \qquad (3.18)$$

The ensuing explanation in detailing the relevance of equation (3.17) and (3.18) is still according to the empirical works of Luc and Soete (1981). The contrasts in the two equation is that (3.18) observes resource availability by country (E_j) and estimate each at each industry b_j. This equation is based on Leamer (1974), which bases its foundation on external validation to which Luc and Soete (1981) are not fully in agreement because it suggests absolute superiority of countries. They rather lean towards equation (3.17) as the right fit, that is, regarded the core of the TGTT theory, where 'it is the variation across countries' in innovativeness, which forms the basis for the TGTT theory. However, it was acknowledged that it was difficult to carry out. Perhaps the ECI approach gives impetus to the case of equation (3.18), as it may be the right fit, an analysis of country trade sophistication or innovativeness that we may finally employ that perspective well. Hence, Cheng (1984) points out that a significant attention should be placed on the implications of creation and flow of new technology for trade pattern, investment and the nation or state prosperity.

The argument for the TGTT as perhaps the more relevant theory, is also on the bases of the PCI, where the countries are arranged accordingly in the order of the more sophisticated or knowledge-imbedded products produced and traded. This then differentiate the countries according to ubiquity and diversity which ranks the countries. The more diverse and ubigious the export basket the higher the developmental state of the country as seen through the ECI. This suggests then that the country's export potential is far greater and this suggests a much healthier current account, ceteris paribus. The contradiction with the NTT is o the ground that the NTT argues for the fact that the final prediction is a greater diversity of goods consumed and also lower prices, whereas the TGTT is concerned with the creation and flow of new technology for trade purposes that leads to a country's prosperit.

3.2.5. The Accelerator Theory of Investment

The attempt in explaining the output (ECI)-investment model is through the Accelerator Theory of Investment, which might help extrapolate the link in sophisticated output and the level of investment in a given economy. This study reserves the term 'Investment' for transaction that scales up the size of the real aggregate wealth in the economy, and any injections that improve infrastructure to have ease of business.

The category of investment that receives the most attention is business fixed investment, which is the purchase of new structures and equipment by business firms for production purposes (Parker, 2010). It is acknowledged that the accelerator theory of investment is relatively a new concept, perhaps its application in a more econometric analysis (Junankar, Durlauf & Blume, 2008). The accelerator model borrows from

Marx's (1863) theories, his part 2 version of surplus value. The earliest promoter of the acceleration theory was Aftalion's (1913) 'Les Crises periodiques de surproduction'. This is followed by the work of Clark (1917), and later Pigou (1927) and Harrod (1936), who discussed the acceleration theory both as a basis of investment and in its role in explaining business cycles. Kumar (2015) in relating the theory to the economy defines investment that it is a tangible level of capital in the economy, and that it decides the long run production capabilities and ads to economic growth.

The underlying modelling of the accelerator model is based on the work of Junankar *et al*. (2008) and is interjected through earlier work by the work of Shapiro (1986) in perhaps relating one shortcoming related to the study at hand. The notion behind this model of investment is that there is some prime association between output and capital stock. Hence, the ensuing equation is stated, the simplest version:

$$K_t^* = vY_t \qquad \text{(On the condition that: } K_t = K_t^*\text{)} \qquad (3.19)$$

It is argued that if output is growing, an increase in capital stock is required. Where K_t^* denotes planned stock of capital, and K_t is the actual capital of stock, and a rise in output leads to an increase in planned capital stock, and v is positive capital-output coefficient. This then leads to the equation:

$$K_{t+1}^* = vY_{t+1} \quad \text{(On the assumption that:} K_{t+1}^* - K_t^* = K_{t+1} - K_t = I_t = v(Y_{t+1} - Y_t = v\Delta Y_t) \qquad (3.20)$$

This explains that for net investment to be progressive, there should be growing output, and v is as such called the accelerator. The problem with this modelling is the context of whether the economy (or the firm) was working at full capacity because of optimal adjustments. This shortcoming is because the acceleration model can be derived from a cost minimising ideal on the assumption of either fixed (technical) coefficients and exogenous output, or variable coefficients with constant relative prices of inputs and exogenous output (Junankar *et al*. 2008). An additional and most significant shortcoming of the accelerator model is its neglect of technological change. However, other scholars were quick to remedy this situation, one where innovation is not incorporated in the accelerator theory of investment. This would imply that progress in industries and thereby products or services may not help determine investment. Shapiro (1986) argues that empirical evidence reflects that since 1981, the investment drive was due to more economic expansion than incentives. He further states that the firm's capital accumulation decision is linked to its technological production, and changes in long-run capital stock are driven by changes in shocks to technology and labour supply. To this effect, the more generalised accelerator principle would still hold, that is:

$$I_t = b(K_t^* - K_{t-1}) \tag{3.21}$$

Equation (3.21) seeks to address this major shortcoming of the simple accelerator. This is called the flexible accelerator model, which suggests that there is an optimal relationship between capital stock and output but allows for lags in the adjustment of the actual capital stock towards the optimal level.

To better offer an argument for the sole analysis and adoption of the Accelrator model through its extended accelerator model the empirical offering of Alexiadis & Felsenstein (2012) provides an informative synopsis. This is so because the study can better infer the PCI and ECI as perhaps decomposing the output value as leading to the investment environment in the country, of course at firm level. The authors (Alexiadis & Felsenstein, 2012) affirm that the flexible accelerator model suggests an affiliation between investment and output. An output in this study context is seen through the PCI and also further argue that it is based on the postulation of a stock adjustment course between a firms ‘desired’ level of capital stock and its actual level. Lucas (1969) then affirms that it is the rate of variation of definite capital stock that will be proportional to the difference between the desired and actual stock. To this effect, the ECI in this instance is used as the main index for estimating a country’s capital stocks. This capital stock relates the difference in the regions through trade.

3.3. EMPIRICAL LITERATURE

This section aims to give relevance to the study through empirical works done thus far according to the set objectives.

3.3.1. Economic complexity and GDP Per Capita

Much like GDP per capita, which tests the well-being of a nation in its people, the Gini-coefficient also does. As such, Ncanywa *et al*. (2021) carried out a study on whether economic complexity can boost the selected SSA (South Africa, Kenya, Tanzania, Cote d’Ivoire, Ghana, Mozambique, Cameroon and Nigeria) income inequality prospects utlising a Panel Autoregressive Distributed Lag (PARDL) approach for the period 1994 to 2017. The results indicated that economic complexity is a negative and significant predictor of income inequality. This meant that economic complexity can reduce income disparities in the selected SSA. Caous and Huarng (2020) disseminated the link between the ECI and Human Development Index (HDI) and the mediating effects of income inequality amongst developing countries. The statistical analysis was based on a hierarchical linear modelling of 87 developing countries from 1990 to 2017. The results indicated that ECI does not influence income inequality in the short term, but meaningfully reduced income inequality in the long run-in developing countries. In a report on economic diversification in Sub-Saharan Africa, Yellapragada (2018) found that cross-country data suggest that macroeconomic stability, access to credit, good infrastructure, a conducive regulatory environment, a skilled workforce, and income equality are all associated with higher economic diversification.

A study on economic complexity and export competitiveness in Turkey, using a regression model (least squares method, cross sectional analysis) was performed for 110 countries to estimate the relation between the variables (Erkan & Yildirimci, 2015). The findings indicated that by reducing complexity level, production process becomes easier and much more basic, and this is detrimental for growth of a country's GDP nor does it make the country more developed. Hartmann, Guevara, Jara-Figueroa, Aristaran and Hidalgo (2017) used multivariate regression analysis incorporating methods from econometrics, network science, and economic complexity for 150 countries and their associated changes in income inequality during 1963 to 2008. The findings indicated that economic complexity is a significant and negative predictor of income inequality, and that this relationship is robust when controlling for aggregate measures of income, institutions, export concentration, and human capital.

Hidalgo and Hausmann (2009) presented a technique that uses available economic data to develop measures of countries product complexity and showed strong correlation between income per capita and complexity. The relationship between ECI and economic growth data was explored on 16 countries from South Eastern and Central Europe for the period 1995 to 2013 (Stojkoski & Kocarev, 2017). The results were summed up that change in economic complexity has no effect on short run changes in the income of South Eastern and Central Europe. On the other hand, change in investment and GDP per capita were significant explanatory variables of short-run income changes. Contrary to short-run, ECI was seen as a positive contributor to the elasticity of income per capita. It was found that on average, there were increases of GDP per capita by 45%. Gao and Zhou (2018) quantified economic complexity of China's provinces by analysing firm data against some selected macroeconomic indicators from 1990 to 2015. Their findings indicated that economic complexity was a positive and significant indicator of economic development, as suggested by the high correlation between ECI and GDP per capita.

Felipe, *et al* (2012) ranked 5,107 products and 124 countries in measuring whether product complexity has an impact on economic development. Estimation results show that out of the 5107 products, 2554 have statistically significant positive elasticities; 680 have statistically significant negative elasticities; and there are 1873 products with statistically insignificant elasticities. For example, self-propelled railway cars and external electric power showed the estimated share elasticity of 1.55, which means that as income per capita increases by 10%, the share of this product in total exports increases by 15%. Gala *et al.* (2018) analysed the relationship between ECI and GDP per capita by employing heterogeneous regressions for a sample of 147 countries and covers the period 1979-2011. The results indicated that capita and ECI is negative and statistically different from zero with GDP per capita. This was analysed as indicating that countries with high export complexity are more capable of reducing the income gap to developed countries than countries with low export complexity.

Using linear algebra, Ivanova, Øivind, S, Kushnirc and Leydesdorff (2017) measured the correlation (causality) of the 'triple Helix' [Economic Complexity Index, Patent Complexity Index (PatCI)] during the period 2000–2014 for the 34 OECD member states, the BRICS countries, and a group of emerging and affiliated economies (Argentina, Hong Kong, Indonesia, Malaysia, Romania, and Singapore). The findings indicated that complexity indicators are correlated between themselves; but the correlations with GDP per capita are virtually absent. Of the world's major economies, Japan scores highest on all three indicators, while China has been increasingly successful in combining economic and technological complexity. Furthermore, the authors could not reproduce the correlation between ECI and average income that has been central to the argument about the fruitfulness of the economic complexity approach.

Following on the works of Stojkoski and Kocarev (2017) with regards to income inequality, it was found that there is a negative and significant correlation between economic complexity and relative income differences, which coincided with previous findings based on international trade data.

With an aggregate data from thirty-one (31) Organisation for Economic Co-operation and Development (OECD) economies in the period 1982 to 2017, Udeogu *et al*. (2021) undertook a study examining the concept that the level of product complexity is a good factor of economic growth in the long run. When forecasting the results through the IRF ECI had a significant impact on economic growth with a one standard deviation shock to the ECI at time zero contributed around 2.34% points to the average growth rate of output within the 1st period. The point estimates were positive up to the 3rd period. Additionally, in the long run, the cumulative IRF showed that the aggregate impact on economic growth was about 4.4%.

Measuring subnational economic complexity in Spain for the period 1995 to 2016, Pérez-Balsalobre, Llano-Verduras and Díaz-Lanchas (2019) forecast respective measure of complexities against $GDPpc$ for the next ten years. The results indicated that all variables had a positive and significant relation with future $GDPpc$. Additionally, the ECI indicator for total trade flows provides outstanding results, explaining almost 40% of future GDPpc. Furthermore, a distinction was made for both EC and PC's explanatory power over $GDPpc$ (provincially though). Product complexity appeared to have a good explanatory power, particularly for the growth of absolute $GDP\ per\ capita$. Nevertheless, ECI becomes the only one variable capable of accounting for the largest proportion of provincial $GDP\ per\ capita$ (in relative or absolute values) in 10 and 15 year periods. Therefore, it was highlighted that total ECI clearly is the most relevant variable explaining future long-run regional economic growth.

Following a study by Albeaik *et al.* (2017) that provides predictions of annualised future economic growth for the period between 2013 and 2033 deploying a twenty-year OLS model, it was noted that OLS predictions had a strong regression to the mean, so the actual values should not be as informative as the relative rankings. Yet, ECI+ is more optimistic, ECI was a predictor in the future economic growth of Peru, Mexico and Mongolia, and less optimistic in the growth of East African economies. Stojkoski *et al*.

(2016) studied the ECI-growth nexus with the aim of testing whether economic complexity may be a predictor of future economic growth. The results indicated that the standardised coefficients found that a one standard deviation increase in the aggregated ECI is associated with an increase in the growth variable equal to 18.6% of a standard deviation in that variable, and the disaggregated ECI marginal effect of country complexity overgrowth is 55.7 percent.

Sahasranaman and Jensen (2018) attempted to uncover the economic competitiveness of Indian states based on the framework of Economic Complexity for the period 2009-10 to 2016-17 across a consistent set of 165 products employing matrix modelling. The results show that increasing Fitness (EC) appears to correspond to increasing ability to predict evolution of income per capita. A study mapping the relationship between products in global trade and the products a country exports as a network to devise a measure of the density of links between the products in a country's export basket and a measure of network proximity from a country's export basket to products that a country does not export was carried out (Kali, Reyes, McGee & Shirrell, 2013). The results indicated that, as hypothesised, the density of links within the products constituting a country's export basket and the network proximity to new products are together of importance for the country's ability to move to new products and experience growth acceleration.

Jarreau and Poncet (2012) further analysed their results with the purpose of forecasting the estimates. The interpretation was that the magnitude of the estimated coefficients, holding other factors constant, indicated that a 10% increase in export sophistication raises the average annual real income per capita growth rate over the following 12-year period by about 0.7 percentage points.

3.3.2. Economic complexity and current account

Current account and complexity nexus is approached with caution because literature is indeed lacking. However, its sub-account relationship is found far in-between. As such, literature put forward relates to the relationship between exports, terms-of-trade and so forth.

Utkovski *et al.* (2018) went about to interpret economic complexity having the capabilities and ability to model the productive structure of economies on emerging and developing countries for the period 2016–1970. The results showed that countries that produce more diverse commodities are more capable of exporting more complex and diversified commodities, with few countries having the ability to export high-tech commodities. Yalta and Yalta (2017) attempted to contribute to the literature by exploring the determinants of economic complexity in the MENA (Middle East and North Africa) region with special emphasis on the role of the composition of human capital. To this end, they employed a system GMM approach based on annual data for 12 countries for the period 1970 to 2015. The results indicated that terms-of-trade had a negative and significant relationship with economic complexities. However, the coefficient estimates were rather miniature.

The work of Lemoine and Unal-Kesenci (2004) explores China's outstanding performance in trade up to the period 2004. The China analysis shows that the outstanding export performance is directly linked to its integration in the international segmentation of production processes. Additionally, China has engaged in production sharing with Asian countries and has specialised in assembly operations, which has allowed for a rapid diversification of its manufactured exports, from textiles and clothing to the electric and electronic industries. Emphasis is further placed on assembly, which has a considerable input on the technological upgrading of China's trade. This directly suggests that product complexity and economic complexity are relevant contributions to China's development. As stated, diversification of manufactured exports segmentation of production process is the key to trade performance.

Jetter, Ramırez and Hassan (2013) explored the roots of export diversification on selected countries of the world for the period 1960 to 1960. The results showed that out of the 43 factors examined, one of the factors having a long-run relationship with export diversification was foreign direct investment. Zhu and Fu (2013) analysed the determinants of export upgrading using a cross-country panel dataset over the 1992–2006 period. The results suggest that the export sophistication of countries is enhanced by capital deepening, engagement in knowledge creation, transfers via investment in education and R&D and foreign direct investment and imports. Knowledge creation is an attribute of ECI and PCI.

A study to determine how efficiently nations from Latin America and Asia measuring a country's performance in converting economic complexity into human development between 2010 and 2014 by employing the Variable Returns of Scale (VRS) Model and Window Analysis was carried out (Ferraz, Moralles, Campoli, Oliveira & Rebelatto, 2018b). The results indicated that GDP per capita was statistically significant and obtained an expected signal for all social variables (though GDP was a control variable in their model). ECI obtained a high degree of statistical significance (level of 1%) and expected signals for all social variables. In the case of efficient Asian countries, it was noted that governments have developed public policies that encourage export of high technology products, mechanisation of agriculture, and reallocation of workers in technologically sectors, such as industry and productivity increase. It was also noted that structural changes were accompanied by increase in individual capabilities, increase in human capital and improvement in the infrastructure.

The relationship between technology and trade is potentially endogenous, and some studies report the existence of reverse causality. Grossman and Helpman (1995) demonstrate not only that technology affects trade, but that the causality also runs in the other direction and trade affects technology. As several authors argue, international trade stimulates technology adoption (Caselli & Coleman, 2001; Lileeva & Trefler, 2010; Bustos, 2011; Rodrik, 2011).

Xie and Xue (2019) proposed theoretically that FDI (Foreign Direct Investment) not only increases the share of high-quality export products in China's manufacturing industry, but it also exerts an effect of demonstration and competition on local enterprises, thus facilitating local enterprises to improve the quality of their export products. We empirically test this theory by using the customs database, which confirms that FDI has a positive impact on the quality of Chinese export products. On the one hand, the export products of foreign-funded enterprises, making up more than 50% of the share of China's exports, are of a higher quality than those of China's local enterprises. On the other hand, FDI strengthens the market competition of local enterprises and promotes the TFP (Total Factor Productivity) of Chinese enterprises, thereby positively affecting the quality of their export products.

Yan and Yang (2008) empirically demonstrate that foreign capital inflows and current account imbalances interact in different ways between developed countries and emerging market countries. The sample starts on the first quarter of 1989 (or 1989Q1) when foreign capital resurged and began to flow into developing countries, and it ends in 2005Q4. Five countries that were heavily affected by the currency crises of the 1990s are included: Argentina, Mexico, Indonesia, South Korea, and Thailand. For countries with limited data, like Argentina, Indonesia and Thailand, the sample starts from 1993Q1, 1991Q1, and 1993Q1, respectively, and for Mexico and South Korea, it ends on 2005Q4,; while for Argentina, Indonesia, and Thailand it ends on 2004Q4. The results show that employing Granger non-causality test found that foreign capital inflows Granger-cause the current account in the cases of emerging market countries, while a causal relation is negligently detected in the cases of developed countries. Indeed, distinct from developed countries, the current accounts of emerging market countries are susceptible to the influence of foreign capital inflows. Knowledge creation activities such as human capital and R&D investment show a consistent and robust positive impact on export upgrading. FDI and imports also demonstrate a robust significant positive effect on the export sophistication index (Zhu & Fu, 2013)

Once more, the work of Pérez-Balsalobre *et al*. (2019) sheds light and provides much needed literature by making inference to trade flows as predicted by complexity analysis. For the provinces with small share of international trade flows, intra-national EC indicators gain huge explanatory power. Additionally, it was seen that models that incorporated EC reported even larger R-squared than those including standard variables in the literature. This suggests that economic complexity is a relevant indicator to predict trade flows. Further, work of Erkan and Yildirimci (2015) revealed that export competitiveness improved, due to increase especially in 2000s R&D based products exports (specifically for easy to imitate science-based goods). It was concluded that there is an increase in R&D investments, more use of scientific methods in export and production, creating more value-added production, which results in increase in complexity index.

As presented in the previous section, Hidalgo and Hausmann (2009) further analysed that economic complexity and product spacing are predictive of future growth; and are predictive of the complexity of a country's future exports, making a strong empirical case that the level of development is indeed associated with the complexity of a country's economy. Using a new dataset with transaction-level export data from four African countries (Malawi, Mali, Senegal and Tanzania), a study was explored to determine the success upon entry into export markets, defined as survival beyond the first year at the firm-product-destination level (Cadot, Iacovone, Pierola & Rauch, 2013). The findings indicated that adding one product to a given destination has a smaller effect on exports success (one percentage point) than adding an additional destination for that product (1.7 percentage point). This was seen as somewhat natural, as the analysis was at a disaggregated level in terms of products (5000 potential products at HS6, although our African countries export far fewer), so the additional product sold on destination can be very close to the original; by contrast, destination countries are much fewer, so adding one more shipping destination for products is a substantial move.

Kali *et al.* (2013) proceeded and incorporated opening the economy for trade (Liberalisation), and terms of trade shocks (Terms of Trade), which of course have a direct link with the current account. The results indicated that there is a positive effect between terms-of-trade, liberalisation and density, network proximity of products. However, only shocks on trade were significant at 5% for all models specified.

3.3.3. Economic complexity and Investment

Sepehrdoust, Davarikish and Setarehie (2019) undertook a study to investigate the impact of trade liberalisation on the economic complexity as a strategy adopted by the Middle East developing economies during the period 2002–2017 using the panel vector auto regression model (PVAR). In estimating short and long-run estimates, the results show that in the long run, the effect of imports of intermediate and capital goods is initially increasing and, after a short period, has a positive downward effect on economic complexity. A real exchange rates, economic complexity, and investment study for advanced, emerging, developing Asia, developing Europe, Latin American and Caribbean (LAC), MENA and SSA economies was carried out (Brito, Magud & Sosa, 2018). With an unbalanced firm level focus in investment across industries in 71 countries for the period 1995 – 2016, findings indicated that higher economic complexity is related to higher firm-level investment as expected. Additionally, it was observed that the lower quartile of the ECI measure the estimated coefficient was positive, suggesting that real exchange rate overvaluation is positively associated with investment at the firm level.

Yalta & Yalta (2017) followed-on on their work by incorporating other economic indicators. The findings indicated that Investment (public investment) and economic complexity had a positive and significant relationship in the long-run, while Foreign Direct Investment (FDI) had a negative and significant relationship with economic complexity. Moreover, because the study focused mainly on finding determinants of economic complexity, this suggests that FDI and terms of trade do not contribute to economic complexity. Once more, the work of Lemoine and Unal-Kesenci (2004) still advocates for the importance of FDI and productive structure of China, hence leading to the sophistication of exports.

Gauselmann, Knell and Stephan (2011) introduced two variables related to technology in a qualitative research. The first one is Access to local knowledge and technology, which is discovered to be an important strategic motive for investment. The second one is a location factor that shows the perceived quality of potential for technological cooperation in Central-Eastern Europe and appears to be of a high level of quality, which means that the investors' motive matches perceived location factor. Sharma and Bandara (2010) mention Knowledge capital as a key location factor of FDI, particularly among developed countries. It happens through differences in cross-country levels of technology, determined by differences in Knowledge capital. The relationship between this variable and FDI was found to have an unexpected negative sign. A limitation of this result is that the authors investigate Australian outward investment. Second, as mentioned by the authors, measuring Knowledge capital through R&D expenditure is problematic because not all of this expenditure is commercially successful and contributes to Knowledge capital. However, this finding represents a single result, unconfirmed by further studies.

Once more, the work of Lemoine and Unal-Kesenci (2004) suggests a causal relationship between the sophistication of products and investment. Their findings indicated that the effect of overall FDI in China (including FDI from industrialised countries which has been more oriented toward the domestic market) on the restructuring of country's manufacturing industry has been outstanding. In 1999, foreign affiliates were responsible for 28% of China's industrial output. In electronic and telecommunication equipment, they have a dominant share (70% of output). Jarreau and Poncet (2012) considered the relationship between export sophistication in 1997 and real income per capita growth rates between 1997 and 2009 across Chinese provinces, after controlling for initial levels of GDP per capita. The analysis ventured also, as controlled variables, a measure of human capital was viewed generally a positive and significant coefficient, while that of physical capital accumulation was insignificant. Additionally, as expected, the openness rate and FDI over GDP attract positive signs, while that on the State share of investment is negative. The coefficients were however not significant.

A study with the objective of measuring the effect of Absorptive Capacity and FDI on economic complexity, empirically proving the causal relationship between the variables and discussing the best way to model the phenomenon analysed was carried out by Ferraz, Moralles, Costa and Rebelatto (2018a). Using data spanning the period 2010 to 2014, econometric techniques were used for panel data, which consisted of 106 municipalities for Brazil, and additionally estimated their models through the Feasible Generalised Least Squares (FGLS) fixed effect procedure. The results indicated that there is a positive relationship between FDI and economic complexity significant at 1%. However, in this study FDI was the predictor.

The work of Pérez-Balsalobre *et al*. (2019) is of paramount importance once more, providing work or closing some gaps because literature is lacking with regards to complexity-investment analysis. However, their work does focus on the impact of economic complexity and investment, however, the investment in their work is measured in human and physical capital. The results indicated that there is a positive and significant relationship between economic complexity, human capital and physical capital in the next five plus years. With a view to forecast the variables understudy, Sepehrdoust *et al*. (2019) revealed that immediate reaction shows that over a period of 10 years, economic complexity increases with positive shock from variables of trade freedom, foreign direct investment and gross fixed capital formation. Over 10 years, creating a positive shock to the formation of gross fixed capital raises economic complexity. The increase in gross fixed capital formation has a small positive effect on economic complexity, but as the effect of increasing gross fixed capital formation on economic complexity increased, it gradually increased until finally after about 10 years.

A study with the objective of measuring the effect of Absorptive Capacity and Foreign Direct Investment on economic complexity, empirically proving the causal relationship between the variables and discussing the best way to model the phenomenon analysed was carried out by Ferraz, Moralles, Costa and Rebelatto (2018a). Using data spanning the period 2010 to 2014, econometric techniques were used for panel data, which consisted of 106 municipalities. The results confirmed the hypotheses established, indicating there is a positive and significant impact of Foreign Direct Investment on the complexity in Brazil. It was also observed that there is a moderating effect of Absorptive Capacity on FDI that impacts economic diversification.

To some-up this forecasting section, literature relating to forecasting is lacking, and pertinent techniques for forecasting were not utilised. However, previous works gave an impression that it is essential to predict future growth of economies through ECI and PCI, using techniques for forecasting from panel fixed effect to Ordinary Least Square (OLS), which gave no reliable estimates (Albeaik *et al.*, 2017; Stojkoski, Utkovski & Kocarev, 2016; Hidalgo & Hausmann, 2009). Hence, this study seeks to address this rather unconventional forecasting tools to more relevant forecasting techniques such as impulse response function and variance decomposition.

3.3.4. Selected SSA and BRICS comparative analysis

This sub-section brings forth an analysis of any work done that reveal the developmental stands of these two sets of countries. The idea is to relate work done that also answers the question on why some countries are more developed in ECI terms. Lee and Yoon (2015) undertook a comparative study that was meant to identify different patterns of latecomers' technological learning in developing complex product systems (CoPS). The study incorporated two BRICS countries, China and Brazil including South Korea in military aircraft development to explain the learning process in attaining indigenous technological capability. The method of study was the development of military technological learning by comparing differences in technological patterns in the military aircraft industries and projects of 1945 to 1999 in Brazil, of 1969 to 2012 in Korea, and of 1952 to 1999 in China. The findings indicated that in the case of Brazil, the important role played by universities and government research institutes in developing CoPS with a focus on design capability was beneficial. It was also explained that the phenomenon was similar to the catching-up of Korea and Taiwan in mass-produced goods, that of semi-conductor or electric products, that fostered the spin-offs and commercialisation of the research outcomes from their universities and government research institutes. In the case of China, the following were findings since the early 1950s. The country establised more than 400 research units to strategically focus on reverse engineering were highly skilled Chinese scientists and engineers returned from the United States of America (USA). Finally, the acquisition of foreign companies enabled China to access foreign technology and link up with global R&D. On the overall, the findings were also that the role of foreign partners is crucial in acquiring highly sophisticated technology through coproduction, co-development and reverse engineering.

Naudé, Szirmai and Lavopa (2013) provide an industrial comparative study on the BRICS countries by analysing the manufacturing sector for the period 1980 to 2010 to address and contribute to the gap and patterns of structural change. The findings indicated that three of the BRICS experienced a de-industrialisation, that is, Brazil, Russia and South Africa. China was the only country where an expanding manufacturing sector accounted for a substantial part of total growth. The differences between the member economies was drawn down to differences in industrial policy where China industrial policy supported both foreign and domestic investment for technological catch-up. China was the only country where domestic investment started becoming increasingly important compared to FDI from 1995 onwards. China and India's rapid growth of per capita is said to have been complemented by structural changes away from agriculture, and into manufacturing and services, respectively. It was also summed up with regards to technological progress, that China had the most significant progress, followed by India, and to a minor extent Brazil, Russia and South Africa. The latter two remain economies that are essentially dominated by natural resource extraction and services, and by difficulties in their political and social transition processes.

Rubbo *et al*. (2021) provide a comparative analysis among the BRICS memebers in respect to their innovation index and economic complexity index. The findings indicated that India and Brazil weakened the most in the innovation status or ranking, while Russia realised the worst descent in the ECI ranking. Moreover, China ascended seven places in the ECI position, but stagnated in innovation. Of interest was that in SSA Africa, South Africa showed the most similarities in comparison, rising up in both innovation and ECI rankings. However, the resulting conclusion was that economic complexity and the innovation ranking are not equivalent. They display discrepancies regarding the rises and declines among BRICS economies. These are important results because they reflect on the industry or manufacturing development of these countries.

In the African context, a trend report on the prospective of manufacturing and industrialisation, opportunities, and strategies by the Brookings Institute submits some recent trends (Signé & Johnson, 2018). Current industry setting contributes meaningfully to the build-up of physical and human capital. Of significance, the manufacturing sector offers fairly well-paid jobs for large numbers of unskilled or under-educated workers, particularly those who are not integrated in the formal economy. To this effect, increases household income and subsequently domestic demand. The concern however, was that in terms of two indicators of industrial development, manufacturing value added (MVA) and manufacturing exports, Africa lags far behind the rest of the world and even in comparison to developing countries. Bhorat *et al.* (2019) also gave a comparative among some of the SSA (South Africa, Kenya, Senegal and Ghana) countries, and the following summation on a report on building economic complexity in Africa. There was indication of a minor shift concerning manufacturing in Senegal and Kenya, although economic activity was said to have shifted away from manufacturing in South Africa and Ghana. The general conclusion was that the scale of manufacturing-led structural change across the African continent was insufficient to drive immense job growth.

3.3.5. Selected SSA and BRICS Product complexity

Section 4.1.1 will shed light on the significance of this section, which seeks to address the last study objective, that is, to draw on the product complexity in the selected SSA and BRICS countries. This is more so because product complexity is a catalyst for economic development (Felipe *et al*., 2012). Britto, Romero, Freitas and Coelho (2019) investigated economic complexity and the path to development in Brazil and the Republic of Korea. It was seen that the average product complexity of every technological sector revealed a strong correlation amongst the technological content of respective industry and the level of complexity of production in Brazil. This study reflects well on the Brazilian economy and the strides made in comparison to earlier works.

Following on the work of Felipe *et al*. (2012), the study goes further to reflect on the countries that are found on the list of most complex products and those on the least of complex products. In relating to the most complex products and the top five countries that produce and export them, none of the BRICS or selected SSA were found. However, on the list of the least product complex products, some of the selected SSA and BRICS countries were found. Nigeria was the least rated country in product complexity, while the likes of Ghana and Cameroon were also exporters of raw or unfinished products. Brazil, China and India also featured in the least product complexity.

Cadot *et al*. (2013) substantiate on the success and failures of African exporters and submit that exporters in the set of African nations experiment a lot on export markets, at a low scale and with low survival rates, particularly in the first year. The study included Tanzania where 1685 exported products were investigated. Adding on to this trend, Gebrerufael (2017) forwards a study on the dynamics of product complexity in the Africa context employing a structural Model Samson (SMS) approach to understand the productive structure of the continent among 23 countries together with OECD. The submission with regards to African countries was that a positive relationship between ECI and PCI was found, though the concern was the analysis that African nations are diversifying their products towards the technologically less intensive and familiar commodities that could not challenge their relative labour productivity. This is in sharp contrast to strides made by BRICS countries of China and India (Lee & Yoon, 2015).

Bhorat *et al*. (2019) further investigated the product complexity in the SSA setting focussing on Senegal, Kenya, Ghana and South Africa. The findings were that, in analysing the drive for manufacturing-led structural change, there was little evidence of a move toward manufacturing in Senegal and Kenya, while economic activities were said to have shifted away from manufacturing in South Africa and Ghana. It was then concluded that the magnitude of manufacturing-led structural change across the continent was insufficient to drive massive job growth. This affirms that the productive structure was less desirable when factoring complexity in the products.

3.4. CONCLUSION

This chapter presented five unique but related theories that aided explain the relationship between the concepts covered. The Solow growth Model together with the endogenous growth model were explored to emphasise the relationship between innovation and technology, the leading components of economic complexity on the economic progress or growth of economies.

The Solow growth model is said to be a capital augmenting progress in its structure on the economy, where technological presence is equivalent to the economy having more capital. Its main disadvantage was that it does not propose an explanation of how technological progress could be accelerated, while the revised endogenous growth theory, Paul Romer's work in 2019 concluded on this discussion by saying that new ideas are critical to advance individuals' consumption. The idea was that in each economy; you can increase the productivity of any number of people by inventing a single new idea. This meant that the productive capabilities of a country were endogenously based. Chapter four will bring forth the chosen theory of the study in analysing the relationship between economic complexity and GDP per capita.

On the relationship between current account or trade between economic complexity the New Trade Theory and the Technological Gap Trade Theory were narrated. In the New Trade Model, it was the model of infinite variety that gave perspective that a coherent general-equilibrium analysis of trade was made relevant, which emphasised specialisation and large-scale production results in a greater diversity of commodities through prising. The case in point is simply that the final prediction is a greater diversity of goods consumed. On the other hand, the TGTT pronounced on the difference between two concepts of technology leading to product process, those are process innovation and product innovation. The argument was placed on the product innovation, which emphasised building on the expansion of the characteristics of the products in each economy. The concluding remark on the TGTT was that a substantial devotion should be born on the effects of creation and flow of new technology for trade pattern, investment, and the prosperity of respective economies.

The theory devoted to the investment-economic complexity nexus was the accelerator theory of investment. This was, according to literature, the only theory that may be seen as aiding the analysis thereof. This theory paved the way and acknowledged that the firm's capital accumulation decision was linked to technological production, and changes in long-run capital stock as driven by changes in shocks to technology and labour supply. The model was later developed to be flexible, and the allowed the analysis that there is an optimal relationship between capital stock and output but permits for lags in the adjustment of the actual capital stock towards the optimal level.

These theories bring forth a level of novelty to the study and the body of knowledge. The theories are argued for in that in the present-day world globalisation is affecting countries regardless of their economic status through trade. The status in this sence is on macroeconomic indicator as some authors alludes. Hence, the uniqueness is drawn on the fact that, as espoused by Beyene (2015), one of the features that decide the success of an economy in international trade is the competitiveness of its commodities in the world. The classical comparative advantage theory such as the Solow growth model has valuable merits, but not in the modern high-tech/sophistication era of fast communication and mobility of resources; it is being called into doubt. Hence, the likes of the endogenous growth model, the TGTT, and the accelerator theory of investment may be seen as the more appropriate theories. These are further unpacked in the subsequent section.

Economic complexity as already introduced, alluded to the fact that it is a re-emerging concept. Empirical literature also reflects as such, and most of the work is attributed to Hausmann, Hartmann, Guevara and Hidalgo. Additionally, most of the studies were Europe focussed and Asia based, and a few dealt with BRICS or the African context. Additionally, not many studies were directly advocated for ECI and current account or investment while those for GDP per capita were found. The set objective on the three macroeconomic variables were hard to find literature on, especially on causality and forecasting. Nonetheless, there was some literature which advocates for such research. To this end, this makes the study even more an interesting execution because it will sure add to the much-needed literature. As such, this proves further the significance of the study in the context of a comparative analysis.

New knowledge is added in that the most relevant in the African context was Ncanywa *et al*. (2021) who explored a PARDL in the SSA context in a ECI-Gini coefficient study. An added macroeconomic analysis is made in this study with an ECI-GDP per capita nexus with the selected SSA, and additionally so in comparative setting with BRICS. The work of Utkovski *et al.* (2018), Yalta & Yalta (2017) and Ferraz et al. (2018b) are the closest to this study in the context of ECI-Current account nexus. To this end, the current account investigation adds another macroeconomic indicators within the domain of other macro-analysis like terms of trade as Yalta & Yalta (2017) did. On the ECI-Fixed investment front, only Sepehrdoust *et al.* (2019) comes close to this study. However, the authors used the PVAR approach with SSA included while this study uses a different methods with BRICS added. Hence, fixed investment is explored further and we go a step further in understanding its behaviour in the African context, and comparatively so with BRICS.

The chapter that follows seeks to unpack the diverse techniques that are expected to address the set study objectives and answer the questions presented. This is done so to effectively reflect on and add to the gap at hand, that is, no study was found that explored the three econometric approach as seen in the literarure presented.

CHAPTER 4

RESEARCH METHODOLOGY

4.1. INTRODUCTION

The study employs econometrics techniques in its method of analysis to analyse the relationship between economic complexity and some selected macroeconomic variables (economic growth per capita, current account, fixed investment) in selected SSA and BRICS countries. Leading to the process of estimation of respective models, data sources and model specification are stated, followed by descriptive statistics, and correlation analysis. Thereafter, the estimation process starts off with unit root tests, and optimal lags selection, cointegration tests, and followed by panel autoregressive distributed lag. Afterwards, to the subsequent analysis are panel Granger causality test, and the forecasting techniques of impulse response function and variance decomposition. The last three techniques are preceded by some diagnostic tests.

4.2. THEORETICAL FRAMEWORK AND THE ESTIMATED MODEL

This section is demarcated into three distinct models (GDP Per Capita, current account, and Fixed investment model) across the two economies. As such, the theoretical and estimated model will follow. However, to connect economic complexity and the adopted theory, the chapter starts off with the theoretical concept of ECI, leading into the three estimated models.

4.2.1. Measuring Economic Complexity and product complexity

It came to light that economic complexity is the productive knowledge, which is key to prosperity, that is, larger amounts of productive knowledge require an increasingly complex network of human collaboration (MIT Atlas, 2018). Additionally, ECI is built on the two previously stated concepts of diversity and ubiquity in the local products and subsequently exported products. The process leading into measuring ECI will help relate how product complexity are intertwined, hence the analysis of economic complexity, product complexity and the selected macroeconomic variables. The diversity and ubiquity of products leading to ECI is measured as follows (MIT, Atlas (2017):

$$Diversity = k_{c,0} = \sum_p M_{cp} \quad (4.1)$$

$$Ubiquity = \ k_{p,0} = \sum_{P} M_{cp} \qquad (4.2)$$

The MIT Atlas lab uses a matrix mathematical approach. Equations (4.1) and (4.2) represent a matrix M_{cp} in which rows signify various countries and columns signifies various products. A component of the matrix is equal to 1 if country c produces product p, and 0 otherwise. To this effect, diversity and ubiquity are simply measured by summing over the rows or columns of that matrix. However, for a more precise measure of the number of know-hows or capabilities available in a country, or essential by a product, there was a need to correct the evidence that diversity and ubiquity carry by using each one to correct the other. Hence, the following adjustment seeks to do that:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{P} M_{cp} \, . \, k_{p,N-1} \qquad (4.3)$$

$$k_{p,N} = \frac{1}{k_{p,0}} \sum_{c} M_{cp} \, . \, k_{c,N-1} \qquad (4.4)$$

Equation (4.4) was then substituted into equation (4.3) to produce:

$$k_{c,N} = \frac{1}{k_{c,0}} \sum_{P} M_{cp} \frac{1}{k_{P,0}} \sum_{C'} M_{C'P} \, . \, k_{C'.N-2} \qquad (4.5)$$

$$k_{c,N} = \sum_{C'} k_{C'.N-2} \sum \frac{M_{cp} M_{C'P}}{k_{c,0} k_{p,0}}. \qquad (4.6)$$

The equation is now rewritten as:

$$k_{c,N} = \sum_{C'} \widetilde{M_{CC'}} k_{C'.N-2} \qquad (4.7)$$

$$\widetilde{M_{CC'}} = \sum_{P} \frac{M_{cp} M_{C'p}}{k_{c,0} k_{p,0}} \qquad (4.8)$$

The resulting equation articulates the requirement and calculation that the information that the average ubiquity of the products country's exports, and the average diversity of the countries that make those products and so forth are different. For products, this is the average diversity of the countries that make them and the average ubiquity of the other products that these countries make.

Equation (4.7) is satisfied if and only if $k_{c,N} = k_{c,N-2} = 1$. This tallies to the eigenvector of which is linked with the biggest eigenvalue. Subsequently, this eigenvector is a vector of 1, it is not informative; instead, for the eigenvector linked with the second biggest eigenvalue. This consideration is the measure of ECI, where the eigenvector captures the biggest extent of variance in the system. Hence, ECI is stated as:

$$ECI = \frac{\vec{K} - < \vec{K} >}{stdev\ (\vec{K})} \tag{4.9}$$

Where $< \ >$ characterises an average, and $stdev$ is an abbreviation for standard deviation and $\vec{K}$ equals eigenvector of $\widetilde{M_{CC'}}$ linked second biggest eigenvalue. It was then seen that because of the symmetry of the problem, it was analogous to define Product Complexity Index (PCI) by simply exchanging the index of countries (c) with that for products (p) in equation 4.9. As such, PCI is defined as:

$$PCI = \frac{\vec{Q} - < \vec{Q} >}{stdev\ (\vec{Q})} \tag{4.10}$$

Where $\vec{Q}$ equals eigenvector of $\widetilde{M_{PP'}}$ linked second biggest eigenvalue. Given the central role of $\widetilde{M}$ in calculating ECI and what it represents, when applied to country trade data, one can think of $\widetilde{M}$as a weighted similarity matrix, reflecting how similar two countries' export baskets are (Mealy *et al*. 2018). In the context of the study, it is because of the information symmetry between ECI and PCI that we investigate them on the three macroeconomic variables. However, the study is mainly based solely on the ECI whereas PCI is inferred because ECI is based on the products or commodities that each country produces and exports, as already indicated. This is further substantiated by Mealy *et al*. (2018) in that the application of ECI and PCI from export data sheds clarity on specialisation arrangements across countries. Pérez-Balsalobre *et al*. (2019) also gives praise to the PCI, ECI in that they can be estimated for each region. They validated by stating that high-PCI (low-PCI) products have a tendency to be exported by richer (poorer), high-ECI (low-ECI) countries. High-PCI (low-PCI) products tend to be more (less) technologically sophisticated. This underscores the importance of technological upgrading in the development process.

The MIT lab through the '*The Atlas of Economic Complexity'* offers researchers an explanation based on "Economic Complexity," a measure of a society's productive knowledge. As such, '*The Atlas'* attempts to measure the amount of productive knowledge countries hold and how they can move to accrue more of it by making more complex products. This may be seen as improving some macroeconomic stands such as the well-being of the people (GDP per capita), improve the current account, or a catalyst to induce more fixed investment (gross fixed capital formation).

4.2.2. The Estimated GDP per capita and ECI Model

An evaluation of theoretical and empirical works on GDPpc and ECI reflects the approval that indeed there exists a connection where economic complexity is an important feature in most economies performance (Hildago & Haussman, 2009; Erkan & Vildirimci, 2015; Hartman et al, 2017; Ivanova et al, 2017). It is thus argued that sustained growth for a period of decades involves the continual introduction of new goods, not merely continual learning on a fixed set of goods. To this effect, the theoretical perspective is emphasised by Romer's (2018) Knowledge-based Endogenous Growth Model to which the impact of economic complexity imbed in it the idea of knowledge and innovation leading to progress of an economy, and indeed its people. To this end, the theoretical analysis between GDPpc and economic complexity (ECI) is set on the grounds of the endogenous growth model of Romer's (2018) work.

The endogenous growth model is a significant theoretical adoption because it states clearly what sophistication and knowledge thereof lead to the progression of economies. This clearly states a positive relation between ECI and GDPpc. The work of Romer (2018) stems from his passed works (1983; 1986; 1990; 1994) and advocates for improving economies with reference to absolute and comparative trade advantages. Hausmann and Hidalgo (2011) capture other economists' views that say that a successful theory of development has to involve more than aggregative modelling.

The Economic Complexity index thus provides the cardinal measure of knowledge and sophistication embedded in countries as measured in its exports. Therefore, providing a measure of how countries may be classified accordingly in respect of the knowledge in a society as expressed in the products makes and competes international markets. This index provides solutions to Steedman and Steedman's (2001) question that

"Even if 'knowledge' either is or can be rendered homogeneous – and that is a very big 'if' – the question arises whether there exists any cardinal measure of the single stock of knowledge". This intertwines with Romer's (1994) argument that technological advance comes from things that people do; the aggregate rate of discovery is still determined by things that people do. This notion is at the heart of ECI as reflected by Revealed Comparative Advantage (RCA), a direct link to endogenous growth. The endogenous growth theory is therefore relevant as revealed by Romer (2018). It contrasts with neoclassical growth theories that argue that factors affecting growth are exogenous. Hence, this means that factors affecting economic growth are rather endogenous factors through exploitation of knowledge. Romer (2018) mentions that knowledge is non-rival in nature. This means that the fact that ECI uses exports as measures for respective indexes does not render any other irrelevant. But rather, it is equally important a measure of sophistication leading to improved product sophistication and economic valuations using export data.

A multivariate model or framework is used in this study to examine the relationship between economic complexity and GDPpc (and 4.2.2 and 4.2.3, current account and fixed investment models, respectively), adopting and improving on earlier studies (Hartmann *et al*., 2016; Stojkoski & Kocare, 2017). For a comparative setting, there exists two par models, that is, SSA and BRICS models. Each model is infused with a control variable to indeed make the frameworks multivariate and to have better estimates following the above stated authors. The adopted models across the two groups of economies are (SSA and BRICS) modelled as such:

$$GDPPC_{SSA} = f(ECI, INF,\ HHE, IMPI, GOVEX, REER) \quad (4.11)$$

$$GDPPC_{BRICS} = f(ECI, INF, HHE, IMPI, IND, EMPL) \quad (4.12)$$

- Where in model 4.11 (the SSA), GDPPC is gross domestic product per capita, ECI is economic complexity index, REER is real effective exchange rate, INF denotes inflation, GOVEX stands for government expenditure, HHE is household consumption expenditure, and IMPI is import index.

- And in model 4.12 (BRICS) GDPPC, ECI, INF, HHE, and IMPI denotes same as SSA model, while IND relates to industrial production, and EMPL stands for employment.

The resulting econometric model from the functions is identified as follows:

$$\Delta GDPPC_{itSSA} = ECI_{it} + INF_{it} + LHHE_{it} + LIMPI_{it} + LGOVEX_{it} + REER_{it} + \varepsilon_{it} \quad (4.13)$$

$$\Delta GDPPC_{itBRICS} = ECI_{it} + INF_{it} + HHE_{\_it} + LIMPI_{it} + LIND_{it} + LEMPL_{it} + \epsilon_{it}] \quad (4.14)$$

- In both models (SSA & BRICS), the percentage change in GDP per capita ($\Delta GDPPC_{it}$) is annual percentage growth rate of GDP per capita based on constant local currency. GDP per capita is gross domestic product divided by midyear population (World Bank, 2020). This form of dependant variable transformation is followed based on other works where the goal was to follow an endogenous theory and the effect of ECI on GDP per capita (Stojkoski & Kocarev, 2017).
- Economic complexity (ECI_{it}) is the complexity of a nation's productive assembly by merging information on the variety of a country's exports, and the ubiquity of its products, that is, the volume of nations that export the merchandise or service (Hidalgo & Haussmann, 2009).
- Inflation at GDP deflator (INF_{it}) as measured by the annual growth rate of the GDP implicit deflator shows the rate of price change in the economy as a whole. The GDP implicit deflator is the ratio of GDP in current local currency to GDP in constant local currency (World Bank, 2020)
- The log of household consumption expenditure ($LHHE_{it}$) provides values for households and NPISHs (Non-profit institutions serving households) final consumption expenditure expressed in current international dollars converted by purchasing power parity (PPP) conversion factor. Household final consumption expenditure (formerly private consumption) is the market value of all goods and services, including durable products (such as cars, washing machines, and home computers) purchased by households. It also includes payments and fees to governments to obtain permits and licenses (World Bank, 2020).
- Log of imports value index ($LIMPI_{it}$) is the current value of imports converted to U.S. dollars and expressed as a percentage of the average for the base period (2000) (World Bank, 2020).
- Log of general government final consumption expenditure ($LGOVEX_{it}$) includes all government current expenditures for purchases of goods and services (including

compensation of employees). It also includes most expenditures on national defence and security, but excludes government military expenditures that are part of government capital formation (World Bank, 2020)

- Real effective exchange rate ($REER_{it}$) is the nominal effective exchange rate (a measure of the value of a currency against a weighted average of several foreign currencies) divided by a price deflator or index of costs (World Bank, 2020; Federal Reserve Bank of ST. Louis, 2021).
- Log of Industry as a percentage of GDP ($LIND_{it}$) also includes construction.
- The log of employment ($LEMPL_{it}$) relates to population ratio, from the age of 15+ as total percentage

From the above adopted theoretical link and the subsequent model specification, the following hypothesis is developed in line with the study objective:

H_0: *Changes in economic complexity has no association with GDP per capita in both the selected SSA and BRICS economies*

H_1: *Changes in economic complexity has an association with GDP per capita in both the selected SSA and BRICS economies*

4.2.3. The Estimated Current Account and ECI Model

In relating the trade performance in exports captured under the current account and economic complexity nexus, the technological gap theory is adopted. The theory draws relevance because the study employs a re-emerging index of relative comparative advantage through the ECI in capturing innovation or technological progress. The study seeks to address or attempt to react to the work of Leamer (1974) and Luc and Soete (1981), who stated that available data at the time was industry specific and not country specific. The work of Hidalgo and Hausmann (2009) has made advances to measure sophistication or knowledge embedded in output in an aggregate scenario, that is, country specific through ECI. To this effect, the technological gap theory of trade is made significant as concluded by Luc and Soete (1981), who used R&D and patents as proxy for technology-output at industry level. The level of complexity of countries in commodity production can be determined by the index of economic complexity (Hidalgo *et al*., 2007). Therefore, it became essential to use the TGTT as the fundamental theory. It is thus expected or hypothesised that the current account and

ECI relationship is a positive one, ceteris paribus, as exports performance improves with advances in the type of goods or services manufactured in the country. Whether this holds true for both SSA and BRICS remains to be empirically explored.

To put economic comlexity in context to influence trade it fills a gap to advance equation (3.18) where it has not been possible to test the TGTT model, it is through product diversity and ubiquity that demonstrate the relevance thereof. As already mentioned, diversity relates to different kinds of products a country is able to make and observing the number of countries that are able to make a product, product ubiquity. It is on these grounds that the argument by Cheng (1984) and Markusen and Svensson (1983) are finally put to test empirically. That is, on a theoretical front, a trade model of a country will on average export goods which it has superior technology, if technological differences are products.

On the theoretical front, Markusen and Svensson (1983) have shown in a very general trade model that a country will "on average" export merchandises for which it has superior technology if technological differences are product-augmenting and trade volume should increase. This will in turn enhance the current account, ceteris paribus. The TGTT focuses on the supply side and explains differences in national productivity rates by differences in the technology stock across countries (Jochem & Schleich, 2011). Following on from the models effected in 4.2.2, the adopted models across the two groups of economies are (SSA and BRICS) for ECI-Current account model, and its control variables are:

$$CA_{SSA} = f(ECI, AGRICEX, INF, IMPI, SAV, UNEMR) \quad (4.15)$$

$$CA_{BRICS} = f(ECI, AGRICEX, INF, IMPI, GOVEXP, EMPL) \quad (4.16)$$

- Where, in both 4.14 and 4.16 CA are current account relating to the credit items or income, while ECI, INF, IMPI AND EMPL are as defined in 4.2.2 above.
- AGRICEX in both models are agricultural raw materials exports as a percentage of merchandise exports.
- And in model 4.15 (SSA), SAV is the savings in each country in dollar monetary value and UNEMR denotes the rate of unemployment in each country.
- And in model 4.16 (BRICS), GOVEXP is government expenditure as a share of GDP.

The resulting econometric model from the functions is identified as follows:

$$[LCA_{itSSA} = ECI_{it} + AGRICEX_{it} + INF_{it} + LIMPI_{it} + LSAV_{it} + LUNEMR_{it} + \mu_{it}] \tag{4.17}$$

$$[LCA_{itBRICS} = ECI_{it} + AGRICEX_{it} + INF_{it} + LIMPI_{it} + LGOVEXP_{it} + LEMPL_{it} + \pi_{it}] \tag{4.18}$$

- Where LCA in both models is the log of exports of goods, services and primary income, that is, only receivables in the current account of the balance of payment.
- In the SSA model (4.17), AGRICEX maintains its measure as a percentage of raw exports in merchandise exports.
- LSAV is the log of gross savings as calculated as gross national income less total consumption, plus net transfers denominated in respective currency of the country.
- LUNEMR is the log of Unemployment refers to the share of the labour force that is without work but available for and seeking employment.
- LGOVEXP is the log of Annual percentage growth of general government final consumption expenditure based on constant local currency.

From the above adopted theoretical link and the subsequent model specification, the following hypothesis is developed in line with the study objective:

H_0: *Changes in economic complexity has no impact on the current account of both the selected SSA and BRICS economies*

H_1: *Changes in economic complexity has an impact on the current account of both the selected SSA and BRICS economies*

4.2.4. The Estimated Fixed Investment and ECI Model

The estimated fixed investment and ECI model is based on the accelerator theory of investment because of its departure from a simple modelling to a flexible version which to some degree allows technological progress in relating how investment may be altered. As such, equation (3.21) above has some relevance in augmenting output upon some lags to effect investment. Technological progress assumes positive economic expansion, and a sudden surge of such alludes to a positive shock in an economy. It is in the basis of Shapiro (1986) that optimal output related to technological progress may envisage a direct link to a surge in fixed investment. This fixed investment of course alludes to investment in machinery and equipment or improvements in infrastructure due to an expansion in product sophistication and leading to exportable merchandise.

Durlauf and Blume (2008) sum up the relevance of this model in that it has been used to explain investment in capital equipment, the production of durable consumer goods (this is the ECI in this case) and investment in inventories and firms' investment behaviour. The firm's investment behaviour is the initial investment in the manufacturing of durable goods, and therefore the ripple effect in the aggregate fixed investment in the economy. This is so because it is acknowledged that it is mostly individual or private citizens who are manufacturers of most of these merchandise and exports thereof. The fundamental notion in adopting this model is that the demand for capital goods is a result of demand and that variations in the demand for output lead to changes in the demand for investment stock and, hence, lead to fixed investment (Durlauf & Blume, 2008). As such, ECI plays this critical measure of changes in the type of output in the aggregate economy in merchandise exports. Put more bluntly Shapiro (1986) in his investigation alludes to his modelling of investment, that it, the consequence of a firm's choice of the capital stock that maximises the present value of profits. Therefore, the choices made by economic agents such as firms may lead to the fixed investment level in economies. The following multivariate models are then stated as such:

$$FINV_{SSA} = f(ECI, INF, IMPI, IND, AGRICEX, UNEMR) \qquad (4.19)$$

$$FINV_{BRICS} = f(ECI, INF, FDI, IMPI, IND, UNEMR) \qquad (4.20)$$

- Where for both models (4.19 & 4.20), FINV is gross fixed capital formation denominated in dollar terms. Additionally, ECI, INF, IND, AGRICEX, UNEMR and IMPI are as defined above.
- In the BRICS model (4.20), FDI is Foreign direct investment, net inflows as a percentage of GDP.

The subsequent econometric model from the functions is identified as follows:

$$[LFINV_{itSSA} = ECI_{it} + INF_{it} + LIMPI_{it} + LIND_{it} + AGRICEX_{it} + LUNEMR_{it} + \mu_{it}] \quad (4.21)$$

$$[LFINV_{itBRICS} = ECI_{it} + INF_{it} + LIMPI_{it} + LIND_{it} + FDI_{it} + LUNEMR_{it} + \pi_{it}] \quad (4.22)$$

- In both models, LFINV is the log of gross fixed capital formation (formerly gross domestic fixed investment) like land improvements, plant and machinery, equipment purchases; and the construction of roads, railways, and the likes of commercial and industrial buildings. Additionally, all other predictors are as defined in the above models in subsection 4.2.2 and 4.2.3.

- In the BRICS model (4.22), FDI relates to foreign direct investment as the net inflows of investment to acquire a lasting management interest of more than 10% of voting stock in an enterprise operating in an economy other than that of the investor. It is the sum of equity capital, reinvestment of earnings, other long-term capital, and short-term capital as shown in the balance of payments

From the above adopted theoretical link and the subsequent model specification, the following hypothesis is developed in line with the study objective:

H_0*: Changes in economic complexity has no impact on the fixed investment for both the selected SSA and BRICS economies*

H_1*: Changes in economic complexity has impact on the fixed investment for both the selected SSA and BRICS economies*

4.3. DATA SOURCES

The study uses secondary yearly data spanning the period 1994 to 2018. Data for ECI was obtained from Massachusetts Institute of Technology (MIT) Atlas of Economic complexity observatory lab and data for all dependant variables (GDP per capita, Current account, and fixed investment) were obtained from the World Bank. Additionally, all the variables included in respective SSA and BRICA models were also sourced from World Bank. However, real effective exchange rate of Tanzania was sourced from Federal Reserve Bank of ST. Louis. The period is chosen on the bases of data availability across all the countries, especially with the economic complexity index (ECI). Some SSA countries start in 1994, and also one of the BRICS countries, Russia data was lacking. A common time span was from 1994 across all countries.

In this study, the following Sub-Saharan African countries were chosen due to the availability of data, the strength of economies in respect of GDP and the population size following the work of (Muhammad *et al*., 2010). The selected SSA countries are South Africa, Nigeria, Tanzania, Ghana and Cameroon. While BRICS is an acronym of countries who amalgamated for economic integration of Brazil, Russia, India, China and South Africa. South Africa is in both set of the group settings.

4.4. ECONOMETRIC TECHNIQUE

The study is set on a panel data platform in terms of investigating the initiated objectives, that is, a study across countries (N) over time (T). Panel is cited by many authors having powers over simple time series or cross-sectional in estimation. Hsiao (2005) submits that a panel data analysis may help to control omitted variables that vary over time though constant over time. Additionally, where time series and cross-sectional may suffer the degree of freedom, that is, lack of observation, panel data corrects such. It is for this reason that panel is explored with evidence of lack of updated data in the SSA region with regards to ECI. Also, where data is available for multiple countries for several years, panel allows controlling for omitted variables that differ between countries, but are constant over time (Jochem & Schleich, 2011). It is on this basis that a Panel Autoregressive Distributed Lag (PARDL) is deployed, especially in investigating the first study objectives. PARDL is favoured because “economic behaviour is inherently dynamic so most econometrically interesting relationship are explicitly or implicitly dynamic” (Hsiao, 2005).

For purposes of this study, especially that the models are multivariate, there need to be a descriptive statistics, an analysis of the variables involved. The descriptive are necessary to reflect on the nature of the inspected variables. Each variables will be run inspected for each group of economies, and reflect on the mean and the standard deviation.

4.4.1. Panel unit root tests

Contemporary works suggests that panel built stationarity tests have higher power than stationarity tests grounded on single time series. These are the five types of stationarity tests that are commonly used: Levin, Lin and Chu (LLC), (2002), Breitung (2000), Im, Pesaran and Shin (IPS) (2003), Fisher-type tests using ADF and PP tests (Maddala and Wu (1999) and Choi (2001) and Hadri (2000). While these tests are commonly termed "panel unit root tests, tests hypothetically, are simply multiple-series stationarity tests that have been applied to panel data constructions (where the presence of cross-sections generates "multiple series" out of a single series).

The first group, the LLC (2002), Hadri (2000) and Breitung (2000) assume a common unit root process, meaning that they assume homogenous autoregressive coefficients between the cross-sections. While the second group, the IPS (2003) and Fisher-type test using ADF and PP, the tests assume individual unit roots, and the assumption is that the first order autoregressive parameter varies with cross-sections. All the other tests test the null hypothesis of non-stationarity (or unit root) except Hadri (2000), which tests the null hypothesis of stationarity.

4.4.1.1. Levin, Lin and Chu (2002)

The Levin, Lin, Chu (2002) test is a technique meant to test for the properties in the variables understudy. The LLC unit root test pools the autoregressive coefficients across the cross-section units during the unit root test and thus restricts the first-order autoregressive parameters to be the same for all countries (Herzer & Vollmer, 2012). Possible correlation and heteroskedasticity is allowed by the LLC, though still supposing sustained individuality across cross-sections. The LLC has the null hypothesis that each individual time series contains a unit root, and the alternative hypothesis is that each time series is stationary. Stated below as:

H_0 = Each individual time series contains a unit root

H_A = Each time series is stationary

The LLC involves running a separate augmented Dickey-Fuller regression for each cross-section, and suggests a three step testing procedure as stated in the equation below (Barbieri, 2009):

$$\Delta x_{it} = z_{it}\gamma_i + \rho x_{it} + \sum_{j=1}^{k_i} \varphi_{ij}\Delta x_{it-j} + \epsilon_{it} \qquad for\ i = 1, 2, \ldots.. \qquad (4.23)$$

Where k_i denotes lag length while z_{it} represents the deterministic terms vector in addition to the individual trends, and γ_i corresponds to vector of coefficients. Equation (4.23) reveals that the LLC stationarity tests pools the autoregressive coefficients through the cross-section elements during the test and thus confines the 1st autoregressive constraints to be the same for all countries $\rho_i = \rho$. There are three steps performed in conducting the LLC-test statistics, which are:

Step one:

The first is to obtain the residuals, ϵ_{it}, from individual regressions of x_{it} on its lagged values (and on z_{it}).

Second step:

The x_{it-j} is regresses on the lagged value of x_{it} and on z_{it} to obtain the residuals of this regression v_{it} :

$$\Delta x_{it} = \sum_{j=1}^{k_i} \theta_{2ij} \Delta x_{it-j} + z_{it}\gamma_i + v_{it} \qquad (4.24)$$

Step three:

$\widehat{e_{it}}$ is regresses on:

$$\widehat{v_{it-1}}, \widehat{e_{it}} = \delta \widehat{v_{it-1}} + \beth_{it} \qquad (4.25)$$

The LCC estimation to unit root test could control for heterogeneity in the variances of the series. In its conventional t-statistics setting for autoregression coefficient p is said to have a standard normal limiting distribution if the underlying model does not include fixed effects and individual time trends (z_{it}). Levin *et al*. (2002) states the following limitation of the LLC test, that the test procedure assumes cross-sectional independence and thus may lead to spurious inferences if the errors, ϵ_{it}, are not independent across i.. While Baltagi (2008) states the following LCC limitations:

- It is dependent upon the independence assumption across cross-sections. This makes the test inapplicable in the presence of cross-sectional correlation.
- The assumption that all cross-sections are non-stationary is limiting.

To this effect, the second test, the IPS stationarity test may be employed to cover these shortcomings.

4.4.1.2. IM, Pesaran and Shin (IPS) (2003)

Given the disadvantage faced by the LCC above, Persaran (2007) proposes the IPS (2003) by Im, Pesaran and Shin. Its validity is based on the fact that the test augments the standard ADF regression with cross-section of lagged levels. Therefore, it allows cross-sectional dependency as its first-difference individual series (Herzer & Vollmer, 2012). This allows the augmented ADF to regress each country estimation separately, allowing different autoregressive parameters in every panel. The cross-sectional augmented ADF regression is stated as follows:

$$\Delta x_{it} = z_{it}\gamma_{it} + p_{it}x_{it} + \sum_{j=1}^{k_{it}} \varphi_{it}\Delta x_{it-1} + \alpha_i \hat{x}_{t-1} + \sum_{i=0}^{k_i} n_{ij}\Delta \hat{x}_{t-1} + v_{it} \quad (4.26)$$

Where cross-sectional mean x_t is x_{it} and $\hat{x}_t = N^{-1}\sum_{j=1}^{N} x_{it}$. The null hypothesis may be written as:

$$H_0: p_i = 0, for\ all\ i = 1, 2, \dots \dots N_1 \quad (4.27)$$

While the alternative hypothesis is given by:

$$H_1 \begin{cases} p_i = 0, & for\ all\ i = 1, 2, \dots \dots . N_1 \\ p_i < 0, & for\ all\ i = N+1, N+2, \dots \dots N \end{cases} \quad (4.28)$$

To test the null hypothesis against the alternative hypothesis, the cross-sectional IPS (CIPS) statistic is calculated as the average of the individual cross-sectional ADF statistics:

$$CIPS = N^{-1}\sum_{i=1}^{N_i} t_i \quad (4.29)$$

Where t_i is the Ordinary least square t-ratio of p_i in equation (4.29) regression. The IPS test statistic requires specification of the number of lags and the specification of the deterministic component for each cross-section ADF equation. On the choice of test equation specification, it is stated that one may choose to include individual constants, or to include individual constant and trend terms.

4.4.1.3. Breitung (2000) test

The distinction between the Breitung (2000) method and the LLC (2002) are in two-fold. First, only the autoregressive portion (and not the exogenous components) is removed when constructing the standardised proxies. Secondly, the proxies are transformed and detrended.

From the second distinction, it is then stated that:

$$\left.\begin{aligned}\Delta y_{it}^{*} &= \sqrt{\frac{(T-t)}{(T-t+1}}\left(\Delta y_{it} - \frac{\Delta y_{it}+\cdots.+\Delta y_{it}}{T-1}\right)\\ y_{it}^{*} &= y_{it} - y_{it}\frac{T-1}{T-1}\end{aligned}\right] \quad (4.30)$$

The persistence parameter α is estimated from the pooled proxy equation:

$$\Delta y_{it}^{*} = \alpha y_{it-1^{*}} + v_{it} \quad (4.31)$$

The Breitung method shows that in the null scenario, the resulting estimator α^{*} is asymptotically spread as a standard normal. The Breitung method requires only a specification of the number of lags used in each cross-section ADF regression, p_i , and the exogenous regressors. In contrast with the LLC unit root technique, the Breitung does not need the kernel computations.

4.4.1.4. Fisher-ADF and Fisher-PP [Maddala and Wu (1999) and Choi 2001)] Test

The fourth type of unit root testing is the ADF and the Phillips-Perron chi-square developed by Fisher (1932). These are alternative approaches validated by Maddala and Wu (1999) and Choi (2001). These approaches to panel stationarity testing use Fisher's (1932) results to develop tests that add the p-values from individual unit root tests. Under the notion of cross-sectional individuality, the statistic projected by Maddala and Wu (1999) is defined as:

$$P = -2\sum_{i=1}^{N} \log(p_{i)} \quad (4.32)$$

Equation (4.32) shows that asymptotically, the distribution is on the chi-square basis with 2N degree of where $T \rightarrow \infty\, and\, N$ is fixed. For both Fisher tests (ADF and PP-Fisher), the exogenous variable must be defined; alternatively possible not to include the exogenous variables or to include individual intercepts and/or trend terms (Chapsa *et al*., 2018).

However, for a large N sample, Choi (2001) offers a parallel standardised statistic:

$$Z = -\frac{\sum_{i=1}^{N} \log(p_i + N}{\sqrt{N}} \quad (4.33)$$

Under the cross-sectional independence assumption, Z→(0,1), under the unit root hypothesis. In using the Z test, we reject the null hypothesis when the Z test is smaller than a critical value from the lower tail of a standard normal distribution. In contrast, critical values for the P test are taken from the upper tail of the chi-square distribution. For both Fisher tests, you must specify the exogenous variables for the test equations. You may elect to include no exogenous regressors, to include individual constants (effects), or include individual constant and trend terms.

4.4.1.5. The Hadri (2000) Test of Stationarity

The Hadri (2000) unit root test contradicts the previous tests in that it is based on the null hypothesis of stationarity. Hadri proposes a residual-based Lagrange multiplier test for the null hypothesis that the individual series $y_{i,t} for\ i = 1,2, \dots \dots, N$ are stationary around a deterministic level or around a deterministic trend. The tests proposed are LM tests when we assume that the disturbance terms are normally distributed instead of being only $i.d.d.$.

$$LM_H = \frac{1}{N}(\sum_{i-1}^{N}(\frac{\sum_t s_i(t)^2/T^2)}{f_0}) \quad (4.34)$$

Where S_{it} symbolises the collective sums of the residuals and f_0 is the average of the individual estimators of the residual range at frequency zero. In summary of all the above stationarity test, Table 4.1 gives a brief description of similarities and differences of all the 5 tests.

Table 4.1: Unit Root Tests descriptive Summary

Test	Null	Alternative	Possible Deterministic Component	Autocorrelation Correction Method
Levin, Lin and Chu	Unit root	No Unit Root	None, F, T	Lags
Breitung	Unit root	No Unit Root	None, F, T	Lags
IPS	Unit Root	Some cross-sections without UR	F, T	Lags
Fisher-ADF	Unit Root	Some cross-sections without UR	None, F, T	Lags
Fisher-PP	Unit Root	Some cross-sections without UR	None, F, T	Kernel
Hadri	No Unit Root	Unit Root	F, T	Kernel

Source: E-views 9 (Online E-views help)

The next sub-section is the lag length criteria, its determination and its challenges.

4.4.2. Lag length Criteria

Prior to running the panel and subsequent short and long-run estimates, it is required that the lag length for respective models be estimated. Using the unrestricted model and an information criterion allows us to decide the choice of lags for each model. A delicate issue in econometrics analysis is in the choice of appropriate lag order specification to capture time responses in time series analysis (Han, Phillips & Sul, 2017). Schmidt (1971, 1973, 1974) and Schmidt and Sickles (1975) provide early works partly suggested various solutions. And recent works can be attributed to Gujarati (2003) and Gujarati and Porter (2009), who submit the following criteria as measures of lag length criteria:

- Akaike Selection Criterion (AIC) (Akaike, 1973) is often used if there are limited observations in a VAR estimation.
- Schwartz Information criterion (SIC) (Schwarz, 1978), which some researcher prefers when the variables are more than four, uses the AIC when the variables are less than four.

- Final Prediction Error (FPE) (Akaike, 1969), which is recommended for the estimation of autoregressive distribution lag length along with the AIC (Liew, 2004).
- Hannan-Quinn criterion (HQC) (Hannan and Quinn, 1979), which is found to outdo the rest in correctly identifying the true lag length when observations are higher than 120.

In brief, an autoregressive (AR) model process of lag length(p) alludes to a time series where the current value is reliant on its initial (p) lagged values and normally symbolised by AR(p). Therefore, the AR lag length (p) is always unidentified and thus has to be estimated through the above stated lag length selection criteria. The concern is that VAR and ARDL models are susceptible to arbitrary use of lags as this may erode the degrees of freedom, weaken the significance of the coefficients, may induce autocorrelation and weaken the strength of diagnostic tests (Liew, 2004). The issue of lag length criteria remains a contentious issue in research for economists and researchers alike. If (p) is erroneously stated, the problem of misspecification errors may be contended with (Gujarati, 2009). The easiest way out of this quagmire is to decide using a criterion like the Akaike or Schwarz, and to choose the model that gives the lowest values of these criteria. Most econometric packages easily compute these optimal lag lengths, but note that some trial and error is inevitable while taking cognisance of the highest allowed lag length. Hence, the automatic selection is utilised in some techniques for the adopted software package to detect the most suited lags.

4.4.3. Panel-Cointegration

Upon testing and establishing unit roots in the variables, the next step is testing for cointegration. The general tests used in panel cointegration are the Kao test, the Fisher (combined Johansen) test and Pedroni test. Pedroni and Kao tests are based on Engle-Granger (1987) two-step (residual-based) cointegration tests. The Fisher test is a combined Johansen test. Several additional issues are of potential importance. These include heterogeneity in the parameters of the cointegrating relationships; heterogeneity in the number of cointegrating relationships across countries; and the possibility of cointegration between the series from different countries (Verbeek, 2004).

4.4.3.1. Pedroni (2004) Panel Cointegration Test

The first cointegration test, and often used in Panel cointegration analysis is the Pedroni (2004) test, which a built-up from the Pedroni (1999) and based on the within-dimension and between-dimension ADF and PP test statistics. The tests' approximation technique is developed on the Engle and Granger's methodology. The estimations are based on, first for each cross-section, the dependent variable is regressed on the explanatory variables such that:

$$y_{it} = \sigma_{it} + \gamma_{it} + \beta x_{it} + \epsilon_{it} \quad (4.35)$$

Pedroni projected seven unique panel data cointegration statistics tests, which are:

- the v-statistic,
- the p-statistic,
- the pp-statistic,
- the ADF statistic (the latter three are called within-dimension statistics),
- the group rho-statistic,
- the group pp-statistic and
- the group ADF statistic (the latter three are also called between dimension statistics).

Where the first four are grounded on pooling basis, that is, the within dimension, and the last three are constructed on the between dimension. The two groups of tests focus on the null premise of no cointegration. The sample distribution, the finite distribution for the seven statistics was tabulated by Pedroni using the Monte Carlo simulations. Neagu (2019) states that the test statistics must be smaller than the tabulated critical value to reject the null hypothesis of the absence of cointegration. Additionally, the cointegration tests allow for heterogeneous intercepts and trend coefficients across cross-sections. This is observed through the following equation:

$$y_{it} = \alpha_i + \delta_{it} + \beta_{1i}x_{1it} + \beta_{2i}x_{2it} + \cdots \beta_{Mi}x_{Mit} + \epsilon_{it} \quad (4.36)$$

Where y are x are presumed to be incorporated of order one, meaning I(1), and the parameters α_i and δ_{it} individual and trend effects which may be set to zero if desired. Under the null hypothesis of no cointegration, the residuals ϵ_{it} will be I(1). The general approach is to obtain residuals from Equation (4.36) and then to test whether residuals are I(1) by running the auxiliary regression. The P-value should be observed to be less than 5% to reject the null hypothesis of no cointegration.

4.4.3.2. The Kao method (Kao, 1999)

The Kao method of cointegration test is established within the ADF, Dickey-Fuller (1981) test and is grounded on the Engle- Granger two-step procedure while assuming homogeneity on cross-sectional units (Menegaki, 2020). This Kao test type investigates the null hypothesis of no cointegration in panel data in the special case where cointegration vectors are homogeneous between individuals (different intercepts, common slopes) (Barbieri, 2008). Moreover, the long-run covariance matrix is assumed to be the same across individuals. These tests do not allow for heterogeneity under alternative hypothesis and they cannot be applied to a bivariate system. Hence, it is suitable for this study as it is a multivariate panel data modelling.

Kao goes on to reflect that it is possible to find a suitable normalisation of the projected parameter such that the asymptotic null spread of the ADF test statistic congregates to a standard normal one (Barbieri, 2008). With the starting tests points is the following model:

$$y_{it} = \alpha_{it} + \beta x_{it} + e_{it}, i = 1, \dots., N, t = 1, \dots.., T \quad (4.37)$$

$$y_{it} = y_{it-1} + u_{it} \quad (4.38)$$

$$x_{it} = x_{it-1} + e_{it} \quad (4.39)$$

The long run covariance is estimated using the usual kernel estimator.

4.4.3.3. Johansen-Fisher Panel cointegration test

Maddala and Wu (1999), with the assistance of Fisher (1932), adjusted the Johansen (1988), a time series cointegration to test for panel data.

$$\Delta y_{it} = ב_i y_{it-1} \sum_{j=1}^{k} א_{ij} \Delta\, y_{it-j} + \varphi_i z_{it} + \varepsilon_{it} \quad (4.40)$$

In equation (6.20) y_{it} is a $p \times 1$ vector of endogenous variable; p is the number of variables and $ב_i$ represents the long-run $p \times p$ matrix. If $1 < rank\ (ב_i) < p$, the matrix can be inscribed as $\alpha_i \beta_i$, where β_i is a $p \times 1$ matrix that yields the amount of each cointegration vector entering the error correction model.

The Johansen-Fisher test statistic is calculated on the Maddala and Wu (1999) IPS stationarity test:

$$P = -2\sum_{i=1}^{N} \ln(p_i) \rightarrow X_{2N}^{2} \quad (4.41)$$

The only deviation is that the equation is summed over the p-values of the cross- sectional trace or maximum eigenvalue cointegration tests. The variance amongst those two tests is the hypothesis formulation:

- The trace test is a one-sided test with an alternate of more than r cointegrating vectors.
- Maximum eigenvalue accomplishes separate tests on each eigenvalue with an alternative hypothesis of exactly r + 1 cointegration vectors.

The advantage of these tests is that they do not specify the cointegrating vectors. Instead, they search for how many stationary combinations can be made with the set of variables. Consequently, if it is concluded that there are one or two cointegrating vectors, there is still the problem of deciding which ones are they. However, this problem is addressed through the Pedroni test explained above through the different dimensions stated, within-dimension and between-dimension ADF and PP test statistics.

4.4.4. Panel Auto Regressive Distributive Lag (PARDL)

The first three study objectives are explored through panel ARDL, the long and short-run relationship among macroeconomic indicators and economic complexity. The ARDL models are standard least squares that incorporate lags of both independent and depended variables as regressor (Pesaran & Pesaran, 1997). The ARDL approach was developed by Pesaran, Shin and Smith (2001), for testing the presence of cointegration between the variables possesses more advantages over other econometric techniques. Firstly, the ARDL method can be applied on variables integrating at different orders, that is, I (0) and order I (1), but not order I (2). Secondly, ARDL captures the long run and short run estimates simultaneously. Thirdly, the approach is applicable on small number of observations. Fourthly, the approach can accommodate the structural breaks in time series data (Pesaran *et al*., 2001). Despite the advantages of ARDL over other symmetric cointegration techniques outlined above, the model is employed because variables employed in the study integrate at different orders, and the method is applicable to small sample size time series.

One point to note, in advocating for the use of the ARDL system in a panel sets with individual properties, standard regression estimation of ARDL model is that it is said to be problematical due to bias caused by correlation between the mean differenced regression and error term (Pesaran *et al*. 2001). Nonetheless, the biasness of the technique fades with large number of observations T, and cannot be corrected by increasing the number of cross-section, N. To address the difficulty of small T and large N the General Methods of Moments (GMM) was developed. Though, in large T, the GMM are mostly unsuitable and regularly the estimator breaks down. To this effect, an alternative, in this study is the Pooled Mean Group (PMG) estimator of (Pesaran, Shin and Smith, 1999). The PMG model adopts the cointegration form of the simple ARDL system which adapts for a panel scenery by allowing the intercepts, short run estimates and cointegration to vary across the cross-section

In testing the long and short-run estimates, the first study objective, the respective SSA and BRICS models are based on the following generalised ARDL model specified as such:

$$y_{it} = \sum_{j=1}^{p} \delta_i \, y_{i,t-j} + \sum_{j=0}^{q} \beta_{ij} \, X_{i,t-j} + \varphi_i + \varepsilon_{ij} \qquad (4.42)$$

Where y_{it} is the dependent variable, and (X_{it}) is the $k \times 1$ vector that is allowed purely to be I(0) or I(1) or cointegrated, δ_i is the coefficient of the lagged dependent variable called scalar, β_{ij} are the $k \times 1$ coefficient vectors, φ_i is the unit-specified fixed effect, while $i = 1, \ldots. N; t = 1,2, \ldots. T; p \; and \; q$ are optimal lag orders for the dependent and independent variables, respectively, and lastly ε_{ij} is the error term.

However, the most significant representation is the Error Correction Term or model (ECT), which is the re-parameterised ARDL, and incorporates a differenced operator for the dependent variable stated as:

$$y_{it} = \theta_i [y_{i,t-1} - \tau_i X_{i,j-1}] + \sum_{j=1}^{p-1} \omega_{ij} \Delta \, y_{i,t-j} + \sum_{j=0}^{q-1} \beta_{ij} \, \Delta X_{i,t-j} + \varphi_i + \varepsilon_{ij} \qquad (4.43)$$

Where θ_i represents the speed of adjustment for the group which is supposed to be negative and significant for any model to be acceptable, τ_i is the vector of long-run relationship, the ECT is represented by all the estimates in parenthesis, $[y_{i,t-1} - \tau_i X_{i,j-1}]$, and lastly the short-run dynamic coefficients are represented by $\omega_{ij}\ and\ \beta_{ij}$.

One of the stated advantages of panel is that it is able to control the impact of omitted variables (Hsiao, 2005). To this effect, the study PARDL model has also gone to the end in addressing this by having six regressors in each of the SSA and BRICS models. This limits the repercussions of the 'presence' of missing or unobserved variables in the respective models.

4.4.5. Diagnostic Tests

As already mentioned above, that working with panel presents some advantages, and running diagnostic tests is seen as an optional undertaking rather than the norm. For instance, it was alluded to the fact that the pooling of data reduces the presence of heteroskedasticity. Nonetheless, the study utilises two sets of diagnostic tests to test for residual or normality tests, and stability tests as the bare minimum, especially with the use of VAR executed in the study.

4.4.5.1. Residual Normality Test

With Normality tests, the histogram and descriptive statistics of the residuals, including the Jarque-Bera statistic for testing normality is observed. The task is to see if the residuals are normally distributed, therefore the histogram must be bell-shaped and the Jarque-Bera statistic should not be significant (Kao and Chiang, 2001). To this effect, the p value should be greater 5%. The Jarque-Bera statistic has a distribution with two degrees of freedom under the null hypothesis of normally distributed errors.

4.4.5.2. Stability test

Lütkepohl (1991) reports on the inverse roots of the characteristic AR polynomial to prove that the equations are stable. This is meant to echo that the estimated VAR is stable or stationary if and only if all roots have modulus lie inside a unit circle. If the VAR is not stable, then procedures like the impulse response function cannot be trusted as the standard errors are not valid.

4.4.6. Panel Causality Test

The second part in addressing the study objectives is the causality of the variables concerned. This is meant to test for any immediate or short-run causal effect between economic complexity and the macroeconomic variables. This based on the least square scenario or settings, where the least squares regressions may take a number of different forms, depending upon assumptions made about the structure of the panel data (Ramanathan, Engle, Granger, Vahid-Araghi, Brace, 1997). Granger Causality is computed by running bivariate regressions. There are a number of different approaches to testing for Granger Causality in a panel context. The study adopted the multivariate regressions in a panel data, which take the following form:

$$y_{it} = \alpha_{0,i} + \alpha_{1,i} + y_{i,t-1} + \cdots + \alpha_{1,i} y_{i,t-1} + \cdots + \beta_{1,i} x i,_{t-1} + \epsilon_{\epsilon it} \quad (4.44)$$

$$x_{i,t} = \alpha_{0,i} + \alpha_{1,i} x_{i,t-1} + \cdots + \alpha_{l,i} x_{i,t-1} + \beta_{1,i} y_{i,t-1} + \cdots + \beta_{1,i} y_{i,t-1} + \epsilon_{it} \quad (4.45)$$

The study adopts the assumption that the panel data as one large stacked set of data performs the Granger Causality. This is the standard procedure. This is on the exception of not letting data from one cross-section enter the lagged values of data from the next cross-section (Tervo, 2009). Therefore, this method assumes that all coefficients are the same across all cross-sections.

$$\alpha_{0,i} = \alpha_{0j} \alpha_{1,i} += \alpha_{1,i} = \alpha_{l,i} \beth_{ij} \quad (4.46)$$

$$\beta_{1,i} = \beta_{1,j} \ldots . \beta_{l,i} = \beta_{li} \beta_{1j} \beth_{i,j} \quad (4.47)$$

Then from the above equations, there are four possible directions of causality:

- Unidirectional causality: this form of causality implies that causality from the independent to the dependent variable is statistically significant.
- Unidirectional causality from the dependent to the independent variable is statistically significant.
- Feedback or bi-directional causality arises if both the independent and dependent set coefficients are statistically significant in both equations.
- Neutrality: this is when both sets of independent and dependent coefficients are statistically insignificant.

Sahu, Bandopadhyay and Mondal (2014) submit that notwithstanding the importance of conducting causality tests, the empirical inferences based on the causality test do not determine the power of the causal relationships between the variables nor do they define the relationship between these variables over time. For the purpose of causal strength, the impulse response function and variance decomposition are utilised while forecasting, as described in detail in the subsequent section.

4.4.7. Impulse Response Function and Variance Decomposition.

This segment offers the two complementary techniques that test and seek to answer the third study objective, to forecast the shock effect from the regressors to the macroeconomic indicators. The work followed the ideals of Menegaki (2020) in that it was viewed that the two techniques were viewed as complements rather than as substitute as indicated by Shan (2005) and Kyophilavong, Shahbaz, Anwar and Masood 2015). These techniques are used because many authors agree that they are better used when dealing with macroeconomic variables (Shan, 2005; L€utkepohl, 2010; Kyophilavong *et al*., 2015; Menegaki, 2020). The techniques are now interrogated individually.

4.4.5.1 Variance Decomposition

The three macroeconomic variables are studied from the perspective what would happen if there was a shock emanating from the ECI and the other predictors. By utilising the variance decomposition, the variance of the predicted Y (between Y and X relationship) is the summation of its projected value plus the variance of its anticipated value, that is, the sum of the probable variation due to the predictors (X) plus the unsolved variation with origin different from predictors (Menegaki, 2020). This technique, the decomposition of variance, is applied when handling a dynamic stochastic system model.

The term variance decomposition actually implies variance decomposition of forecast errors and is used in macroeconomics more scarcely to pronounce as an interpretation mechanism on the relationship relating to vector autoregressive (VAR) models (L€utkepohl, 2010). In the context of VAR model, all variables are endogenous and the variance decomposition technique throws light to the fundamental relationships in the variables and does that directly from the coefficient matrices (Menegaki, 2020). Therefore, it is on this basis that the study explores how ECI and all predictors contribute to the knowledge of how much of the forecast error variance for each can be explained by exogenous shock to the other variables. In this case, according to the objective, how much of the shock may help explain the reaction in GDP per capita, current account and Fixed investment. Given that the study has quite several models across the SSA and BRICS economies, the following economic model template is utilised to reflect how the analysis is applied. Consequently, we have the following three variable models:

$$lny_t = a_1 + \sum_{i=1}^{k} a_{1i}\, lny_{t-1} + \sum_{i=1}^{k} b_{1i} ln\, x_{t-1} + \sum_{i=1}^{k} d_{1i} ln\, z_{t-1} + e_{1t} \quad (4.48)$$

$$lnx_t = a_1 + \sum_{i=1}^{k} a_{2i}\, lnx_{t-1} + \sum_{i=1}^{k} b_{2i} ln\, y_{t-1} + \sum_{i=1}^{k} d_{2i} ln\, z_{t-1} + e_{2t} \quad (4.49)$$

$$lnz_t = a_3 + \sum_{i=1}^{k} a_{1i}\, lnz_{t-i} + \sum_{i=1}^{k} b_{3i} ln\, y_{t-i} + \sum_{i=1}^{k} d_{3i} ln\, z_{t-1} + e_{3t} \quad (4.50)$$

Shan (2005) emphasises that the variance decomposition method reveals the exact amount of feedback in a variable due to innovative shocks in another variable over various time horizons. While Kyophilavong *et al*. (2015) reflect that the one advantage of this method is that it is not sensitive to the orderings of the variables. Additionally, the variance decomposition builds and addresses one fundamental problem associated with the previous method of Granger causality in that it shows the relative strength of causality and does not provide any information about the time period, nor does it capture the exact causal effect of one variable to or from the other.

4.4.5.2. Impulse Response Function

The Impulse Response Function (IRF) is a function that defines a shock to the VAR structure. It answers what the response of the macroeconomic variables (the predicted variables) to a shock is, and this dependent variable is an endogenous variable (Menegaki, 2020). The IRF, through the standard deviation of the error term, applies a unit shock on the VAR structure. The utmost significance of the IRF is that it emphasises the effects on current and forthcoming values of the predicted variable of one standard deviation shock to one of the innovations. Therefore, the GDP per capita, current account and fixed investment current outcomes are predicted on the basis of a one standard deviation shock to one innovator, the ECI, and the additional innovators. This is of course described on the evolution in a given or specified time horizon from the base year.

With the IRF calculation, it is imperative to command or order the variables, for instance, with the Cholesky degree of freedom. This can be useful to both the VAR (unrestricted VAR and the restricted VAR) (Marques, Fuinhas and Menegaki, 2014). When employing the IRF, the following are of importance in answering the third objective of the study (Menegaki, 2020):

- It is vital to remark what happens after the shock.
- Does the dependent variable remain constant for some period?
- Does it constantly have a positive reaction?
- Does this reaction ever become adverse or negative?
- Is the reaction symmetric or asymmetric?
- The reactions need to be intuitively precise or to be consistent with economic theory and a priori expectations.

As such, the IRF is often carried out with the aid of graphical presentation to detect through the trend line in answering the above stated questions and directives, where it is either a positive or negative shock.

4.5. CONCLUSION

This chapter brought forth the theoretical adoption in the three models of GDP per capita, current account and fixed investment with economic complexity across the two sets of economies. On the GDP per capita and complexity nexus, the endogenous growth model was adopted because it imbeds in it the idea of technology as a factor input in improving economic growth, while on the current account and complexity nexus, the technological gap trade theory was adopted as it also infers technological progress as a catalyst for a much-improved trade outlook hence the current account. Lastly, on the fixed investment complexity nexus, the accelerator investment theory was adopted. This theory was assumed on the basis that optimal output related to technological progress may envisage a direct link to a surge in fixed investment.

This therefore, through the set study objective and the chosen theories bring forth certain level of originality and contribute to knowledge. The chosen index, economic complexity, brings a new measure of development and in this regard, the prominence of and amount of trust on the notion of comparative advantage has increased. Measuring this index against the selected macroeconomic indicators across the two set groups (selected SSA and BRICS) suggest new learnings that will aid the development of a fresh policy perspective. The significance of competing through RCA based on the ECI is highly supported and is becoming the order of the day (Beyene, 2015). Furthermore, Trade's (GATT) is the promotion of free trade in the world that discourages trade restrictions of various forms. With the addition of the AfCFTA, this study becomes more relevant at it seeks to inform public policy decision makers on the type exports. This is done through a diverse econometric techniques to underpin new learnings and insights.

The next part was to outline the econometric technique to be utilised for purposes of answering the set study questions through the set objectives. PARDL was adopted to answer the first part of the objective, which is a long-run and short-run determination. However, unit root tests are a prerequisite in an econometric modelling setting, panel cointegration tests follow while determining the lag length criteria prio; nonetheless some authors acknowledge the trial and error in running the likes of panel cointegration tests is common. Five unit root tests were explained. However, not all may be run, but part of them for practicality purposes given the number of variables in the study; but enough to conclude the results with certainty. With regards to the cointegration tests, all tests, the Pedroni, the Kao, and the Johanse-Fisher cointegration tests are all utilised.

The second part of the objective, the causality tests are run through the standard panel causality tests. Lastly, the variance decomposition and the impulse response function are carried out to forecast the models. Although working with panel has some stated advantages like not violating heteroskedasticity, nonetheless, some diagnostic tests were adopted given that some methods are run through VAR.

CHAPTER 5

RESULTS, DISCUSSION AND INTERPRETATION OF FINDINGS

5.1. INTRODUCTION

This chapter is presented to give an exhibition of results of each individual technique in order of procedure as presented in chapter 4, to respond to the analysis of the relationship between economic complexity on some selected macroeconomic variables (economic growth per capita, current account, fixed investment) in selected SSA and BRICS. E-views 9 software was used to test all the estimations.

5.2. STUDY RESULTS

The first three objectives that require econometrics estimation are unpacked as such. Upon unit root and the cointegration, PARDL is used to estimate the short-run and long-run estimation, and Granger causality and forecasting upon running the diagnostic tests. Descriptive statistics will follow first, then the rest of the tests will be unpacked as described in chapter 4. Thereafter, there will be reflection on the comparative analysis in terms of objective four, and lastly the PCI analysis of both the selected SSA and BRICS will follow.

5.2.1. Descriptive Analysis

The descriptive analysis is unpacked in the order followed in the model specification in chapter 4, starting with the GDP per capita model, the current account model and lastly the fixed investment model.

5.2.1.1. GDP per capita Descriptive Analysis

Table 5.1 shows both economies, SSA and BRICS nations. The analysis reflects on both groups to show how unique their economies are. The yearly GDP per capita changes are unique across the two groups with an average (mean) change of 2.11% for SSA and a 3.68% in BRICS. This reflect that the GDP per capita for BRICS improves at a faster rate than the selected selected SSA. The standard deviation for selected SSA stands at 2.365 and 4.178 for BRICS. But the slight variation is expected as GDP per capita is expressed in percentage change as opposed to real monetary GDP per capita values. Nonetheless, it is concluded that there is a greater variation in the BRICS economies than the selected SSA with respect to GDP per capita change.

Table 5. 2: Descriptive statistics for selected SSA and BRICS (GDPPC Models)

Panel A: SSA							
Statistical Tests	**GDPpc**	**ECI**	**INF**	**IMPI**	**REER**	**HHE**	**GOVEX**
Mean	2.116479	-1.136619	12.62298	286.6680	99.97627	1.52E+11	1.46E+10
Median	1.873828	-1.216820	8.418683	249.3804	98.03009	6.76E+10	3.56E+09
Maximum	12.45747	0.284770	80.75458	793.6536	275.2927	8.21E+11	8.27E+10
Minimum	-4.232816	-2.764250	-1.119766	64.13671	64.66765	8.01E+09	4.65E+08
Std. Dev.	2.365558	0.751240	13.73607	196.9300	28.16128	1.91E+11	2.17E+10
Observa-tions	125	125	125	125	125	125	125
Panel B: BRICS							
Statistical Tests	**GDPpc**	**ECI**	**INF**	**IMPI**	**IND**	**HHE (%GDP)**	**EMPL**
Mean	3.685504	0.341492	31.00486	332.7251	31.14123	5.174354	55.61004
Median	3.982017	0.266418	7.431225	265.0769	29.21911	5.470858	56.38800
Maximum	13.63582	1.163790	2302.841	998.5153	47.55857	15.46467	76.59800
Minimum	-12.53979	-0.304549	-1.268410	51.36254	18.12915	-9.326956	36.71100
Std. Dev.	4.178092	0.279746	207.2090	264.5855	7.963890	4.300405	10.40994
Observa-tions	125	125	125	125	125	125	125

Source: Author's computation

Economic complexity also reflects the disparities between the two groups with SSA ECI mean in the negatives at -1.033 and BRICS at 0.341, a better positive state. This difference show that the BRICS economies are deleloped with an index above zero, while negative ECI's for selected SSA reveal that they are less developed. This then tells us that the two group of economies have a varied developmental state according to the ECI. At any given time within the studied period, the highest ECI index was 0.28 and the lowest was – 2.76 in the selected SSA. While for BRICS, the highest ECI index was 1.66 and the lowest was – 0.30. The MIT Atlas (2018) places South Africa as the highest positioned country among the selected SSA and Nigeria was the worst positioned, while China was leading in the BRICS economies.

The rest of the variables are explained accordingly with respect to the standard deviation. The inflation rate (as measured as measured in GDP deflator) is observed to be more varied in the BRICS economies than in the selected SSA at 207.20 and 13.73 respectively. Indeed BRICS had more inflation rates with the highest rate at 2302.84% as compared to 80.75% for the selected SSA. The imports index standard deviation reflects a higher deviation in BRICS at 264.58 and 196.93 for selected SSA. This shows that prices were rising at a higher rate in the BRICS economies. The highest imports index was at 998.51 in BRICS and 793.65 in the selected SSA.

The rest of the three remaining macrovariables are reported for each model. Where, REER, HHE and GOVEX had a standard deviation of 28.16128, 1.91E+11 and 2.17E+10 respectively in the selected SSA model. While in the BRICS model IND, HHE (%GDP) and EMPL were at 7.96, 4.30 and 10.40 repectively.

5.2.1.2. Current Account Descriptive Analysis

Secondly, Table 5.2 shows the descriptive analysis from the current account model. With ECI already explained, only the current account is examined. The mean difference is visible across SSA and BRICS with 1.50 and 4.10 to the 11th exponential, which shows that the BRICS nations had more receivables than the SSA in the current account. Additionally, the highest current account receivables in the BRICS is twice as much from the selected SSA at 2.89E+12 compared to 1.10E+12. The standard deviations also reflect the difference in the two groups, with the BRICS standard deviation at 6.36E+11 compared to 2.95E+11 for SSA.

On the AGRICEX, this is agricultural exports as a share of GDP, and the descriptive analysis show that the selected SSA has a hogher AGRICEX share than BRICS with a mean of 7.53% and 2.45% respectively. The standard deviation in BRICS at 1.29 shows that the deviation from the mean is small, while in the selected SSA is 8.04 and as such for any given country some may have even greater AGRICEX as a share of GDP. The selected SSA have a reliance of AGRICEX than BRICS. SAV and UNEMR, and also GOVEX_ and EMPL only appear in respective models of selected SSA and BRICS. Without reflecting on the comparative stunts, their standard deviation across all other variables are varying as such the variables are varied.

Table 5.2: Descriptive Analysis for selected SSA and BRICS (Current Account Models)

Panel A: SSA							
	CA	ECI	AGRICEX	INF	IMPI	SAV	UNEMR
Mean	1.50E+11	-1.136619	7.537146	12.62298	286.6680	4.64E+12	9.369944
Median	8.67E+09	-1.216820	4.356374	8.418683	249.3804	1.16E+12	4.562000
Maximum	1.10E+12	0.284770	31.55502	80.75458	793.6536	3.63E+13	33.47300
Minimum	9.69E+08	-2.764250	0.005946	-1.119766	64.13671	99312280	1.990000
Std. Dev.	2.95E+11	0.751240	8.047700	13.73607	196.9300	7.73E+12	9.556295
Observations	125	125	125	125	125	125	125
Panel B: BRICS							
	CA	ECI	AGRICEX	INF	IMPI	GOVEX___	EMPL

Mean	4.10E+11	0.341492	2.457488	31.00486	332.7251	16.33547	55.61004
Median	1.59E+11	0.266418	2.250526	7.431225	265.0769	17.83058	56.38800
Maximum	2.89E+12	1.163790	5.254768	2302.841	998.5153	21.28224	76.59800
Minimum	3.10E+10	-0.304549	0.417099	-1.268410	51.36254	9.802470	36.71100
Std. Dev.	6.36E+11	0.279746	1.296783	207.2090	264.5855	3.506506	10.40994
Observa-tions	125	125	125	125	125	125	125

Source: Author's computation

5.2.1.3. Fixed Investment Descriptive Analysis

Lastly, Table 5.3 shows the fixed investment model for the two economies. The distinction is clear that on average, BRICS countries had more investment spending compared to SSA countries. BRICS mean stands at 5.83E+11 which is exponential than the 22.93405 for SSA. The highest investment stood at 5.95E+12 compared to 42.06784 for SSA. The explanatory variables do not violate the standard deviation principle of similarity. In the BRICS formation FDI as a share of GDP had a mean of 2.25% and the highest share was 5.98%. With a deviation of 1.42 the countries share was not that varied. The UMEMR in the two groups were similar with mild difference. The mean was at 9.36% and 10.82% for selected SSA and BRICS respectively. The maximum UNEMR was 33.47% in both models, which was from the common country South Africa. The deviation is as such 9.55 and 8.92 for selected SSA and BRICS respectively.

Table 5.3: Descriptive Analysis for Selected SSA and BRICS (Fixed Investment Models)

Panel A: Selected SSA							
	FINV	ECI	INF	IMPI	IND	AGRICEX	UNEMR
Mean	22.93405	-1.136556	12.62298	286.6680	25.90190	7.537146	9.369944
Median	21.51154	-1.216820	8.418683	249.3804	26.13797	4.356374	4.562000
Maximum	42.06784	0.284770	80.75458	793.6536	37.44548	31.55502	33.47300
Minimum	11.76409	-2.764250	-1.119766	64.13671	13.00126	0.005946	1.990000
Std. Dev.	6.569124	0.751360	13.73607	196.9300	4.293484	8.047700	9.556295
Observa-tions	125	125	125	125	125	125	125
Panel B: BRICS							
	FINV	ECI	INF	FDI	IMPI	IND	UNEMR
Mean	5.83E+11	0.341492	31.00486	2.250570	332.7251	31.14123	10.82996
Median	2.18E+11	0.266418	7.431225	2.029804	265.0769	29.21911	6.661000
Maximum	5.95E+12	1.163790	2302.841	5.987156	998.5153	47.55857	33.47300
Minimum	1.75E+10	-0.304549	-1.268410	0.174541	51.36254	18.12915	2.897000
Std. Dev.	1.13E+12	0.279746	207.2090	1.426539	264.5855	7.963890	8.921686
Observa-tions	125	125	125	125	125	125	125

Source: Author's computation

The next step will be to disseminate all the variables behaviour, and relate the pattern thereof.

5.2.2. Panel Unit Root Tests

Panel units or stationarity tests are carried out in two forms, the informal graphical tests and the formal econometric tests.

5.2.2.1. Selected SSA Informal unit root tests

Below is the informal analysis of all the variables in the study. The selected SSA variables are stated first followed by the BRICS variables. Figure 5.1 reflects the percentage change in GDP per capita, and was only run at default, the raw data, as it suggests that it may be stationary at level. This is so because the trend line seems to be hovering along the mean of zero, with minor periodic deviations from the mean. This was expected when working with percentage change.

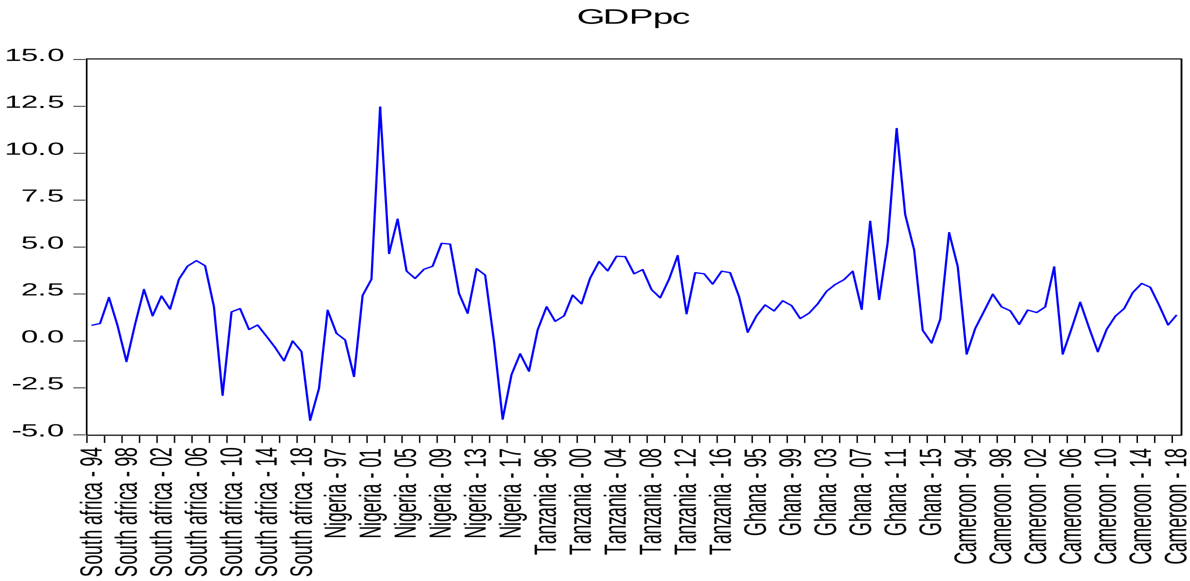


Figure 5.1. Selected SSA GDP per capita yearly percentage change (1994 – 2018)
Source: Authors' computation

Figure 5.2 is the log of fixed investment and panel (a) diagram reflects that the variable has no unit root, which is at level. However, upon the first difference, the trendline hovers around the mean of zero. LFINV is therefore seen to be stationery at first level [I(1)].

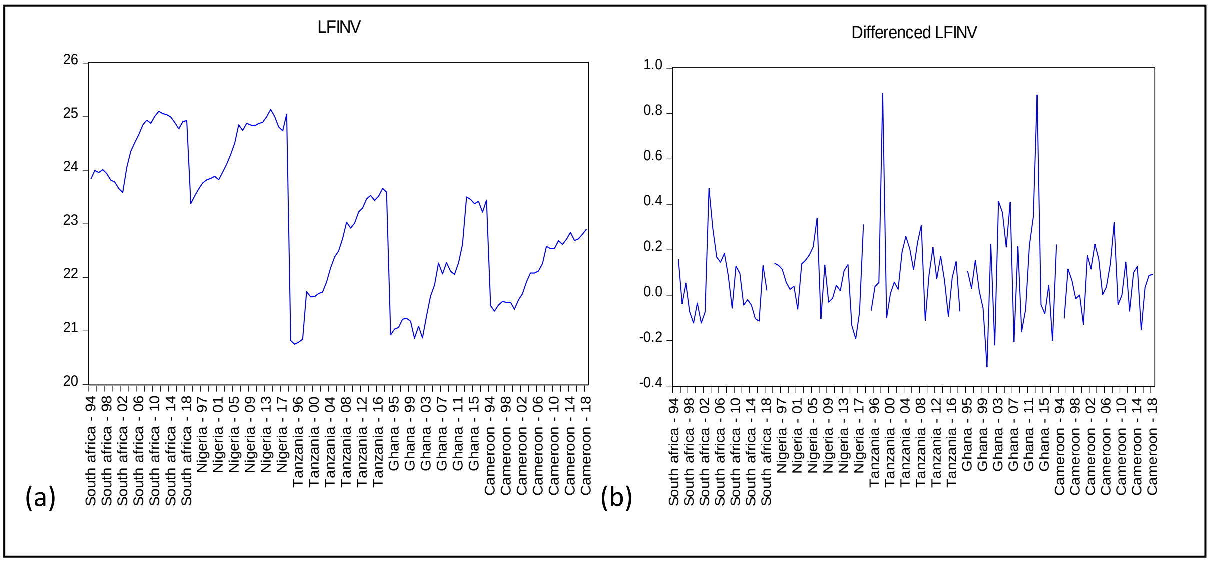


Figure 5.2: Selected SSA Log of Fixed Investment (1994 – 2018)

Source: Authors' computation

Figure 5.3 is the log of current account, panel (a) diagram clearly shows that the variable has no unit root, which is at level. But, upon the first difference, the trend line hovers around the mean of zero. LCA is therefore seen to be stationery at first level [I(1)].

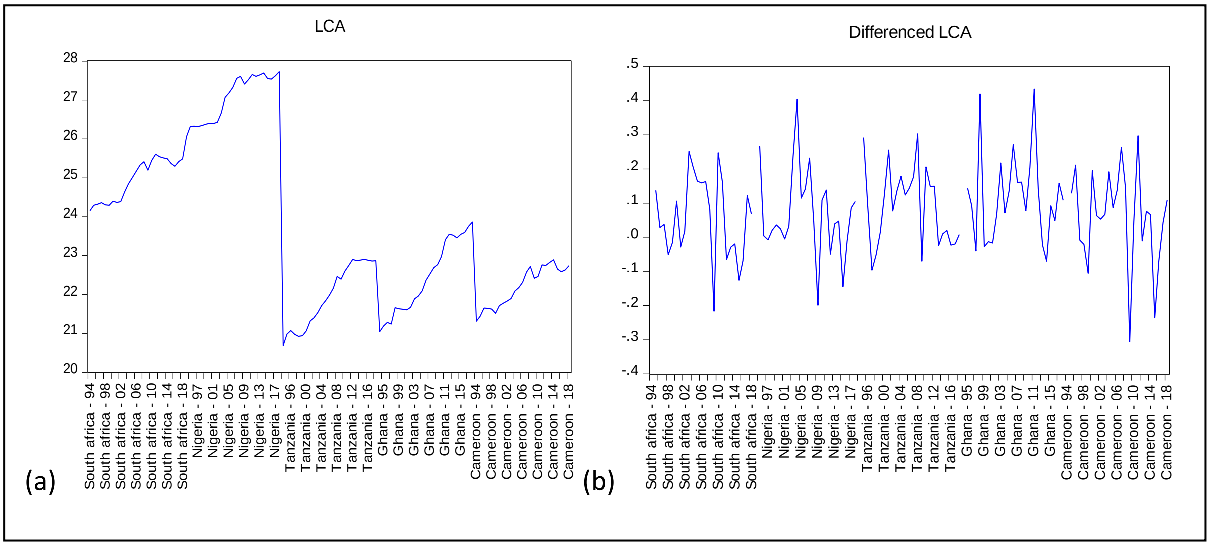


Figure 5.3: Selected SSA Log of Current Account (1994 – 2018)

Source: Authors' computation

Figure 5.4a and 5.4b reflects the ECI trend analysis at level and first difference, respectively. At level the data is unstructured with no clear pattern. However, at first difference, ECI is seen to be hovering along the mean of zero. This suggests that ECI may be stationary at first difference.

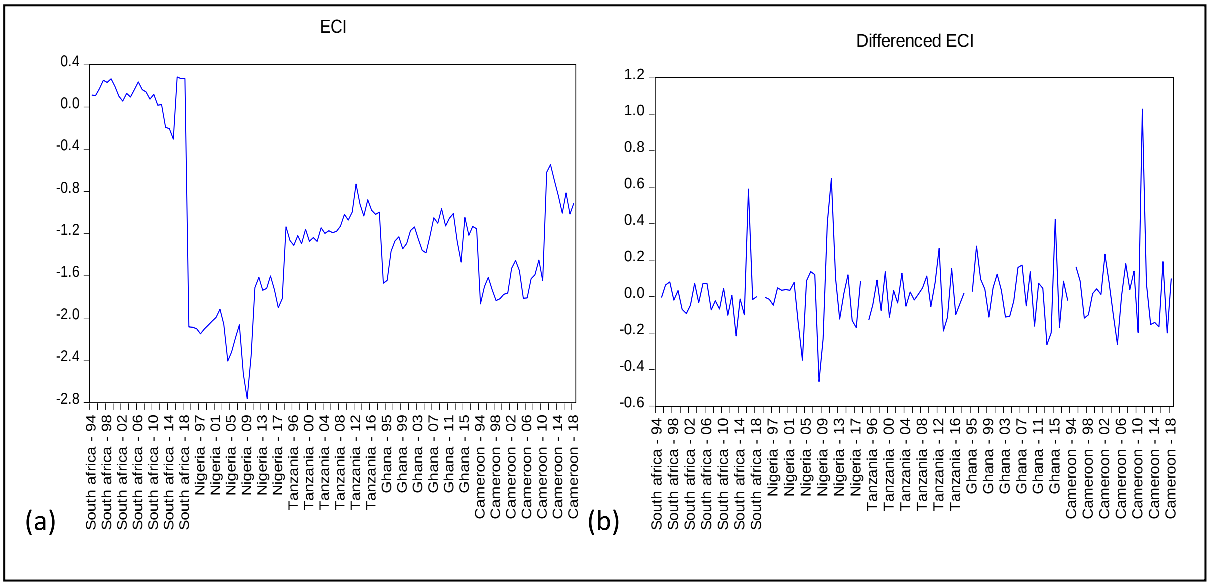


Figure 5.4: Selected SSA Economic Complexity Index (1994 – 2018)

Source: Authors' computation

Figure 5.5 is the real effective exchange rate that shows that it is stationery at I(1) with diagram (a) and (b) reflecting the trend status at level and first difference, respectively. At level the data is unstructured with no clear pattern. However, at first difference, the variable is seen to be hovering along the mean of zero. This suggests that REER is stationary at first difference.

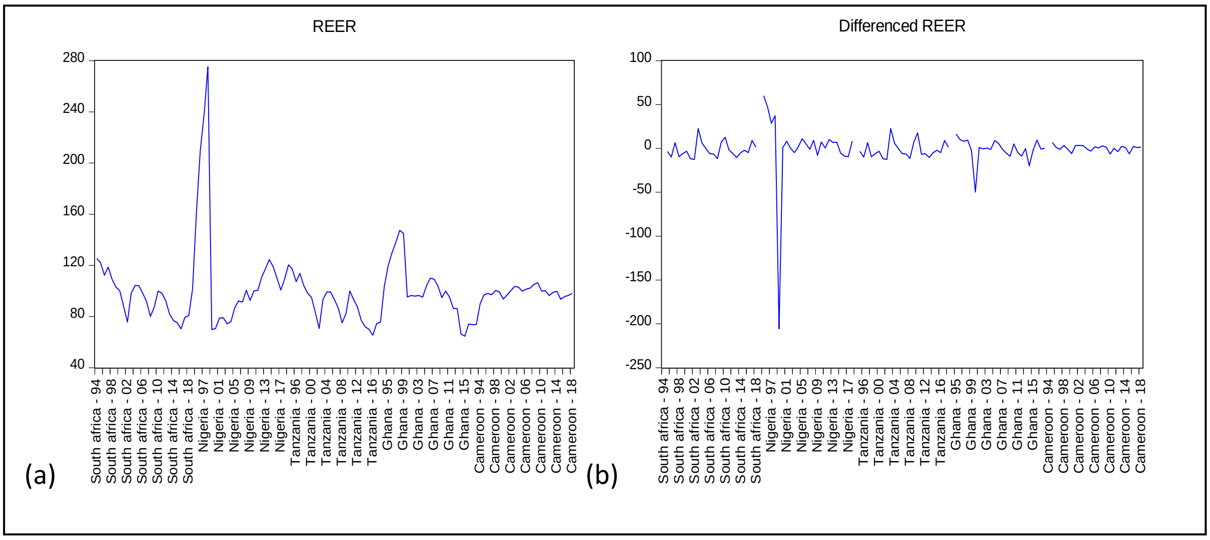


Figure 5.5: SSA Real Effective Exchange Rate (1994 – 2018)
Source: Authors' computation.

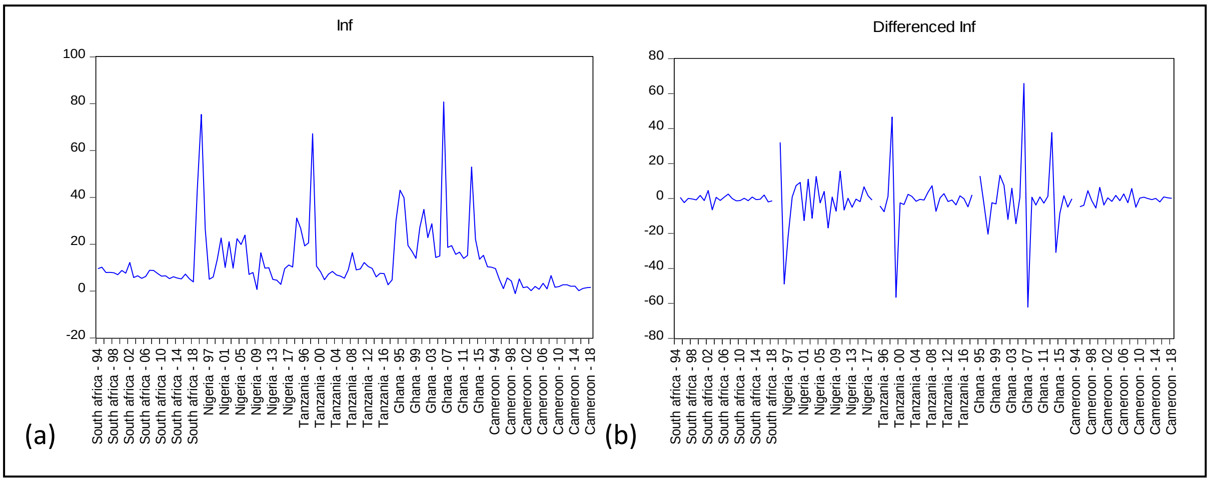


Figure 5.6: Selected SSA Inflation deflator rate (1994 – 2018)
Source: Authors' computation.

Figure 5.6 is the inflation deflator, panel (a), which is at level shows a trend line which is hovering above the mean zero and the trend spikes in the upper positives. It was then necessary to test the variable at first difference, that is, panel (b), which is clearly defined to be hovering on the mean of zero. This suggests that inflation may be stationary at first difference. The formal test will be necessary to have conclusive stands of stationarity.

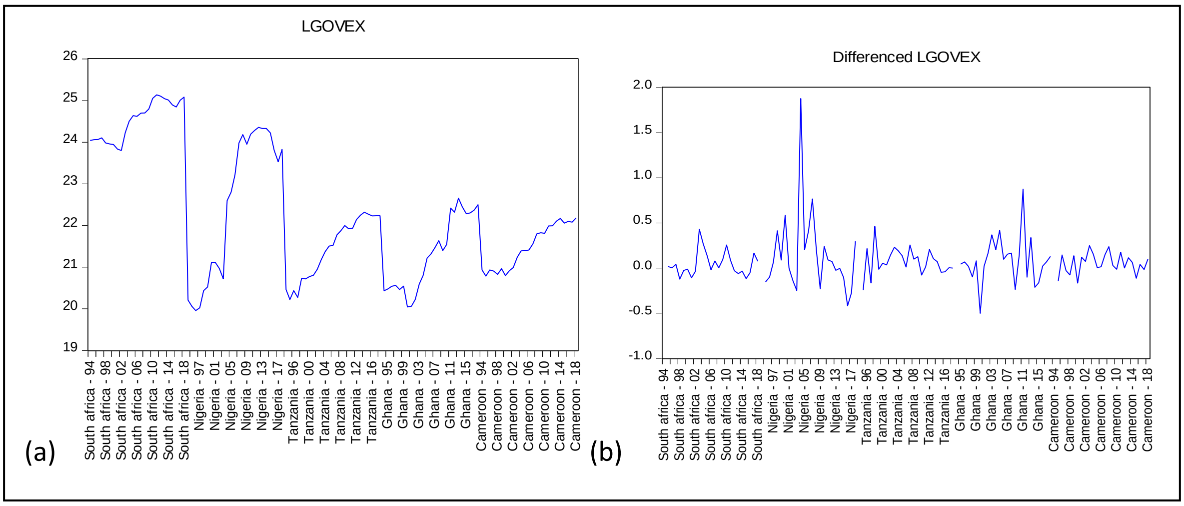


Figure 5.7: Selected SSA Government expenditure (1994 – 2018)
Source: Authors' computation.

Figure 5.7 is the log of government expenditure, the actual value spent. Its trend behaviour is unstructured as reflected by panel (a) at level. However, at first difference, the variable is now seen to be hovering along the mean of zero. This suggests that it may be stationary at first difference.

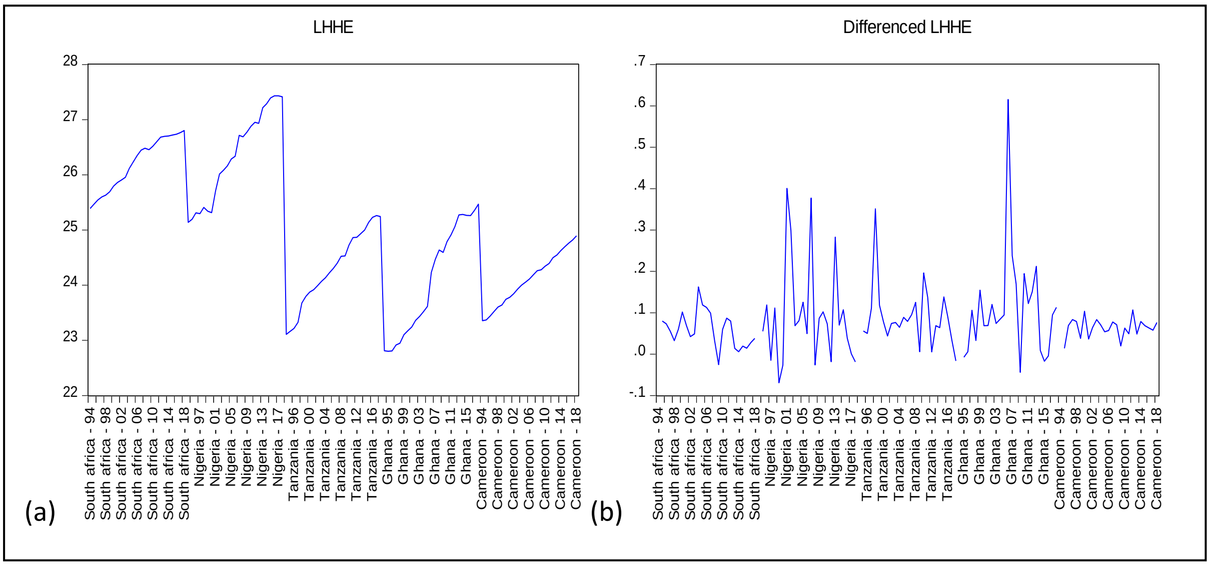


Figure 5.8: Selected SSA log of household expenditure (1994 – 2018)
Source: Authors' computation.

Figure 5.8 is the log of household expenditure, the actual value spent. Its trend behaviour is formless as reflected by panel (a) at level. Though at first difference the variable is now seen to be hovering along the mean of zero, but still it has trends spikes that are mostly moving away from the zero mean. Log of household expenditure too needs a formal analysis to conclude the I(1) stands at first difference from panel (b).

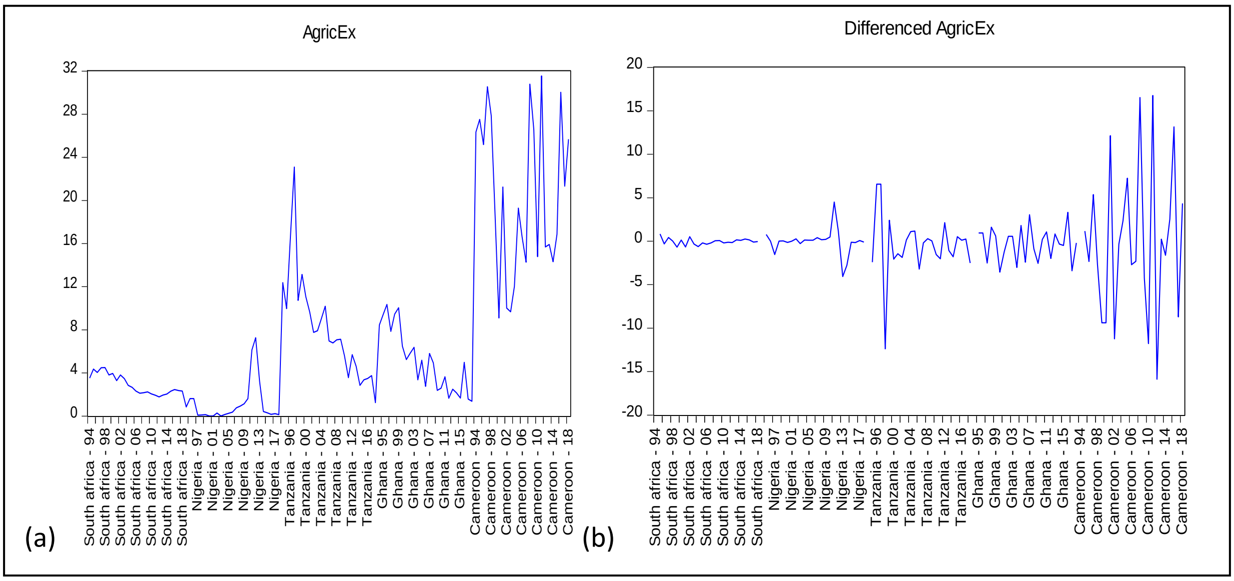


Figure 5.9: Selected SSA Agricultural Exports (1994 – 2018)
Source: Authors' computation.

Figure 5.9 represents selected SSA agricultural exports as a percentage of GDP. It is clear at panel (b) that the variable is stationary at first difference. Of the SSA countries, it is worth noting that Cameroon shows some volatility though still hovering along the zero mean.

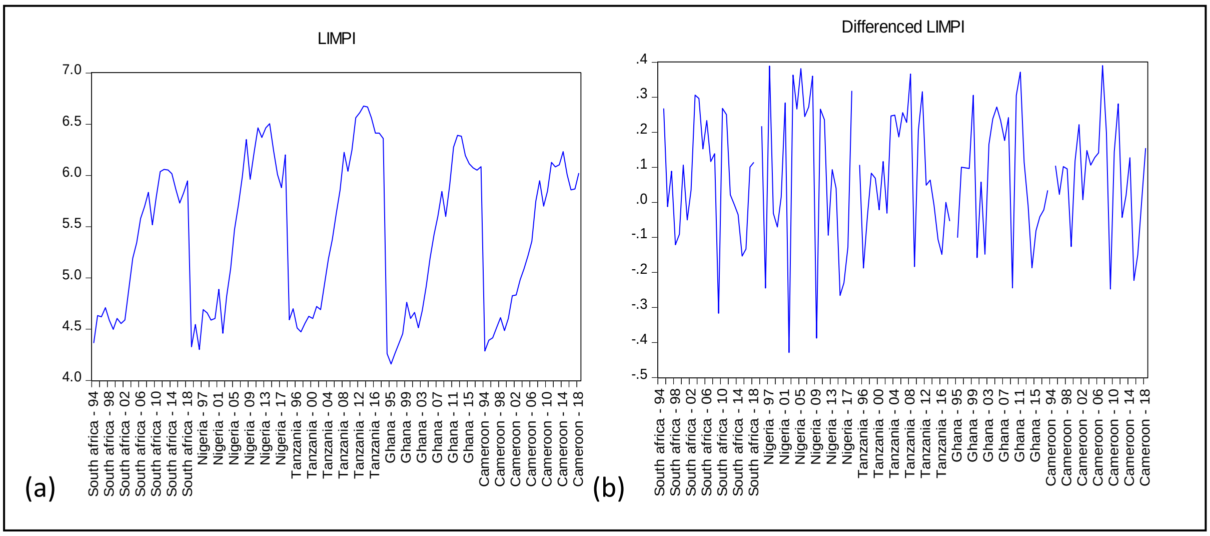


Figure 5.10: Selected SSA Log of Imports Index (1994 – 2018)
Source: Authors' computation.

Figure 5.10 is the log of imports index. It is concluded upon reflecting that it needed to be differenced to observe unit root in panel (b) as panel (a) is clearly not well defined trend line for analysis purposes.

Figure 5.11 is the log of industrial index in the selected SSA and with panel (a) clearly reflecting an obscure trend line, it was necessary to difference as seen in panel (b). The trend line hovers on the mean of zero and it is therefore an I(1) stationarity.

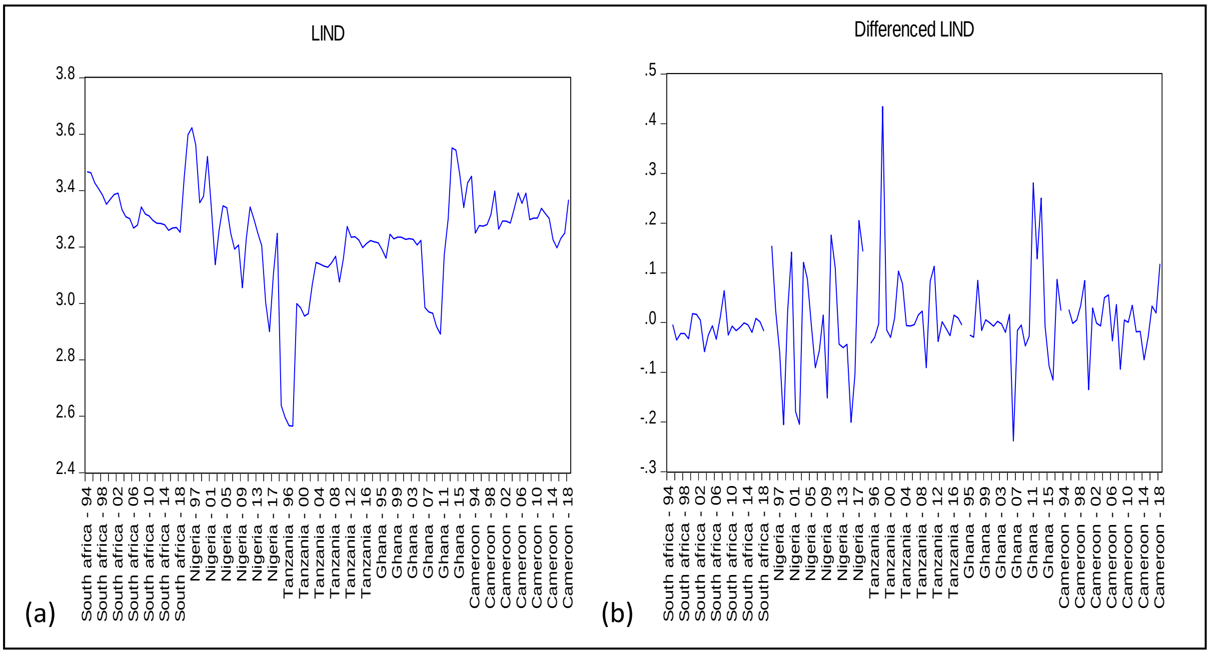


Figure 5.11: Log of industrial index (1994 – 2018)

Source: Authors' computation.

Figure 5.12 is the log of industrial index in the selected SSA and panel (a) evidently reflects a non-stationarity observation, and it was necessary to difference as seen in panel (b). The trend line now hovers on the mean of zero, and it is therefore an I(1) stationarity.

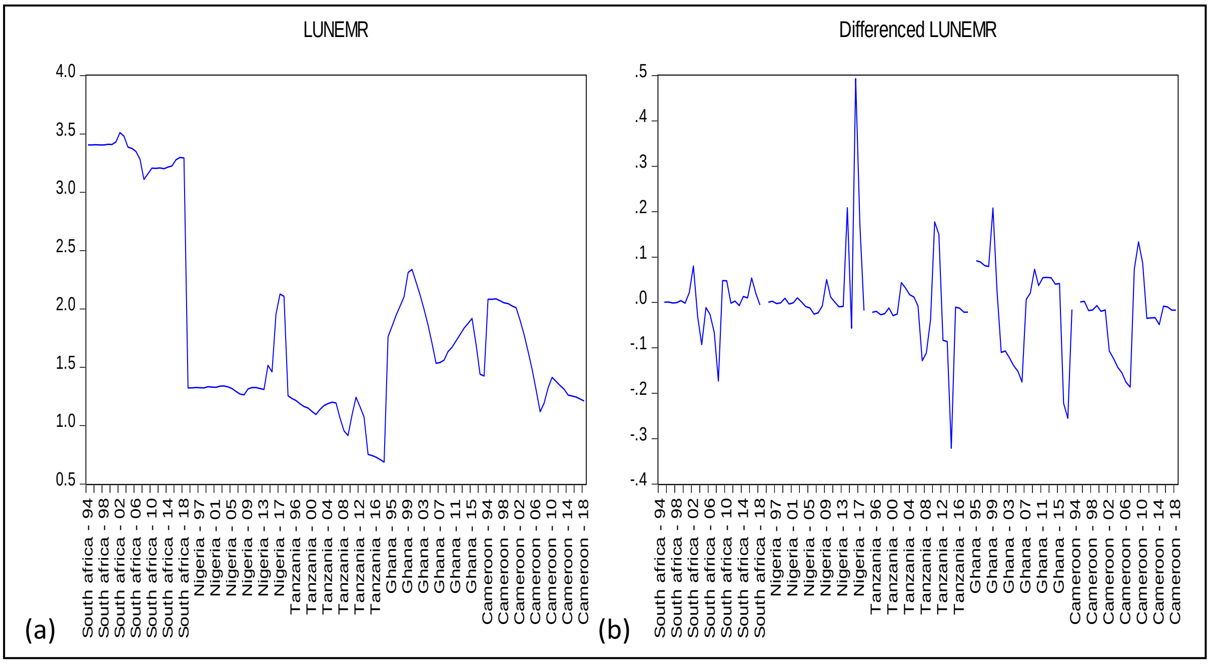


Figure 5.12: The Log of Unemployment Rate (1994 – 2018)
Source: Authors' computation.

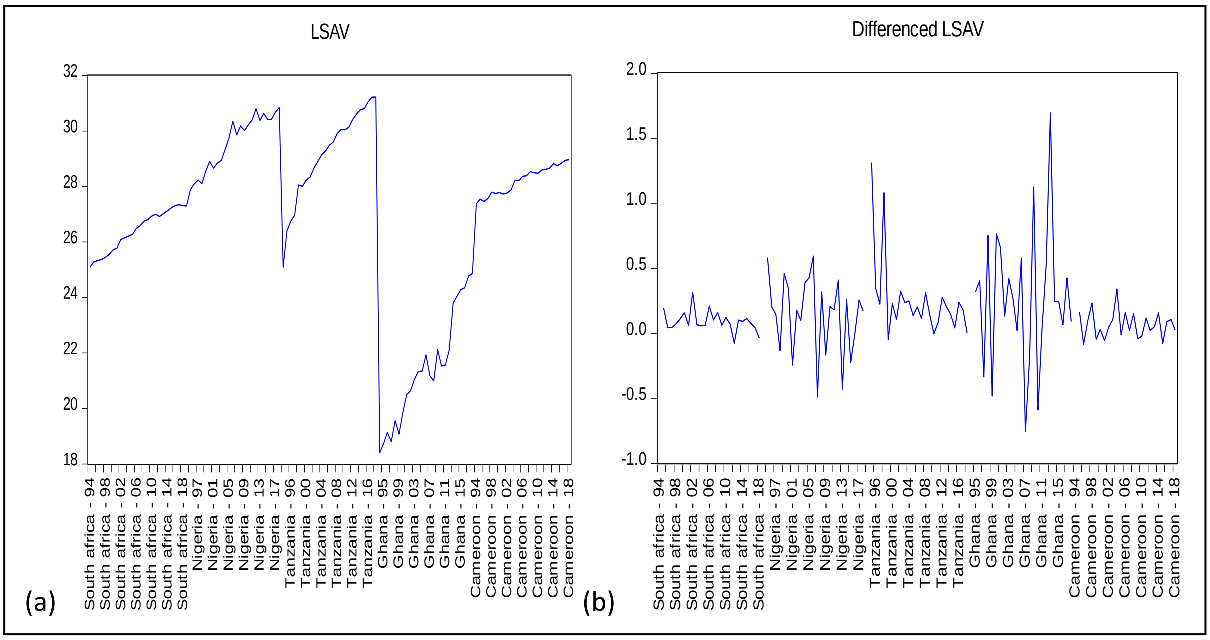


Figure 5.13: The Log of Savings Rate (1994 – 2018)
Source: Authors' computation.

Figure 5.13 is the log of unemployment rate in the selected SSA, and panel (a) has a clear non-stationarity observation. It was then required to difference as seen in panel (b). The trendline now hovers on the mean of zero, with Nigeria and Tanzania showing some spikes in the trend line, but still stationary at (1).

5.2.2.2. BRICS Informal unit root tests

This section now reflects on the informal unit root tests in the BRICS economies. Figure 5.14 is the BRICS percentage change in GDP per capita and at level, panel (a), only Brazil has a trend that suggests stationarity. The other four nations' trend line seem to move away from the mean. Hence, it became essential to difference and observed that all the countries now reflect a common stance of stationarity as observed in panel (b), which is contrary to the selected SSA group of I(0).

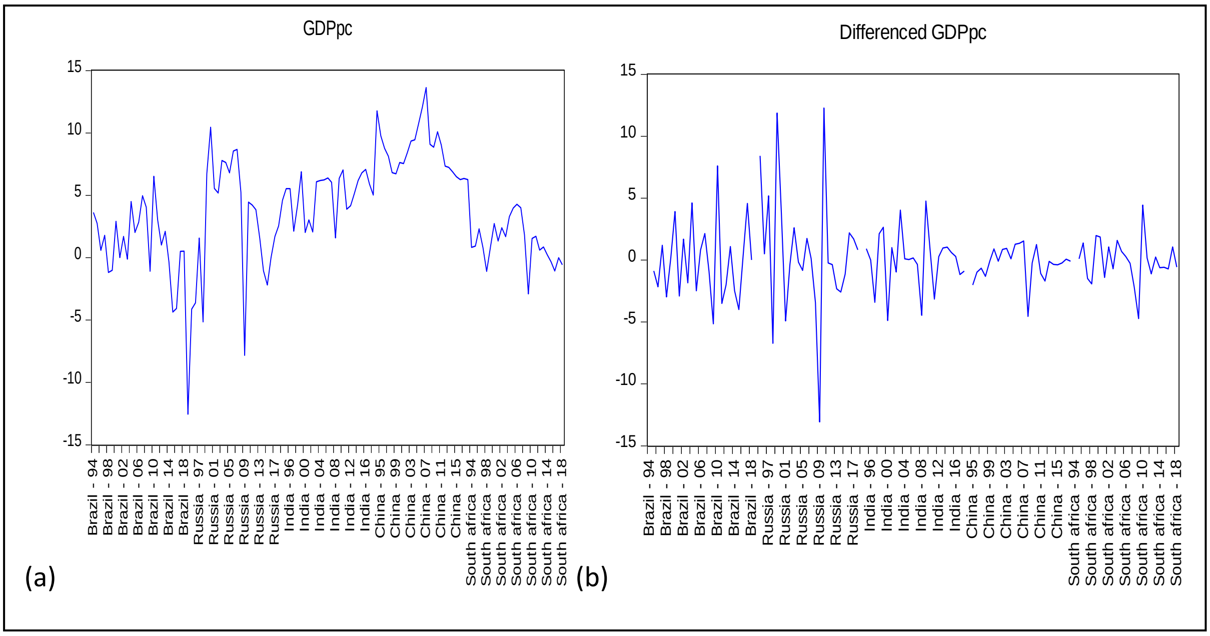


Figure 5.14: BRICS GDP Per Capita (1994 – 2018)

Source: Authors' computation.

Figure 5.15 is the log of current account, and suggests an I(1) conclusion as seen in the differenced panel (b) having a trend line that hovers along the mean of zero as opposed to panel (a).

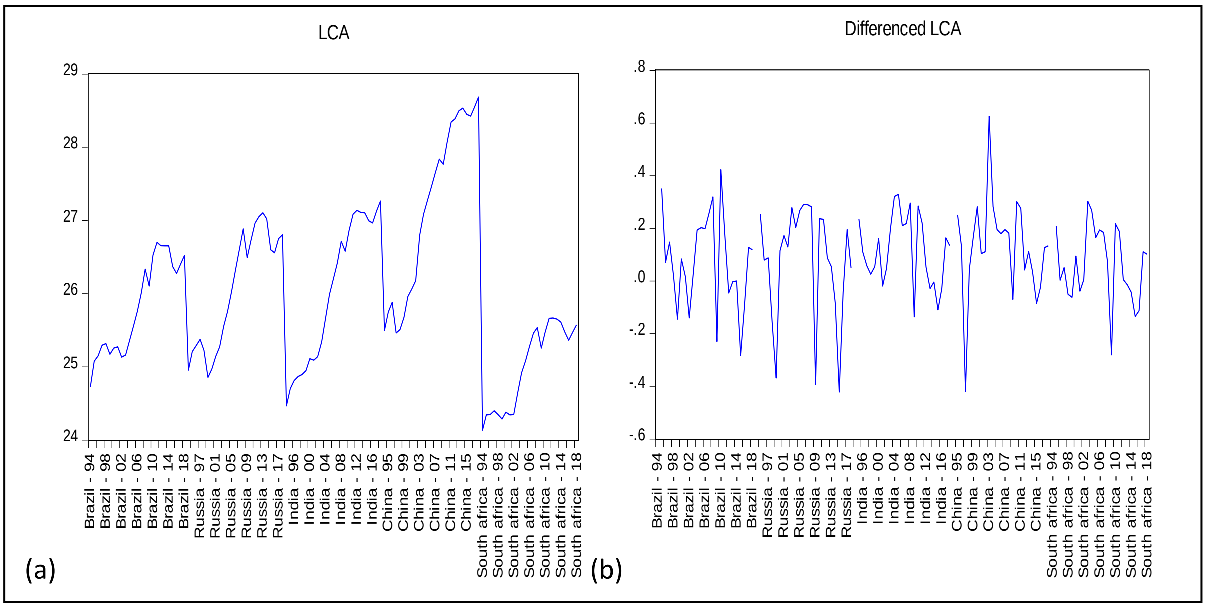


Figure 5.15: BRICS Log of Current Account (1994 – 2018)

Source: Authors' computation.

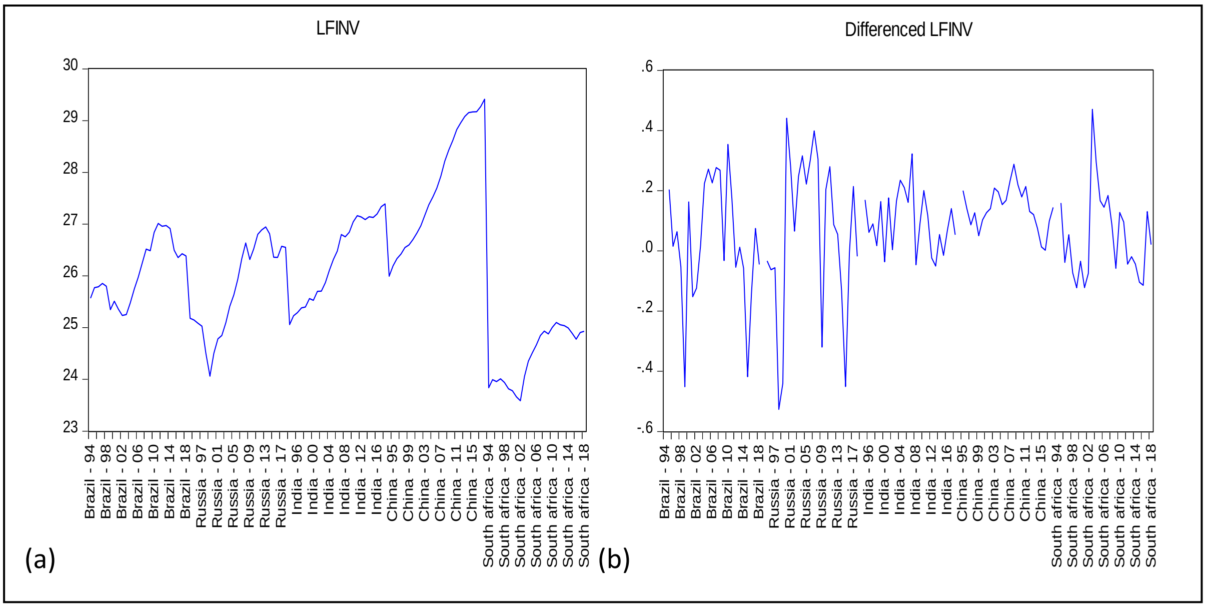


Figure 5.16: BRICS Log of Fixed Investment (1994 – 2018)

Source: Authors' computation.

Figure 5.16 proceeds to reflect the log of fixed investment, which has a more pronounced first difference order I(1) upon realising that panel (a) has an unstructured trend across the countries.

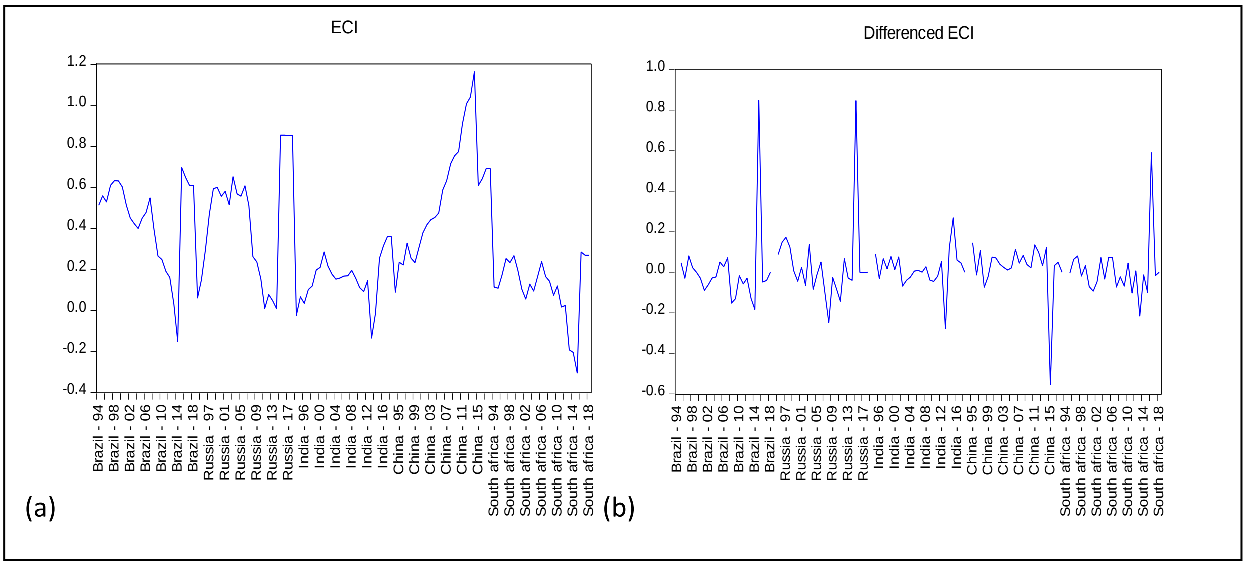


Figure 5.17: BRICS Economic Complexity Index (1994 – 2018)

Source: Authors' computation.

Figure 17 shows the BRICS ECI stationarity analysis and at level, panel (a), the trend line is close but above the required mean of zero. Hence, it was required that the variable be differenced one in panel (b). The variable is now seen to be stable with a mean of zero trend line across all the countries.

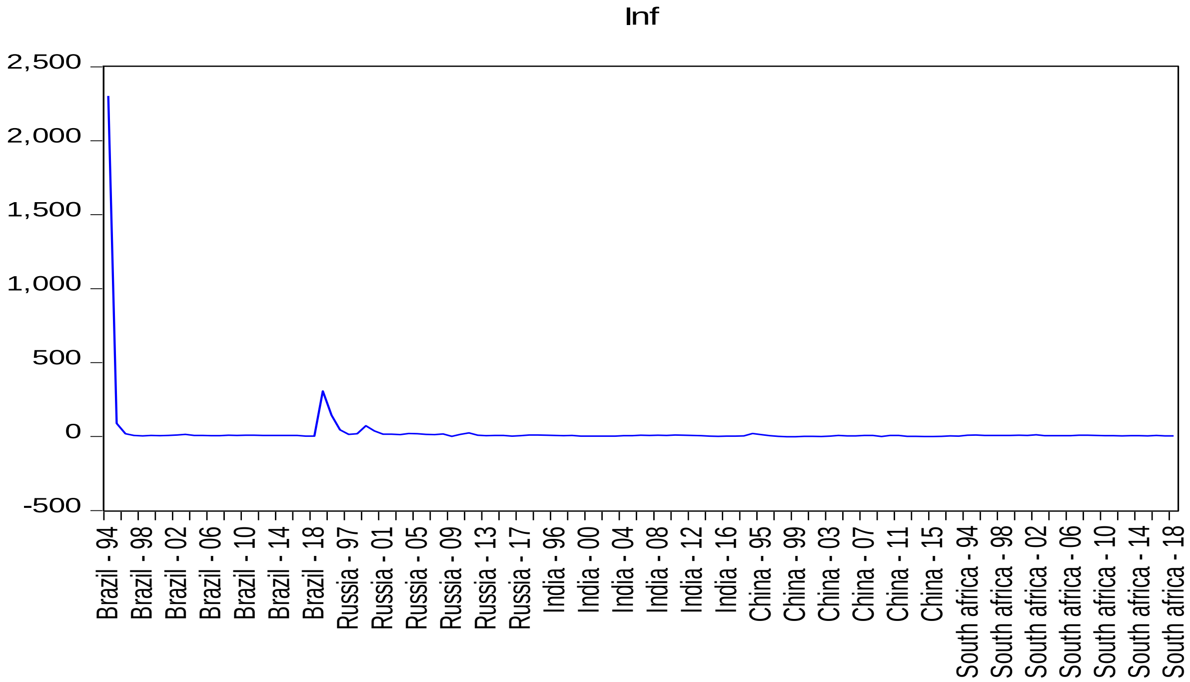


Figure 5.18: BRICS Inflation GDP Deflator (1994 – 2018)
Source: Authors' computation.

Figure 18 is the BRICS inflation and it has a contradiction with its SSA counterparts. It is observed at level that it has a unit root, hence an I(0) stance. Only Brazil had a deviation away from the zero mean from 1994 to 2018.

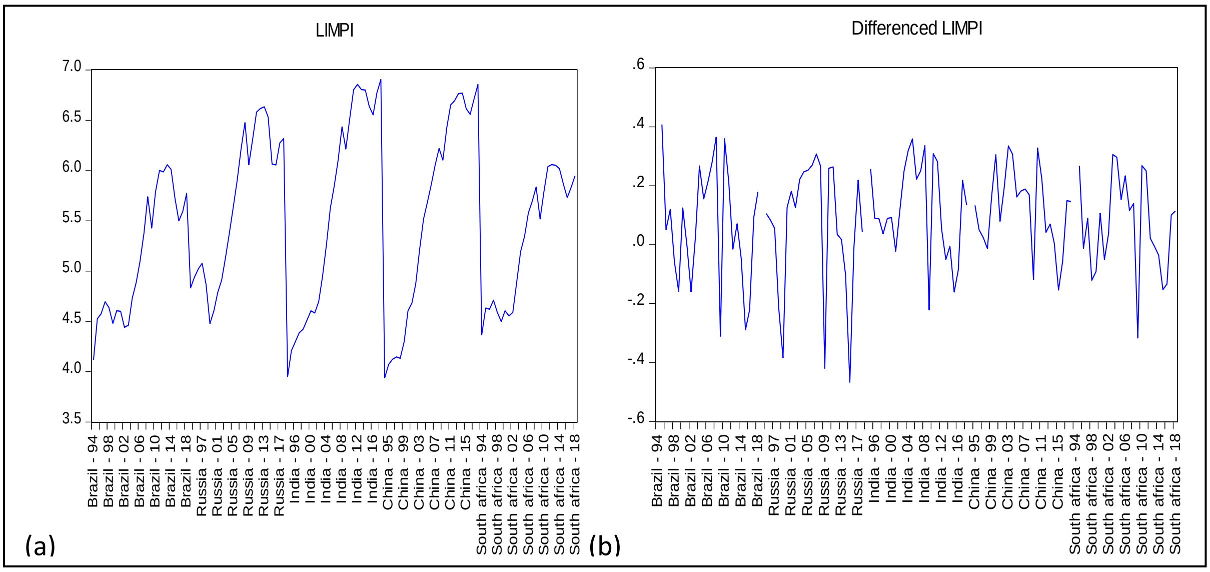


Figure 5.19: BRICS Log of Imports Index (1994 – 2018)

Source: Authors' computation.

Figure 19 is the BRICS log of imports and it is therefore, through observations in panel (b), concluded as I(1) stationarity. This is a result of observing panel (a) that it is not stationary.

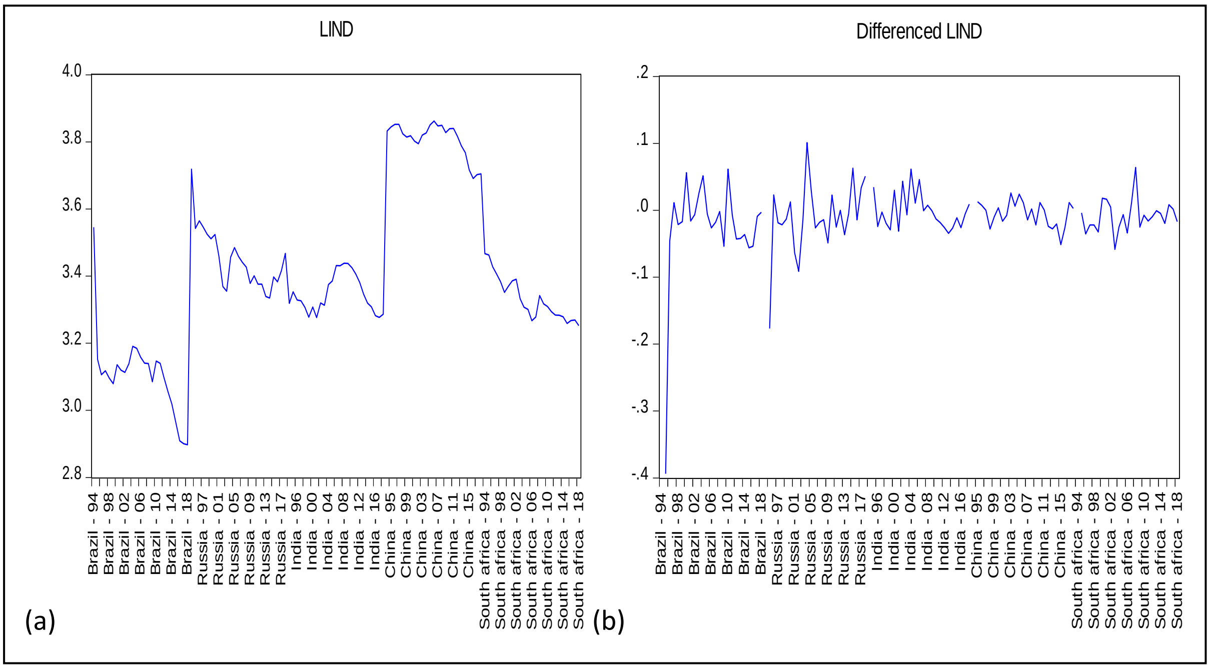


Figure 5.20: Log of Industrial Index (1994 – 2018)
Source: Authors' computation.

Figure 20 is the BRICS log of industrial index, which is evidently stationary at I(1) upon differencing in panel (b). Panel (a) is quite unstructured trendline. The findings are consistent with the SSA observations.

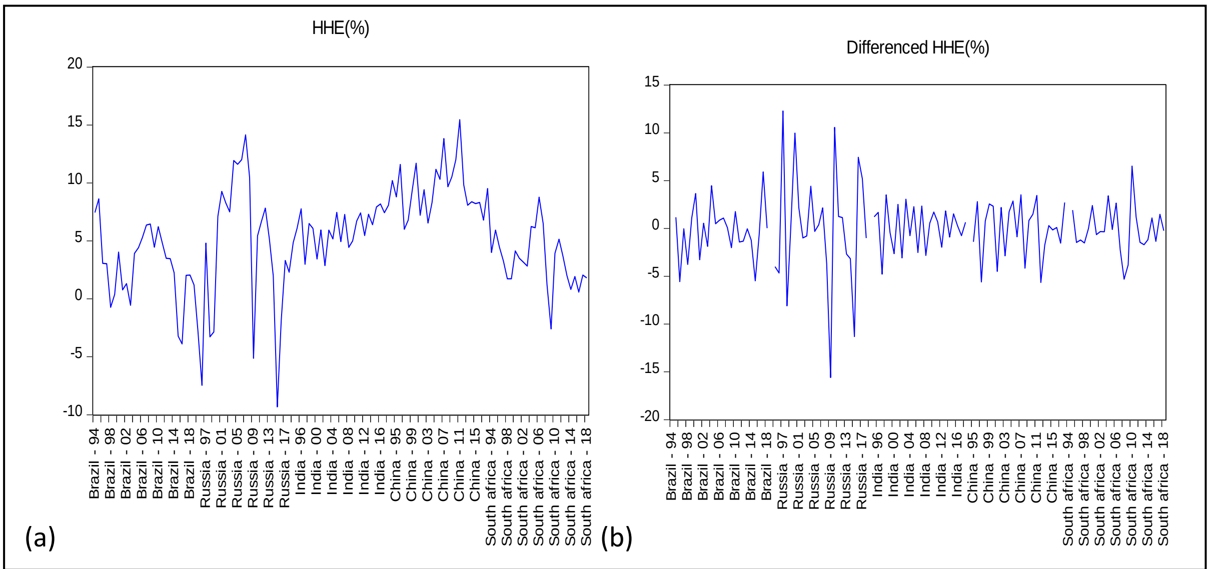


Figure 5.21: BRICS Household Expenditure (1994 – 2018)

Source: Authors' computation.

Figure 21 is the BRICS' household expenditure as a percentage of GDP. Panel (a) reflects inconclusive observations of stationarity with Brazil and China, reflecting a trend line moving along the mean of zero and South Africa in some years. The other countries' trend line is seen to be deviating from the zero mean. It then became essential to observe the first difference observations in panel (b). The variable has a well-defined stationarity for all countries at I (1).

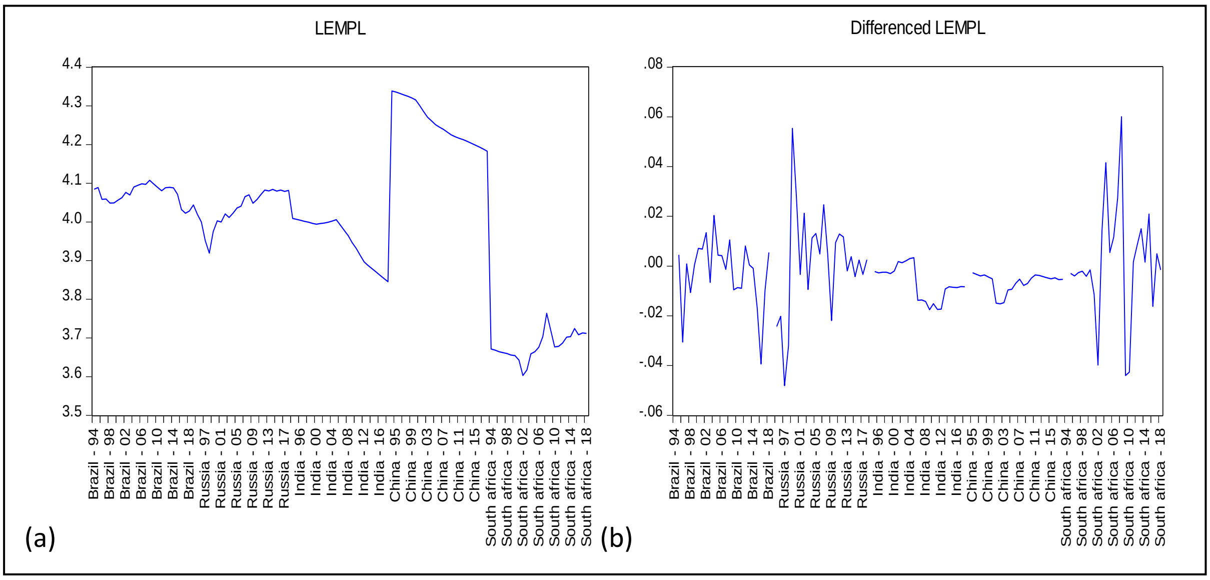


Figure 5.22: BRICS Log of Employed Population (1994 – 2018)

Source: Authors' computation.

Figure 22 is the BRICS log of employment, and it is therefore, through observations in panel (b), concluded as I (1) stationarity. This is a result of observing panel (a) that it is not stationary. The observations are expected because of the varying population status of these countries as reflected in chapter 2.

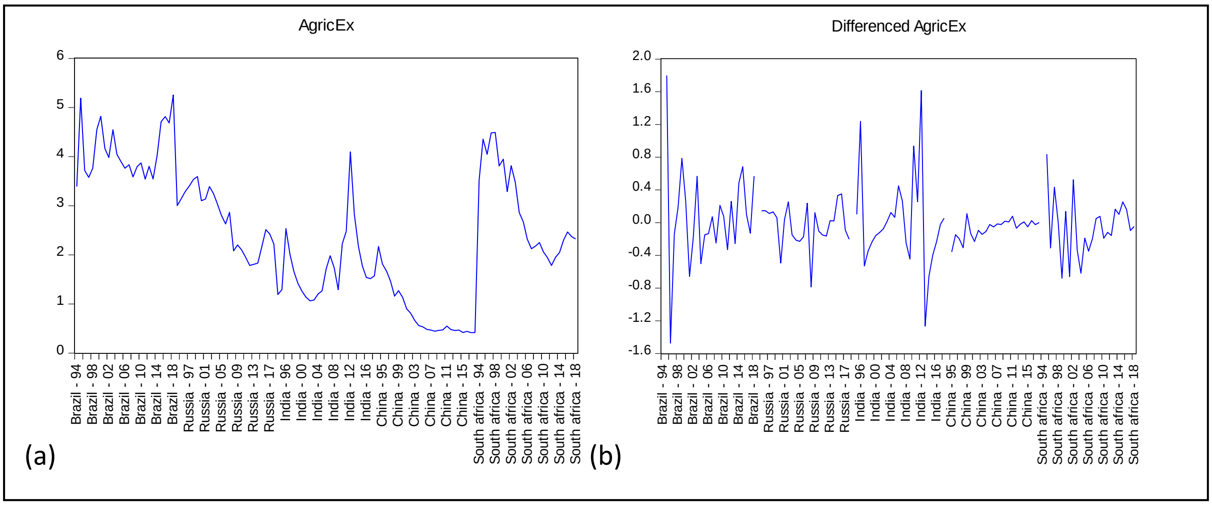


Figure 5.23: BRICS Agricultural Exports (1994 – 2018)

Source: Authors' computation.

Figure 23 is the BRICS agricultural exports as a percentage of GDP, and just like the SSA analysis, it was found to be stationary at first difference in panel (b).

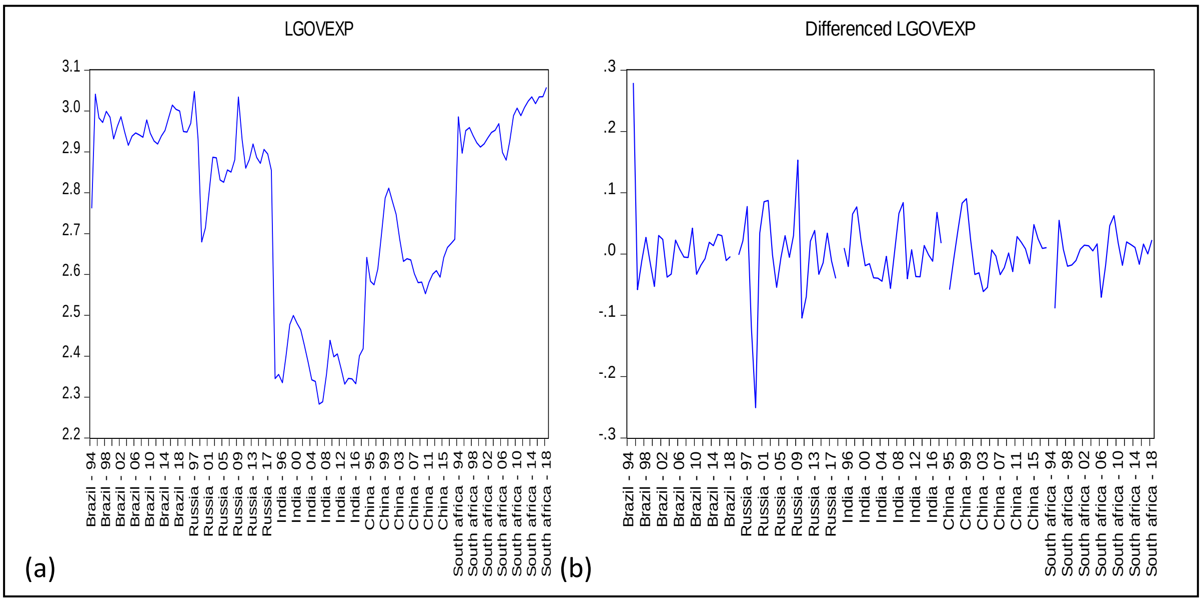


Figure 5.24: BRICS Log of Government Expenditure as a share of GDP (1994 – 2018)

Source: Authors' computation.

Figure 24 is the BRICS log of government expenditure over the years, and panel (a) clearly shows non-stationarity. Hence, it was then differenced once in panel (b), which was then concluded that the variable is stationary at I(1).

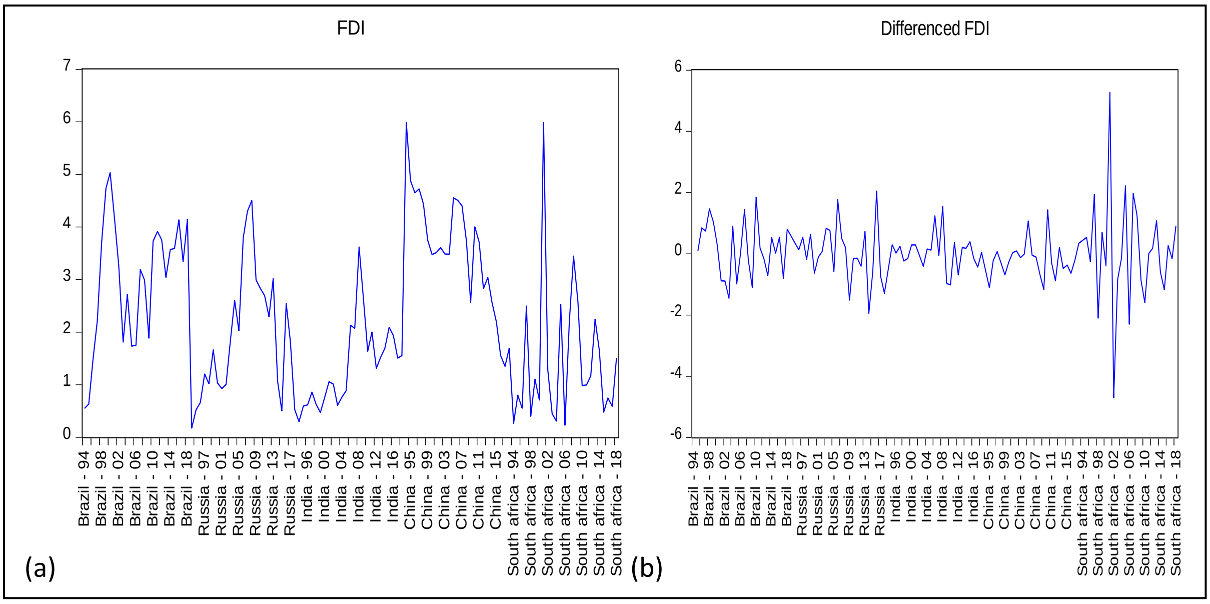


Figure 5.25: BRICS Foreign Direct Investment (1994 – 2018)

Source: Authors' computation.

Figure 5.25 is the BRICS inflow of foreign direct investment, and it can be seen that it is not stationary at level on panel (a). It was then differenced once in panel (b), reflecting stationarity at I(1).

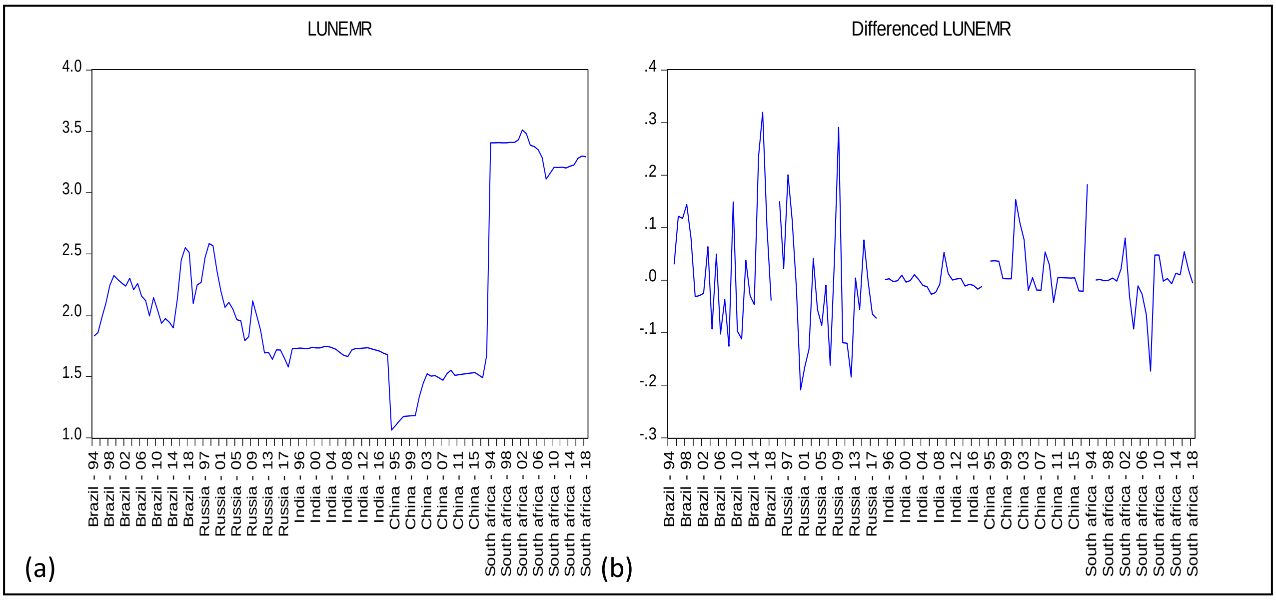


Figure 5.26: BRICS Log of Unemployment Rate (1994 – 2018)

Source: Authors' computation.

Figure 26 is the log of BRICS unemployment rate. It can be picked up from panel (a) that South Africa has a upward trend and the rest of the countries do not show a mean zero outcome. It then became imperative to differentiate once and stationarity was then observed. Hence, log of unemployment rate is informally stated to be I(1).

5.2.2.3. Formal Unit Root Tests (SSA and BRICS)

This section provides the formal unit root tests using econometric tests as outlined in chapter four. For ease of results submission, the results demarcated into three groups, that is, according to the stated models in chapter 4. Therefore, a simultaneous unit root are carried out in respective models for SSA and BRICS for ease of analysis. Where the variable is both in the SSA and BRICS models it is simply stated. However, bracket labelling is incorporated to reflect that the said variable estimates are for SSA or BRICS. Additionally, the analysis is presented according to the stated models in chapter 4.

Table 5.4: Selected SSA and BRICS GDPpc Model Variables

Variable	**Test Method**	**Test equation**	**Panel A: SSA**		**Panel B: BRICS**	
			Level	**1st Difference**	**Level**	**1st Difference**
GDPPC	LLC	Intercept	-2.60112***	-	-4.38148***	-
		Intercept and trend	-2.46307***	-	-3.96672***	-
	Fisher-ADF	Intercept	25.7660***	-	22.7382**	-
		Intercept and trend	14.6037	54.0622*	17.5867*	-
	Fisher - PP	Intercept	37.7353***	-	35.3485***	-
		Intercept and trend	22.9299**	-	29.9664***	-
	IPS	Intercept	-2.95166***	-	-2.50258	-
		Intercept and trend	-1.32044*	-	-1.57753*	-
ECI	LLC	Intercept	-1.137437 *	-	-0.02687	-4.52622 ***
		Intercept and trend	1.2456	-4.16096 ***	2.05574	-3.27607 ***

	Fisher-ADF	Intercept	35.6590	121.678 ***	11.6328	39.3655 ***
		Intercept and trend	26.4328	91.2575 ***	5.25662	26.7375***
	Fisher - PP	Intercept	16.3667***	-	14.1218	77.2954***
		Intercept and trend	17.3310***	-	6.63532	60.7126***
	IPS	Intercept	-1.76217 **	-	-0.93705	-4.58693 ***
		Intercept and trend	-0.31496	-7.05014 ***	0.63045	-3.16422 ***
INF	LLC	Intercept	-1.49286 ***		201.268	213.555
		Intercept and trend	1.56082	-2.27990 **	224.266	243.499
	Fisher-ADF	Intercept	-7.49552 *	-	43.8744*	-
		Intercept and trend	-6.46289 *	-	39.7492*	-
	Fisher - PP	Intercept	55.9612***	-	60.2596***	-
		Intercept and trend	54.0687***	-	548.539	-
	IPS	Intercept	-8.41795 ***	-	-4.79407***	-
		Intercept and trend	-7.33102 ***	-	-4.45067***	-
LHHE (SSA) & HHE(%) (BRICS)	LLC	Intercept	-1.24125	-4.48407***	-3.27935***	-
		Intercept and trend	0.55743	-4.00989***	-2.20430**	-
	Fisher-ADF	Intercept	3.63830	43.0475***	24.3555***	-
		Intercept and trend	7.68255	33.2352***	17.8452*	-
	Fisher - PP	Intercept	5.03124	77.0133***	37.1685***	-
		Intercept and trend	11.0426	71.8165***	30.7646***	-
	IPS	Intercept	1.45786	-4.96301***	-2.74111***	-
		Intercept and trend	0.17908	-3.96658***	-1.81344**	-
LIMPI	LLC	Intercept	-1.22098	-4.04410 ***	-0.83004	-4.66337***
		Intercept and trend	2.8278	-2.03614 **	0.97100	-3.86447***

	Fisher-ADF	Intercept	6.30399	53.2680***	2.62576	28.5753**
		Intercept and trend	3.61005	36.0795***	3.28354	17.6301*
	Fisher - PP	Intercept	3.37980	57.6195***	3.88911	47.7973***
		Intercept and trend	1.97059	42.8808***	1.94311	32.3061***
	IPS	Intercept	1.6759	-4.53442 ***	1.47948	-3.34992***
		Intercept and trend	2.7958	-2.80755 ***	1.31482	-1.87643**
LGOVEX (SSA) & LIND(BRIC)	LLC	Intercept	0.31638	-4.41871 ***	1.41921	-0.82671
		Intercept and trend	0.05947	-3.97245 ***	2.16839	0.24831
	Fisher-ADF	Intercept	17.8782	76.7105***	5.90164	34.2006***
		Intercept and trend	15.8296	55.6063***	5.78853	27.6361***
	Fisher - PP	Intercept	1.91885	75.0894***	24.0267***	-
		Intercept and trend	5.90303	63.6762***	16.6950*	-
	IPS	Intercept	0.02487	-6.48810 ***	1.05292	-3.75227***
		Intercept and trend	0.30381	-4.73680 ***	1.46951	-2.82147***
REER (SSA) & LEMPL (BRICS)	LLC	Intercept	-0.42932	-4.50368 ***	-0.91486	-2.00914**
		Intercept and trend	1.46622	-2.59011 ***	-0.95548	-1.09560
	Fisher-ADF	Intercept	20.8335	80.8096 ***	5.65375	28.2112***
		Intercept and trend	19.8894	53.1013 ***	14.5762	19.5463**
	Fisher - PP	Intercept	17.5513	72.3334***	3.37330	33.7253***
		Intercept and trend	16.7607*	-	7.45849	21.8880**
	IPS	Intercept	0.20691	-6.04710 ***	0.61610	-3.04814***
		Intercept and trend	-3.64686	-3.64686 ***	-0.93490	-1.86398**

Source: Author’s computation
Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

Table 4.1 submits the formal unit roots test for the selected SSA and BRICS model in the GDPpc model, respectively. The results maintain the informal unit root results for the GDPpc variable with respective group of economies, maintaining a stationarity of I(0) because all the tests were seen to be significantly attributing to be stationary at level. Only the selected SSA model had a minor deviation with Fisher – ADF test reflecting an I(1) observation at trend and intercept specification. The BRICS GDPpc unit roots results contradict the informal unit root observations above.

With respect to ECI, the BRICS ECI had a definite stationarity level of I(1) with all the tests proving the 1st difference criteria. The selected SSA ECI had an indefinite conclusion with four of the eight test proving a I(0) and the other four showing an I(1). It is then concluded that ECI in the selected SSA is stationary at I(1) because the confidence level was higher at 1% level of confidence as seen at LLC, Fisher-ADF and IPS methods at the intercept and trend specification. While the remainder had significance at the more weaker level of significance (10%), only the IPS at intercept had an I(0) stationarity significance at 5%.

Inflation (INF) was also pronounced for both models as seen to be an I(0) stationarity with all methods stating as such. The only deviation was the LLC at Intercept and trend showing an I(1) stationarity for the selected SSA and the BRICS inflation was non-stationary after 1st difference.

The log of household expenditure (LHHE) for the selected SSA model was observed to be an I(1) stationarity with all the methods proving such, while the household expenditure as a percentage of GDP (HHE) for the BRICS model was seen to be an I(0) stationarity across all the methods.

Log of imports index (LIMPI) maintains the same stance across the two groups. All the methods tested reflect that the log of imports index is stationary at I(1) with the variable in both the models. On the other hand, the log of government expenditure (LGOVEX) is also seen to be an I(1) stationarity with all the methods approving as such for the selected SSA model. While the log of industrial production was observed to be an I(1) also for the BRICS model, only Fisher – PP maintained a stationarity of I(0).

Lastly, real effective exchange rate (REER) and the log of employment rate (LEMPL) for selected SSA and BRICS model were concluded to be an I(1) level of stationarity. All the methods approved of this finding. A complete summary of the unit root test results is made for the selected SSA and BRICS below with the order of stationarity reflected below each variable in parenthesis for each variable.

$$\Delta GDPPC_{itSSA} = ECI_{it} + INF_{it} + LHHE_{it} + LIMPI_{it} + LGOVEX_{it} + REER_{it} + \varepsilon_{it}$$

[I(0)] [I(1)] [I(0)] [I(0) [I(1)] [I(1)] [I(1)]

$$\Delta GDPPC_{itBRICS} = ECI_{it} + INF_{it} + HHE_{-it} + LIMPI_{it} + LIND_{it} + LEMPL_{it} + \epsilon_{it}]$$

[I(0)] [I(1)] [I(0)] [I(0)] [I(1)] [I(1)] [I(1)]

Table 5.5 reflects on the variable which are modelled on the current account for selected SSA and BRICS. A deviation in the table is that not all variables are included as some have already been analysed under the GDPpc model above, the same is advanced on the fixed investment models.

Table 5.5: Selected SSA and BRICS Current Account Model Variables

Variable	Test Method	Test equation	Panel A: SSA		Panel B: BRICS	
			Level	1st Difference	Level	1st Difference
LCA	LLC	Intercept	-0.52358	-4.9573***	-1.03559	-4.5635***
		Intercept and trend	0.92074	-3.4936***	1.62677	-3.4804***
	Fisher-ADF	Intercept	2.40847	39.4805***	2.64559	29.4228***
		Intercept and trend	4.28694	26.9347***	1.95190	18.7289**
	Fisher -PP	Intercept	1.79846	-4.5669***	3.59305	47.8461***
		Intercept and trend	0.97136	-3.1295***	2.12304	32.0738***
	IPS	Intercept	1.79846	-4.5669***	1.45174	-3.4446***
		Intercept and trend	0.97136	-3.1295***	1.92272	-2.03302**
AGRICEX	LLC	Intercept	-1.66483**	-	-2.9357***	-

		Intercept and trend	-1.50872*	-	1.29945	-2.5967***
	Fisher-ADF	Intercept	13.0954	74.5307*	17.8914***	-
		Intercept and trend	21.0834***	-	5.18907	31.5250***
	Fisher -PP	Intercept	14.4283	237.524***	30.1820***	-
		Intercept and trend	27.0073*	-	26.5508***	-
	IPS	Intercept	-0.76386	-8.2735***	-1.36855	-4.5031***
		Intercept and trend	-1.62138*	-	0.95690	-3.7714***
LSAV (SSA) & LGOVEXP (BRICS)	LLC	Intercept	-2.44828***	-	-1.06515	-2.5800***
		Intercept and trend	0.46267	-2.62795*	-0.42528	-1.69752**
	Fisher-ADF	Intercept	9.07715	44.8820*	23.3261***	-
		Intercept and trend	8.63267	36.8537***	17.2403*	-
	Fisher -PP	Intercept	17.8899*	-	31.9696***	-
		Intercept and trend	54.3512***	-	26.8868***	-
	IPS	Intercept	0.53025	-5.17540***	-2.36515***	-
		Intercept and trend	0.47208	-4.44993***	-1.59767**	
LUNEMR	LLC	Intercept	-0.40571	-2.58232***		
		Intercept and trend	0.10574	-1.09706		
	Fisher-ADF	Intercept	6.83796	29.6573***		
		Intercept and trend	11.5317	20.6233**		
	Fisher -PP	Intercept	2.77991	35.4968***		
		Intercept and trend	3.24850	26.8275***		
	IPS	Intercept	0.93261	-3.44805***		
		Intercept and trend	0.25090	-2.29761**		

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

The log of current account (LCA) in both models (selected SSA and BRICS) is seen to be stationary at I(1) with all the methods advocating as such. On the other hand, agricultural exports as a share of exports (AGRICEX) which is also in both models is also stationary but an analysis ir required to conclude the stationarity. In the selected SSA scenario, five tests across the four methods prove that AGRICEX is stationary at I(0). With only Fisher-ADF, Fisher –PP and IPS at the intercept only equation showing stationarity of (I(1). On the BRICS side of the model, it is concluded that AGRICEX is stationary without violating the I(2) stance. The stationarity is observed to be equally (I(0) and I(1) with four methods proving for the two forms of stationarity each. We may not conclude with certainty, but none-the-less stationary to incorporate in respective models.

In the selected SSA model, the log of savings is proved to be stationary at I(1) with five of the tests affirming the outcome. Only the LLC at intercept criteria and the Fisher-ADF in both equations reflect the I(0) stance. On the other side, the log of government expenditure as a share of GDP (LGOVEXP) is unanimously proved to be I(0) with only the LLC at intercept and trend had an I(1) outcome. The log of unemployment rate (LUNEMR) captured in the selected SSA model is unanimously proved to be I(1) as all the test methods and equations advocate for such. The summary stationarity analysis is also carried out to observe each current account model for selected SSA model and BRICS:

$[LCA_{itSSA} = ECI_{it} + AGRICEX_{it} + INF_{it} + LIMPI_{it} + LSAV_{it} + LUNEMR_{it} + \mu_{it}]$
[I(1)] [I(1)] [I(1)] [I(0)] [I(1) [I(1) [I(1)]

$[LCA_{itBRICS} = ECI_{it} + AGRICEX_{it} + INF_{it} + LIMPI_{it} + LGOVEXP_{it} + LEMPL_{it} + \pi_{it}]$
[I(1)] [I(1)] [I(1,0)] [I(0)] [I(1)] [I(1)] [I(1)]

Table 5.6 also indicates the stationarity tests for the variables in the fixed investment for both groups of economies. Likewise, only those variable not stated in the above two preceding tables are analysed while concluding for all at the end.

Table 5.6: Selected SSA and BRICS Fixed Investment model variable

Variable	Test Method	Test equation	Panel A: SSA		Panel B: BRICS	
			Level	1st Difference	Level	1st Difference
LFINV	LLC	Intercept	-1.00265	-2.90301*	-0.25710	-2.60770*
		Intercept and trend	0.55261	-1.83605**	-0.09492	-1.53097***
	Fisher-ADF	Intercept	3.37215	35.4448*	2.58134	21.3225**
		Intercept and trend	6.41330	24.8105*	7.97393	11.6029
	Fisher -PP	Intercept	0.9655	62.4228*	2.90894	36.5789*
		Intercept and trend	5.87016	108.846*	2.18426	23.6538*
	IPS	Intercept	1.35870	-4.09325*	1.60515	-2.38128*
		Intercept and trend	0.28006	-2.76432*	0.32873	-0.77545
LIND (SSA) & FDI (BRICS)	LLC	Intercept	-2.4536***	-1.76843	-1.12536	-5.64779***
		Intercept and trend	-1.9154***	-	-0.45597	-4.46515***
	Fisher-ADF	Intercept	16.9432*	-	20.4073**	-
		Intercept and trend	18.6128**	-	13.0201	38.3365***
	Fisher -PP	Intercept	14.9189	66.9693***	27.5157***	-
		Intercept and trend	8.55688	99.8806***	20.2321**	-
	IPS	Intercept	-1.76843**	-	-1.87471**	-
		Intercept and trend	-1.68010**	-	-0.67591	-4.61009***
LUNEMR	LLC	Intercept			-0.42397	-3.77770***
		Intercept and trend			-0.04188	-2.27461***
	Fisher-ADF	Intercept			10.0533	31.4847***
		Intercept and trend			13.3505	18.7575**
	Fisher -PP	Intercept			5.49010	37.6003***
		Intercept and trend			6.80029	23.3975***
	IPS	Intercept			-0.37867	-3.68888***

		Intercept and trend			-1.00418	-2.01472**

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

The log of fixed investment (LFINV) for the selected SSA model is proved to be an I(1) across all the test methods. The BRICS LFINV has also been proved to be at I(1) unit root across the test methods. The only test which failed to acknowledge the presence of stationarity at either level or first difference is Fisher-ADF and IPS at trend and intercept.

The log of industrial production for the selected SSA model was unanimously concluded to be an I(0) unit root with LLC at intercept and the Fisher – PP on both tests, suggesting an I(1) unit root. Foreign direct investment (FDI) in the BRICS model is proved to be an I(1) unit root. Log of unemployment (LUNEMR) in the BRICS model is also reflected by all the test methods across the test equation to be an I(1) stationarity. The below states the stationarity results for the respective models:

$[LFINV_{itSSA} = ECI_{it} + INF_{it} + LIMPI_{it} + LIND_{it} + AGRICE_{it} + LUNEMR_{it} + \mu_{it}]$

[I(1)] [I(1)] [I(0)] [I(1) [I(0)] [I(1)] [(1)]

$[LFINV_{itBRICS} = ECI_{it} + INF_{it} + LIMPI_{it} + LIND_{it} + FDI_{it} + LUNEMR_{it} + \pi_{it}]$

[I(1)] [I(1)] [I(0)] [I(1) [I(1)] [I(1)] [(1)]

5.2.3. Lag length Criteria

Prior to estimating the results, the lag length is carried out to infer Tables 5.7, 5.8 and 5.9, which relate the lag length criteria for all the models for GDP per capita, current account and fixed investment. There exists a breed of mixed results across all the models. Each is unpacked below.

5.2.3.1. GPD per capita Model Lag length criteria

The GDP per capita model in Table 5.7 for both groups of economies, the SSA and BRICS provide contradictory results across the lag length criteria. As a rule of thumb, the BRICS model reflects that the maximum allowed lag is one (1) with the FPE, SC, and HQ as observed by the asterisk (*). However, given the nature of the model as an ARDL approach, the AIC lag length is adopted as advised by Liew (2004). Therefore, the maximum allowed lag is eight as this allows lagging to be anywhere between 1 and eight. Similarly, with the SSA model, the AIC is also adopted, and is a maximum of eight lags. The FPE also affirms the maximum lag of eight.

Table 5.7: GDPPC models Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
Panel A: selected SSA						
0	-1188.211	NA	3856.352	28.12261	28.32377	28.20352
1	-595.5066	1073.841	0.010763	15.32957	16.93884*	15.97686*
2	-534.2507	100.8921	0.008248	15.04119	18.05858	16.25487
3	-489.3049	66.62545	0.009617	15.13659	19.56210	16.91665
4	-396.4076	122.4059	0.003841	14.10371	19.93733	16.45015
5	-357.5768	44.76954	0.005954	14.34298	21.58473	17.25582
6	-293.7982	63.02827	0.005789	13.99525	22.64511	17.47447
7	-207.6166	70.97307*	0.003964	13.12039	23.17837	17.16599
8	-114.8635	61.10795	0.003036*	12.09091*	23.55700	16.70289
Panel B: BRICS						
0	-663.1865	NA	0.016638	15.76910	15.97025	15.85001
1	-52.41000	1106.583	3.04e-08*	2.550824	4.160100*	3.198119*
2	-16.59986	58.98140	4.23e-08	2.861173	5.878566	4.074853
3	28.88512	67.42480	4.87e-08	2.943879	7.369389	4.723943
4	65.30308	47.98601	7.35e-08	3.239928	9.073554	5.586375
5	130.8680	75.59247*	6.07e-08	2.850165	10.09191	5.762997
6	183.3942	51.90830	7.70e-08	2.767195	11.41705	6.246410
7	250.4838	55.25024	8.26e-08	2.341558	12.39953	6.387157
8	337.3140	57.20577	7.27e-08	1.451435*	12.91753	6.063419

Source: Author's computation.

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

5.2.3.2. Current Account Model Lag length criteria

Table 5.8 affirms the current account model for the two economies. Like the GDP per capita model, three of the criteria (FPE, SC and HQ) confirm the lag length as one. However, the AIC is adopted on the same ground as stated above and the highest maximum lag length allowed is eight for the SSA current account model. For the BRICS model, a similar stand is adopted as the results mirror each other across all the criteria.

Table 5.8: Current account models Lag length criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
Panel A: selected SSA						
0	-1132.980	NA	1051.452	26.82306	27.02422	26.90397
1	-298.3539	1512.146	9.89e-06*	8.337739	9.947015*	8.985035*
2	-258.9145	64.95900	1.27e-05	8.562694	11.58009	9.776374
3	-220.1814	57.41616	1.71e-05	8.804268	13.22978	10.58433
4	-154.8610	86.06924*	1.31e-05	8.420258	14.25388	10.76671
5	-114.1772	46.90600	1.94e-05	8.615934	15.85768	11.52877
6	-69.25905	44.38970	2.94e-05	8.711978	17.36184	12.19119
7	-10.93890	48.02836	3.88e-05	8.492680	18.55066	12.53828
8	59.72619	46.55582	4.99e-05	7.982913*	19.44901	12.59490

Panel B: BRICS						
0	-400.8520	NA	3.47e-05	9.596516	9.797676	9.677428
1	376.8711	1409.051	1.25e-12*	-7.549908	-5.940631*	-6.902612*
2	406.8057	49.30414	2.00e-12	-7.101311	-4.083919	-5.887632
3	442.9424	53.56731	2.86e-12	-6.798645	-2.373136	-5.018581
4	480.9419	50.06987	4.16e-12	-6.539809	-0.706183	-4.193361
5	529.5038	55.98909	5.13e-12	-6.529502	0.712241	-3.616670
6	577.0579	46.99456	7.31e-12	-6.495479	2.154380	-3.016264
7	686.2972	89.96178*	2.91e-12	-7.912874	2.145101	-3.867275
8	764.5644	51.56430	3.13e-12	-8.601515*	2.864577	-3.989532

Source: Author's computation.

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

5.2.3.3. Fixed Investment Model Lag length criteria

The fixed investment model lag length criteria are reflected in Table 5.9 for both SSA and BRICS. The SSA model also mirrors the current account model above. As such the same conclusions are made in that the AIC lag length of eight is adopted, in opposition to the one lag criteria stated by the FPE, SC and HQ. In the BRICS model, there is an equal stance in the lag length criteria where FPE and AIC affirm eight lags while the SC and HQ affirm one lag. Similarly, as advised by Liew (2004), the adopted maximum lags are eight, as denoted by the AIC and FPE criteria.

Table 5.9: Fixed Investment models Lag length criteria

Panel A: selected SSA						
Lag	**LogL**	**LR**	**FPE**	**AIC**	**SC**	**HQ**
0	-853.4857	NA	1.464611	20.24672	20.44788	20.32763
1	-243.4163	1105.302	2.72e-06*	7.045088	8.654365*	7.692384*
2	-207.3730	59.36540	3.77e-06	7.349953	10.36735	8.563632
3	-176.2753	46.09769	6.09e-06	7.771184	12.19669	9.551248
4	-124.0629	68.79762	6.33e-06	7.695597	13.52922	10.04204
5	-74.45637	57.19336	7.61e-06	7.681326	14.92307	10.59416
6	-26.63099	47.26274	1.08e-05	7.708964	16.35882	11.18818
7	58.18777	69.85074	7.62e-06	6.866170	16.92415	10.91177
8	175.1121	77.03250*	3.31e-06	5.267951*	16.73404	9.879934
Panel B: BRICS						
0	-3986.193	NA	1.51e+32	93.95747	94.15863	94.03838
1	-3234.675	1361.573	1.00e+25	77.42764	79.03692*	78.07494*
2	-3179.228	91.32379	8.80e+24	77.27596	80.29335	78.48964
3	-3121.068	86.21456	7.52e+24	77.06042	81.48592	78.84048
4	-3073.628	62.50912	8.75e+24	77.09712	82.93075	79.44357
5	-3026.520	54.31289	1.12e+25	77.14164	84.38338	80.05447
6	-2975.044	50.86988	1.45e+25	77.08339	85.73325	80.56261
7	-2889.993	70.04178	1.02e+25	76.23514	86.29311	80.28074
8	-2777.141	74.35004*	4.87e+24*	74.73272*	86.19881	79.34470

Source: Author's computation

Notes: * indicates lag order selected by the criterion; LR: sequential modified LR test statistic (each test at 5% level); FPE: Final prediction error; AIC: Akaike information criterion; SC: Schwarz information criterion; HQ: Hannan-Quinn information criterion

5.2.4. Panel Co-integration Results

Panel cointegration results are now carried out to ascertain the existence of a long-run co-movement in all the models. The three co-integration estimates are run concurrently below. The Pedroni, Kao, and Johansen-Fisher Panel cointegration tests follow as such.

5.2.4.1. Pedroni Cointegration tests results

Table 5.10 relays the Pedroni panel cointegration results for both set of economies. The Pedroni cointegration test results are categorised into three sections, the no deterministic trends, the deterministic intercept and trend, and the no deterministic intercept or trend scenarios. Each section has been segmented into three columns which report on within and between dimension statistics, panel t-statistic, and panel probability value. The null hypothesis is that there is no cointegration between the variables.

The SSA model in panel A and the BRICS model in panel B were demarcated, reflecting the seven test equations of within dimension or panel statistics and between dimensions or group mean statistics on both the weighted statistics and the normal test statistics.

Table 5.10: Pedroni Panel Cointegration results (GDPPC Model)

Equation	Statistical method	Panel A:Selected SSA Model		Panel B: BRICS Model	
		Test Statistic (P-value)	Weighted Statistic (P-value)	Test Statistic (P-value)	Weighted Statistic (P-value)
No deterministic trends					
Within Dimension / Panel Statistic	Panel v-Statistic (+)	-0.613510	-0.911716	-0.597738	-1.893057
	Panel rho-Statistic	1.292346	0.881193	0.749532	0.834924
	Panel PP-Statistic	-1.049247	-2.277214	-2.731101***	-3.147150***
	Panel ADF-Statistic	0.437094	-0.103801	-2.779114***	-3.141453***
Between Dimensions / Group Mean Statistic	Group rho-Statistic	1.793944		1.516829	
	Group PP-Statistic	-1.698360**		-1.438903***	
	Group ADF-Statistic	0.892715		-4.074792***	
Deterministic intercept and trend					

Within Dimension / Panel Statistic	Panel v-Statistic (+)	-0.310014	-1.335988	-1.488327	-3.085099
	Panel rho-Statistic	1.910911	1.217663	2.110724	1.922205
	Panel PP-Statistic	-1.351391***	-3.311757***	-13.30655***	-7.881133***
	Panel ADF-Statistic	-2.846002***	-4.101147***	-6.041966***	-5.623757***
Between Dimensions / Group Mean Statistic	Group rho-Statistic	2.239311		2.369951	
	Group PP-Statistic	-2.190070**		-19.03516 ***	
	Group ADF-Statistic	-3.602405***		-6.574810***	
No deterministic intercept or trend.					
Within Dimension / Panel Statistic	Panel v-Statistic (+)	-0.177390	-0.605167	-0.164711	-1.526331
	Panel rho-Statistic	0.843612	0.705850	0.398908	0.368276
	Panel PP-Statistic	-1.58407*	-2.534714***	-2.758381***	-3.235984***
	Panel ADF-Statistic	-0.351017	-1.042354	-2.881648***	-3.322323***
Between Dimensions / Group Mean Statistic	Group rho-Statistic	1.596497		1.450761	
	Group PP-Statistic	-2.368227***		-5.428704***	
	Group ADF-Statistic	-0.448772		-3.576117***	

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

Analysing the no deterministic trend scenario first, the results maintain the null hypothesis with no co-integration across the seven equation in both weights. While the BRICS models reject the null hypothesis with the majority of equations advocating for co-integration with six of the eleven equations rejecting the null hypothesis. Two of the three between dimension equations reject the null hypothesis, and four of the eight within dimension equations rejected the null hypothesis.

When incorporating the deterministic intercept and trend, both the selected SSA model and the BRICS model are observed to follow the same pattern of results. With seven of the 11 equations reflecting estimates suggesting cointegration, that is, four of the within dimension having p values lower than 5%, the Panel PP-Statistic and Panel ADF-Statistic on both weights are significant. Additionally, the Group PP-Statistic and Group ADF-Statistic also reflected to be statistically significant of a co-movement in the SSA GDP per capita model. Similarly, the BRICS GDP per capita model also has the same tests reflecting cointegration. Thus, four of the seven statistics method approve a long-run co-movement for the SSA and BRICS models.

When incorporating the no deterministic intercept or trend equation, only the BRICS equation produces co-integration results, rejecting the null hypothesis on the same basis as the no deterministic trend. The selected SSA maintains the null hypothesis.

In summary, it is confirmed that the Pedroni test advocates for the presence of cointegration since in the selected SSA and BRICS models were two of the three methods rejecting the null hypothesis in the selected SSA, while all the methods in BRICS results confirmed cointegration.

Table 5.11: Pedroni Panel Cointegration results (Current Account Model)

Equation	Statistical method	Selected SSA Model		BRICS Model	
		Test Statistic (P-value)	Weighted Statistic (P-value)	Test Statistic (P-value)	Weighted Statistic (P-value)
No deterministic trends					
Within Dimension / Panel Statistic	Panel v-Statistic (+)	-0.596726	-0.814836	-2.073322	-1.773844
	Panel rho-Statistic	1.828587	1.506872	0.317996	0.403358
	Panel PP-Statistic	-0.588723	-1.289397*	-4.535492***	-4.543062***
	Panel ADF-Statistic	-0.720221	-1.342124	-4.646348***	-4.683974***
Between Dimensions / Group Mean Statistic	Group rho-Statistic	2.374527		2.005947	
	Group PP-Statistic	-1.742772**		-5.665550***	
	Group ADF-Statistic	-2.207461		-4.759628***	
Deterministic intercept and trend					
Within Dimension / Panel Statistic	Panel v-Statistic (+)	-0.131985	-0.245926	-0.243783	-3.085099
	Panel rho-Statistic	1.185147	1.179341	2.078288	1.922205
	Panel PP-Statistic	-0.793095**	-1.474841**	0.782335***	-7.881133***
	Panel ADF-Statistic	-1.786119**	-2.327197**	0.728246***	-5.623757***
Between Dimensions / Group Mean Statistic	Group rho-Statistic	1.948210		2.729417	
	Group PP-Statistic	-1.600990 ***		0.769313***	
	Group ADF-Statistic	-3.151216 ***		0.524868 ***	
No deterministic intercept or trend.					
Within Dimension / Panel Sta	Panel v-Statistic (+)	-2.91076	-2.906522	-2.87505	-2.929629
	Panel rho-Statistic	1.925641	2.060951	1.709121	2.044719

tistic					
	Panel PP-Statistic	0.559058	1.034450	0.110603	0.780832
	Panel ADF-Statistic	0.616316	1.107365	0.136799	0.824825
00Between Dimensions / Group Mean Statistic	Group rho-Statistic	2.571896		2.189373	
	Group PP-Statistic	-0.039083		-0.097449	
	Group ADF-Statistic	0.038393		-0.063851	

Source: Author's computation

Note: *, **, *** represents significance at 1%, 5% and 10%, respectively.

Table 5.11 reflects the selected SSA and BRICS current account Pedroni panel cointegration results. There is a similar submission of results as the GDP per capita model. In analysing the no deterministic trend scenario, the results resemble the same findings as in the GDP per capita model for both the selected SSA and BRICS models. The results maintain the null hypothesis with no co-integration across the seven equation in both weights for the selected SSA. While the BRICS models reject the null hypothesis with the majority of equations advocating for co-integration with six of the eleven equations rejecting the null hypothesis. Two of the three between dimension equations reject the null hypothesis, and four of the eight within dimension equation rejected the null hypothesis.

Similar results still hold when incorporating the deterministic intercept and trend equation. Four of the eight statistical methods in the within dimension reflect cointegration with a p-value of less than 5%. Additionally, two of the three statistical methods in the between dimension proved the presence of cointegration for both the selected SSA and BRICS. Therefore, there is evidence of cointegration. Lastly, when incorporating the no deterministic intercept or trend equation all the equations accept the null hypothesis of no cointegration for both the selected SSA and BRICS models.

In summary, it is confirmed that the Pedroni test advocates for the presence of cointegration since only in the BRICS MODEL as two of the three methods reject the null hypothesis. In the selected SSA, cointegration can be fully proved as one method rejected the null hypothesis.

Table 5.12: Pedroni Panel Cointegration Results (Fixed Investment Model)

Equation	**Statistical method**	**Selected SSA Model**		**BRICS Model**	
		Test Statistic	**Weighted**	**Test Statistic**	**Weighted**

		(P-value)	Statistic (P-value)	(P-value)	Statistic (P-value)
No deterministic trends					
	Panel v-Statistic (+)	-0.139185	0.151350	0.305577	0.470600
	Panel rho-Statistic	1.367980	1.434172	1.451401	1.197557
	Panel PP-Statistic	-0.564128	-0.918380	-0.766276	-1.394971
	Panel ADF-Statis-tic	-1.977798**	-2.50138***	-0.621756	-0.715923
	Group rho-Statistic	2.350614		1.916252	
	Group PP-Statistic	-0.540187		-3.327392***	
	Group ADF-Statistic	-2.645711**		-1.022419	
Deterministic intercept and trend					
Within Di-mension / Panel Sta-tistic	Panel v-Statistic (+)	0.423461	0.531211	0.770232	0.794228
	Panel rho-Statistic	2.445666	2.254813	1.848621	1.471655
	Panel PP-Statistic	0.266428***	-0.954397***	-3.006977***	-3.813299***
	Panel ADF-Statis-tic	-1.549891***	-2.438925***	-3.606430***	-4.307089***
Between Dimensions / Group Mean Sta-tistic	Group rho-Statistic	3.016132		1.962127	
	Group PP-Statistic	-0.770021**		-4.648550***	
	Group ADF-Statis-tic	-2.122290**		-5.123321***	
No deterministic intercept or trend.					
Within Di-mension / Panel Sta-tistic	Panel v-Statistic (+)	-2.737882	-2.778613	-2.519792	-2.451834
	Panel rho-Statistic	1.541096	1.404091	1.583545	1.403879
	Panel PP-Statistic	0.040668	-0.351899	0.647010	0.313525
	Panel ADF-Statis-tic	-0.212821	-0.608663	0.537320	0.187996
Between Dimensions / Group Mean Sta-tistic	Group rho-Statistic	2.312607		2.148398	
	Group PP-Statistic	0.260335		0.529898	
	Group ADF-Statis-tic	-0.101784		0.408739	

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

In the fixed investment model across the SSA and BRICS models, the results are reflected in Table 5.12. When analysing the no deterministic trend scenario, both the selected SSA and the BRICS models accept the null hypothesis of no cointegration across all the dimensions. However, when utilising the deterministic intercept and trend, the selected SSA still maintain the null hypothesis, whereas the BRICS model rejects the null ypothesis in favor of a long-run co-movement. The same statistical methods across the two dimensions approve the presence of cointegration. Lastly, similar to the no deterministic trend findings, even the no deterministic intercept and trend accept the null hypothesis.

In summary, it is confirmed the fixed investment-ECI models for both selected SSA and BRICS cointegration cannot be fully advocated for with only one method rejecting the null hypothesis. To this end, the study proceeds to estimate the cointegration through the Kao cointegration technique.

5.2.4.2. Kao panel cointegration tests results

A second panel cointegration method in the study is the Kao panel cointegration assessment, which adopts the null hypothesis of no cointegration between the within the SSA and BRICS across the GDP per capita, current account and the fixed investment models. Table 13 reflects on the GDP per capita model for the two groups, the SSA and BRICS models.

Table 5.13: Kao Panel Cointegration results (GDPPC Model)

Method	Selected SSA Model	BRICS Model
	Test Statistic (P-value)	Test Statistic (P-value)
Kao ADF Test	-4.410024***	-2.967474***
Residual variance	4.551008	5.560897
HAC variance	2.204551	4.279451

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

The results in Table 5.13 show that cointegration exists in the SSA and BRICS models as seen by the ADF t-statistics of -4.410024, and a probability of 0.0000 for the SSA, which is less than 5%. While the BRICS models also confirm cointegration with the ADF t-statistic of -2.967474 and a probability of 0.0015. The results therefore mean that there exists a long-run co-movement among the variables in respective models as outlined in chapter 4.

Table 5.14 shows the current account model results for both SSA and BRICS. The existence of a co-movement in the estimated models was present with the ADF t-statistics for the SSA model at -4.835304, the BRICS model at -4522147, and a probability of 0.0000 for the respective models. As such, there is a long-run cointegration in the estimated models as reflected in chapter 4.

Table 5.14: Kao Cointegration Results (Current Account Model

Method	**Selected SSA Model**	**BRICS Model**
	Test Statistic (P-value)	**Test Statistic (P-value)**
Kao ADF Test	-4.835304***	-4.522147***
Residual variance	0.008589	0.004664
HAC variance	0.003489	0.004394

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

Lastly, the fixed investment model across the two groups, SSA and BRICS models are reflected in Table 15. They too are seen to have a long-run cointegration results, with the SSA model having an ADF t-statistic of -4.849547 and a probability of 0.0000, while the BRICS model has an ADF t-statistic of -3.715946 accompanied by a probability of 0.0001. To this end, the SSA and BRICS models estimated in chapter 4 are proved to have a long-run co-movement according to the Kao test.

Table 5.15: Kao Cointegration Results (Fixed Investment Model)

Method	**Selected SSA Model**	**BRICS Model**
	Test Statistic (P-value)	**Test Statistic (P-value)**
Kao ADF Test	-4.849547***	-3.715946***
Residual variance	0.021502	0.011041
HAC variance	0.015324	0.009364

Source: Author's computation

Note: *, **, *** represents significance at 1%, 5% and 10%, respectively.

Upon reflecting upon the Pedroni cointegration method and the Kao, the study also employs the Johansen-Fisher cointegration test to outline whether cointegration does exist. This is more so especially that the Pedroni test was not conclusive, though conclusive in the fixed investment models.

5.2.4.3. Johansen-Fisher Panel cointegration test

Following-on on the Pedroni and the Kao tests the Johansen-Fisher panel cointegration is also carried out to examine whether cointegration between the variables in the three models is present. The results are in both the Fisher statistics for trace and max–eigenvalue. The Johansen-Fisher panel cointegration test carries more weight than the previous two cointegration tests. The results are presented in Table 5.16 with 5.16A for the selected SSA countries and 5.5B for the BRICS countries.

Table 5.16: Johansen-Fisher Panel Cointegration Results (GDPPC Model)

Panel A: Selected SSA				
Hypothesised No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	240.7	0.0000	217.7	0.0000
At most 1	134.6	0.0000	95.36	0.0000
At most 2	53.38	0.0000	36.71	0.0001
At most 3	24.76	0.0058	15.25	0.1232
Panel B: BRICS				
None	282.3	0.0000	335.1	0.0000
At most 1	239.5	0.0000	139.8	0.0000
At most 2	135.6	0.0000	95.42	0.0000
At most 3	60.66	0.0000	49.23	0.0000
At most 4	22.49	0.0128	20.04	0.0289
At most 5	11.05	0.3535	6.551	0.7670
At most 6	20.42	0.0256	20.42	0.0256

Source: Author's computation

Table 5.16 reveals that both the Fisher trace statistics and max-eigenvalue revealed three cointegration vectors in the selected SSA models and four in the BRICS model at 1% level of significance in both models and 5% (at the 4th cointegration level in BRCS). These results then show that there exists a long-run co-movement in GDP per capita and economic complexity model for both sets of economies.

Table 5.17: Johansen-Fisher Panel Cointegration Results (Current Account Model)

Panel A: SSA				
Hypothesised No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	288.6	0.0000	308.7	0.0000
At most 1	209.6	0.0000	136.3	0.0000
At most 2	99.87	0.0000	73.15	0.0000
At most 3	39.73	0.0000	31.50	0.0005
At most 4	16.07	0.0976	10.86	0.3684
Panel B: BRICS				
None	198.5	0.0000	424.3	0.0000
At most 1	242.4	0.0000	132.4	0.0000
At most 2	153.2	0.0000	85.25	0.0000
At most 3	89.37	0.0000	56.64	0.0000
At most 4	43.34	0.0000	33.86	0.0002

At most 5	18.86	0.0420	14.81	0.1392
At most 6	19.83	0.0309	19.83	0.0309

Source: Author's computation

Table 5.17 also shows the panel Johansen-Fisher cointegration results in the current account model for the two economies. There is evidence of long-run cointegration in the selected SSA model with three cointegration vectors, and significant at 1% in both the trace and max-eigen test in panel A, while the BRICS current account model in panel B also shows the existence of long-run cointegration with four cointegration vectors significant at 1%.

Table 5.18: Johansen Panel Cointegration Results (Fixed Investment Model)

Panel A: SSA				
Hypothesised No. of CE(s)	**Fisher Stat.* (from trace test)**	**Prob.**	**Fisher Stat.* (from max-eigen test)**	**Prob.**
None	264.8	0.0000	313.8	0.0000
At most 1	157.9	0.0000	86.64	0.0000
At most 2	91.17	0.0000	62.79	0.0000
At most 3	40.16	0.0000	35.11	0.0001
At most 4	15.12	0.1276	7.109	0.7151
Panel B: BRICS				
None	181.3	0.0000	126.2	0.0000
At most 1	75.02	0.0000	49.51	0.0000
At most 2	35.08	0.0001	28.14	0.0017
At most 3	15.99	0.1000	12.41	0.2585
At most 4	9.639	0.4727	8.745	0.5565
At most 5	12.57	0.2490	12.57	0.2490

Source: Author's computation

Table 5.18 proceeds with the final cointegration test in the fixed investment models. The panel Johansen-Fisher cointegration results in the fixed investment model for the two economies gave positive results. There is evidence of long-run cointegration in the selected SSA model with three cointegration vectors, and significant at 1% in both the trace and max-eigen test in panel A, while the BRICS model in panel B revealed two cointegration vectors and significant at 1% in panel B.

In conclusion, cointegration is confirmed with two of the three cointegration tests, the Kao and the Johansen-Fisher conclusively advocating for cointegration in the three macroeconomic models across the two economies. In the BRICS case, the Pedroni also confirmed cointegration with most tests advocating for such. In the selected SSA, there was, however, inconsistent results. Nonetheless, there exists a co-movement of the variables in the long-run for all the models.

5.2.5. Panel Autoregressive Distributed Lag (PARDL) tests results

Upon answering the question on whether there exists any long-run cointegration in the respective models, the next phase addresses one of the study objectives. The first objective is addressed through the PARDL method. The two sub-sections below reveal the long-run and short-run (including error correction model), respectively.

5.2.5.1. Long-run Estimates Results

The first macroeconomic variable is the GDP per capita, estimated against economic complexity and the five other predictors in the two groups of economies, the selected SSA model and BRICS model. The two models were estimated using the Akaiko selection criteria, and two lags were used under the constant trend specification for the selected SSA models, while the BRICS model adopted the linear trend specification.

Table 5.19: GDPPC Long-run Estimates Results

Panel A: SSA					**Panel B: BRICS**				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***	**Variables**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
ECI	0.605474	0.296392	2.042817	0.0471	ECI	0.623318	0.329825	1.889841	0.0662
INF	-0.160115	0.016074	-9.960854	0.0000	INF	0.008970	0.029609	0.302933	0.7636
LHHE	0.842013	0.494218	1.703730	0.0955	HHE (%)	0.392926	0.041640	9.436345	0.0000
LIMPI	0.034114	0.368436	0.092592	0.9266	LIMPI	-0.029025	0.228752	-0.126884	0.8997
LGOVEX	-1.025375	0.630513	-1.626255	0.1110	LIND	8.120936	1.780731	4.560451	0.0000
REER	0.010563	0.008708	1.213112	0.2316	LEMPL	0.008970	0.029609	0.302933	0.7636

Source: Author's computation

Table 5.19 shows the long-run estimates in answering the first objective about whether economic complexity affects the GDP per capita desirably, and other predictors for both the selected SSA and BRICS. Panel A of the table are the selected SSA results, while panel B is for the BRICS. For the selected SSA estimates, in the long-run evidence reflects that there exists a positive association between economic complexity and GDP per capita, significant at a 5% level. Therefore, any 1% upward change in economic complexity is associated with a positive 0.605% increase on GDP per capita. In the BRICS nations, the same empirical stand holds in that there is a positive association between economic complexity and GDP per capita, however, significant at 10% level. A 1% change in economic complexity is associated with a 0.623% increase GDP per capita. These sets of economies affirm the endogenous growth model as a catalyst to economic and the people’s well-being in the long-run. Both the selected SSA findings and BRICS economies findings are in line with argument by Hausmann *et al*. (2014), who assured a strong positive relationship between GDP per capita and economic complexity. As such, Romer’s (2019) observations that a sophisticated society or a technologically advanced production in countries is a prerequisite for development holds in the long-run. Additionally, these results are also substantiating or uphold the work of Ncanywa *et al.* (2021) on ECI improving the income inequality outlook in the selected SSA context. What this also suggests in a developmental scenario is that a local value chain in the production line that leads to manufacturing for the export market is an impotant facets of the economy that primes the wellness of the citizens of these two group of economies. Moreso, for the less developed region of SSA in that this may aid the improvement in the standard of living.

The remainder of the predictors are outlined as such. Firstly, inflation has a negative and significant association on GDP per capita at 1% level for the selected SSA, while in the BRICS case an insignificant positive association was observed. Secondly, the log of household expenditure in the selected SSA had a positive and 10% significant relationship on GDP per capita, while the BRICS case household expenditure as a percentage of GDP also had a positive and significant relationship at 1%. Thirdly, the log of imports index for both economies was seen as an insignificant predictor of GDP per capita. Fourthly, the log of government expenditure was seen as an insignificant negative predictor of GDP per capita in the selected SSA countries, while in BRICS the log of industrial production it was seen that there exists a positive association which is significant at the 1% level. Lastly, real effective exchange rate and the log of employment were insignificant predictors of GDP per capita for selected SSA and BRICS, respectively.

The second macroeconomic variable is the current account, estimated against economic complexity and the five other predictors in the two groups of economies, the selected SSA model and BRICS model. Like the GDP per capita models, the two current account models were estimated using the Akaiko selection criteria, and two lags were used under the linear trend specification. Table 5.20 shows the selected SSA current account model in panel A and the BRICS current account model in panel B.

Table 5.20: Current Account Long-run Estimates Results

Panel A: SSA					Panel B: BRICS				
Variables	**Coeffi-cient**	**Std. Error**	**t-Statistic**	**Prob.***	**Variables**	**Coefficient**	**Std. Er-ror**	**t-Statistic**	**Prob.***
ECI	0.132532	0.039247	3.376843	0.0012	ECI	0.496428	0.087284	5.687518	0.0000
AGRICEX	0.001370	0.001728	0.792662	0.4305	AGRICEX	-0.046369	0.004908	-9.448510	0.0000
INF	-0.007826	0.001865	-4.196388	0.0001	INF	0.034333	0.009589	3.580373	0.0009
LIMPI	0.670828	0.031579	21.24260	0.0000	LIMPI	0.792864	0.047874	16.56140	0.0000
LSAV	0.095770	0.045029	2.126882	0.0368	LGOVEXP	-0.202875	0.036364	-5.579012	0.0000
LUNEMR	-0.227094	0.058071	-3.910626	0.0002	LEMPL	0.158896	0.245673	0.646776	0.5216

Source: Author's computation

In panel A, the results of the selected SSA current account model estimates are analysed as such, simultaneously with the BRICS current account model in panel B. In the long-run, economic complexity has a positive impact on the current account in the selected SSA countries, and is significant at the 1% level. Thus, the estimates show that a 1% increase in economic complexity will result in a 0.132% increase in current account. Similarly, there exists a positive impact of economic complexity on current account in the BRICS countries, which is also significant at 1%. Accordingly, the estimates show that a 1% increase in economic complexity will result in a 0.496% increase in the BRICS current account.

These results confirm the technological gap theory as holding in the two economies from Luc and Soete (1981) perspective. This means that the current account is seen to improve given the exportation of a more sophisticated basket as opposed to a more unsophisticated exports basket. These findings are in line with argument by Ivanova *et al.* (2017) for both the selected SSA and BRICS, who found same in developed, developing and BRICS analysis. To this end, the argument by Luc and Soete (1981) that the focus on R&D and the number of patents in respective countries as a measure of technological know-how is essential as development tool. This will lead to a better ECI and as such a competitive current account through trade. This is so because these findings approve that restructuring the respective economies by mobilising resources in favour of the knowledge-intensive manufacturing sector by improving PCI, thereby leading to a well-diversified exports and trade is necessary. The selected SSA and BRICS economies can boost the essential output growth capable of instigating a long-run maintainable economic development. This then exposes the idea that should the

African region, given the AfCTA, export more of value added goods among each other or the world it would act a stimulus to current account surplus for respective economies in the long-run. This bodes well to catch-up to the most industrialised BRICS countries like China and India.

The rest of the five predictors across the two models are each analysed as such. First, agricultural exports as a share of GDP had a positive but insignificant impact on the current account in the selected SSA countries, while in the BRICS economies, there was a negative and significant impact on the current account. Secondly, inflation in the selected SSA countries was negative and significant at 1% on the current account. In the BRICS case, there was a positive and 1% significant impact on the current account. Thirdly, regarding the log of imports index, there exists a positive impact on the current account in both the selected SSA and BRICS case, significant at 1% level in both instances. Fourthly, the log of savings in the selected SSA countries had a positive and significant impact at 5%, while in the BRICS case, the log of government expenditure as a share of GDP had a negative and significant impact on the current account at 1%. Lastly, in the selected SSA countries, the log of unemployment rate had an adverse impact on the current account, significant at the 1% level, and in the BRICS economies, the log of employment was an insignificant positive claim on the current account.

Lastly, the third macroeconomic variable under study is a fixed investment estimated against economic complexity and five other predictors in the two groups of economies, the selected SSA model and BRICS model. Like the two previous models, the fixed investment models and the two current account models were estimated using the Akaiko selection criteria, and two lags were used under the linear trend specification. Table 5.21 shows the selected SSA countries fixed investment model in panel A and the BRICS fixed investment model in panel B.

Table 5.21: Fixed Investment Long-run Estimates Results

Panel A: SSA					**Panel B: BRICS**				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***	**Variables**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
ECI	0.188694	0.101071	1.866947	0.0694	ECI	0.221309	0.033370	6.632009	0.0000
INF	0.020871	0.004251	4.909988	0.0000	INF	-0.019129	0.010706	-1.786737	0.0818
LIMPI	-0.044383	0.084654	-0.524293	0.6030	LIMPI	0.787425	0.083552	9.424358	0.0000

LIND	1.336429	0.183362	7.288473	0.0000	LIND	1.868856	0.366863	5.094151	0.0000
AGRICEX	0.010142	0.005311	1.909755	0.0635	FDI	0.018408	0.015719	1.171026	0.2487
LUNEMR	-0.471001	0.081718	-5.763736	0.0000	LUNEMR	-1.215730	0.276409	-4.398295	0.0001

Source: Author's computation

In panel A the selected SSA fixed investment model estimate results are analysed concurrently with the BRICS fixed investment model estimates in panel B. In the long-run economic complexity has a positive effect on fixed investment in the selected SSA countries seen to be significant at the 10% level. Consequently, the estimates reflect that a 1% upsurge in economic complexity will result in a 0.188% increase in fixed investment. Correspondingly, there exists a positive effect of economic complexity on fixed investment in the BRICS countries, which is significant at 1%. Accordingly, the estimates reflect that a 1% gain in economic complexity will result in a 0.221% increase in fixed investment. These results confirm the accelerator theory of investment as holding in the two economies. In the selected SSA countries, these findings are also found by Yalta and Yalta (2017), and in the BRICS economies, the findings are in line with the empirical findings by Pérez-Balsalobre *et al*. (2019). Consequently, this means that investment in these countries is seen to improve given the exportation of a more sophisticated basket. Additionally, when advocating for the accelerator theory of investment, a deliberate move to improve the ECI's of both economies will maintain Kumar's (2017) views on investment. The views were that investment is a tangible level of capital in the economy, and that it decides the long run production capabilities and adds to economic growth.

These findings extend to the investment-ECI nexus, especially the argument by Pérez-Balsalobre *et al*. (2019), who say that there is a positive and significant relationship between economic complexity, human capital and physical capital. Moreover, Udeogu *et al.* (2021) puts forward a well-rounded argument that improving the set of human capital, both tacit and explicit knowledge, may be attained through quality education, and investment in physical capital containing improvement in available tools and machines and relevant infrastructure such as roads, railways, sea and air ports, electricity, internet. This was placed as such because within a place and time, this will encourage capital accumulation as well as fast-track economic complexity as the fundamental criterion of growth.

The rest of the five independent variables across the two models are each summarily analysed. First, inflation is observed to have a positive effect on fixed investment in the selected SSA countries, and is significant at 1%, while in the BRICS economies, there was a negative and significant effect on fixed investment significant at 10% level. Secondly, the log of imports index in the selected SSA countries had a negative and insignificant effect on fixed investment, and in the BRICS case, there was a positive and 1% significant effect on fixed investment. Thirdly, the log of industrial production has a positive and 1% significant effect on fixed investment for both the selected SSA and BRICS case. Fourthly, agricultural exports as a share of GDP have a positive effect significant at 10% on fixed investment in the selected SSA countries, while foreign direct investment has a positive but insignificant effect on fixed investment in the BRICS economies. Lastly, in the selected SSA countries and the BRICS economies, the log of unemployment rate had a negative effect on fixed investment, which is significant at the 1% level.

5.2.5.2. Short-run and Error Correction Model Results

This section provides answers to the second part of the first objective, which is the short-run estimates and the most significant results; and the Error Correction Model (ECM) results, which affirm the long-run estimates for the two models. The results are submitted following the same order as the long-run estimates above.

Table 5.22: GDPPC Short-run and ECM Estimates

Panel A: SSA					**Panel B: BRICS**				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***	**Variables**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
COINTEQ01	-0.096541	0.290451	-3.775308	0.0005	COINTEQ01	-0.484128	0.292499	-5.073966	0.0000
D(GDPPCC(-1))	0.042527	0.142859	0.297688	0.7673	(GDPPCC(-1))	0.339126	0.247269	1.371485	0.1781
D(ECI)	-0.409964	1.543881	-0.265541	0.7918	D(ECI)	1.667073	1.589785	1.048615	0.3008
D(ECI(-1))	-1.533568	1.078108	-1.422462	0.1619	D(ECI(-1))	0.160092	1.178763	0.135813	0.8927
D(REER)	-0.011333	0.026002	-0.435857	0.6651	D(INF)	0.198016	0.057109	3.467337	0.0013
D(REER(-1))	-0.016450	0.020911	-0.786676	0.4357	D(INF(-1))	0.112919	0.117215	0.963351	0.3413
D(INF)	0.080030	0.052101	1.536046	0.1317	D(LIMPI)	-0.250412	3.478282	-0.071993	0.9430

D(INF(-1))	0.004023	0.051765	0.077725	0.9384	D(LIMPI(-1))	1.697663	1.046582	1.622103	0.1128
D(LGOVEX)	2.569577	1.358900	1.890925	0.0652	D(LIND)	-7.809979	10.81057	-0.722439	0.4743
D(LGOVEX(-1))	0.643978	0.672213	0.957997	0.3433	D(LIND(-1))	7.912508	6.153824	1.285787	0.2061
D(LHHE)	19.17227	6.985070	2.744750	0.0087	D(HHE%)	-0.202496	0.178708	-1.133114	0.2641
D(LHHE(-1))	13.60647	8.138724	1.671819	0.1017	D(HHE%(-1))	-0.163336	0.161337	-1.012388	0.3176
D(LIMPI)	0.745866	1.258707	0.592565	0.5565	D(LEMPL)	-6.189081	32.42616	-0.190867	0.8496
D(LIMPI(-1))	1.291119	1.133453	1.139103	0.2608	D(LEMPL(-1))	49.34770	73.36690	0.672615	0.5052
C	2.490436	1.146652	2.171921	0.0353	C	5.666372	1.989952	2.847491	0.0070

Source: Author's computation

Table 5.22 shows the short-run and ECM estimates for the selected SSA model in panel A and the BRICS model in panel B. For both models, the short-run estimates reveal that economic complexity is not a significant predictor of GDP per capita. This shows that economic complexity is not an immediate contributor to the economic progress of the respective group of economies' people's well-being. Moreover, the most significant results are that of the error correction term or model, which indicates that, in the selected SSA countries, the speed of adjustment is both negative and significant at 1%. This shows that any short-run disequilibrium will adjust back to equilibrium, however at a much slower pace of 9.65% of the disequilibrium corrected within the first period. However, in the BRICS case, the adjustment path to equilibrium given the prevalence of disequilibrium is much faster compared. The error correction term shows that the BRICS model will correct any disequilibrium by 48.41% in the first period.

The two groups of economies seem to have a similar stand in the short-run but differ in the adjustment path with the BRICS model adjusting much faster. The BRICS model adjusts 96% of the disequilibrium within two years. The statistical insignificance of the short-run results suggests that Romer's (2018) endogenous theory does not hold water in the short-run. Additionally, the results also confirm the findings of Felipe *et al.* (2012), who found statistically insignificant estimates between complexity and income. To this end, the ECI and income nexus may not be seen as a short-run driven process, but rather, as a long-run driven process. This was also evident in that previous observations indicating that ECI does not influence income inequality in the short term, but meaningfully reduced income inequality in the long run in developing countries (Caous & Huarng, 2020).

With regards to the other five predictors in the two models, only the log of government expenditure and the log of household expenditure had a positive association on GDP per capita and significant at 10% and 1%, respectively, for the selected SSA countries in panel A. The other three independent variables were observed as insignificant predictors. On the other hand, only inflation had a positive and significant association on GDP per capita at 1%, with all the other predictors seen as insignificant for BRICS in panel B.

The next analysis in Table 5.23 is the current account short-run and ECM estimates for the two groups in panel A for the selected SSA countries, and panel B for BRICS below.

Table 5.23: Current Account Short-run and ECM Estimates

Panel A: selected SSA					**Panel B: BRICS**				
Variables	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***	**Variables**	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.***
COINTEQ01	-0.521375	0.197102	-2.645204	0.0100	COINTEQ01	-0.432299	0.231026	-1.871215	0.0688
D(ECI)	0.009989	0.048297	0.206821	0.8367	D(LCA(-1))	0.146005	0.181618	0.803913	0.4263
D(AGRICEX)	-0.002826	0.013556	-0.208453	0.8354	D(ECI)	-0.162770	0.105607	-1.541280	0.1313
D(INF)	0.004298	0.002272	1.891799	0.0624	D(ECI(-1))	-0.094965	0.064346	-1.475857	0.1480
D(LIMPI)	0.190623	0.082896	2.299552	0.0243	D(AGRICEX)	-0.061188	0.034312	-1.783295	0.0823
D(LSAV)	0.029087	0.065491	0.444138	0.6582	D(AGRICEX(-1))	0.008587	0.059853	0.143471	0.8867
D(LUNEMR)	0.072580	0.085174	0.852140	0.3969	D(INF)	-0.010172	0.005493	-1.851928	0.0716
C	8.791768	3.332693	2.638037	0.0102	D(INF(-1))	-0.002020	0.002961	-0.682250	0.4991
@TREND	-0.001209	0.005222	-0.231450	0.8176	D(LIMPI)	0.422525	0.216731	1.949534	0.0584
					D(LIMPI(-1))	-0.079504	0.165821	-0.479459	0.6343

					D(LGOVEXP)	-0.883589	0.367583	-2.403784	0.0211
					D(LGOVEXP(-1))	0.122157	0.383492	0.318537	0.7518
					D(LEMPL)	2.539608	2.784645	0.912004	0.3674
					D(LEMPL(-1))	-1.465146	2.063763	-0.709939	0.4820
					C	9.061124	4.774217	1.897929	0.0651

Source: Author's computation

Table 5.23 illustrates the short-run estimates for economic complexity on the current account for both models, and reveal that economic complexity is not a significant predictor for both the selected SSA countries and the BRICS economies. Much like the GDP per capita results, these results show that economic complexity does not stand as a short-run contributor to the current account in the respective groups of economies. Nonetheless, the most important results are that of the ECM, which shows that in the selected SSA countries, the speed for adjustment is both negative and significant at 1%. This shows that any short-run disequilibrium will adjust back to equilibrium 52.14% of the disequilibrium corrected within the first period. Equally, in the BRICS model, there is a parallel and good adjustment path to equilibrium given the prevalence of disequilibrium. The error correction term shows that the BRICS model will correct any disequilibrium by 43.23% in the first period. The two groups of economies seem to have a similar stand in the short-run and the adjustment path. The insignificance results in the short-run means that the technological gap theory as advocated for by Soete (1981) does not hold water for both the selected SSA and BRICS countries.

On the other five predictors of current account, only a few are significant in the Selected SSA model. Only inflation and the log of imports index had a positive and significant impact on the current account at 10% and 1%, respectively. In the BRICS economies, a number of macroeconomic predictors were significant in the short-run. Agricultural exports as a share of GDP has a negative and significant impact on the current account at 10%, additionally, inflation too had similar results. Moreover, the log of government expenditure was also negative but significant at 5%, while the log of imports index was the only predictor to have a positive impact on the current account in the short-run and significant at 10% in the BRICS economies.

The third and last results submission is that of the short-run and ECM estimates for the selected SSA countries model and BRICS economies for fixed investment. Table 5.24 thus submits the results as reflected below.

Table 5.24: Fixed Investment Short-run and ECM Estimates Results

Panel A: SSA					**Panel B: BRICS**				
Varia-bles	**Coeffi-cient**	**Std. Error**	**t-Statistic**	**Prob.***	**Varia-bles**	**Coeffi-cient**	**Std. Error**	**t-Statistic**	**Prob.***
COINTEQ01	-0.651376	0.165453	-3.936928	0.0003	COINTEQ01	-0.459170	0.196344	-2.338595	0.0246
D(LFINV(-1))	-0.110996	0.317716	-0.349357	0.7287	D(LFINV(-1))	0.141181	0.191639	0.736702	0.4657
D(ECI)	0.138610	0.250123	0.554165	0.5826	D(ECI)	-0.083741	0.108150	-0.774302	0.4434
D(ECI(-1))	0.077050	0.123107	0.625879	0.5350	D(ECI(-1))	-0.035367	0.120818	-0.292731	0.7713
D(INF)	-0.015186	0.012241	-1.240603	0.2222	D(INF)	0.009030	0.006836	1.320880	0.1942
D(INF(-1))	-0.003689	0.006871	-0.536912	0.5944	D(INF(-1))	0.014004	0.007361	1.902382	0.0645
D(LIMP)	0.677067	0.194638	3.478601	0.0013	D(FDI)	-0.006907	0.024262	-0.284679	0.7774
D(LIMP(-1))	0.325634	0.312331	1.042592	0.3036	D(FDI(-1))	-0.011560	0.011518	-1.003624	0.3217
D(LIND)	-0.356944	0.873353	-0.408705	0.6850	D(LIMPI)	0.167894	0.180307	0.931152	0.3575
D(LIND(-1))	-1.356008	0.573331	-2.365140	0.0231	D(LIMPI(-1))	-0.161915	0.143167	-1.130952	0.2650
D(AGRICEX)	0.009632	0.013523	0.712299	0.4805	D(LIND)	0.176429	0.988561	0.178471	0.8593
D(AGRICEX(-1))	0.053114	0.047950	1.107687	0.2748	D(LIND(-1))	0.079519	0.515357	0.154299	0.8782
D(LUN-EMR)	-0.290674	0.230375	-1.261744	0.2145	D(LUN-EMR)	-0.153280	0.769113	-0.199294	0.8431
D(LUN-EMR(-1))	-0.688262	0.655970	-1.049228	0.3005	D(LUN-EMR(-1))	0.081073	0.310808	0.260845	0.7956
C	11.64372	2.777884	4.191579	0.0002	C	8.361595	3.557332	2.350524	0.0239

Source: Author's computation

Table 5.24 is a display of the short-run and ECM estimates for the selected SSA model in panel A and the BRICS model in panel B. Much like the two preceding macroeconomic models for both sets of economies, the short-run estimates reveal that economic complexity is not a significant predictor of fixed investment. This also shows that economic complexity does not hold water as an immediate contributor to the investment prospects for respective group of economies. Nevertheless, a noteworthy outcome is that of the error correction model, which indicates that in the selected SSA countries, the speed of adjustment is both negative at -0.651376 and significant at 1%. This shows that any short-run disequilibrium will adjust back to equilibrium and 65.14% of the disequilibrium will be corrected within the first period. Likewise, in the BRICS case, there is an adjustment path to equilibrium given the prevalence of disequilibrium, which reflects a negative and significant result at 5% (-0.459170). The error correction term shows that the BRICS model will correct any disequilibrium by 45.92% in the first period. Comparatively, it seems that the selected SSA model will have a much quicker recovery in the disequilibrium presence in its model than the BRICS economies in the fixed investment model. These results then reject the TGTT in the short-run. As such, the argument by Jochem *et al.* (2011) that on the supply side the differences in national productivity rates by differences in the technology stock across countries lead to the current account wellness do not hold water.

With respect to the other five predictors in the two models, only two predictors were significant contributors. One was a significant contributor on fixed investment in the short-run for the selected SSA and the BRICS economies, respectively. The log of imports index had a positive and significant at 1% level, while the log of industrial production was seen to negatively affect fixed investment significantly at 5% for the selected SSA countries in panel A. In the BRICS economies, the only macroeconomic predictor that has an effect on fixed investment in the short-run is inflation with a positive effect at 10% level of significance.

5.2.6. Diagnostic test results

As reflected in chapter four, the following diagnostic tests are submitted. The residual normality and the stability results.

5.2.6.1. Residual Normality Test

The normality results are provided to reflect on the Jargua-Bera (JB) t-statistics and probability values tests while also providing the figures to reflect on the shape of the distribution, and if they are bell-shaped. Table 5.25 provides the JB results for all the models, the GDP per capita, the current account and the fixed investment model for the two sets of economies. The conditions for normality are met across all the models with p-values above 5%. As such, there is normal distribution across all the models.

Table 5.25: Normality Results

Test	Null Hypothesis	t-statistics	Probability
Panel A: GDP Per Capita models			
Jarque-Bera (JB) (selected SSA)	There is a normal distribution	5.591232	0.051016
Jarque-Bera (JB) (BRICS)	There is a normal distribution	3.863394	0.144902
Panel B: Current Account models			
Jarque-Bera (JB) (selected SSA)	There is a normal distribution	0.180343	0.913774
Jarque-Bera (JB) (BRICS)	There is a normal distribution	1.890418	0.388579
Panel C: Fixed Investment models			
Jarque-Bera (JB) (selected SSA)	There is a normal distribution	5.256691	0.072198
Jarque-Bera (JB) (BRICS)	There is a normal distribution	3.193559	0.202548

Source: Author's computation

Notable comment is made on the p-value in the GDP per capita model in the selected SSA scenario in panel A. The p-value is 5.10%, which is just 0.1% above the 5% threshold for normality condition. While the in the BRICS scenario is 14.49% p-value.

Figure 5.27 then proceeds to provide proof of the JB results for the GDP per capita model across the selected SSA (a) and BRICS (b), while reflecting on the distribution, the histogram. Both models reflect a bell-shaped distribution and as such meet the condition for normality in the models.

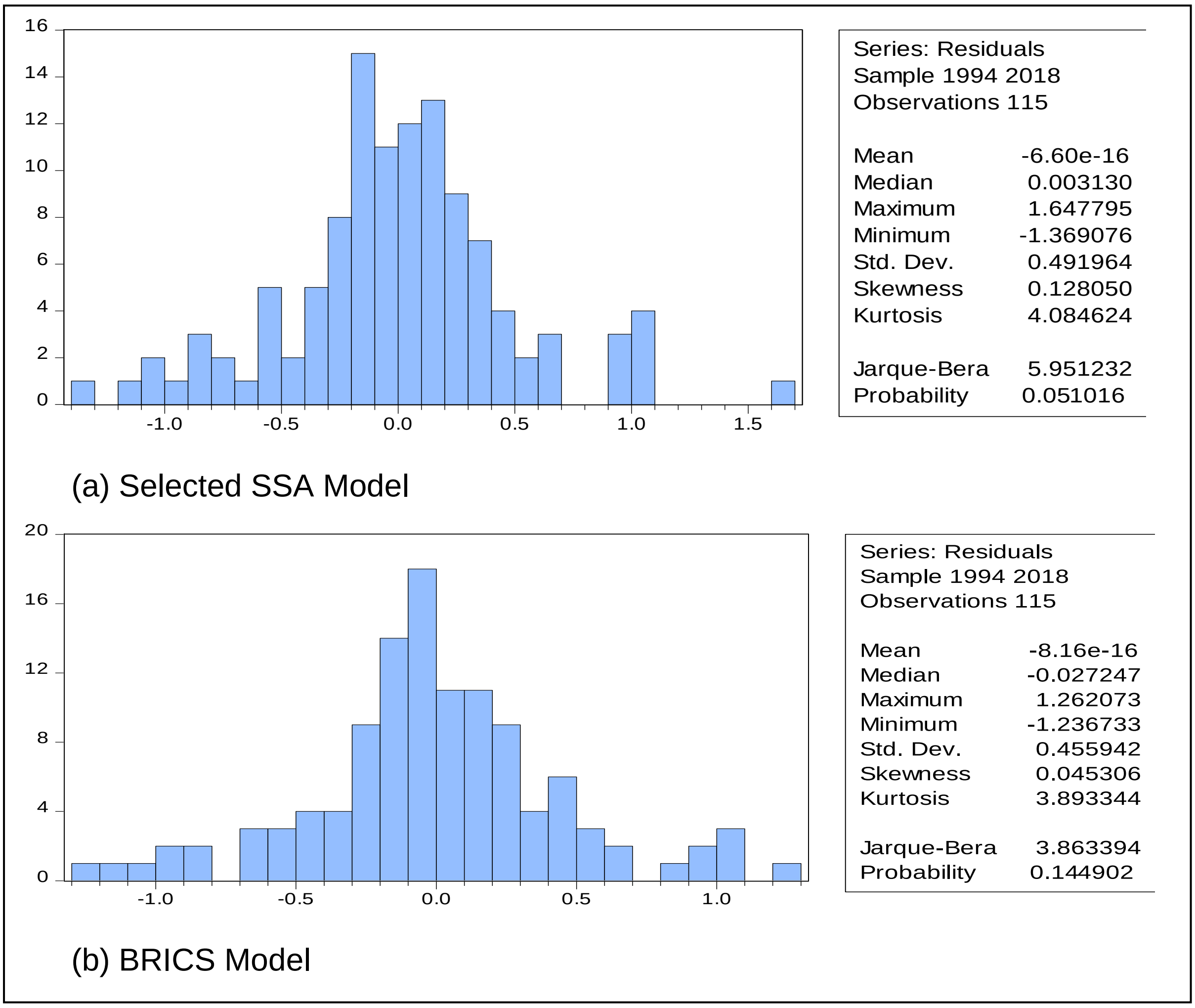


Figure 5.27: GDP per Capita Model Histograms
Source: Author's computation

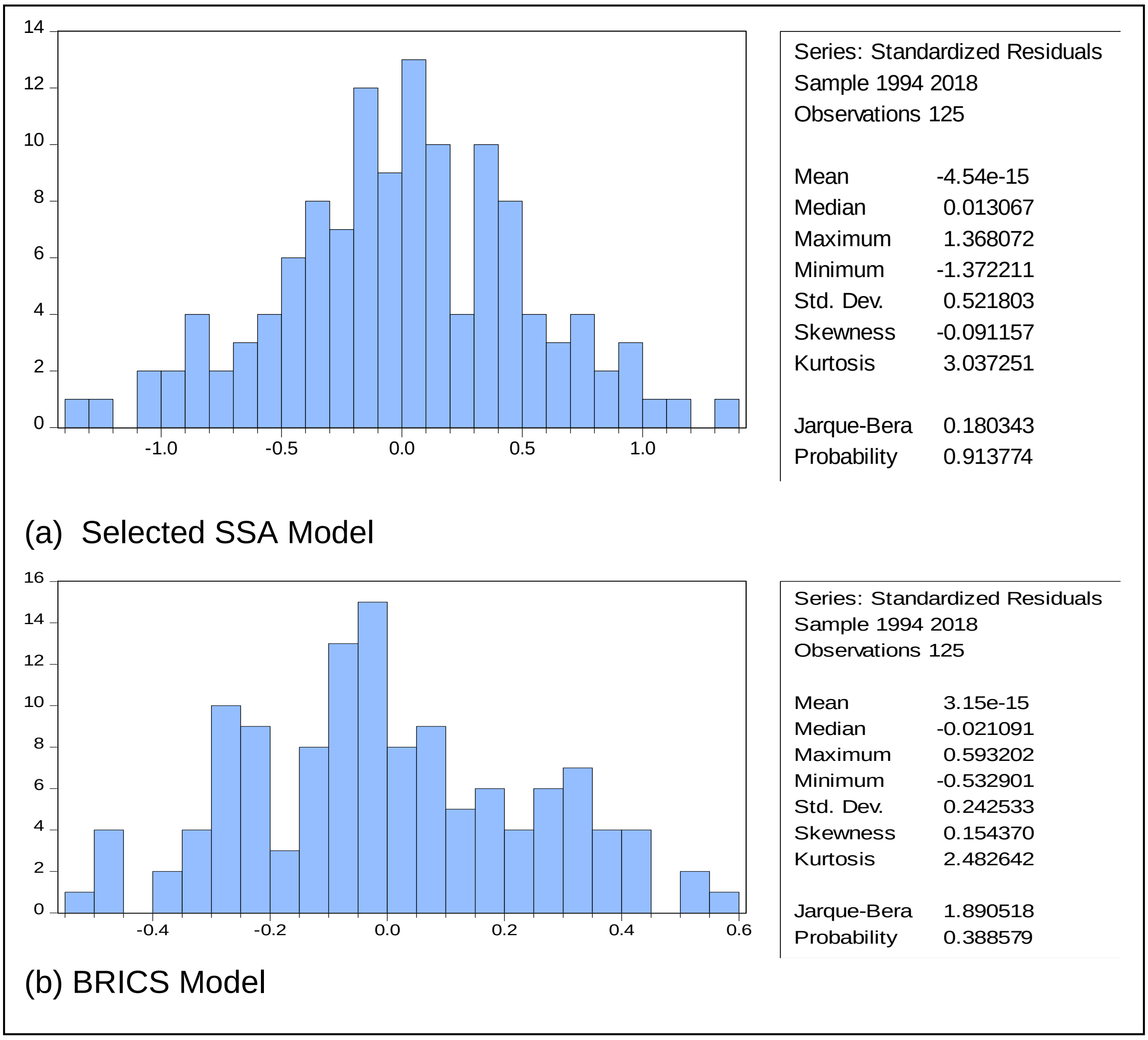


Figure 5.28: Current Account Model Histograms

Source: Author's computation

Figure 5.28 also proceeds to provide proof of the JB results for the models across the selected SSA (a) and BRICS (b). Both models reflect a bell shaped distribution and as such meet the condition for normality. However, panel B the BRICS model does not have a convincing bell-shaped distribution. To this end, the Kurtosis is evaluated as an additional condition of normality, to which it is at 2.48, hence below the 3.00 requirement.

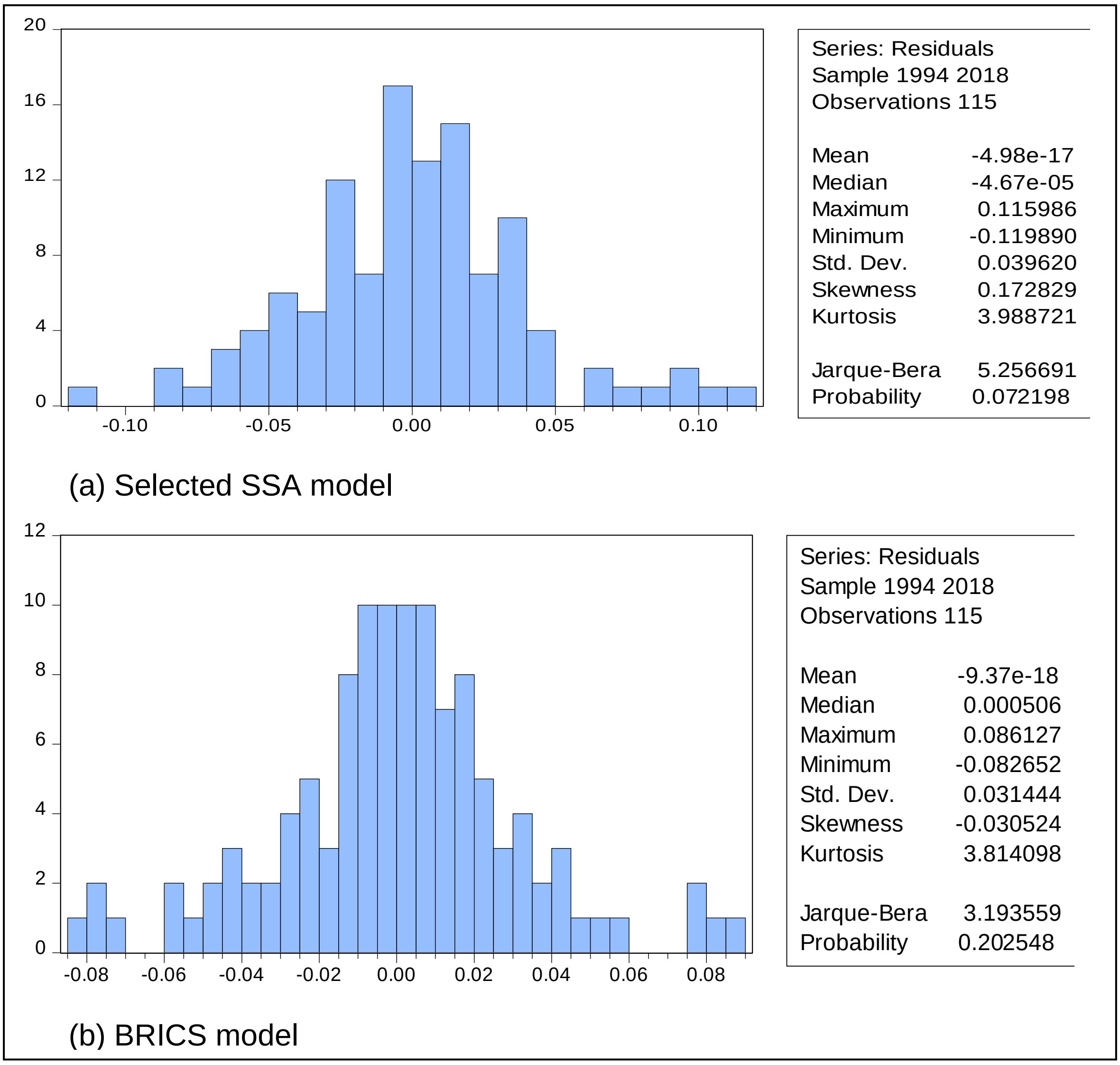
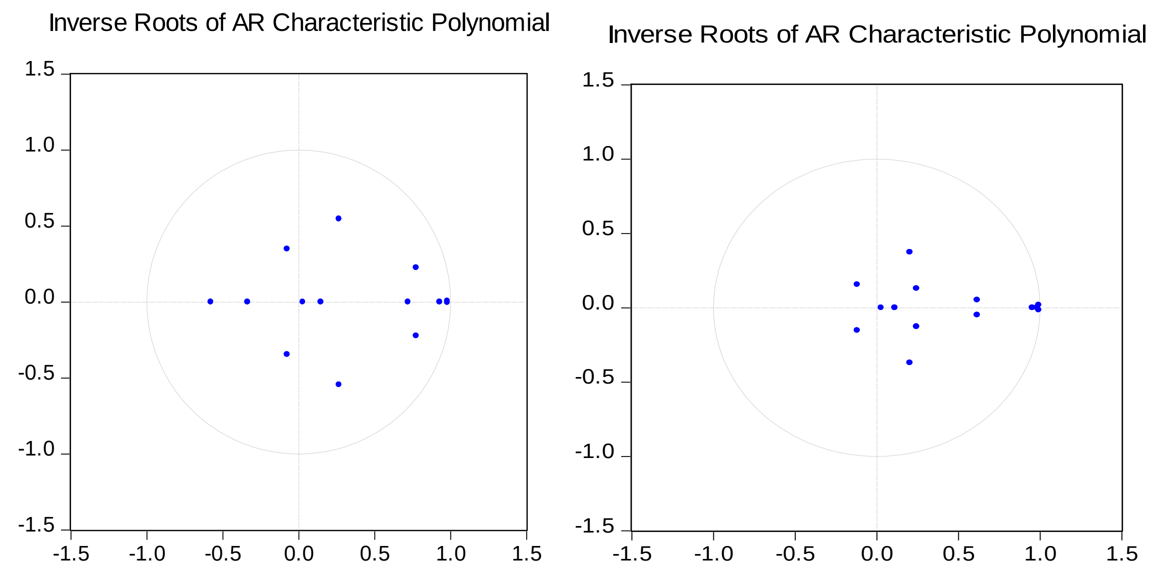


Figure 5.29: Fixed Investment Model Histograms
Source: Author's computation

Figure 5.29 also proceeds to provide proof of the JB results for the models across the selected SSA (a) and BRICS (b). Both models reflect a bell-shaped distribution, and therefore, meet the condition for normality.

5.2.6.2. Stability tests

The inverse roots of AR polynomial characteristics polynomial results are shown below for all the sets of economies in the respective macroeconomic models.

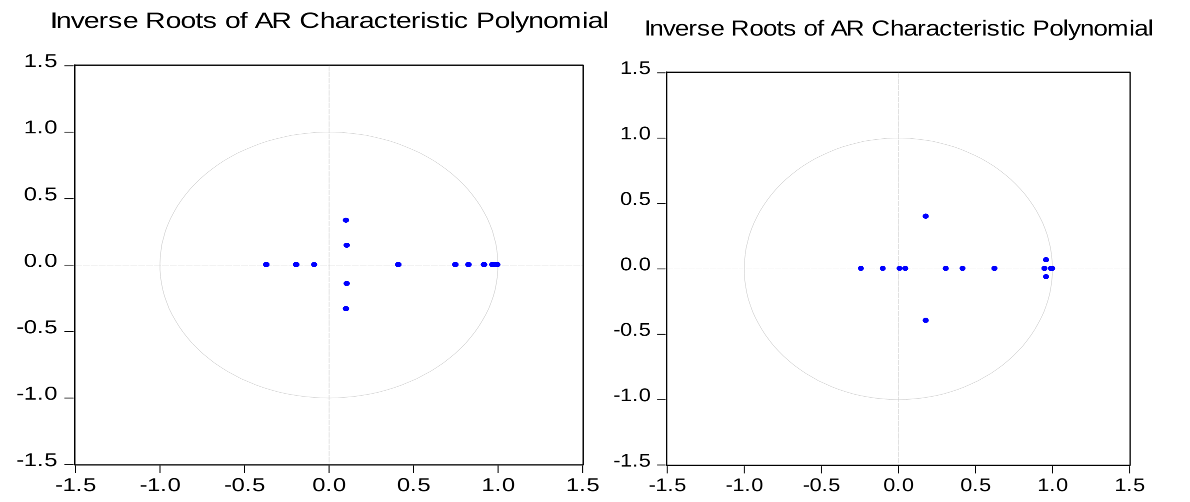


(a) Selected SSA Model (b) BRICS Model

Figure 5.30: GDP per capita Model Stability

Source: Author's computation

Figure 5.30 presents the inverse AR characteristics polynomial graph for both the selected SSA and the BRICS GDP per capita models, which are meant to test for stability and subsequently reliability. The two graphs both in (a) the selected SSA and (b) the BRICS model tests confirm the stability of the models grounded on the point that all the dots are situated inside the unit circle. Therefore, the estimated models of economic complexity and GDP per capita are stable and reliable for statistical estimation.



(a) Selected SSA Model (b) BRICS Model

Figure 5.31: Current Account Model Stability

Source: Author's computation

Figure 5.31 presents the inverse AR characteristics polynomial graph in the current account models. The two graphs both in (a) the selected SSA and (b) the BRICS model tests confirm the stability of the models founded on the point that all the dots are situated inside the unit circle. Therefore, the estimated models of economic complexity and current account are stable and reliable for statistical estimation.

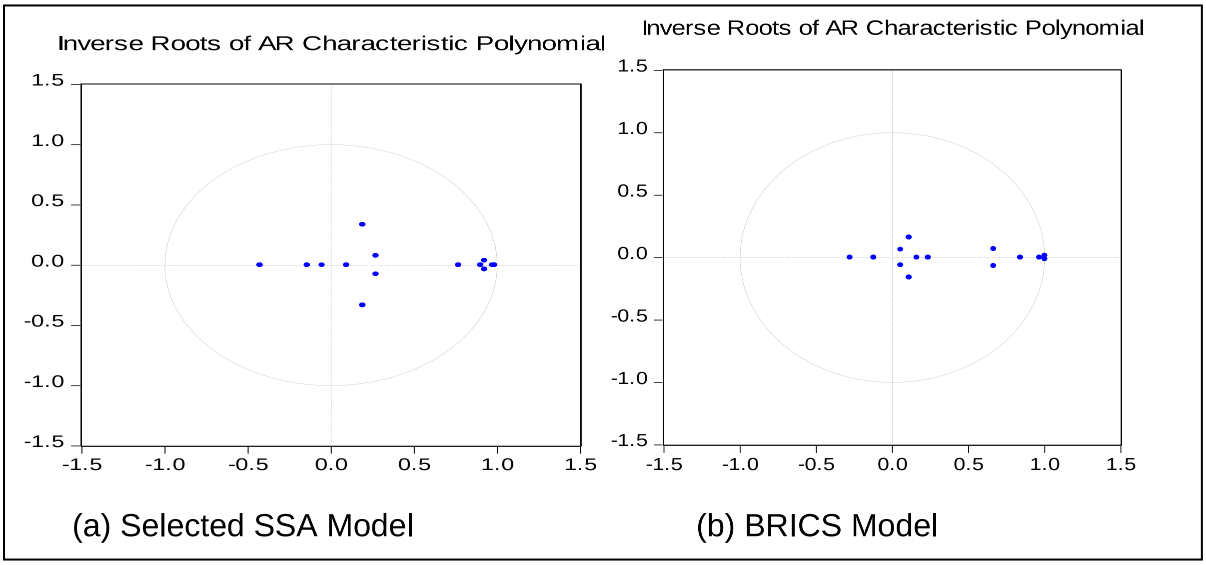


Figure 5.32: Fixed Investment Model Stability
Source: Author's computation

Lastly, figure 5.32 shows the inverse AR characteristics polynomial graph for both the selected SSA and the BRICS fixed investment models. The two graphs, both in (a) the selected SSA and (b) the BRICS model tests confirm the stability of the models founded on the point that all the dots are situated inside the unit circle. Therefore, the estimated models of economic complexity and fixed investment are stable and reliable for statistical estimation.

5.2.7. Panel Granger Causality Results

This section reflects on the Granger causality results in answering the second objective of causality effect. Given the multivariate modelling approach with quite a number of predictors, it became practical to only submit the main findings, which is the economic complexity and the other predictors on the three dependent macroeconomic variables.

Table 5.26: GDP per capita Causality Results

		Panel B: Selected SSA		Panel A: BRICS	
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**	**F-Statistic**	**Prob.**
ECI does not Granger Cause GDPPC	115	0.57801	0.5627	-0.68665	0.4923
GDPPC does not Granger Cause ECI		1.60014	0.2065	-0.60071	0.5480
INF does not Granger Cause GDPPCC		2.04259	0.1346	0.82598	0.4405
GDPPCC does not Granger Cause INF		4.00387	0.0210**	2.14217	0.1223
LHHE does not Granger Cause GDPPCC		1.52472	0.2222	4.66553	0.0114***
GDPPCC does not Granger Cause LHHE		1.38773	0.2540	19.7655	5.E-08
LIMPI does not Granger Cause GDPPCC		2.02902	0.1364	5.44535	0.0056***
GDPPCC does not Granger Cause LIMPI		3.69139	0.0281**	6.97578	0.0014
LGOVEX does not Granger Cause GDPPCC		2.08650	0.1290		
GDPPCC does not Granger Cause LGOVEX		6.85414	0.0016*		
REER does not Granger Cause GDPPCC		2.15544	0.1207		
GDPPCC does not Granger Cause REER		1.67263	0.1925		
LIND does not Granger Cause GDPPCC				6.43894	6.43894
GDPPCC does not Granger Cause LIND				0.0023	0.0023***
LEMPL does not Granger Cause GDPPCC				1.12321	1.12321
GDPPCC does not Granger Cause LEMPL				0.3289	0.3289

Source: Author's computation

Note: *, **, *** represents significance at 10%, 5% and 1%, respectively.

Table 5.26 provides the causality effects between GDP per capita and economic complexity for both the selected SSA in panel A and the BRICS results in panel B. On whether there exists any causality from economic complexity to GDP per capita, the p-value maintained the null hypothesis of no causality at 0.5627 and 0.4923 for the selected SSA and BRICS, respectively. Likewise, on whether GDP per capita has a causal effect on economic complexity, the same results of no causality are maintained for both set of countries with the p-values of 0.2065 and 0.5480 in the selected SSA and BRICS, respectively. These findings are in line with Ivanova *et al.* (2017), who in the BRICS case and other developing countries, no correlation between ECI and GDP per capita was found. This affirms the short-run results above for both economies. However, in contrast to the OECD findings, economic complexity was seen to Granger-cause real GDP per capita growth at the 5% level of significance (Udeogu *et al*., 2021).

With regards to the five other GDP per capita predictors in the selected SSA countries, it is observed that GDP per capita had a significant causal effect on inflation, LIMP and the log of government expenditure at 5%, and 1 % for LGOVEX. No formal causal effect was detected between GDP per capita, REER and EMPL was found. In the BRICS economies, there were at least two predictors that had a causal effect on GDP per capita. LHHE and LIMP had a causal effect on GDP per capita at the significance level of 5% and 1%, respectively. The only exception was that GDP per capita had a causal effect on the lLIND.

Table 5.27: Current account causality results

		Panel B: Selected SSA		Panel A: BRICS	
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**	**F-Statistic**	**Prob.**
ECI does not Granger Cause LCA	115	0.27405	0.7608	2.83648	0.0629*
LCA does not Granger Cause ECI		0.51202	0.6007	1.71822	0.1842
AGRICEX does not Granger Cause LCA		5.50103	0.0053***	1.91761	0.1518
LCA does not Granger Cause AGRICEX		2.53451	0.0839*	0.65789	0.5200
INF does not Granger Cause LCA		0.87157	0.4212	0.15026	0.8607
LCA does not Granger Cause INF		0.39910	0.6719	1.72437	0.1831
LIMPI does not Granger Cause LCA		1.12613	0.3280	3.28484	0.0412**
LCA does not Granger Cause LIMPI		5.34332	0.0061***	1.84941	0.1622
LSAV does not Granger Cause LCA		3.08803	0.0496**		
LCA does not Granger Cause LSAV		0.10094	0.9041		
LUNEMR does not Granger Cause LCA		0.00118	0.9988		
LCA does not Granger Cause LUNEMR		1.86910	0.1591		
LGOVEXP does not Granger Cause LCA				1.37009	0.2584
LCA does not Granger Cause LGOVEXP				0.65681	0.5205
LHHE does not Granger Cause LCA				1.10516	0.3348
LCA does not Granger Cause LHHE				3.83596	0.0245**

Source: Author's computation

Note: *, **, *** represents significance at 1%, 5% and 10%, respectively.

Table 5.27 reflects on the current account models results on whether there exists any causal direction between predictors and the predicted macroeconomic variable with the selected SSA in panel A and BRICS economies in panel B. On whether economic complexity has a causal effect on the current account, the null hypothesis was maintained in the selected SSA countries with a p-value of 0.7608. Similarly, we fail to reject the null hypothesis on whether current account had a causal effect on economic complexity. However, the BRICS economies economic complexity rejects the null hypothesis with a causal effect on current account and significant at the 10% level with the p-value of 0.0629. But the null hypothesis could not be rejected on whether the current account had a causal effect on economic complexity with a p-value of 0.1842. The BRICS results confirm the argument by Grossman and Helpman (1995), who demonstrated that technology has a causal effect on trade. To this end, alluding to causality, the argument by Yan and Yang (2008) hold in terms of the conclusion that Knowledge creation activities such as human capital and R&D investment show a consistent and robust positive impact on export upgrading. This analysis holds true for the BRICS as opposed to the selected SSA in the short-run causal analysis.

On the five other predictors, the selected SSA countries had a bi-directional causal effect from agricultural exports as a share of GDP to current account, and vice-versa at 1% and 10%, respectively. This means that each variable had the ability to influence one another given any behaviour from each. Additionally, current account has a causal effect on the LIMPI at the 1% level of significance. LSAV had a 5% level of significance causal effect on the current account. On the hand, in the BRICS case, only one predictor had a causal effect on the current account with the log of imports index seen to granger cause the current account at the 5% level. Whereas, current account had a causality on LHHE at the 5% significance level. Lastly, INF, GOVEX and UNEMR had no formal causality with the current account I the BRICS eonomies.

Table 5.28: Fixed investment causality Results

		Panel B: SSA		Panel A: BRICS	
Null Hypothesis:	**Obs**	**F-Statistic**	**Prob.**	**F-Statistic**	**Prob.**
ECI does not Granger Cause LFINV	115	0.16815	0.8454	3.16056	0.0463**
LFINV does not Granger Cause ECI		0.02309	0.9772	0.80827	0.4483
INF does not Granger Cause LFINV		1.26224	0.2871	0.05597	0.9456
LFINV does not Granger Cause INF		2.35365	0.0998*	1.71348	0.1850
LIMPI does not Granger Cause LFINV		0.91997	0.4016	2.77948	0.0664*
LFINV does not Granger Cause LIMPI		0.05936	0.9424	2.60279	0.0786*
LIND does not Granger Cause LFINV		1.89435	0.1553	2.32882	0.1022
LFINV does not Granger Cause LIND		0.76851	0.4662	0.97432	0.3807
AGRICEX does not Granger Cause LFINV		1.05867	0.3504		
LFINV does not Granger Cause AGRICEX		0.54828	0.5795		
LUNEMR does not Granger Cause LFINV		0.09594	0.9086	0.46203	0.6312
LFINV does not Granger Cause LUNEMR		2.01388	0.1384	0.14264	0.8672
FDI does not Granger Cause FINV				0.03710	0.9636
FINV does not Granger Cause FDI				0.27904	0.7570

Source: Author's computation

Note: *, **, *** represents significance at 1%, 5% and 10%, respectively.

Table 5.28 proceeds and relates the Granger causality effects in the fixed investment models in the two sets of economies, the selected SSA in panel A and BRICS in panel B. The null hypothesis of no causality is maintained in the selected SSA countries as the p-value estimates is 0.16815 where ECI has no causal effect on fixed investment. Similar, the null hypothesis is maintained where fixed investment has no causal effect on ECI with as p-value of 0.80827. However, in the BRICS case, the null hypothesis of no causality from ECI to fixed investment is rejected at the 5% significance level from the p-value of 0.0465. On the other hand, the null hypothesis of no causality was maintained when probing if fixed investment had a causal effect on economic complexity. The selected SSA findings are in line with the work of Udeogu *et al.* (2021), who could not find any causality between ECI and gross fixed capital formation. Nonetheless, the BRICS economies add to literature by empirically stating the opposite where ECI Granger-cause investment.

Additionally, in the selected SSA countries, of the five other predictors it was only observed that fixed investment had a causal effect on inflation at the 10% level of significance. The other predictors INF, LIMPI, LIND, AGRICEX and LUNEMR had no rejection of the null hypothesis in either direction with fixed investment. In the BRICS economies there was an observation that there exists a bi-directional causality between the LIMPI and fixed investment both at the 10% level of significance. While INF, LIND, LUNEMR and FDI maintained the null hypothesis with fixed investment.

5.2.8. Forecast Results

This section presents the two forecast techniques results, the impulse response function and the variance decomposition results. The two methods provide the same answers in the respective models but from a different set of results submission given the strength of each as outlined in chapter 4.

5.2.8.1. Impulse response function results

The selected SSA and the BRICS GDP per capita model results are reflected below in figure 5.33 and figure 5.34, respectively. The results are run against the Cholesky one standard deviation set-up.

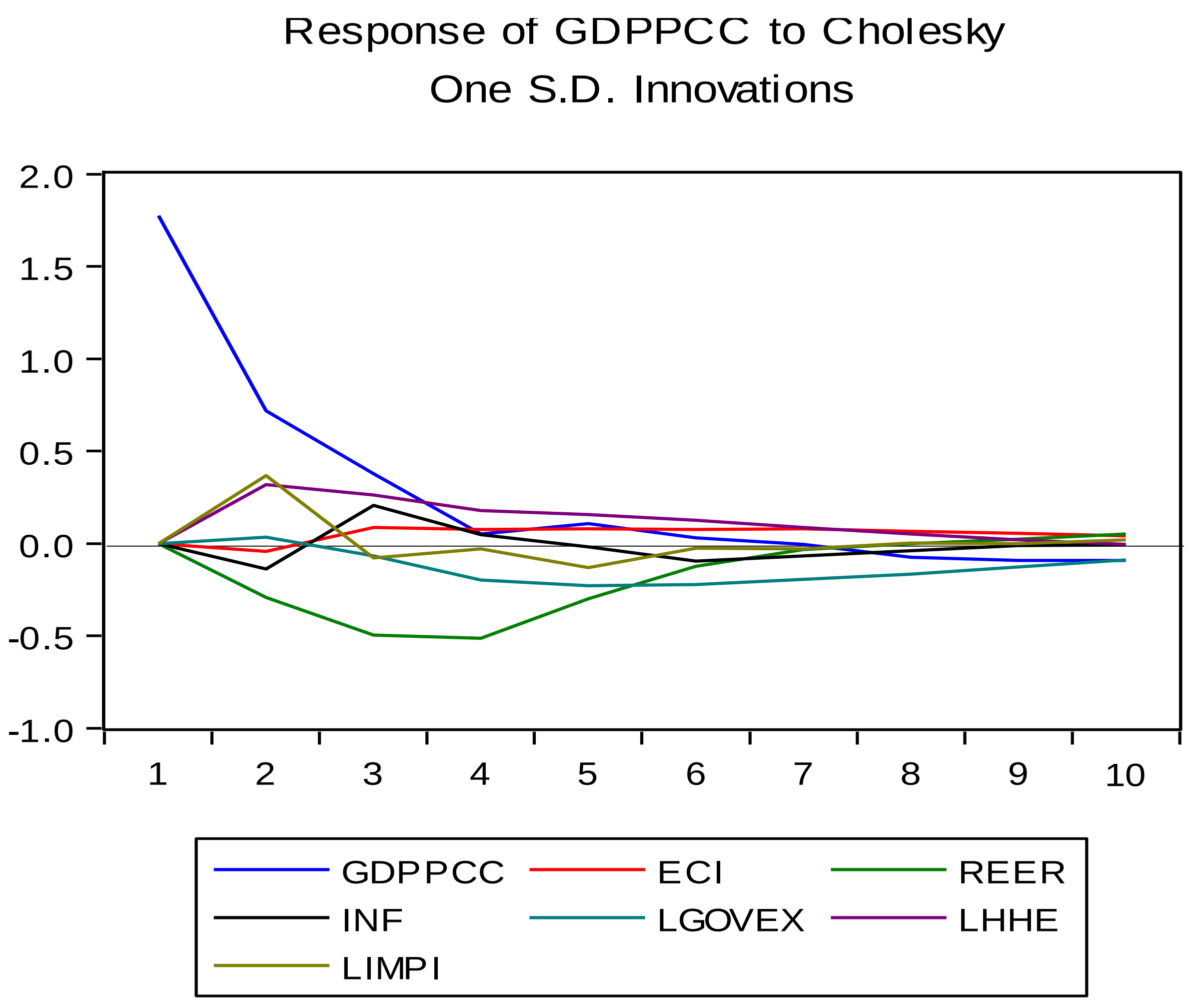


Figure 5.33: Selected SSA GDP per capita IRF

Source: Author's computation

From figure 5.33, it can be observed that in the immediate term between the first period and the second period, GDP per capita has a negative but smaller reaction in response to a one standard innovation from economics complexity. Afterwards, from the second period onwards, there is a positive reaction although it is still smaller. This positive effect fades to neutrality as it approaches the 10^{th} period. As such, overall the reaction in GDP per capita in the selected SSA countries is not that responsive to a shock emanating from economic complexity. These results seem to affirm the argument by Albeaik *et al.* (2017*)*, who says that ECI as a predictor in the future economic growth of East African countries was less optimistic in the future. Likewise, GDP per capita in the selected SSA has a visible but smaller reaction emanating from a shock in economic complexity.

On the rest of the explanatory macroeconomic variables, a one standard innovation or shock from the predictors had the following effect on the selected GDP per capita reaction. Inflation had an instant influence on the GDP per capita from the first and second period. Afterwards, it had a positive effect from the 2 ½ period to the 4 ½ period and remained neutral afterwards with a mild negative effect in the 6th period. Likewise, the log of imports index had a similar trajectory. However, GDP per capita had a positive reaction from the 1st to the 3rd period, and afterwards there was a mild negative reaction until the 6th period, remaining neutral throughout the last period. The two predictors that GDP per capita reacted to the most was the real effective exchange rate and the log of household expenditure.

GDP per capita reacted positively to household expenditure from the 1st period to the last period though in a diminishing rate. GDP per capita then reacted negatively to the real effective exchange rate from the 1st to the 6 ½ period, while remaining neutral throughout to the last period. With regards to the log of government expenditure, GDP per capita had a very small positive effect until the 2 ½ period. Thereafter, there was a visible and significant negative effect until the 10th period with a diminishing positive rate from the 7th period.

The next IRF analysis is on the BRICS economies on the reaction of GDP per capita from economic complexity and the five predictors as reflected in figure 5.34. A one standard deviation or innovation in economic complexity has a positive shock effect on the BRICS GDP per capita from the 1st to the last period. As opposed to the selected SSA GDP per capita results, the BRICS GDP per capita reaction is more pronounced and reacts positively although the reaction starts to diminish from the 7½ to the 10th period. These BRICS findings are in line with argument by Udeogu *et al*. (2021), who also, in the OECD, found that ECI was a significant predictor of economic growth where a 1 standard deviation shock at time zero contributed around 2.34% on the rate of growth of real GDP per worker average within the first period. However, the difference is that on BRICS, the reaction diminishes in the long-run.

The rest of the predictors shock effect on the BRICS GDP Per capita are analysed, and a one standard deviation from the predictors is explained as such. The impact from inflation to the GDP per capita is neutral; there is no meaningful reaction. However, a shock from the log of imports, the log of employment and household expenditure as a share of GDP had the same shock effect on the BRICS GDP per capita. BRICS GDP per capita reacts with a negative shock effect from the three predictors from the 1st period to the 3rd period, and afterwards the reaction diminishes and remains neutral from employment and household expenditure. The positive shock reaction in BRICS GDP per capita from the log of imports remains positive from the 1st to the 7 ½ period and remain neutral thereafter until the 10th period.

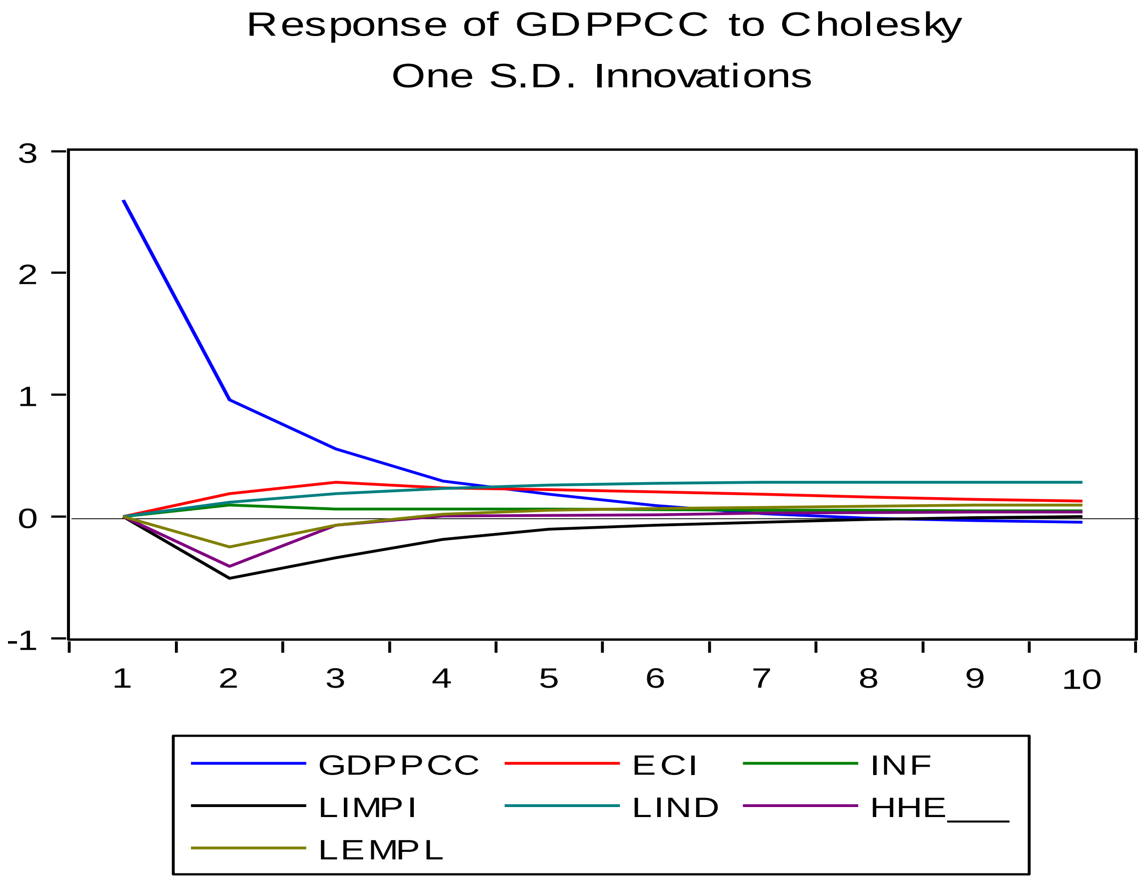


Figure 5.34: BRICS GDP per capita IRF
Source: Author's computation

On the selected SSA current account model, figure 5.35 depicts the reaction thereof emanating from a shock in economic complexity and the other five predictors. The IRF results show that there is a neutral or no reaction from the shock in economic complexity until the 3rd period, and afterwards there exists a moderate but expanding negative shock effect on the selected SSA current account until the 10th period. To this end, a shock on ECI does not auger positively well on the trade prospects, with a negative but moderate effect thereof on the current account. The negative effects observed for the selected SSA can be explained by the abundance of natural resources, which backs the low diversity of their export baskets and focus of exports in less complex goods (Breitenbach *et al.,* 2021). This was argued on the basis that Africa primarily exports homogeneous commodities which are subject to global price changes.

On the other five predictors and the shock effect to the selected SSA current account, the following IRF are submitted. The log of unemployment rate has a neutral or unresponsive shock effect on the selected SSA current account with the trend line moving along the mean of zero. The rest of the predictors are seen to follow the same shock effect on the current account. That is, one standard deviation or innovation in the four variables has a negative shock effect on the selected SSA current account with different variations but moderate variations. However, agricultural exports as a share of exports have a more profound negative shock reaction in the current account, which seems to be more explosive.

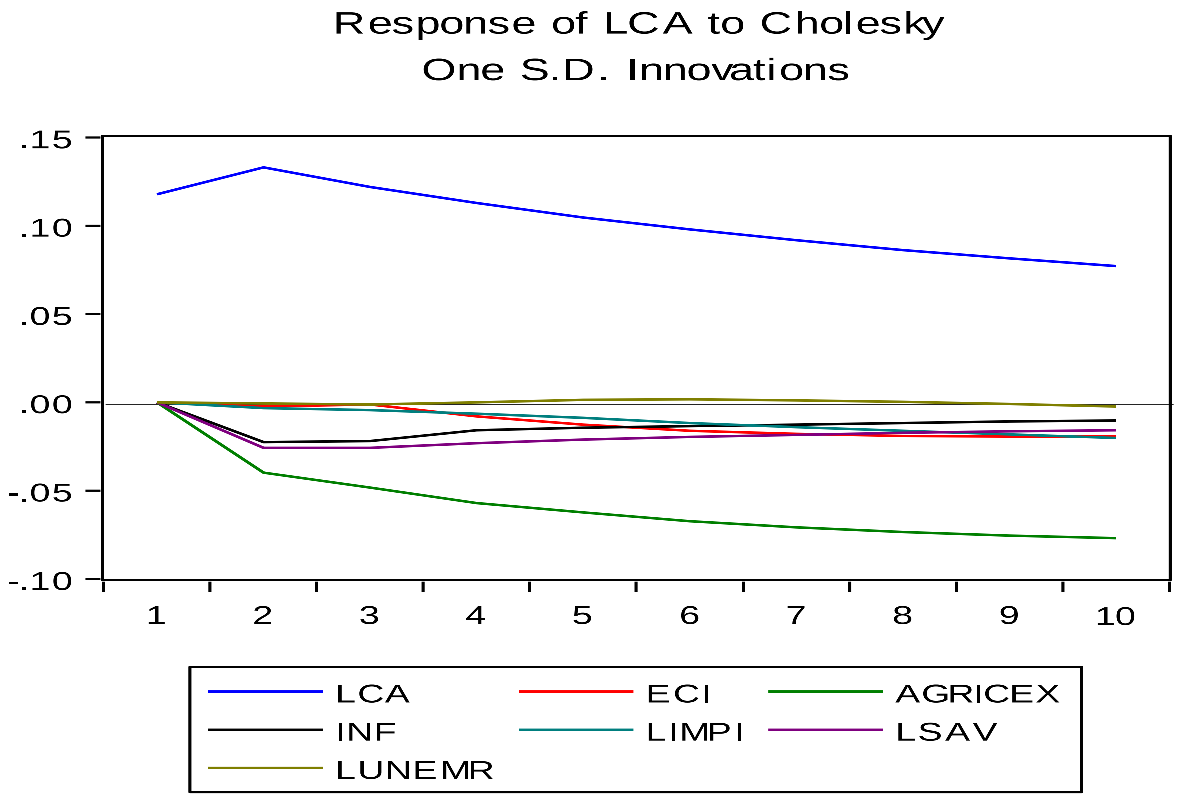


Figure 5.35: Selected SSA Current Account IRF
Source: Author's computation

Figure 5.36 depicts the BRICS current account impulse response from economic complexity and five other predictors. In the BRICS case there is an inverse response as compared to the selected SSA response. A shock in economic complexity has a positive shock response in current account. This reaction is captured as an increasing positive rate of the BRICS current account from the 1st period throughout to the 10th period. Comparatively, the BRICS economies react well to a shock on ECI, which produces positive and expanding response unlike the selected SSA region. These findings confirm those by Hidalgo and Hausmann (2009), that a strong empirical case where the level of development is associated with the complexity of a country's economy as predicting a country's future exports. To this end, the manufacturing sector and the industries involved in the trade sector need to upgrade their output to have a more respectable PCI. The UNCTAD (2021b) reports on trade argues that countries in Africa trades more manufactured and agricultural commodities between themselves and fewer extractive commodities than with the rest of the world. The reason was based on a fact that most mineral and metal refining activities take place outside of the continent. Hence, on an aggregate level in comparison to the rest of the world African regions do not compete. This affects adversely so as seen by the negative response function.

The rest of the explanatory variables shock effect on the BRICS current account are explained. Of the five predictors, only inflation has a positive shock effect on the BRICS current account though at a moderate and constant pattern. Agricultural exports as a share of GDP had a positive effect only in the immediate terms to the 3rd period, and afterwards the current account reacted to this shock negatively throughout to the 10th period. The rest of the predictors, the log of imports index, the log employment and the log of government expenditure had a negative shock effect on the BRICS current account.

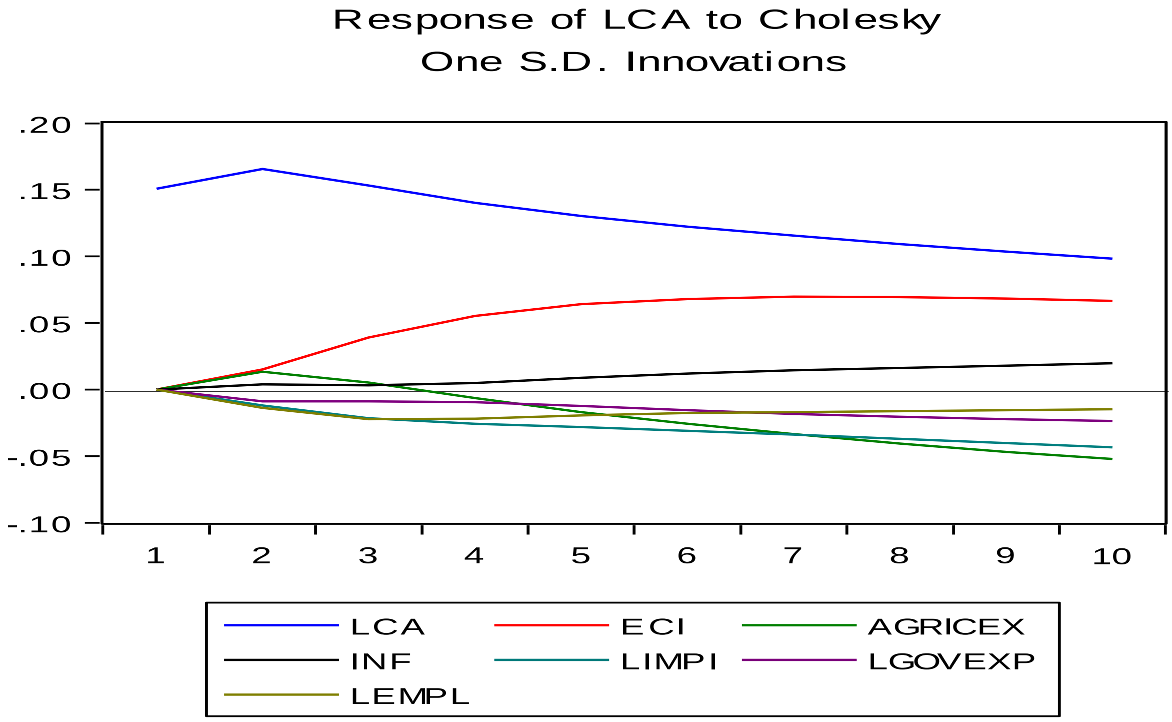


Figure 5.36: BRICS Current Account IRF Response
Source: Author's computation

Figure 5.37 depicts the selected SSA fixed investment impulse response results as a result of economic complexity and the other five independent variables. The selected SSA fixed investment has a very small but positive impulse response as a result of a shock in economic complexity from the 1st to the 3 ½ period. Afterwards, fixed investment response is neutral until the 8 ½ period and thereafter it is negative until the 10th period. It appears that fixed investment in the selected SSA countries does not have an impulsive reaction to economic complexity. Perhaps the average negative ECI across the selected SSA region as seen through the descriptive statistics does not formalise any reaction on investment. On the current fronts, these findings harness Signé (2021) in a Brookings Institute's African perspective report as saying that the lack of investment in the African region has had extensive penalties. The penalties are summed-up that the deprivation of the economic and scientific infrastructure essential for innovation, the continent has constantly relied on the past resource extraction based model of colonial, which is both unmaintainable and mainly responsible for its debilitating poverty. As already highlighted in chapter 2 that the selected SSA coutries' share of the world market is not that significant and this adds to the woes. The challenges are that smaller markets limit the long-term investments and persistent capital that would have fostered innovation and drive technology transmission in the setting of globalisation (Signé, 2021). Countries that are characterised by low levels of economic complexity or confined productive capabilities restrain their capacity to structurally transform (Bhorat & Steenkamp, 2018).

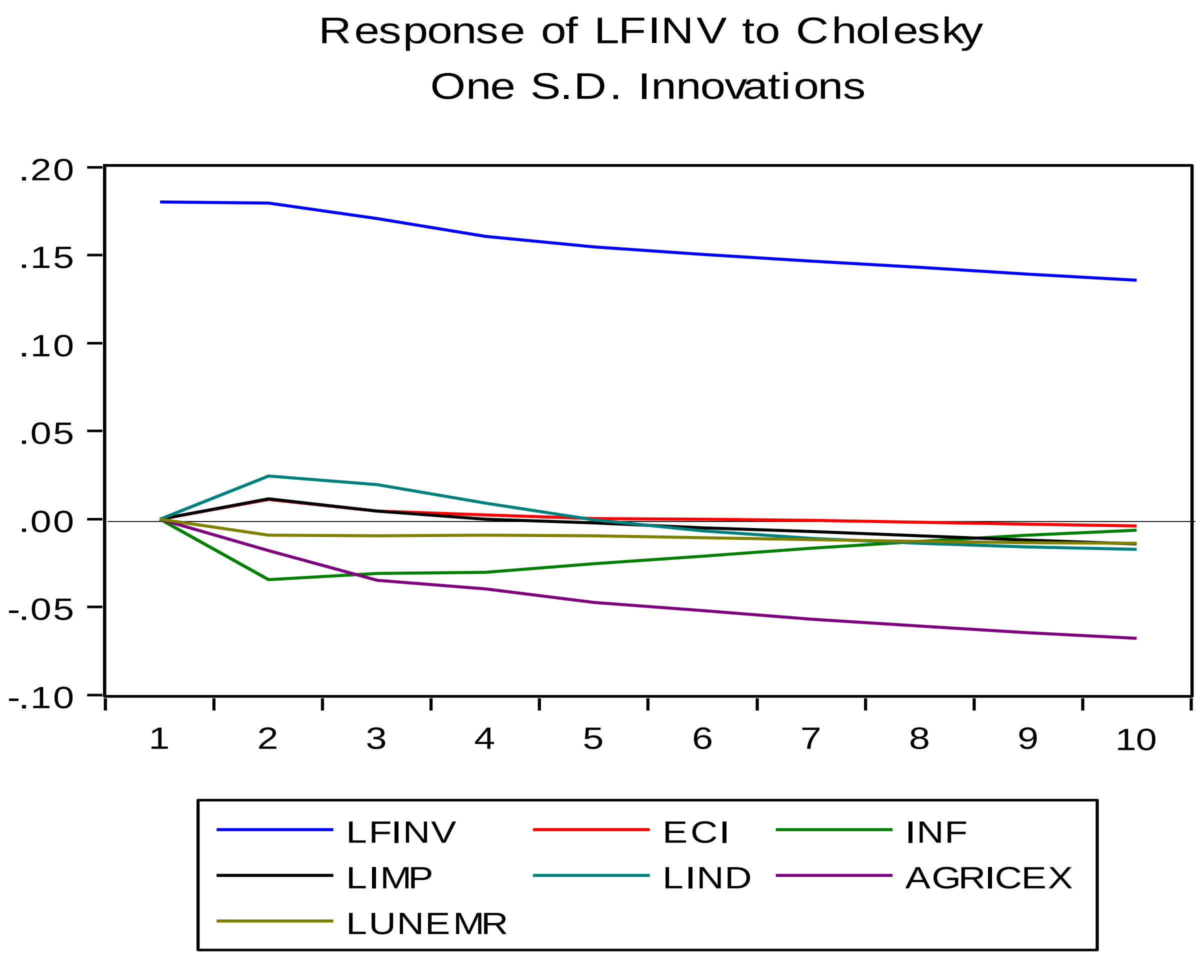


Figure 5.37: Selected SSA Fixed Investment IRF
Source: Author's computation

With respect to the impulse reaction in the selected SSA fixed investment from the other five independent variables, the results are as follows. The log of imports index and the log of industrial production were seen to have a positive impulse response in the fixed investment movement from the 1^{st} to the 4^{th} and 5^{th} term, respectively, and afterwards there was a minimal negative to neutral impulse response. The other three explanatory variables, inflation, agricultural exports as a share of GDP and the log of unemployment rate had a negative impulse response in fixed investment. However, it was the agricultural exports that had the most shock effect on fixed investment in the selected SSA with an exploding or increasing negative impulse until the 10^{th} period.

Investment is a critical injector of development, and economic complexity seem not induce an impulse response in the selected SSA.

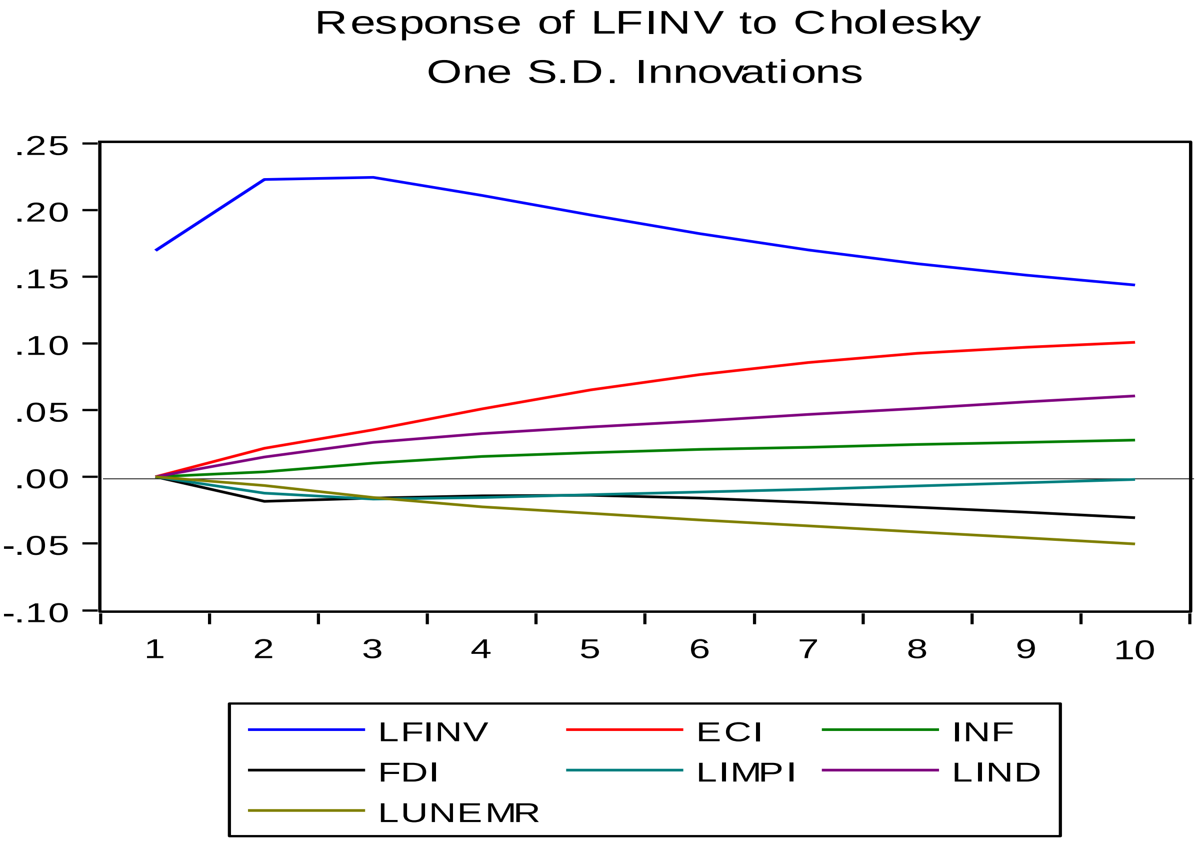


Figure 5.38: BRICS Fixed Investment IRF
Source: Author's computation

Figure 5.38 depicts the BRICS fixed investment impulse response from economic complexity and the rest of the predictors. A shock in economic complexity has an immediate and positive impulse reaction on the BRICS fixed investment. There is a positive and exploding or increasing shock effect on the fixed investment from the 1st to the 10th period. These results are in clear contrast to the selected SSA fixed investment with a neutral impulse response emanating from economic complexity shock. This shows that the positive average ECI in the BRICS perspective induces a reaction or alters a positive change in investment. The difference in the selected SSA and BRICS impulse response is perhaps revealing the two different developmental state.

There is contradiction in the exports market in both economies, where, for instance, machines are very complex and interconnected, thus, they use similar capital, knowledge, technologies, etc., while clothing, textiles, and food products have less interconnectedness and therefore, have low complexity (Moiseev & Bondarenko, 2020). The lack of technical know-how or capital intensity in the selected SSA with low ECI results in instances where a shock effect has a somewhat neutral reaction in fixed investment as opposed to the much intensive capital product in the BRICS case. The likes of China and India had a much higher world export share, hence the BRICS coutries with a positive ECI mean suggesting development has a higher effect on the ivestment outlook.

The other five explanatory variables were seen to also have an impulse response effect on the BRICS fixed investment. The log of industrial production and inflation had a positive but moderate increasing impulse response in fixed investment from the 1st to the 10th period, while the log of imports index and foreign direct investment had a negative shock on fixed investment. The log of unemployment rate had a more explosive negative shock effect on the BRICS fixed investment until the 10th period.

5.2.8.2. Variance Decomposition

The next technique in forecasting the response of the three macroeconomic variables due to the shock effect from economic complexity and the other predictors is the variance decomposition. As already alluded in chapter 4, the IRF and the variance decomposition are seen as complementary in revealing the forecast estimates. The IRF revealed the time length of the causal effect and the variance decomposition analysis is explored to show the marginal analysis offered in respect to elasticity terms in the typical short and long-run analysis (Menegaki, 2020). The third period is chosen to reflect the short-run effect and the last period, the tenth, is the long-run innovative shocks analysis.

Table 5.29 provides the selected SSA and BRICS GDP per capita forecast results. In the short-run, the 0.21% of the selected SSA GDP per capita ix explained by innovative shocks from economic complexity and in the long run the estimates are still low at 0.79%. In the BRICS economies, 1.31% of GDP per capita is explained by economic complexity in the short-run, and in the long-run, 3.60 of GDP per capita is explained by economic complexity. These observations clearly show that GDP per capita is not elastic in reaction to economic complexity shocks in both the groups of countries with BRICS showing some elasticity shock reaction in the long-run at 3.59%. The BRICS findings seem to follow that of Jarreau and Poncet (2012) and Udeogu *et al*. (2021) in that the reaction is rather meaningful. The selected SSA results also follow-on on the work of Albeaik *et al. (2017)* because the reaction in GDP per capita is less than 1% in both terms. This is further substantiated by Bhorat *et al.* (2019) that less variation in African countries is because they are characterised by relatively lower ECI's. This is certainly so as we have seen, with the major exports still much concentrated in raw and unprocessed goods, the agricultural sector in the African region. While the BRICS formation has an influential industry performance (5.70) and also the ECI (at 3.59) has a much healtier impact on the GDP per capita. Given that ECI is a developmental index, this present a challenge to the selected SSA given the AfCFTA programme. The AfCFTA address challenges stemming from the extreme reliance in Africa on the supply of primary merchandises symbolising limited value added to world markets (UNCTAD, 2021b)

Table 5.29: Selected SSA and BRICS GDP per capita Variance Decomposition

Panel A: Selected SSA								
Period	**S.E.**	**GDPPCC**	**ECI**	**INF**	**LIMPI**	**REER**	**LHHE**	**LGOVEX**
1	1.774323	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	2.127028	84.13758	0.208427	1.337902	3.127870	7.303314	3.755981	0.128924
10	2.306755	72.24330	0.794452	1.482438	3.038200	13.23127	4.735269	4.475073
Panel B: BRICS								
	S.E.	**GDPPCC**	**ECI**	**INF**	**LIMPI**	**LIND**	**HHE (%)**	**LEMPL**
1	2.596248	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	2.958616	90.94648	1.308122	0.140267	4.287410	0.564937	1.986915	0.765865
10	3.121108	83.05236	3.596114	0.323180	4.419110	5.704121	1.831823	1.073294

Source: Authors' own computation

Reflecting purely on the long-run estimates with regards to the remainder of the explanatory variables for both the selected SSA and the BRICS economies, a few were seen to have some shock effect. Only real effective exchange rate had a noteworthy innovative shock effect on economic complexity in the selected SSA countries at 13.23% on GDP per capita with household expenditure and government expenditure explaining the GDP per capita by an average of 4.7%. Imports explained 3.04% innovative shock in GDP per capita while inflation was a mere 1.48%.

Table 5.30 provides the selected SSA and BRICS current account innovative shocks response in economic complexity and the other five predictors. In the short-term, the selected SSA current account in panel A clearly reflects that the current account is less responsive to innovative shock in economic complexity, which is only explained by 0.02%, and again by 1.25% in the long-run. However, in the BRICS economies, 0.45% of the current account is explained by innovative shocks from economic complexity in the short-run, while 14.18% of the current account is explained in the long-run. Once more, in the long-run the BRICS response is much more than in the selected SSA. These low responses in the selected SSA may be explained through the work of Breitenbach *et al.* (2021), who found that the output volatility is mitigated as the economic complexity of a country increases (this reflect the BRICS results), though low income countries (the selected SSA) take longer to respond to changes in ECI. In reflection of current African perspective, these results suggests that the continent may not actually take full advantage of the AfCFTA pact. Ogbalu (2021) in view of a potential $560 billion exports market that may additionally boost income may be dettered by the region;s inability to integrate African businesses into global supply chain. One meaures argued for to create business friendly environment is the development of a central payment and clearing infrastructure to sustain trade in this new arrangement (AfCFTA). This speaks volume of the need to have a sophisticated arrangement within the African region.

Table 5.30: Selected SSA and BRICS Current Account Variance Decomposition

Panel A: Selected SSA								
Period	**S.E.**	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	0.117697	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.229480	88.01141	0.015467	7.466728	1.894472	0.063247	2.544151	0.004523
10	0.393900	69.54259	1.252289	24.31872	1.401963	0.972220	2.502888	0.009330
Panel B: BRICS								
Period	**S.E.**	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.150779	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.225784	98.34356	0.456618	0.346921	0.030350	0.289960	0.149274	0.383318
10	0.477534	74.96578	14.18032	3.912784	0.629614	3.977538	1.067908	1.266056

Source: Author's computation

Additionally, with regards to the five other explanatory variables for both the selected SSA and the BRICS economies, only agricultural exports proved to be of impact in the long-run. In the selected SSA countries, 24.32% of the current account is explained by innovative shocks from agricultural exports as reflected in panel A, and only 3.91% explains the current account in the BRICS case. Only imports in the BRICS case that any of the predictors revealed a moderate innovative shock impact on the current account at 3.98%, and all other variables were below 3%.

The last dependent macroeconomic indicator under analysis is the fixed investment in Table 5.31 with panel A the selected SSA variance results and the BRICS economies in panel B. With regards to the selected SSA model, in the short-term, only 0.13% in fixed investment is explained by innovative shocks in economic complexity, and in the long-run, there is still a very small effect at only 0.06%. In the BRICS analysis, there is a 1.29% reaction in the short-run and an 11.67% reaction in the long-run on fixed investment, which is explained by innovative shocks in economic complexity. These results augment the argument by Brito *et al.* (2018) that higher economic complexity supplement higher firm-level investment as one would have expected. This is relevant given the ECI disparities between BRICS and the selected SSA in ECI. That is why most economies relying on natural income sources have not been capable to progress in their indicators of economic complexity and high technology utilisation (Sepehrdoust *et al*. (2019). Recent views by Nathan (2021) profiles why these challenges in the SSA region, that is, fragile infrastructure is broadly accepted as a central limitation to growth in Africa. Other views include that governments in the region tussle to meet the basic needs such as critical ivestment, the likes of reusable infrastructure that could provide long-term solutions to social problems.

Table 5.31: Selected SSA and BRICS Fixed Investment Variance Decomposition

Panel A: Selected SSA								
Period	**S.E.**	**LFINV**	**ECI**	**INF**	**LIMP**	**LIND**	**AGRICEX**	**LUNEMR**
1	0.180223	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.314545	94.77831	0.139950	2.183768	0.154174	0.987389	1.570310	0.186100
10	0.527437	88.28610	0.062278	1.705505	0.242095	0.706245	8.584209	0.413567
Panel B: BRICS								
Period	**S.E.**	**LFINV**	**ECI**	**INF**	**LIMPI**	**LIND**	**FDI**	**LUNEMR**
1	0.169488	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
3	0.364191	96.97146	1.289803	0.092491	0.323005	0.666039	0.441400	0.215800
10	0.654374	80.04790	11.66139	0.844270	0.262237	3.910238	0.879871	2.394092

Source: Author's computation

The other five explanatory variables were observed as not having a meaningful explanation on the fixed investment for both groups, with only agricultural exports in the selected SSA having some impact and industrial production in the BRICS economies.

In the long-run, 8.58% of fixed investment is explained by innovative shocks in agricultural exports in the selected SSA countries and 3.91% of the fixed investment is explained by industrial production in the long-run. The rest of the explanatory variables in both the selected SSA and BRICS innovative shock estimates on fixed investment were below 2.4%.

5.3. SELECTED SSA AND BRICS COMPARATIVE ANALYSIS

The study is an analysis of both the selected SSA and BRICS economies in trying to solve the set objectives. The comparative nature of the study allows for the two groups of economies to be measured against each other, more so for the selected SSA to have some learning perspective as the more developing region as already reflected in the descriptive analysis with a negative ECI. On the relationship between ECI and the three macroeconomic variables, the findings were similar in the short-run and in the long-run in some scenarios, but different when incorporating other techniques. In the BRICS economies, there was a much healthier long-run forecast where the GDP per capita is positively influenced, whereas the selected SSA is rather neutral. To this end, the selected SSA still has much ground to cover and improve on its developmental stands and influence ECI, thereby following in the trajectory of the BRICS economies with a GDP per capita that reacts positively to ECI shocks or deviations. The selected SSA are worse off compared to BRICS.

On the second objective, the technological gap theory also held for both selected SSA and BRICS in respect to the nexus between the current account and ECI. However, when controlling for shocks and forecasting subsequently, the results are concerning for the selected SSA. The lack of competiveness in the global trade network places the selected SSA region in a trade predicament emanating from the negative PCI and subsequently negative ECI. On the third objective, the accelerator theory of investment also holds, but only in the long-run for both the selected SSA and BRICS with respect to the ECI-Fixed Investment nexus. Incorporating shocks, however, produce less optimism in the selected SSA, while BRICS has a positive feedback.

The less enthusiastic IRF and variance results in respect to the selected SSA are further substantiated by Whitehead and Bhorat (2021), who was stated that it is typically the case that elementary products are often mining or agricultural commodities, a shift in production towards more sophisticated manufactured products, which is complexity building, is synonymous to a process of manufacturing-led structural transformation. Hence, it should be unequivocal for Africa to undergo structural transformation. South Africa once more may be positioned to also realise gains purely by being part of the BRICS economic integration. However, the country also needs to reposition itself towards more industrialisation. Additionally, the observations were that countries can build complexity by accruing capabilities, permitting them to swing production away from simple products to a large range of complex products. This was observed in chapter two with BRICS exports more diversified.

Technology "gaps" characterise differences in per capita income and productivity between countries. These technology gaps provide a huge potential for catch-up if absorptive capacities are in place, in the absence of which countries can fall behind (Naudé *et al*., 2013). These sentiments provide comparative stands in both BRICS and selected SSA, where the latter is advised to improve by closing the gap in technology. Lee and Yoon (2015) provide a learning curve for the selected SSA where China adopted CoPS to advance the country's complex systems moving towards technology as latecomers. This will aid the selected SSA to advance further the argument by Signé and Johnson (2018). The interpretation is that the industries will contribute meaningfully to the accumulation of physical and human capital, where the manufacturing sector will offer a fairly well-paid jobs for enormous numbers of unskilled or under-educated workers, particularly those who are not integrated in the formal economy.

5.4. CONCLUSION

In reflection of the econometric procedure followed and gave the results and analysis thereof, of whether or not prior expectations were valid in the two groups. First, the descriptive analysis gave the difference in the developmental state of each of the two groups of economies. It was evident that the selected SSA countries were less developed with an average ECI of below zero. Whereas, the BRICS formation had a much better development stunts were the ECI was above zero. Additionally so, there was disparities among the selected macrovariables. The BRICS economies had a much better standard of living in reflection of the higher GDP per capita, and also in the trade front the BRICS countries a much pronounced export market as seen through the current account. Similar stands were also reported for fixed investment with the BRICS economies having more domestic infrustructure investment than the selected SSA. Comparatively, these findings suggests that, indeed, as expected, the BRICS formation is a much better world player and leading economies than the selected SSA countries when inspecting the macroeconic indicators, and the development indicator in trade, the ECI. This was also observed in the country analysis in chapter 2, that indeed the products exported by the African countries are still much raw and unprocessed in nature, where only South Africa had an ECI mildly above zero suggesting it was better of compared to its SSA peers.

Stationarity was attained with different orders of integration at levels [I (0)] and at first difference [I (1)] across the different variables in all the models. Hence, the PARDL was chosen as the best model estimator to estimate the long and short-run estimates upon finding cointegration. Of the three cointegration techniques, it was the Kao and the Johansen-Fisher cointegration test that unanimously confirmed long-run movement in the three models across the two groups of countries. The Pedroni tests across the three equations only confirmed cointegration at the deterministic intercept and trend. To this end, it was concluded that there was a long-run cointegration in all the models of the selected SSA and BRICS. It was the assertion of cointegration that allowed the determination of long and short-run estimates in the GDP per capita, current account and fixed investment models estimated against economic complexity and the rest of the control variables.

Interrogating the GDP per capita, current account and fixed investment against economic complexity respectively, the following results were found. Applying the PARDL in both the selected SSA and BRICS settings, the endogenous growth theory was seen to hold in the GDP per capita-ECI association in the long-run, but not in the short-run. This suggests that both set of economies do need their export basket to be of a high level in knowledge imbeddednes and sophistication. Whereby, the domestic value chain needs to develop to address the standard of living for its people. As such, economic complexity as a development indicator is to be treated as significant predictor in the respective economies to improve the wellness of the inhabitants in these economies. The concern was the absence of causality in the two economies in the variables in the short-run. This may mean that the GDP per capita-ECI association is a rather a long term phenomena instead of short-run.

Additionally so, forecasting estimates also show that there isn't enough in the ECI to suggest that in the foreseeable future GDP per capita is well placed. Rather, the innovative shocks from ECI were too small to direct any meaningful movement of the GDP per capita in the long-run. However, in the BRICS formation there was enough information from ECI innovative shocks that reflects that its GDP per capita in the long-run was pronounced with a positive movement in the foreseeable future as seen through the IRF and variance decomposition.

On the current account-ECI impact applying the PARDL approach following results were seen. In the short-run economic complexity was an insignificant predictor in both models. However, the TGTT theory did hold in the long-run suggesting that a developed country as seen through its export is a catalyst for a much healtier current account, as such, it would promote surpluses in the economies. On the causality effect through the Granger causality technique, it was seen that economic complexity does not have a causal effect on the selected SSA. However, there was a unidirectional causal effect on the current account from economic complexity. This suggests that economic complexity has a short-run causal impact on the BRICS current account.

Moreover, when forecasting the current account performance, the IRF and variance decomposition results are as such. That in the selected SSA countries the IRF results showed that the current account response was neutral from the shock in economic complexity until the 3rd period, and afterwards there was a moderate and constant negative shock effect until the 10th period. This reveal that, given the AU's 2063 vision and the AfCFTA, the path to prosperity in trade may not be realized in the foreseeable future. However, the BRICS economies did show a positive and exploding response in the current account, suggesting that ECI will also be a catalyst for future current account growth, which is a good indication of this macroeconomic indocator path.

On the effect of fixed investment-ECI relationship, the following findings were echoed. The PARDL results disclosed that economic complexity had a beneficial and significant effect on both set of economies. The accelerator theory of investment was proven to hold only in the long-run. This reveals that as ECI improves, so will the investment outlook in respective countries. On the other hand, with Granger causality results, there was no causal effect of ECI on fixed investment in the selected SSA, while in the BRICS economies, there was a unidirectional causal effect on fixed investment. This then meant that at least in the BRICS economies, there was a short-run causal effect on the investment level in response to the ECI. This bodes well to contrast that the BRICS economies are well investment focused given were trade reflects the infrustucture status.

On the forecasting front, the IRF and variance decomposition techniques had the following results. With respect to the IRF findings, it was found that a shock in economic complexity had an immediate and positive impulse reaction on the BRICS fixed investment until the last foreseeable period. The selected SSA countries results were in contrast to the BRICS economies, where fixed investment had a neutral impulse response emanating from economic complexity shock. The variance decomposition had a very small innovative shock on fixed investment through out the periods. In the BRICS case, there was a 1.29% and 11.67% explained in the fixed investment by innovative shocks in economic complexity in the short and long-run, respectively. This means that, in contrats to the BRICS, the Afican countries' investment outlook was not promising, and much needs to be done to have a better export investment outlook.

In reflection of these findings it then becomes imperative to conclude and recommend, especially for the selected SSA to effect policy changes. This is so, because though there exists a formal relationship that suggests that indeed economic complexity is a significant predictor in the three macroeconomic indiators, the developmental state as seen through the descriptive statistics may not allow meaningful input in the foreseeable future. It is on these grounds that chapter 6 then provides possible interventions to bring forth structural change in the export basket of the selected SSA countries and reflection to that of BRICS with a positive trajectory. If the African countries remain on the current ECI trajectory, this will deter any progress on the selected macroeconomic indicators in the foreceable future though there exist platform to effect positive and significant relations as seen through the PARDL results.

CHAPTER 6

SUMMARY, CONCLUSION AND RECOMMENDATIONS

6.1. SUMMARY AND INTERPRETATION OF FINDINGS

The focal point of the study was to analyse the relationship between economic complexities on some selected macroeconomic variables for the period 1994 to 2018. The aim of the study was to investigate the relationship among economic complexity and GDP per capita, current account and fixed investment. This was done in a comparative setting between five SSA and BRICS countries to draw experiences. Through a panel data setting, the set objectives were effected to draw diverse findings and analysis thereof. To this upshot, to test the short and long-run relationship between economic complexity and the three macroeconomic indicators a PARDL technique was set forth for the first three objectives. Two, to examine the causal effect between economic complexity and macroeconomic indicators employing a standard Granger causality was employed. Three, to forecast the response of the macroeconomic indicators resulting from economic complexity shocks for the foreseeable future employing IRF and impulse variance decomposition. Lastly, a comparative analysis given the findings.

The unit root technique was then run to determine further behaviour of the variables, and to decide the right approach to estimating the models to which a combination of stationarity was observed across all the selected SSA and BRICS models. As such, panel ARDL was indeed acceptable given the different orders of integration [I(0) and I(1)]. The next was to determine whether there exists a long-run co-movement in the respective selected SSA and BRICS models. Through the Kao, the Pedroni and Johansen-Fisher cointegration, the presence of long-run cointegration was concluded accordingly. The lag length criteria estimation were run prior. Upon the satisfaction of the above techniques, the set objectives were then run to answer the questions in the study through the set objectives.

Since the approach explored was an econometrics approach, a set of techniques were followed to estimate the respective models. Starting with the panel descriptive analysis, it was seen that all the variables included in the respective models across the two set of countries were each unique in their features. The BRICS countries were indeed proven to be more developed than the seleted SSA were the ECI index was negative for selected SSA and positive for BRICS. This then goes to reflect that given that the

ECI is a significant and positive predictor of GDP per capita, current account and fixed investment, the selected SSA may not be structurally tuned to take advantage. The export structure seen through its production output and subsequently exported are not well placed to improve meaningfully to respective macroeconomic indicators as opposed to the BRICS economies. This was seen when forecasting the macrovariables, where the BRICS economies realised positive and higher estimates seen through IRF and variance decomposition. The selected SSA proved to have neutral to negative shock estimates as compared to positive ones for BRICS. This necessitates a change in the structure of the economy given that the current developmental state of the selected SSA is still the export of raw and unprocessed goods or commodities. Of significance is that South Africa, as it is found in the two set of economies, may actually be the only SSA country thriving given that it forms part of BRICS. Hence, as part of BRICS there are some benefits, and indeed according to MIT positioning, South Africa is the highest placed in ECI positioning.

To illustrate further on the findings where the PARDL estimates reflecect that ECI-macroeconomic indicators have a long-run relationship significance, but insignificant in the short-run. Additionally, the causal relationship also reflect that there exist no causality between the variables in the short-run. Only BRICS realised a causal relationship between ECI-current account nexus, and also ECI-fixed investment nexus. This reflect that for the most part the selected SSA need to reflect and make sufficient changes in the economy to facilitate short-run structural changes and subsequently filter well in the long-run. On the GDP per capita and economic complexity relation, this implies that economic development as measured in economic complexity does not directly imply the wellbeing of the people in GDP per capita in the short-run.

In the impact between economic complexity and the current account, this then provides evidence that the BRICS economies' trade balance is impacted or caused by the developmental state as seen by the export basket, hence in direct relation. In the short-run, there is no evidence of causality impacting on the current accounts of the selected SSA economies. Lastly, about the effect of economic complexity on the fixed investment level, Once more, this gives evidence that the BRICS economies' developmental state in the products and services they export has an effect on the investment trajectory from both private and government in the countries concerned in the short-run. Hence, the export of more sophisticated products and services is a catalyst for the likes of infrastructure development in BRICS.

Additionally so, on the overall, reflecting on the AfCFTA, it can be concluded that the trade pact can become a beacon of development as seen through the long-run estimates through the PARDL for the selected SSA. However, given the causality and forecasted outcome for the selected SSA there need to be a development focused on the export structure were high ECI's in respective selected SSA countries is required to realise an improvement in the estimates for the foreseeable given the three macroeconomic variables. To reap the full benefits of the AfCFTA, there need to be a highly sophisticated economic structure of the selected SSA needs to be upscaled to influence positive so the macroeconomic indicators. The presence of raw materials can be a starting point of intra-trade among the SSA coiuntries that feed into industry buil-up of more sophisticated and high intensive know-how goods and services for the world markets.

6.2. CONCLUSIONS AND RECOMMENDATIONS

The economic complexity index in the exports market was meant to infer information on the selected countries with unique results about the capabilities thereof in solving the stated problems. Hence, the selected SSA economies do seem to provide any information that suggests that ECI does have an effect on the three macroeconomic indicators. Though in the short-run, there was no immediate effect results on GDP per capita, current account or fixed investment movement. Also, innovative shocks do not infer enough information on the very macroeconomic variables in the selected SSA. As such, the selected SSA economies need to improve on their product complexity leading into the export basket and subsequently the economic complexity. These selected SSA economies are not developed enough as compared to the BRICS nations.

The following recommendations are placed forward for the selected SSA to improve on the three macroeconomic variables given the ECI results, that is, measures to improve the developmental state through the productive structure. To achieve the AU's vision of ''A shared strategic framework for inclusive growth and sustainable development and a global strategy to optimize the use of Africa's resources for the benefit of all Africans” the following recommendations are placed forward. These recommendations are meant to influence ECI, the measures of the relative knowledge intensity of the selected SSA which were negative, to at least catch-up with the BRICS economies.The recommendations are made on the long-run observations that indeed there is a positive relationship between economic complexity and the selected macrovariables. Additionally, this include the observations of the causality and the forecasting techniques.

- On the well-being of the selected SSA nations, the SSA GDP per capita is still lacking behind some major economies like BRICS, with the exception of South Africa. The SSA region needs to learn from the leading BRICS countries by creating a conducive environment for a better development of innovation that improves the domestic value chain that produces knowledge based products for the export market. The share of the global export market is still much small for SSA. This reflects well were causality was not observed for the selected SSA as opposed to the BRICS formation, and also on the IRF results.
- It is highly recommended that the SSA region promotes and invest vastly on innovation or knowledge building in science and technology from foundation phase education to the universities. This is so because the AU 2063 vision of a better growth path might not be realised due to the lax GDP per capita performance as seen by the lucklaster forecasting performance.
- In line with the understanding that South Africa is seen to be the best placed SSA among the five selected SSA countrie, and that it also a BRICS member. Perhaps the rest of the selected SSA region must also form part of economic integrations with the more developed countries that offer mutual beneficiation and that fast tracks the developmental state. This may be a catalyst for an improved macrovariables from the small variance decomposition results seen in the selected SSA.
- On the current account outlook and the development of the region, much is still required. With the presence of the AfCTA, SSA countries need to advance intra-industry that promotes the artificial removal of the boundaries. This will create unity that promotes the exchange of abundant raw materials to act as input products across the industries. This recommendation is made in acknowledgement that inter-trade was not observed among the SSA countries, as opposed to the BRICS

nations where China and India predominantly featured as among the trade partners. The lack of causality and the much concerning variance decomposition and impulse response function advocste for these change.

- As was seen through the respective country analysis, the SSA region still much relies on raw agricultural products. This bodes well to improve the negative ECI mean as reflected in the descriptive analysis, in the SSA this may explain why the current account had neutral to negative impulse response and very small variance when forecasted for the foreseeable future.
- There is a need to modernise the agricultural and agro-industries. The region must connect or harness the full potential of its agricultural sector. This will of course create a large global market share and perhaps increase the current account outlook through trade with more efficient agri-processed products. Therefore, help improve the impulse response for the selected SSA given a much healtier ECI. This may also effect causality in ECI and trade.

- On the fixed investment front, there should be a strong investment relations between Africa and developed countries to discourage the selected SSA from producing existing commodities that are not process-led in the existing environment or developmental state. The production and export of raw or semi-processed commodities in the region mean that less infrastructure is required. Hence, the dire outlook in the foreseeable future as seen in the impulse response and the the small variance detected as opposed to the BRICS outcome.
- With the implementation of the AfCFTA in 2021, there is a need to improve on infrastructure. The African continent is already home to some of the well sought-after minerals. Public and private partnership is required to improve the ECI, which is also founded by the patent protection, which leads to the development of required infrastructure. To this end and improved infrastructure will augment better better means of production that will most certainly see better investment outlook.
- Africa needs to scale up investment in many fronts from government to private investment to improve infrastructure, more so that the scale of needs is so much in the continent. The likes of ACET do advise that the aggregate funds of private sector investment must mature for African countries to progress, and partnering

with developed countries proved to be beneficial as South Africa is an example in the BRICS formation.

6.3. LIMITATIONS OF THE STUDY

The study focussed on the selected SSA countries and BRICS; only five countries were selected as the subset of SSA. Although this was due to data availability in most countries, a similar and more improved study will help pool better estimates and have a bigger representation of the SSA countries. The other limitation was the update of the ECI data, it is only available until 2018. Once updated to the current period, new research areas may be carried out with updated data. One other limitation is the data used in ECI, which includes data on exports of products, and not services, which is also a significant contributor on trade, which is not well captured by developing countries.

6.4. AREAS OF FUTURE RESEARCH

The analysis that South Africa benefits from being part of the BRICS group is rather an implied notion as it is found in both the studied economies where the BRICS countries were better off as compared to the selected SSA countries. There is a need to provide an empirical study through a similar comparative study, where two trade models are studied. The aim would be to establish the relationship between South Africa and the BRIC countries, and South Africa and some selected SSA countries trade and respective macroeconomic indicators. The study will then provide a substantial finding on whether South Africa really benefits by being part of the BRICS economic integration, or should it strengthen further its regional alliance in line with the expected increase in trade flows in the African continent, intra-trade. A further area of study may be to interrogate regional blogs such as SADC or ECOWAS against the likes of BRICS or other developed countries such as the Scandinavian countries of Norway, Sweden and Norway.

The last area of research interest is to seek an empirical analysis of what may drive countries' economic complexity to improve or worsen. This will aid developing economies to reflect and alter any behaviour in their economic or countries' structure that are conducive to or impede development. For instance, does foreign direct investment and/or governance (such as political and accountability index) inform the development or improvement in ECI? This is a direct approach to further explore the drivers of development, and perhaps influence the much spoken structural change needed in developing countries, especially underdeveloped and developing African countries.

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APPENDIX A.1: SELECTED SSA DATA

Year	Countries	GDPpcC	CA	Finv	ECI	Un-emR	Inf	Imp	Empl	GovEx(%)	Ind	GovEx	HHE	AgricEx	Sav	REER
1994	South africa	0,833179	3,1E+10	2,25E+10	0,113564	30,143	9,561052	78,67508	39,31	19,79856	32,04382	2,7669E+10	1,06386E+11	3,520247	7,85E+10	125,4274
1995	South africa	0,931044	3,55E+10	2,64E+10	0,108519	30,157	10,21348	102,8658	39,194	18,11765	31,91711	2,8166E+10	1,15265E+11	4,356374	9,53E+10	122,0273
1996	South africa	2,311697	3,66E+10	2,54E+10	0,172478	30,194	7,905679	101,64	39,039	19,14527	30,80974	2,826E+10	1,24068E+11	4,046497	9,95E+10	112,2557
1997	South africa	0,818418	3,8E+10	2,68E+10	0,252567	30,164	7,987288	111,1231	38,938	19,29195	30,14121	2,9437E+10	1,31123E+11	4,480562	1,04E+11	118,6739
1998	South africa	-1,09853	3,61E+10	2,49E+10	0,233557	30,154	7,78699	98,47449	38,858	18,91177	29,48712	2,6056E+10	1,35465E+11	4,492536	1,12E+11	109,1219
1999	South africa	0,884309	3,55E+10	2,2E+10	0,266418	30,276	7,028155	89,90066	38,7	18,58083	28,54485	2,5387E+10	1,43875E+11	3,81191	1,25E+11	103,2128
2000	South africa	2,742091	3,95E+10	2,13E+10	0,195963	30,229	8,796302	100	38,642	18,38694	29,06573	2,5073E+10	1,59324E+11	3,948731	1,47E+11	100,0769
2001	South africa	1,339791	3,84E+10	1,88E+10	0,102827	30,896	7,64186	95,12713	38,2	18,53406	29,55043	2,2522E+10	1,70733E+11	3,28863	1,56E+11	88,36502
2002	South africa	2,397943	3,91E+10	1,75E+10	0,055371	33,473	12,20528	98,55868	36,711	18,80519	29,69304	2,1717E+10	1,78132E+11	3,813647	2,13E+11	75,73972
2003	South africa	1,696827	5,02E+10	2,8E+10	0,128366	32,456	5,793571	133,8542	37,244	19,05789	28,00773	3,34E+10	1,87054E+11	3,477379	2,28E+11	98,35226

2004	South africa	3,289033	6,17E+10	3,76E+10	0,094685	29,576	6,527026	180,0498	38,824	19,15756	27,31361	4,3792E+10	2,20078E+11	2,85923	2,41E+11	104,2553
2005	South africa	3,982017	7,27E+10	4,45E+10	0,16654	29,253	5,449103	209,8141	39,037	19,47819	27,13741	5,0209E+10	2,47922E+11	2,671229	2,57E+11	104,1317
2006	South africa	4,277783	8,53E+10	5,14E+10	0,237984	28,489	6,255249	265,0769	39,493	18,15353	26,23562	4,9312E+10	2,77608E+11	2,320869	3,17E+11	98,19824
2007	South africa	4,0085	1E+11	6,18E+10	0,165269	26,666	8,849399	297,8602	40,59	17,81401	26,52626	5,3338E+10	3,06562E+11	2,123786	3,51E+11	91,70786
2008	South africa	1,823488	1,09E+11	6,74E+10	0,142773	22,433	8,831509	342,2798	43,103	18,65793	28,28426	5,3505E+10	3,17079E+11	2,173772	4,12E+11	80,09876
2009	South africa	-2,89873	8,77E+10	6,37E+10	0,074112	23,538	7,504521	249,3804	41,249	19,86448	27,58362	5,8786E+10	3,09153E+11	2,250526	4,38E+11	87,2427
2010	South africa	1,551073	1,12E+11	7,23E+10	0,119045	24,693	6,351038	326,1002	39,526	20,22964	27,38134	7,5932E+10	3,28171E+11	2,060779	4,95E+11	100
2011	South africa	1,720714	1,32E+11	7,96E+10	0,016592	24,653	6,532231	419,0268	39,592	19,86224	26,94254	8,271E+10	3,57987E+11	1,942267	5,3E+11	98,2741
2012	South africa	0,607949	1,24E+11	7,62E+10	0,023795	24,732	5,282771	428,2005	39,928	20,25993	26,68106	8,0297E+10	3,87883E+11	1,784398	4,91E+11	92,38248
2013	South africa	0,852685	1,2E+11	7,47E+10	-0,19208	24,569	6,155257	425,4252	40,531	20,57498	26,66809	7,5475E+10	3,93318E+11	1,948755	5,44E+11	82,02047
2014	South africa	0,247279	1,18E+11	7,16E+10	-0,20497	24,898	5,547005	410,6746	40,595	20,79568	26,54514	7,2973E+10	3,95563E+11	2,049448	5,96E+11	77,01875
2015	South africa	-0,34168	1,04E+11	6,45E+10	-0,30455	25,156	5,170614	352,4209	41,452	20,45439	26,02838	6,4967E+10	4,03359E+11	2,302119	6,67E+11	75,07513
2016	South africa	-1,06087	9,7E+10	5,76E+10	0,28477	26,551	7,206346	308,4498	40,787	20,79198	26,24742	6,1619E+10	4,09262E+11	2,465114	7,21E+11	70,35459
2017	South africa	-0,00314	1,1E+11	6,56E+10	0,268797	27,071	5,267458	341,2221	40,988	20,799	26,29314	7,2704E+10	4,20887E+11	2,368871	7,51E+11	79,38364

2018	South africa	-0,57208	1,17E+11	6,7E+10	0,268797	26,92	3,91654	382,5725	40,925	21,28224	25,85349	7,838E+10	4,37197E+11	2,322445	7,25E+11	80,7564
1994	Nigeria	-4,23282	2,07E+11	1,42E+10	-2,08403	3,756	43,29646	75,82846	58,404	1,769021	31,31839	598513642	82739022079	0,851055	7,19E+11	101,4312
1995	Nigeria	-2,53005	2,71E+11	1,64E+10	-2,08757	3,759	75,40165	94,2692	58,263	1,166196	36,54049	513854734	87423785587	1,622144	1,29E+12	161,4489
1996	Nigeria	1,634581	2,72E+11	1,87E+10	-2,10242	3,77	26,49109	73,82386	58,12	0,911235	37,44548	465420494	98454796731	1,622144	1,58E+12	209,2533
1997	Nigeria	0,406833	2,7E+11	2,09E+10	-2,15015	3,761	5,055346	108,9436	58,004	0,912571	35,24885	496966165	97029256051	0,079966	1,82E+12	238,0304
1998	Nigeria	0,0572	2,75E+11	2,21E+10	-2,10267	3,758	6,009344	105,6196	57,896	1,375668	28,70244	751170665	1,08493E+11	0,099477	1,6E+12	275,2927
1999	Nigeria	-1,89573	2,86E+11	2,27E+10	-2,0675	3,793	13,43057	98,46926	57,819	1,383378	29,36369	821347860	1,0126E+11	0,134313	2,54E+12	69,77688
2000	Nigeria	2,419142	2,93E+11	2,36E+10	-2,02891	3,78	22,67374	100	57,726	2,123442	33,823	1474704210	98623961963	0,005946	3,58E+12	70,75352
2001	Nigeria	3,290568	2,91E+11	2,22E+10	-1,99444	3,778	10,07648	132,8472	57,704	1,990621	28,27627	1473664333	1,47211E+11	0,006176	2,8E+12	78,84075
2002	Nigeria	12,45747	3,01E+11	2,55E+10	-1,91639	3,817	21,10905	86,53526	57,518	1,340488	23,04084	1278635447	1,9847E+11	0,281333	3,35E+12	79,07684
2003	Nigeria	4,657786	3,81E+11	2,98E+10	-2,05963	3,821	9,804324	124,4425	57,49	0,951747	26,00241	998495868	2,12606E+11	0,009263	3,7E+12	74,29173
2004	Nigeria	6,4896	5,71E+11	3,55E+10	-2,40836	3,786	22,36834	162,407	57,462	4,787637	28,39004	6529666089	2,30485E+11	0,145298	5,46E+12	75,96831

2005	Nigeria	3,721624	6,41E+11	4,4E+10	-2,32188	3,74	19,85849	237,9691	57,497	4,544547	28,20158	8004496320	2,61301E+11	0,25347	8,37E+12	87,0464
2006	Nigeria	3,326217	7,38E+11	6,18E+10	-2,1849	3,646	23,86438	304,1122	57,629	5,125842	25,75164	1,2102E+10	2,7463E+11	0,361642	1,52E+13	92,28289
2007	Nigeria	3,82207	9,31E+11	5,56E+10	-2,06466	3,565	7,099731	399,3705	57,733	9,44834	24,34472	2,6042E+10	4,00581E+11	0,76228	9,3E+12	91,35491
2008	Nigeria	3,972514	9,78E+11	6,36E+10	-2,53077	3,539	7,921387	572,7431	57,79	9,428957	24,71425	3,1779E+10	3,90321E+11	0,928697	1,28E+13	100,4979
2009	Nigeria	5,197959	8,02E+11	6,16E+10	-2,76425	3,722	0,686099	388,7755	57,684	8,649948	21,23676	2,5247E+10	4,2569E+11	1,137224	1,08E+13	92,64209
2010	Nigeria	5,158545	8,94E+11	6,08E+10	-2,35951	3,767	16,34277	507,2096	57,645	8,8481	25,31745	3,215E+10	4,71489E+11	1,631811	1,33E+13	100
2011	Nigeria	2,525324	1,03E+12	6,35E+10	-1,71191	3,77	9,778458	642,1061	57,693	8,572152	28,2778	3,5175E+10	5,07511E+11	6,129512	1,59E+13	100,5226
2012	Nigeria	1,472867	9,77E+11	6,47E+10	-1,61348	3,735	9,947637	584,7752	55,369	8,228178	27,07302	3,7798E+10	4,98343E+11	7,268343	2,4E+13	110,5165
2013	Nigeria	3,853731	1,02E+12	7,21E+10	-1,73702	3,703	4,964746	642,1061	53,058	7,155219	25,74232	3,6847E+10	6,61178E+11	3,205081	1,56E+13	117,4086
2014	Nigeria	3,513963	1,07E+12	8,25E+10	-1,72001	4,562	4,662623	668,4783	52,057	6,464486	24,64361	3,6751E+10	7,09495E+11	0,434799	2,02E+13	124,4866
2015	Nigeria	-0,0293	9,22E+11	7,22E+10	-1,60088	4,311	2,863665	512,5383	51,588	6,68812	20,16078	3,3078E+10	7,89763E+11	0,309646	1,62E+13	119,0429
2016	Nigeria	-4,16841	9,11E+11	5,96E+10	-1,73247	7,06	9,54367	407,4197	49,436	5,384282	18,17313	2,1787E+10	8,20715E+11	0,16018	1,63E+13	110,1658

2017	Nigeria	-1,78883	9,93E+11	5,53E+10	-1,90268	8,389	11,11892	358,5799	48,72	4,403315	22,31512	1,6545E+10	8,21289E+11	0,232204	2,1E+13	100,8107
2018	Nigeria	-0,67972	1,1E+12	7,55E+10	-1,81758	8,243	10,23475	493,126	48,74	5,603213	25,7481	2,226E+10	8,06091E+11	0,133974	2,49E+13	109,1045
1994	Tanzania	-1,6198	9,69E+08	1,1E+09	-1,13622	3,511	31,16995	98,7752	84,443	17,11717	13,99429	772129398	10871394158	12,37573	7,85E+10	120,4274
1995	Tanzania	0,584684	1,3E+09	1,03E+09	-1,26575	3,436	26,86195	109,9126	84,429	11,5225	13,42463	605532693	11498556338	9,965327	2,92E+11	117,0273
1996	Tanzania	1,819818	1,42E+09	1,07E+09	-1,31053	3,369	19,31366	91,13632	84,463	11,55442	13,02897	750597395	12090187281	16,53248	4,14E+11	107,2557
1997	Tanzania	1,048394	1,29E+09	1,13E+09	-1,21963	3,28	20,58723	87,73695	84,494	8,284477	13,00126	636567027	13511283063	23,09963	5,18E+11	113,6739
1998	Tanzania	1,339461	1,23E+09	2,75E+09	-1,29562	3,2	67,19972	95,34237	84,502	8,22894	20,07492	1009727812	19198667132	10,7239	1,53E+12	104,1219
1999	Tanzania	2,438474	1,24E+09	2,49E+09	-1,15902	3,162	10,69033	102,1568	84,469	7,83559	19,78693	995998573	21615085753	13,1343	1,45E+12	98,21284
2000	Tanzania	1,978692	1,41E+09	2,51E+09	-1,27194	3,071	8,201104	100	84,498	7,85118	19,20492	1050171990	23376591380	11,08098	1,82E+12	95,07689
2001	Tanzania	3,342612	1,82E+09	2,66E+09	-1,23882	2,994	4,815969	112,3714	84,532	8,003682	19,37385	1087031663	24422317466	9,633749	2,03E+12	83,36502
2002	Tanzania	4,224188	1,97E+09	2,73E+09	-1,27368	3,128	7,233031	108,9772	84,737	8,864388	21,48714	1253604918	26302985247	7,769325	2,81E+12	70,73972
2003	Tanzania	3,733823	2,26E+09	3,3E+09	-1,14524	3,229	8,418683	139,4901	84,95	10,37832	23,23716	1580021479	28401774259	7,912219	3,56E+12	93,35226

2004	Tanzania	4,512537	2,7E+09	4,28E+09	-1,19819	3,285	6,885623	178,9461	85,183	11,4759	23,09756	1913715654	30306619896	9,018777	4,56E+12	99,25534
2005	Tanzania	4,48938	3,05E+09	5,25E+09	-1,17276	3,325	6,389613	215,7543	85,412	11,91804	22,93952	2192806261	33134583464	10,19097	5,23E+12	99,13175
2006	Tanzania	3,579047	3,53E+09	5,88E+09	-1,19109	3,299	5,510095	278,7111	85,679	11,88983	22,84522	2217403727	35872063244	6,976066	6,4E+12	93,19824
2007	Tanzania	3,801081	4,21E+09	7,4E+09	-1,17687	2,902	9,09939	350,3111	85,617	13,10926	23,19719	2863526005	39470543824	6,782368	7,17E+12	86,70786
2008	Tanzania	2,731038	5,7E+09	1,01E+10	-1,1291	2,596	16,38075	505,4085	85,433	11,3176	23,73754	3162269641	44730772719	7,078752	9,78E+12	75,09876
2009	Tanzania	2,293185	5,31E+09	9,01E+09	-1,0167	2,5	9,041662	420,7953	85,023	12,33306	21,67691	3586628682	45001533736	7,123594	1,12E+13	82,2427
2010	Tanzania	3,290252	6,53E+09	9,85E+09	-1,07147	2,986	9,428716	516,8426	84,065	10,3622	23,55617	3317381846	54751020035	5,593323	1,12E+13	100
2011	Tanzania	4,549806	7,58E+09	1,22E+10	-0,99524	3,47	12,19842	708,8453	83,062	9,696879	26,38208	3360661021	62764140091	3,564652	1,22E+13	93,2741
2012	Tanzania	1,442555	8,81E+09	1,31E+10	-0,73065	3,193	10,48389	744,7227	82,663	10,42701	25,3995	4134366137	63121400105	5,703046	1,61E+13	87,38248
2013	Tanzania	3,638008	8,59E+09	1,55E+10	-0,9193	2,93	9,666184	793,6536	82,187	10,04524	25,44675	4588717884	67620931231	4,628457	1,97E+13	77,02047
2014	Tanzania	3,581373	8,67E+09	1,66E+10	-1,03347	2,125	6,050846	787,2198	82,089	9,867791	25,1415	4930421103	72088745457	2,844731	2,29E+13	72,01875
2015	Tanzania	3,025984	8,85E+09	1,51E+10	-0,87925	2,103	7,591364	708,1559	82,078	9,927295	24,48735	4703413059	82795042431	3,368701	2,39E+13	70,07513

2016	Tanzania	3,713714	8,65E+09	1,63E+10	-0,97857	2,077	7,472034	610,4585	82,023	9,066506	24,8584	4512764583	90562123926	3,494842	3,03E+13	65,35459
2017	Tanzania	3,640011	8,48E+09	1,89E+10	-1,01705	2,033	2,703734	610,4485	81,967	8,496346	25,09952	4530304640	93618751927	3,75183	3,63E+13	74,38364
2018	Tanzania	2,352839	8,55E+09	1,76E+10	-0,99781	1,99	4,777468	578,7757	81,888	8,781426	24,97896	4530304640	92090437927	1,248059	3,63E+13	75,7564
1994	Ghana	0,462599	1,38E+09	1,23E+09	-1,66955	5,826	30,12893	70,94364	70,551	13,72334	24,89914	747175732	8068541306	8,444342	99312280	103,3988
1995	Ghana	1,344197	1,6E+09	1,37E+09	-1,64302	6,386	43,04533	64,13671	70,114	12,07348	24,285	780567139	8010622318	9,404651	1,37E+08	119,7577
1996	Ghana	1,916257	1,75E+09	1,41E+09	-1,36653	6,983	39,83774	70,92078	69,68	12,04371	23,57854	835229358	8056947654	10,36496	2,05E+08	129,8195
1997	Ghana	1,598638	1,68E+09	1,64E+09	-1,27141	7,575	19,45817	78,25595	69,245	12,35563	25,66781	851464844	8957490681	7,850228	1,47E+08	138,038
1998	Ghana	2,144239	2,56E+09	1,67E+09	-1,23054	8,2	17,04847	86,2178	68,756	10,32416	25,26654	772347318	9259652638	9,456354	3,12E+08	147,4079
1999	Ghana	1,873828	2,49E+09	1,58E+09	-1,34344	10,1	13,97116	117,0484	67,277	10,84335	25,41278	837036384	10808024878	10,05182	1,93E+08	145,116
2000	Ghana	1,190736	2,46E+09	1,15E+09	-1,29443	10,36	27,23011	100	66,994	10,17162	25,40392	506854102	11578324720	6,488887	4,14E+08	95,30889
2001	Ghana	1,48344	2,42E+09	1,44E+09	-1,17101	9,281	34,81794	105,9833	67,286	9,722364	25,21598	516734888	12408574139	5,252494	8,03E+08	96,39134
2002	Ghana	1,973729	2,58E+09	1,16E+09	-1,13735	8,341	22,81858	91,40352	67,457	9,87277	25,27567	608787607	13993555912	5,81507	9,16E+08	95,9719

2003	Ghana	2,645233	3,21E+09	1,75E+09	-1,24972	7,383	28,70441	107,8705	67,631	11,5332	25,20992	880260960	15069975200	6,377646	1,4E+09	96,39576
2004	Ghana	3,00857	3,45E+09	2,52E+09	-1,35863	6,423	14,35015	136,896	67,809	12,17281	24,71676	1081112285	16397721074	3,368055	1,83E+09	95,13827
2005	Ghana	3,267296	3,95E+09	3,12E+09	-1,38268	5,521	14,96372	179,6847	67,956	15,30817	25,12544	1642816286	18030349159	5,178003	1,87E+09	104,177
2006	Ghana	3,716444	5,18E+09	4,69E+09	-1,22288	4,635	80,75458	226,9427	68,094	8,870722	19,80339	1810484997	33368487450	2,7609	3,33E+09	109,9109
2007	Ghana	1,689109	6,09E+09	3,82E+09	-1,05022	4,667	18,62789	270,8831	67,776	8,52494	19,49281	2110674615	42344731265	5,806079	1,56E+09	109,1149
2008	Ghana	6,371104	7,16E+09	4,73E+09	-1,10115	4,764	19,41027	345,051	67,413	8,73166	19,39956	2490871065	50161056232	4,931658	1,31E+09	103,8218
2009	Ghana	2,211049	7,73E+09	4,03E+09	-0,96517	5,125	15,66657	270,3771	66,855	7,574244	18,51409	1967625568	48009722594	2,378961	4,04E+09	94,83548
2010	Ghana	5,249296	9,49E+09	3,79E+09	-1,12736	5,32	16,59564	367,0138	66,4	7,069499	18,01494	2274595388	58323654377	2,583362	2,24E+09	100
2011	Ghana	11,31545	1,47E+10	4,71E+09	-1,05444	5,619	13,91482	532,1922	65,834	13,7886	23,86366	5455637055	65908003600	3,646262	2,32E+09	95,21353
2012	Ghana	6,733564	1,69E+10	6,65E+09	-1,00907	5,937	15,20528	596,8927	65,234	11,76435	27,13653	4933934959	76646413733	1,659979	3,97E+09	86,46725
2013	Ghana	4,847494	1,65E+10	1,61E+10	-1,27263	6,269	52,98898	591,4178	64,603	10,9279	34,85998	6914873241	94770997627	2,49813	2,16E+10	86,24884
2014	Ghana	0,566072	1,54E+10	1,54E+10	-1,47184	6,527	22,164	490,608	64,009	10,43204	34,59206	5591690737	95635687726	2,159785	2,76E+10	66,37594

2015	Ghana	-0,11393	1,69E+10	1,42E+10	-1,04762	6,806	13,5884	452,4641	63,389	9,656949	31,68267	4749466685	94005499540	1,665415	3,52E+10	64,66765
2016	Ghana	1,149647	1,77E+10	1,48E+10	-1,21682	5,45	15,24938	434,1522	64,312	8,819499	28,22666	4851582434	93619707282	4,983553	3,76E+10	74,22302
2017	Ghana	5,768551	2,07E+10	1,21E+10	-1,13222	4,223	10,35275	424,9867	65,081	8,803559	30,78454	5193815887	1,02925E+11	1,579618	5,76E+10	73,62389
2018	Ghana	3,958667	2,31E+10	1,52E+10	-1,15388	4,157	10,2102	439,8365	65,07	9,014342	31,52748	5909483653	1,15274E+11	1,38141	6,3E+10	73,7762
1994	Cameroon	-0,70795	1,8E+09	2,12E+09	-1,86519	8,028	9,618735	72,7704	76,657	11,62592	25,78565	1232366074	13932542213	26,3519	7,79E+11	90,21931
1995	Cameroon	0,66238	2,05E+09	1,91E+09	-1,70179	8,037	4,992792	80,81532	76,527	11,05362	26,47119	1066006266	14131341548	27,5149	9,17E+11	96,94874
1996	Cameroon	1,591047	2,54E+09	2,14E+09	-1,6158	8,06	1,072764	82,70258	76,398	11,72447	26,41892	1232639403	15145422718	25,1889	8,43E+11	98,03009
1997	Cameroon	2,490315	2,51E+09	2,29E+09	-1,73434	7,917	5,588904	91,59968	76,366	11,0589	26,55993	1198065396	16466498848	30,55093	9,32E+11	97,0382
1998	Cameroon	1,810066	2,46E+09	2,25E+09	-1,83434	7,787	4,308289	100,7664	76,297	10,45829	27,49133	1109922208	17817593493	27,86992	1,18E+12	100,4349
1999	Cameroon	1,608742	2,22E+09	2,25E+09	-1,81816	7,735	-1,11977	88,83619	76,151	11,35881	29,91514	1272002967	18510716553	18,48494	1,12E+12	99,37948
2000	Cameroon	0,8744	2,69E+09	1,98E+09	-1,77589	7,585	5,214817	100	76,092	10,68593	26,13797	1077562186	20535917013	9,099965	1,16E+12	93,68777
2001	Cameroon	1,649185	2,87E+09	2,36E+09	-1,76353	7,46	1,460673	124,829	76,07	11,69639	26,91575	1213070520	21299739269	21,25018	1,1E+12	96,84682

2002	Cameroon	1,505406	3,03E+09	2,64E+09	-1,53014	6,703	1,841656	125,7726	76,571	11,28443	26,8921	1306662759	22711242959	10,01964	1,15E+12	100,3336
2003	Cameroon	1,808363	3,24E+09	3,31E+09	-1,45477	5,924	0,195811	145,8181	77,095	11,51973	26,71152	1675987923	24689251919	9,678943	1,28E+12	103,5604
2004	Cameroon	3,944548	3,92E+09	3,89E+09	-1,55106	5,138	1,986007	162,1903	77,62	11,21106	28,09268	1954192197	26513101090	12,03798	1,8E+12	102,9416
2005	Cameroon	-0,70678	4,28E+09	3,89E+09	-1,81234	4,4	0,748966	184,3452	78,15	10,95358	29,70745	1965519811	27991030570	19,29016	1,78E+12	99,87084
2006	Cameroon	0,67439	4,91E+09	4,04E+09	-1,80901	3,691	3,358664	212,3488	78,736	10,29452	28,64019	1992611832	29634999728	16,59059	2,08E+12	101,5124
2007	Cameroon	2,064856	6,39E+09	4,65E+09	-1,62851	3,063	0,957763	313,8589	79,24	10,35012	29,69748	2314831739	32034509614	14,27185	2,13E+12	102,1074
2008	Cameroon	0,680832	7,39E+09	6,4E+09	-1,59003	3,296	6,612784	383,2596	77,301	11,10516	27,03925	2932848271	34399203502	30,79854	2,48E+12	105,0243
2009	Cameroon	-0,57581	5,44E+09	6,14E+09	-1,45045	3,766	1,645182	299,3815	75,076	11,60297	27,17795	3018850822	35084656828	26,56488	2,38E+12	106,4801
2010	Cameroon	0,61938	5,7E+09	6,14E+09	-1,64686	4,11	1,909828	345,9949	72,864	11,38964	27,19177	2977687234	37368955967	14,79511	2,33E+12	100
2011	Cameroon	1,314427	7,67E+09	7,11E+09	-0,61885	3,969	2,670233	458,3623	73,058	12,11114	28,1477	3553046087	39255612221	31,55502	2,62E+12	100,2225
2012	Cameroon	1,726553	7,59E+09	6,62E+09	-0,54634	3,837	2,6709	439,1304	73,241	12,21817	27,6305	3556028661	43680587079	15,69171	2,67E+12	96,44923
2013	Cameroon	2,577711	8,19E+09	7,32E+09	-0,69924	3,711	2,041155	448,1863	73,405	12,32658	27,13978	3987420047	45862352852	15,92958	2,81E+12	98,90935

2014	Came-roon	3,061836	8,75E+09	8,31E+09	-0,84103	3,534	2,096075	509,1186	73,58	12,15389	25,18185	4246928188	49637196790	14,32526	3,29E+12	99,72419
2015	Came-roon	2,855766	6,92E+09	7,13E+09	-1,0069	3,506	0,179147	407,4275	73,609	12,27678	24,45973	3795515932	53164585601	16,87563	3,05E+12	93,51006
2016	Came-roon	1,901024	6,45E+09	7,38E+09	-0,81457	3,472	1,09464	350,9139	73,636	12,12474	25,28828	3955277516	56641396620	30,02892	3,33E+12	95,63358
2017	Came-roon	0,853486	6,74E+09	8,04E+09	-1,01371	3,414	1,482471	353,6628	73,657	11,13904	25,78155	3890061856	60023874851	21,32916	3,71E+12	96,58751
2018	Came-roon	1,379271	7,51E+09	8,82E+09	-0,91414	3,357	1,599289	413,0085	73,645	11,10667	29,01287	4295525535	64809827168	25,67904	3,8E+12	98,02705

APPENDIX A.2: BRICS DATA

Year	Country	GDPpc	CA	FInv	ECI	FDI	UnemR	Inf	Imp	Empl	GovEx (%)	Ind	GovEx	AgricEx	HHE(%)
1994	Bra-zil	3,627585	51212000000	1,27274E+11	0,512414	0,550427157	6,229	2302,841	61,39586	59,408	15,83179	34,66694	8,84E+10	3,390181	7,443349
1995	Bra-zil	2,749375	56098000000	1,56064E+11	0,558738	0,631608733	6,421	89,49744	92,31659	59,678	20,92792	23,38146	1,61E+11	5,190341	8,621703
1996	Bra-zil	0,596456	57856000000	1,58525E+11	0,529039	1,475965411	7,253	18,45778	97,16557	57,882	19,75083	22,34011	1,68E+11	3,716306	3,06393
19	Bra-zil	1,790	64522000000	1,68893E+11	0,609	2,224865074	8,158	7,729	109,5	57,932	19,53529	22,59	1,73E+11	3,578	3,032

97		611			912			023	476			415		963	974
1998	Brazil	-1,18437	63681000000	1,60155E+11	0,63263	3,694817064	9,423	4,924362	103,4248	57,319	20,07053	22,11879	1,73E+11	3,763963	-0,72001
1999	Brazil	-1,00914	58499000000	1,01994E+11	0,63173	4,735492291	10,208	8,010501	88,27383	57,343	19,78269	21,74671	1,19E+11	4,550533	0,378258
2000	Brazil	2,911826	67337461041	1,19971E+11	0,602188	5,034128682	9,895	5,606065	100	57,753	18,76785	23,00662	1,23E+11	4,820086	4,032632
2001	Brazil	0,01337	69796737824	1,03026E+11	0,512734	4,152126833	9,61	8,225094	99,55425	58,148	19,3433	22,63953	1,08E+11	4,163496	0,771307
2002	Brazil	1,709474	72238303876	91058629636	0,450486	3,2653199	9,371	9,798112	84,78818	58,935	19,80966	22,49533	1,01E+11	3,98177	1,318847
2003	Brazil	-0,12294	85908677704	92707678161	0,42281	1,813120631	9,991	14,09102	86,76385	58,549	19,07748	23,08382	1,07E+11	4,5479	-0,54599
2004	Brazil	4,497077	1,11184E+11	1,15927E+11	0,399357	2,716381065	9,105	7,752061	113,2841	59,752	18,46758	24,30662	1,24E+11	4,046789	3,923494
2005	Brazil	2,026307	1,362E+11	1,52078E+11	0,450112	1,733900669	9,568	7,431225	132,3731	60,015	18,89	24,17258	1,68E+11	3,897916	4,421878
2006	Brazil	2,834754	1,62741E+11	1,90628E+11	0,477157	1,749493337	8,639	6,774274	163,4254	60,265	19,03892	23,54402	2,11E+11	3,763571	5,284699

2007	Brazil	4,974705	1,96096E+11	2,51416E+11	0,548606	3,190894842	8,327	6,439038	215,9588	60,184	18,94299	23,12538	2,65E+11	3,83548	6,376271
2008	Brazil	4,05441	2,40904E+11	3,28741E+11	0,396395	2,990663287	7,343	8,778553	310,995	60,819	18,83939	23,08529	3,19E+11	3,585095	6,464265
2009	Brazil	-1,08194	1,89564E+11	3,18433E+11	0,265535	1,888455825	8,522	7,313483	227,9496	60,24	19,65064	21,87859	3,28E+11	3,796392	4,456396
2010	Brazil	6,524373	2,49692E+11	4,53585E+11	0,248326	3,729955689	7,736	8,423338	326,6142	59,719	19,01686	23,26795	4,2E+11	3,872536	6,229327
2011	Brazil	3,026407	3,1537E+11	5,39172E+11	0,190826	3,915113195	6,917	8,318565	404,0769	59,187	18,66926	23,10206	4,88E+11	3,542213	4,818267
2012	Brazil	1,01451	2,90394E+11	5,10706E+11	0,161553	3,755022099	7,186	7,943179	397,9974	59,667	18,5301	22,13365	4,57E+11	3,801795	3,499502
2013	Brazil	2,108912	2,92646E+11	5,17111E+11	0,032264	3,041524491	6,976	7,5045	427,2567	59,695	18,89246	21,22483	4,67E+11	3,546367	3,471172
2014	Brazil	-0,35248	2,71862E+11	4,8808E+11	-0,15123	3,571425711	6,661	7,846742	407,8156	59,641	19,15354	20,47246	4,7E+11	4,029475	2,250281
2015	Brazil	-4,35148	2,26128E+11	3,2144E+11	0,696066	3,592144788	8,427	7,566277	305,3915	58,652	19,77684	19,36004	3,56E+11	4,712158	-3,21656

2016	Bra-zil	-4,06941	2,30428E+11	2,7877E+11	0,648284	4,137362084	11,6	8,0999901	244,5484	56,388	20,3793	18,34659	3,66E+11	4,813813	-3,8834
2017	Bra-zil	0,508336	2,75778E+11	3,00426E+11	0,608252	3,339346319	12,822	3,47284	268,6464	55,842	20,16852	18,18127	4,16E+11	4,68491	2,027144
2018	Bra-zil	0,526156	2,88199E+11	2,8728E+11	0,608253	4,145494394	12,334	3,025433	321,5444	56,15	20,08491	18,12915	3,79E+11	5,254768	2,055014
1994	Rus-sia	-12,5398	78051420000	86169868685	0,061145	0,174540526	8,131	307,2981	125,5911	57,061	19,09947	41,21529	7,55E+10	3,375106	1,2
1995	Rus-sia	-4,12277	96021270000	83370251412	0,148674	0,522256838	9,449	144,0069	139,5457	55,693	19,07566	34,53919	7,55E+10	3,34698	-2,8
1996	Rus-sia	-3,61498	1,06115E+11	78351802716	0,297075	0,658454456	9,665	46,03638	151,781	54,58	19,49373	35,3467	7,64E+10	3,290729	-7,46385
1997	Rus-sia	1,567711	1,04391E+11	74070872947	0,469322	1,201358893	11,813	15,0585	160,4543	52,017	21,06711	34,68923	8,53E+10	3,403232	4,816835
1998	Rus-sia	-5,14312	90548550000	43760947965	0,593549	1,019119425	13,261	18,53897	129,3188	50,378	18,73272	33,94403	5,08E+10	3,534656	-3,28311
1999	Rus-sia	6,729496	84633120000	28184402924	0,600178	1,662282546	13,036	72,38661	88,13027	53,244	14,57943	33,4962	2,86E+10	3,596261	-2,85369

2000	Russia	10,46372	1,15273E+11	43796658372	0,556283	1,031161116	10,581	37,69793	100	54,763	15,09107	33,91897	3,92E+10	3,101949	7,119773
2001	Russia	5,546717	1,16073E+11	57912238601	0,580501	0,928663004	8,978	16,47962	119,8431	54,581	16,43525	31,83735	5,04E+10	3,138387	9,272252
2002	Russia	5,182747	1,22862E+11	61859649123	0,515668	1,005535945	7,875	15,66191	135,8968	55,752	17,93454	29,05639	6,2E+10	3,392049	8,28493
2003	Russia	7,787965	1,58542E+11	79248664147	0,65224	1,842377384	8,21	13,65714	169,5644	55,229	17,9161	28,65313	7,71E+10	3,24372	7,502349
2004	Russia	7,632493	2,12828E+11	1,0866E+11	0,568381	2,606185281	7,763	20,25515	217,0701	55,858	16,97168	31,70222	1E+11	3,030417	11,929901
2005	Russia	6,806606	2,86351E+11	1,35654E+11	0,557305	2,029804024	7,124	19,27943	279,5997	56,596	16,87154	32,62923	1,29E+11	2,801991	11,61368
2006	Russia	8,554945	3,6297E+11	1,83171E+11	0,607811	3,79771796	7,055	15,12041	366,1919	56,872	17,38814	31,78026	1,72E+11	2,629577	12,00456
2007	Russia	8,685761	4,35974E+11	2,72877E+11	0,510294	4,298948386	6,002	13,84124	498,1633	58,292	17,29753	31,22204	2,25E+11	2,866638	14,15684
2008	Russia	5,246214	5,85254E+11	3,7021E+11	0,262064	4,502698778	6,205	18,01352	650,5751	58,57	17,83058	30,78688	2,96E+11	2,08063	10,46641

2009	Russia	-7,82775	3,76351E+11	2,68922E+11	0,236851	2,99212948	8,301	1,970613	427,54	57,301	20,7866	29,32694	2,54E+11	2,202112	-5,12872
2010	Russia	4,453094	4,79897E+11	3,29769E+11	0,153215	2,8308273	7,369	14,191111	554,2196	57,844	18,72506	29,99959	2,86E+11	2,099478	5,442218
2011	Russia	4,218726	6,16135E+11	4,36225E+11	0,009965	2,692357424	6,536	24,809003	721,8381	58,593	17,46343	29,25855	3,58E+11	1,949195	6,693717
2012	Russia	3,849156	6,37532E+11	4,76135E+11	0,077047	2,290796396	5,436	9,039482	747,7286	59,283	17,83349	29,25629	3,94E+11	1,78487	7,827992
2013	Russia	1,538964	6,34135E+11	5,02973E+11	0,048022	3,019397941	5,458	5,394174	760,7084	59,167	18,53026	28,20521	4,26E+11	1,807298	5,152466
2014	Russia	-1,04526	6,09723E+11	4,41032E+11	0,008439	1,069876215	5,16	7,349598	686,2757	59,39	17,92749	28,0663	3,69E+11	1,828913	1,986044
2015	Russia	-2,18389	4,30302E+11	2,81035E+11	0,855036	0,502608374	5,571	7,587662	430,2505	59,14	17,67161	29,88738	2,41E+11	2,161267	-9,32696
2016	Russia	0,010248	3,72865E+11	2,79377E+11	0,8547	2,548498734	5,559	3,174226	426,849	59,283	18,28593	29,4617	2,35E+11	2,511783	-1,88658
2017	Russia	1,709389	4,57312E+11	3,46043E+11	0,852045	1,814092944	5,212	5,359352	531,3718	59,083	18,07704	30,4717	2,85E+11	2,421105	3,314185

2018	Russia	2,54459	5,60515E+11	3,39781E+11	0,852046	0,526170279	4,846	10,29725	554,3756	59,233	17,37585	32,06611	2,88E+11	2,21835	2,304418
1994	India	4,606288	32381442656	76447937683	-0,02415	0,297385909	5,631	9,980045	52,09858	55,097	10,43581	27,6282	3,42E+10	1,192329	4,860117
1995	India	5,529881	39498835731	90563795241	0,066093	0,594986258	5,636	9,062702	67,36209	54,975	10,54027	28,59981	3,8E+10	1,29417	6,087889
1996	India	5,530417	42386680922	96357166196	0,034912	0,617479056	5,652	7,575018	73,64143	54,824	10,33089	27,91227	4,06E+10	2,533303	7,773661
1997	India	2,123014	46296383983	1,05423E+11	0,101682	0,860208566	5,637	6,476271	80,41453	54,69	11,02873	27,83703	4,59E+10	2,004066	2,989656
1998	India	4,248844	47572909237	1,07271E+11	0,118969	0,625285966	5,631	8,010168	83,41902	54,554	11,90989	27,30304	5,02E+10	1,656051	6,501189
1999	India	6,898116	53305746338	1,26337E+11	0,196844	0,472644846	5,685	3,068396	91,1812	54,391	12,17549	26,51929	5,59E+10	1,418165	6,079353
2000	India	2,021089	62452794818	1,21885E+11	0,210091	0,765212649	5,663	3,64497	100	54,282	11,94784	27,32583	5,6E+10	1,259281	3,439589
2001	India	3,027378	65653991098	1,45304E+11	0,285222	1,056378305	5,659	3,215616	97,80505	54,381	11,76145	26,48778	5,71E+10	1,139468	5,952897

2002	India	2,064875	73807543012	1,45895E+11	0,216505	1,011571805	5,719	3,715684	109,693	54,454	11,3141	27,66065	5,83E+10	1,062796	2,870479
2003	India	6,093705	88285790487	1,72191E+11	0,176804	0,605889255	5,725	3,867798	140,8261	54,571	10,87621	27,47411	6,61E+10	1,079834	5,92532
2004	India	6,193653	1,2071E+11	2,17766E+11	0,152537	0,765601405	5,669	5,725413	193,6525	54,735	10,4047	29,21911	7,38E+10	1,203885	5,171126
2005	India	6,231949	1,60228E+11	2,68719E+11	0,158145	0,88610072	5,598	5,621903	277,2942	54,919	10,36614	29,53376	8,5E+10	1,267759	7,455695
2006	India	6,403285	2,01515E+11	3,15785E+11	0,167513	2,130168425	5,45	8,400938	346,2732	54,169	9,8247	30,92724	9,22E+10	1,717875	4,935776
2007	India	6,048174	2,52732E+11	4,35748E+11	0,168601	2,073395746	5,323	6,944418	445,1805	53,435	9,862116	30,90324	1,2E+11	1,982944	7,281564
2008	India	1,587598	3,20713E+11	4,16232E+11	0,195512	3,620521897	5,281	9,19397	623,0851	52,679	10,53848	31,13672	1,26E+11	1,735406	4,452197
2009	India	6,351089	2,7458E+11	4,55592E+11	0,156613	2,651593127	5,566	7,040365	499,1998	51,762	11,45967	31,12137	1,54E+11	1,289738	5,000777
2010	India	7,042347	3,57996E+11	5,56807E+11	0,111379	1,635034274	5,636	10,52603	679,7614	50,984	11,00761	30,72508	1,84E+11	2,226259	6,720408

2011	India	3,89393	4,56523E+11	6,25551E+11	0,0919946	2,002065027	5,638	8,733578	901,4671	50,103	11,08446	30,16168	2,02E+11	2,481955	7,421984
2012	India	4,1655	4,53744E+11	6,11106E+11	0,1445541	1,312934337	5,652	7,934388	950,4393	49,245	10,68386	29,39853	1,95E+11	4,096087	5,470858
2013	India	5,134957	4,79503E+11	5,81076E+11	-0,13459	1,516275965	5,671	6,186504	903,282	48,794	10,29516	28,4049	1,91E+11	2,829939	7,303177
2014	India	6,186732	4,9822E+11	6,13374E+11	-0,0147	1,695658786	5,608	3,331757	898,4541	48,39	10,44086	27,6564	2,13E+11	2,170948	6,393856
2015	India	6,797039	4,43164E+11	6,04427E+11	0,2541662	2,092115754	5,565	2,279588	764,9635	47,981	10,42829	27,34739	2,19E+11	1,773605	7,928111
2016	India	7,082848	4,45919E+11	6,46868E+11	0,31413	1,9373632	5,511	3,124227	701,9182	47,566	10,30642	26,64217	2,36E+11	1,537323	8,190445
2017	India	5,912398	5,07948E+11	7,44573E+11	0,359807	1,506588286	5,419	3,835505	873,2524	47,176	11,0302	26,49817	2,93E+11	1,514843	7,436232
2018	India	5,024473	5,58423E+11	7,85625E+11	0,359808	1,552336472	5,355	4,111609	998,5153	46,786	11,22881	26,74639	3,05E+11	1,569526	8,078006
1994	China	11,76639	1,24918E+11	1,94357E+11	0,0891556	5,987156294	2,897	20,60061	51,36254	76,598	14,03481	46,16424	7,92E+10	2,171598	10,20551

1995	China	9,754955	1,52431E+11	2,3756E+11	0,234956	4,88044416	3,004	13,67054	58,69552	76,394	13,24598	46,75174	9,73E+10	1,813539	8,807511
1996	China	8,77643	1,78996E+11	2,73307E+11	0,221438	4,651826651	3,118	6,501096	61,74586	76,136	13,12623	47,10545	1,13E+11	1,666305	11,60352
1997	China	8,124498	1,46243E+11	2,98127E+11	0,328308	4,725334152	3,233	1,62216	63,18837	75,833	13,65153	47,10026	1,31E+11	1,46715	6,011504
1998	China	6,816065	1,46948E+11	3,38376E+11	0,254555	4,435577102	3,243	-0,89259	62,35113	75,562	14,83482	45,79881	1,53E+11	1,160324	6,794235
1999	China	6,733486	1,58214E+11	3,55955E+11	0,233022	3,74900388	3,252	-1,26841	73,6757	75,234	16,23898	45,36103	1,78E+11	1,270086	9,367527
2000	China	7,638598	2,02589E+11	3,94626E+11	0,307929	3,475082246	3,261	2,061461	100	74,85	16,63335	45,53728	2,01E+11	1,133612	11,70272
2001	China	7,551655	2,1796E+11	4,48075E+11	0,378568	3,51300212	3,802	2,043115	108,2342	73,742	16,09	44,79457	2,16E+11	0,903333	7,219099
2002	China	8,40488	2,5597E+11	5,15551E+11	0,41801	3,609099885	4,243	0,604851	131,1727	72,633	15,60318	44,45172	2,29E+11	0,808405	9,413079
2003	China	9,354777	4,62071E+11	6,35188E+11	0,442061	3,48740331	4,582	2,605441	183,4293	71,573	14,67688	45,62396	2,44E+11	0,665371	6,548218

2004	China	9,461559	6,25332E+11	7,72942E+11	0,452979	3,483641114	4,494	6,954322	249,4085	70,888	13,90202	45,9014	2,72E+11	0,557166	8,305398
2005	China	10,741138	8,12612E+11	9,01261E+11	0,474971	4,554254034	4,515	3,90264	293,2812	70,229	13,99504	47,02377	3,2E+11	0,534923	11,1837
2006	China	12,0933	1,04629E+12	1,06578E+12	0,587449	4,508579016	4,431	3,927911	351,7229	69,745	13,94901	47,55857	3,84E+11	0,4829	10,31228
2007	China	13,63582	1,34053E+12	1,34531E+12	0,632635	4,40096483	4,347	7,74918	424,8951	69,378	13,49026	46,88532	4,79E+11	0,467319	13,83338
2008	China	9,09028	1,6071E+12	1,79459E+12	0,715732	3,73363489	4,587	7,791802	503,3094	68,839	13,19616	46,97231	6,06E+11	0,445298	9,677157
2009	China	8,855948	1,35797E+12	2,23514E+12	0,753508	2,568888291	4,72	-0,21053	447,0292	68,356	13,21809	45,95798	6,74E+11	0,463033	10,5169
2010	China	10,10283	1,74637E+12	2,67405E+12	0,774908	4,0035629	4,526	6,881145	620,488	68,032	12,84592	46,49861	7,82E+11	0,472464	12,01386
2011	China	9,027174	2,15312E+12	3,31219E+12	0,909906	3,708828902	4,548	8,075596	774,7991	67,789	13,2168	46,53005	9,98E+11	0,550195	15,46467
2012	China	7,339469	2,34213E+12	3,7755E+12	1,00792	2,827090556	4,57	2,335121	808,0938	67,535	13,47545	45,42375	1,15E+12	0,481149	9,818759

2013	China	7,235409	2,53957E+12	4,26063E+12	1,04036	3,039875469	4,59	2,161019	866,5698	67,248	13,58858	44,17746	1,3E+12	0,460667	8,067061
2014	China	6,883229	2,70227E+12	4,59423E+12	1,16379	2,559233447	4,609	0,791193	870,6774	66,934	13,37525	43,28399	1,4E+12	0,46883	8,376046
2015	China	6,498792	2,58335E+12	4,65629E+12	0,60941	2,192181603	4,629	0,062699	746,3933	66,593	14,03607	41,11417	1,55E+12	0,418118	8,223725
2016	China	6,271763	2,42374E+12	4,66769E+12	0,642376	1,55564215	4,535	1,072756	705,6696	66,281	14,38626	40,07072	1,6E+12	0,441976	8,322345
2017	China	6,350905	2,71685E+12	5,15328E+12	0,691307	1,349132679	4,441	3,88417	819,3762	65,92	14,52176	40,54109	1,76E+12	0,417099	6,798394
2018	China	6,26421	2,88582E+12	5,95296E+12	0,691308	1,693905294	5,33	2,933332	949,1201	65,568	14,67618	40,65279	2E+12	0,418353	9,512456
1994	South africa	0,833179	30973638012	22489871996	0,113564	0,267909625	30,143	9,561052	78,67508	39,31	19,79856	32,04382	2,77E+10	3,520247	4,007268
1995	South africa	0,931044	35538043023	26366076340	0,108519	0,803047395	30,157	10,21348	102,8658	39,194	18,11765	31,91711	2,82E+10	4,356374	5,926613
1996	South africa	2,311697	36572081253	25381981265	0,172478	0,553085677	30,194	7,905679	101,64	39,039	19,14527	30,80974	2,83E+10	4,046497	4,471778

1997	South af-rica	0,818418	37959642406	26787766247	0,2525567	2,497285704	30,164	7,987288	111,1231	38,938	19,29195	30,14121	2,94E+10	4,480562	3,257463
1998	South af-rica	-1,09853	36069050876	24919486019	0,2333557	0,399448065	30,154	7,78699	98,47449	38,858	18,91177	29,48712	2,61E+10	4,492536	1,742505
1999	South af-rica	0,884309	35535038116	22042450120	0,2664418	1,100275869	30,276	7,028155	89,90066	38,7	18,58083	28,54485	2,54E+10	3,81191	1,737723
2000	South af-rica	2,742091	39506573038	21294330768	0,1959963	0,710488511	30,229	8,796302	100	38,642	18,38694	29,06573	2,51E+10	3,948731	4,138206
2001	South af-rica	1,339791	38388833052	18846931190	0,1028827	5,983101185	30,896	7,64186	95,12713	38,2	18,53406	29,55043	2,25E+10	3,28863	3,493142
2002	South af-rica	2,397943	39060996814	17495896857	0,0553771	1,281411708	33,473	12,20528	98,55868	36,711	18,80519	29,69304	2,17E+10	3,813647	3,172596
2003	South af-rica	1,696827	50215153637	28008645419	0,1283666	0,446850319	32,456	5,793571	133,8542	37,244	19,05789	28,00773	3,34E+10	3,477379	2,831516
2004	South af-rica	3,289033	61694715396	37625895939	0,0946885	0,30684716	29,576	6,527026	180,0498	38,824	19,15756	27,31361	4,38E+10	2,85923	6,240492
2005	South af-rica	3,982017	72730057771	44456622584	0,16654	2,530174027	29,253	5,449103	209,8141	39,037	19,47819	27,13741	5,02E+10	2,671229	6,133507

2006	South africa	4,277783	85294923089	51407369121	0,237984	0,229456347	28,489	6,255249	265,0769	39,493	18,15353	26,23562	4,93E+10	2,320869	8,776257
2007	South africa	4,0085	1,00413E+11	61820194737	0,165269	2,199883486	26,666	8,849399	297,8602	40,59	17,81401	26,52626	5,33E+10	2,123786	6,51796
2008	South africa	1,823488	1,08974E+11	67423255701	0,142773	3,447015663	22,433	8,831509	342,2798	43,103	18,65793	28,28426	5,35E+10	2,173772	1,211036
2009	South africa	-2,89873	87744964393	63660502496	0,0741112	2,576394037	23,538	7,504521	249,3804	41,249	19,86448	27,58362	5,88E+10	2,250526	-2,59091
2010	South africa	1,551073	1,12387E+11	72314784462	0,119045	0,983955561	24,693	6,351038	326,1002	39,526	20,22964	27,38134	7,59E+10	2,060779	3,934502
2011	South africa	1,720714	1,3217E+11	79604186322	0,0165592	0,994020534	24,653	6,532231	419,0268	39,592	19,86224	26,94254	8,27E+10	1,942267	5,142607
2012	South africa	0,607949	1,23784E+11	76205942703	0,0237795	1,167208533	24,732	5,282771	428,2005	39,928	20,25993	26,68106	8,03E+10	1,784398	3,701824
2013	South africa	0,852685	1,20214E+11	74737724482	-0,19208	2,24423643	24,569	6,155257	425,4252	40,531	20,57498	26,66809	7,55E+10	1,948755	1,993938
2014	South africa	0,247279	1,17905E+11	71553036470	-0,20497	1,650494017	24,898	5,547005	410,6746	40,595	20,79568	26,54514	7,3E+10	2,049448	0,825326

2015	South af-rica	-0,34168	1,03939E+11	64512222858	-0,30455	0,478917399	25,156	5,170614	352,4209	41,452	20,45439	26,02838	6,5E+10	2,302119	1,932678
2016	South af-rica	-1,06087	97001618420	57554117263	0,28477	0,74751226	26,551	7,206346	308,4498	40,787	20,79198	26,247742	6,16E+10	2,465114	0,581499
2017	South af-rica	-0,00314	1,0958E+11	65592245116	0,268797	0,58891594	27,071	5,267458	341,2221	40,988	20,799	26,29314	7,27E+10	2,368871	2,060409
2018	South af-rica	-0,57208	1,17389E+11	66981615397	0,268797	1,512253491	26,92	3,91654	382,5725	40,925	21,28224	25,85349	7,84E+10	2,322445	1,815434

APPENDIX B: SELECTED SSA LAG LENGTH CRITERIA

APPENDIX B1: GDP PER CAPITA LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: GDPPCC ECI REER INF LGOVEX LHHE LIMPI
Exogenous variables: C
Date: 03/22/21 Time: 15:49
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1188.211	NA	3856.352	28.12261	28.32377	28.20352
1	-595.5066	1073.841	0.010763	15.32957	16.93884*	15.97686*
2	-534.2507	100.8921	0.008248	15.04119	18.05858	16.25487
3	-489.3049	66.62545	0.009617	15.13659	19.56210	16.91665
4	-396.4076	122.4059	0.003841	14.10371	19.93733	16.45015
5	-357.5768	44.76954	0.005954	14.34298	21.58473	17.25582
6	-293.7982	63.02827	0.005789	13.99525	22.64511	17.47447
7	-207.6166	70.97307*	0.003964	13.12039	23.17837	17.16599
8	-114.8635	61.10795	0.003036*	12.09091*	23.55700	16.70289

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX B2: CURRENT ACCOUNT LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: LCA ECI AGRICEX INF LIMPI LSAV LUNEMR
Exogenous variables: C
Date: 03/21/21 Time: 01:35
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-1132.980	NA	1051.452	26.82306	27.02422	26.90397
1	-298.3539	1512.146	9.89e-06*	8.337739	9.947015*	8.985035*
2	-258.9145	64.95900	1.27e-05	8.562694	11.58009	9.776374
3	-220.1814	57.41616	1.71e-05	8.804268	13.22978	10.58433
4	-154.8610	86.06924*	1.31e-05	8.420258	14.25388	10.76671
5	-114.1772	46.90600	1.94e-05	8.615934	15.85768	11.52877
6	-69.25905	44.38970	2.94e-05	8.711978	17.36184	12.19119
7	-10.93890	48.02836	3.88e-05	8.492680	18.55066	12.53828
8	59.72619	46.55582	4.99e-05	7.982913*	19.44901	12.59490

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX B3: FIXED IVESTMENT LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: LFINV ECI INF LIMP LIND AGRICEX LUNEMR
Exogenous variables: C
Date: 04/10/21 Time: 13:35
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-853.4857	NA	1.464611	20.24672	20.44788	20.32763
1	-243.4163	1105.302	2.72e-06*	7.045088	8.654365*	7.692384*
2	-207.3730	59.36540	3.77e-06	7.349953	10.36735	8.563632
3	-176.2753	46.09769	6.09e-06	7.771184	12.19669	9.551248
4	-124.0629	68.79762	6.33e-06	7.695597	13.52922	10.04204
5	-74.45637	57.19336	7.61e-06	7.681326	14.92307	10.59416
6	-26.63099	47.26274	1.08e-05	7.708964	16.35882	11.18818
7	58.18777	69.85074	7.62e-06	6.866170	16.92415	10.91177
8	175.1121	77.03250*	3.31e-06	5.267951*	16.73404	9.879934

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX C: BRICS LAG LENGTH CRITERIA

APPENDIX C1: GDP PER CAPITA LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: GDPPCC ECI INF LIMPI LIND HHE___ LEMPL
Exogenous variables: C
Date: 03/22/21 Time: 02:41
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-663.1865	NA	0.016638	15.76910	15.97025	15.85001
1	-52.41000	1106.583	3.04e-08*	2.550824	4.160100*	3.198119*
2	-16.59986	58.98140	4.23e-08	2.861173	5.878566	4.074853
3	28.88512	67.42480	4.87e-08	2.943879	7.369389	4.723943
4	65.30308	47.98601	7.35e-08	3.239928	9.073554	5.586375
5	130.8680	75.59247*	6.07e-08	2.850165	10.09191	5.762997
6	183.3942	51.90830	7.70e-08	2.767195	11.41705	6.246410
7	250.4838	55.25024	8.26e-08	2.341558	12.39953	6.387157
8	337.3140	57.20577	7.27e-08	1.451435*	12.91753	6.063419

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX C2: CURRENT ACCOUNT LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: LCA ECI AGRICEX INF LIMPI LGOVEXP LEMPL
Exogenous variables: C
Date: 04/10/21 Time: 13:09
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-400.8520	NA	3.47e-05	9.596516	9.797676	9.677428
1	376.8711	1409.051	1.25e-12*	-7.549908	-5.940631*	-6.902612*
2	406.8057	49.30414	2.00e-12	-7.101311	-4.083919	-5.887632
3	442.9424	53.56731	2.86e-12	-6.798645	-2.373136	-5.018581
4	480.9419	50.06987	4.16e-12	-6.539809	-0.706183	-4.193361
5	529.5038	55.98909	5.13e-12	-6.529502	0.712241	-3.616670
6	577.0579	46.99456	7.31e-12	-6.495479	2.154380	-3.016264
7	686.2972	89.96178*	2.91e-12	-7.912874	2.145101	-3.867275
8	764.5644	51.56430	3.13e-12	-8.601515*	2.864577	-3.989532

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX C3: FIXED IVESTMENT LAG LENGTH CRITERIA

VAR Lag Order Selection Criteria
Endogenous variables: FINV ECI INF FDI IMP IND UNEMR
Exogenous variables: C
Date: 03/06/21 Time: 21:12
Sample: 1994 2018
Included observations: 85

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-3986.193	NA	1.51e+32	93.95747	94.15863	94.03838
1	-3234.675	1361.573	1.00e+25	77.42764	79.03692*	78.07494*
2	-3179.228	91.32379	8.80e+24	77.27596	80.29335	78.48964
3	-3121.068	86.21456	7.52e+24	77.06042	81.48592	78.84048
4	-3073.628	62.50912	8.75e+24	77.09712	82.93075	79.44357
5	-3026.520	54.31289	1.12e+25	77.14164	84.38338	80.05447
6	-2975.044	50.86988	1.45e+25	77.08339	85.73325	80.56261
7	-2889.993	70.04178	1.02e+25	76.23514	86.29311	80.28074
8	-2777.141	74.35004*	4.87e+24*	74.73272*	86.19881	79.34470

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

APPENDIX D: SELECTED SSA COINTEGRATION RESULTS

APPENDIX D1: GDP PER CAPITA MODEL

Pedroni

Pedroni Residual Cointegration Test
Series: GDPPCC ECI REER INF LEMPL LIMPI LIND
Date: 03/22/21 Time: 15:25
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 3
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.310014	0.6217	-1.335988	0.9092
Panel rho-Statistic	1.910911	0.9720	1.217663	0.8883
Panel PP-Statistic	-1.351391	0.0083	-3.311757	0.0005
Panel ADF-Statistic	-3.108871	0.0009	-4.101147	0.0000

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

	Statistic	Prob.
Group rho-Statistic	2.239311	0.9874

Group PP-Statistic	-2.190070	0.0143
Group ADF-Statistic	-3.602405	0.0002

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
South africa	0.060	1.222673	1.025380	3.00	24
Nigeria	0.216	5.270065	3.451752	3.00	24
Tanzania	0.117	0.327260	0.327260	0.00	24
Ghana	0.122	2.732349	2.814915	1.00	24
Cameroon	-0.154	0.810955	0.597869	4.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
South africa	0.060	1.222673	0	3	24
Nigeria	-0.520	4.108418	2	3	22
Tanzania	-0.466	0.208535	2	3	22
Ghana	-0.782	1.863171	3	3	21
Cameroon	-0.154	0.810955	0	3	24

Kao

Kao Residual Cointegration Test
Series: GDPPCC ECI REER INF LEMPL LIMPI LIND
Date: 03/22/21 Time: 15:34
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.410024	0.0000
Residual variance	4.551008	
HAC variance	2.204551	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/22/21 Time: 15:34
Sample (adjusted): 1995 2018
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.651683	0.082396	-7.909159	0.0000

R-squared	0.344225	Mean dependent var	0.052254
Adjusted R-squared	0.344225	S.D. dependent var	2.353097
S.E. of regression	1.905537	Akaike info criterion	4.135703

Sum squared resid	432.0974	Schwarz criterion	4.158932
Log likelihood	-247.1422	Hannan-Quinn criter.	4.145137
Durbin-Watson stat	2.087435		

APPENDIX D2: CURRENT ACCOUNT MODEL

Pedroni

Pedroni Residual Cointegration Test
Series: LCA ECI AGRICEX INF LIMPI LSAV LUNEMR
Date: 03/21/21 Time: 01:14
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 4
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.131985	0.5525	-0.245926	0.5971
Panel rho-Statistic	1.185147	0.8820	1.179341	0.8809
Panel PP-Statistic	-0.793095	0.0213	-1.474841	0.0071
Panel ADF-Statistic	-1.786119	0.0370	-2.327197	0.0100

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

	Statistic	Prob.
Group rho-Statistic	1.948210	0.9743
Group PP-Statistic	-1.600990	0.0054
Group ADF-Statistic	-3.151216	0.0008

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
South africa	0.113	0.000740	0.000709	1.00	24
Nigeria	0.006	0.007077	0.007077	0.00	24
Tanzania	0.380	0.005134	0.006042	1.00	24
Ghana	0.358	0.010751	0.010508	1.00	24
Cameroon	0.095	0.002646	0.001344	5.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
South africa	0.113	0.000740	0	4	24
Nigeria	0.006	0.007077	0	4	24
Tanzania	-0.385	0.002411	2	4	22
Ghana	0.358	0.010751	0	4	24
Cameroon	0.095	0.002646	0	4	24

Kao

Kao Residual Cointegration Test
Series: LCA ECI AGRICEX INF LIMPI LSAV LUNEMR
Date: 03/21/21 Time: 01:15
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.835304	0.0000
Residual variance	0.008589	
HAC variance	0.003489	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/21/21 Time: 01:15
Sample (adjusted): 1995 2018
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.409745	0.073841	-5.549032	0.0000

R-squared	0.205415	Mean dependent var	0.001379
Adjusted R-squared	0.205415	S.D. dependent var	0.101168
S.E. of regression	0.090180	Akaike info criterion	-1.965714
Sum squared resid	0.967765	Schwarz criterion	-1.942485
Log likelihood	118.9428	Hannan-Quinn criter.	-1.956281
Durbin-Watson stat	1.842516		

APPENDIX D3: FIXED INVESTMENT MODEL

Pedroni

Pedroni Residual Cointegration Test
Series: LFINV ECI INF LIMP LIND AGRICEX LUNEMR
Date: 03/08/21 Time: 15:30
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 3
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.423461	0.3360	0.531211	0.2976
Panel rho-Statistic	2.445666	0.9928	2.254813	0.9879
Panel PP-Statistic	0.266428	0.0060	-0.954397	0.0016
Panel ADF-Statistic	-1.549891	0.0066	-2.438925	0.0074

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

	Statistic	Prob.
Group rho-Statistic	3.016132	0.9987
Group PP-Statistic	-0.770021	0.0206
Group ADF-Statistic	-2.122290	0.0169

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
South africa	0.018	0.003894	0.003894	0.00	24
Nigeria	-0.006	0.006861	0.006743	1.00	24
Tanzania	0.264	0.003018	0.001260	5.00	24
Ghana	0.361	0.028871	0.024997	3.00	24
Cameroon	0.218	0.005038	0.001642	5.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
South africa	0.018	0.003894	0	3	24
Nigeria	-0.006	0.006861	0	3	24
Tanzania	-0.069	0.002374	1	3	23
Ghana	0.107	0.025766	1	3	23
Cameroon	-0.031	0.003998	1	3	23

Kao

Kao Residual Cointegration Test
Series: LFINV ECI INF LIMP LIND AGRICEX LUNEMR
Date: 03/08/21 Time: 15:32
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.849547	0.0000
Residual variance	0.021502	
HAC variance	0.015324	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/08/21 Time: 15:32
Sample (adjusted): 1995 2018
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

RESID(-1)	-0.414131	0.074591	-5.552001	0.0000

R-squared	0.203856	Mean dependent var	0.009310
Adjusted R-squared	0.203856	S.D. dependent var	0.192035
S.E. of regression	0.171347	Akaike info criterion	-0.681958
Sum squared resid	3.493801	Schwarz criterion	-0.658729
Log likelihood	41.91747	Hannan-Quinn criter.	-0.672524
Durbin-Watson stat	1.937538		

APPENDIX E: BRICS COINTEGRATION RESULTS

APPENDIX E1: GDP PER CAPITA MODEL

Pedroni Residual Cointegration Test
Series: GDPPCC ECI INF LIMPI LIND HHE___ LEMPL
Date: 03/22/21 Time: 02:21
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 3
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.488327	0.9317	-3.085099	0.9990
Panel rho-Statistic	2.110724	0.9826	1.922205	0.9727
Panel PP-Statistic	-13.30655	0.0000	-7.881133	0.0000
Panel ADF-Statistic	-6.041966	0.0000	-5.623757	0.0000

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

	Statistic	Prob.
Group rho-Statistic	2.369951	0.9911
Group PP-Statistic	-19.03516	0.0000
Group ADF-Statistic	-6.574810	0.0000

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Brazil	-0.394	0.790371	0.058744	23.00	24
Russia	-0.067	6.233894	0.740396	23.00	24
India	-0.289	1.064234	0.157479	11.00	24
China	0.107	0.609797	0.164565	8.00	24
South africa	-0.205	0.578836	0.503504	5.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Brazil	-0.394	0.790371	0	3	24
Russia	-0.534	5.053794	1	3	23
India	-0.289	1.064234	0	3	24
China	-0.247	0.531828	1	3	23

South africa	-0.205	0.578836	0	3	24

Kao

Kao Residual Cointegration Test
Series: GDPPCC ECI INF LIMPI LIND HHE___ LEMPL
Date: 03/22/21 Time: 02:20
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 2
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-2.967474	0.0015
Residual variance	5.560897	
HAC variance	4.279451	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/22/21 Time: 02:20
Sample (adjusted): 1997 2018
Included observations: 110 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.711129	0.138953	-5.117777	0.0000
D(RESID(-1))	-0.028411	0.105722	-0.268731	0.7887
D(RESID(-2))	-0.231280	0.076313	-3.030687	0.0031

R-squared	0.470060	Mean dependent var	-0.018691
Adjusted R-squared	0.460154	S.D. dependent var	2.237627
S.E. of regression	1.644079	Akaike info criterion	3.859131
Sum squared resid	289.2204	Schwarz criterion	3.932781
Log likelihood	-209.2522	Hannan-Quinn criter.	3.889004
Durbin-Watson stat	2.041698		

APPENDIX E2: CURRENT ACCOUNT MODEL

Pedroni

Pedroni Residual Cointegration Test
Series: LCA ECI AGRICEX INF LIMPI LGOVEXP LHHE
Date: 03/17/21 Time: 03:52
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 3

Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-0.243783	0.5963	-0.784639	0.7837
Panel rho-Statistic	2.078288	0.9812	1.938942	0.9737
Panel PP-Statistic	0.782335	0.0030	0.270426	0.0066
Panel ADF-Statistic	0.728246	0.0068	0.139362	0.0054

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

	Statistic	Prob.
Group rho-Statistic	2.729417	0.9968
Group PP-Statistic	0.769313	0.0091
Group ADF-Statistic	0.524868	0.0002

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Brazil	0.345	0.005878	0.005627	2.00	24
Russia	0.358	0.002557	0.002683	1.00	24
India	0.227	0.000523	0.000419	3.00	24
China	0.021	0.002566	0.002554	1.00	24
South africa	0.169	0.000844	0.000851	1.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Brazil	0.345	0.005878	0	3	24
Russia	0.358	0.002557	0	3	24
India	-0.019	0.000466	1	3	23
China	0.021	0.002566	0	3	24
South africa	0.169	0.000844	0	3	24

Kao

Kao Residual Cointegration Test
Series: LCA ECI AGRICEX INF LIMPI LGOVEXP LHHE
Date: 03/17/21 Time: 03:54
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-4.522147	0.0000
Residual variance	0.004664	
HAC variance	0.004394	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/17/21 Time: 03:54
Sample (adjusted): 1995 2018
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.310305	0.064409	-4.817720	0.0000

R-squared	0.163047	Mean dependent var	-0.001142
Adjusted R-squared	0.163047	S.D. dependent var	0.081777
S.E. of regression	0.074814	Akaike info criterion	-2.339324
Sum squared resid	0.666060	Schwarz criterion	-2.316095
Log likelihood	141.3595	Hannan-Quinn criter.	-2.329891
Durbin-Watson stat	1.759282		

APPENDIX E3: FIXED INVESTMENT MODEL

Pedroni

Pedroni Residual Cointegration Test
Series: LFINV ECI INF FDI LIMP LIND LUNEMR
Date: 03/06/21 Time: 21:03
Sample: 1994 2018
Included observations: 125
Cross-sections included: 5
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
Automatic lag length selection based on SIC with a max lag of 3
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.770232	0.2206	0.794228	0.2135
Panel rho-Statistic	1.848621	0.9677	1.471655	0.9294
Panel PP-Statistic	-3.006977	0.0013	-3.813299	0.0001
Panel ADF-Statistic	-3.606430	0.0002	-4.307089	0.0000

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

	Statistic	Prob.
Group rho-Statistic	1.962127	0.9751
Group PP-Statistic	-4.648550	0.0000
Group ADF-Statistic	-5.123321	0.0000

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
Brazil	-0.020	0.007136	0.003273	4.00	24
Russia	0.141	0.007796	0.002175	10.00	24
India	-0.484	0.002028	0.001757	2.00	24
China	0.251	0.005892	0.004967	3.00	24

South africa	-0.238	0.002880	0.003196	2.00	24

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
Brazil	-0.020	0.007136	0	3	24
Russia	-0.256	0.006049	1	3	23
India	-0.484	0.002028	0	3	24
China	0.251	0.005892	0	3	24
South africa	-0.238	0.002880	0	3	24

Kao

Kao Residual Cointegration Test
Series: LFINV ECI INF FDI LIMP LIND LUNEMR
Date: 03/06/21 Time: 21:05
Sample: 1994 2018
Included observations: 125
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
Automatic lag length selection based on SIC with a max lag of 5
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.715946	0.0001
Residual variance	0.011041	
HAC variance	0.009364	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 03/06/21 Time: 21:05
Sample (adjusted): 1995 2018
Included observations: 120 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.290355	0.065621	-4.424742	0.0000

R-squared	0.138528	Mean dependent var	-0.007164
Adjusted R-squared	0.138528	S.D. dependent var	0.127078
S.E. of regression	0.117948	Akaike info criterion	-1.428846
Sum squared resid	1.655499	Schwarz criterion	-1.405617
Log likelihood	86.73075	Hannan-Quinn criter.	-1.419412
Durbin-Watson stat	2.222964		

APPENDIX F: SELECTED SSA PANEL AUTOREGRESSIVE LAG RESULTS

APPENDIX F1: GDP PER CAPITA MODEL

Dependent Variable: D(GDPPCC)
Method: ARDL
Date: 03/22/21 Time: 15:29
Sample: 1996 2018
Included observations: 115
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): ECI REER INF LGOVEX LHHE LIMPI
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
ECI	0.605474	0.296392	2.042817	0.0471
REER	0.010563	0.008708	1.213112	0.2316
INF	-0.160115	0.016074	-9.960854	0.0000
LGOVEX	-1.025375	0.630513	-1.626255	0.1110
LHHE	0.842013	0.494218	1.703730	0.0955
LIMPI	0.034114	0.368436	0.092592	0.9266
		Short Run Equation		
COINTEQ01	-0.096541	0.290451	-3.775308	0.0005
D(GDPPCC(-1))	0.042527	0.142859	0.297688	0.7673
D(ECI)	-0.409964	1.543881	-0.265541	0.7918
D(ECI(-1))	-1.533568	1.078108	-1.422462	0.1619
D(REER)	-0.011333	0.026002	-0.435857	0.6651
D(REER(-1))	-0.016450	0.020911	-0.786676	0.4357
D(INF)	0.080030	0.052101	1.536046	0.1317
D(INF(-1))	0.004023	0.051765	0.077725	0.9384
D(LGOVEX)	2.569577	1.358900	1.890925	0.0652
D(LGOVEX(-1))	0.643978	0.672213	0.957997	0.3433
D(LHHE)	19.17227	6.985070	2.744750	0.0087
D(LHHE(-1))	13.60647	8.138724	1.671819	0.1017
D(LIMPI)	0.745866	1.258707	0.592565	0.5565
D(LIMPI(-1))	1.291119	1.133453	1.139103	0.2608
C	2.490436	1.146652	2.171921	0.0353

Mean dependent var	0.047363	S.D. dependent var	2.207366
S.E. of regression	1.682574	Akaike info criterion	3.105412
Sum squared resid	124.5664	Schwarz criterion	4.938159
Log likelihood	-113.0883	Hannan-Quinn criter.	3.849961

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX F2: CURRENT ACCOUNT MODEL

Dependent Variable: D(LCA)
Method: ARDL
Date: 03/21/21 Time: 01:08
Sample: 1995 2018
Included observations: 120
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)

Dynamic regressors (2 lags, automatic): ECI AGRICEX INF LIMPI LSAV LUNEMR
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(1, 1, 1, 1, 1, 1, 1)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
ECI	0.132532	0.039247	3.376843	0.0012
AGRICEX	0.001370	0.001728	0.792662	0.4305
INF	-0.007826	0.001865	-4.196388	0.0001
LIMPI	0.670828	0.031579	21.24260	0.0000
LSAV	0.095770	0.045029	2.126882	0.0368
LUNEMR	-0.227094	0.058071	-3.910626	0.0002
	Short Run Equation			
COINTEQ01	-0.521375	0.197102	-2.645204	0.0100
D(ECI)	0.009989	0.048297	0.206821	0.8367
D(AGRICEX)	-0.002826	0.013556	-0.208453	0.8354
D(INF)	0.004298	0.002272	1.891799	0.0624
D(LIMPI)	0.190623	0.082896	2.299552	0.0243
D(LSAV)	0.029087	0.065491	0.444138	0.6582
D(LUNEMR)	0.072580	0.085174	0.852140	0.3969
C	8.791768	3.332693	2.638037	0.0102
@TREND	-0.001209	0.005222	-0.231450	0.8176

Mean dependent var	0.078537	S.D. dependent var	0.127304
S.E. of regression	0.074752	Akaike info criterion	-2.311287
Sum squared resid	0.413497	Schwarz criterion	-1.157335
Log likelihood	195.4554	Hannan-Quinn criter.	-1.842497

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX F3: FIXED INVESTMENT MODEL

Dependent Variable: D(LFINV)
Method: ARDL
Date: 03/08/21 Time: 15:36
Sample: 1996 2018
Included observations: 115
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): ECI INF LIMP LIND AGRICEX LUNEMR
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
ECI	0.188694	0.101071	1.866947	0.0694
INF	0.020871	0.004251	4.909988	0.0000

LIMP	-0.044383	0.084654	-0.524293	0.6030
LIND	1.336429	0.183362	7.288473	0.0000
AGRICEX	0.010142	0.005311	1.909755	0.0635
LUNEMR	-0.471001	0.081718	-5.763736	0.0000
	Short Run Equation			
COINTEQ01	-0.651376	0.165453	-3.936928	0.0003
D(LFINV(-1))	-0.110996	0.317716	-0.349357	0.7287
D(ECI)	0.138610	0.250123	0.554165	0.5826
D(ECI(-1))	0.077050	0.123107	0.625879	0.5350
D(INF)	-0.015186	0.012241	-1.240603	0.2222
D(INF(-1))	-0.003689	0.006871	-0.536912	0.5944
D(LIMP)	0.677067	0.194638	3.478601	0.0013
D(LIMP(-1))	0.325634	0.312331	1.042592	0.3036
D(LIND)	-0.356944	0.873353	-0.408705	0.6850
D(LIND(-1))	-1.356008	0.573331	-2.365140	0.0231
D(AGRICEX)	0.009632	0.013523	0.712299	0.4805
D(AGRICEX(-1))	0.053114	0.047950	1.107687	0.2748
D(LUNEMR)	-0.290674	0.230375	-1.261744	0.2145
D(LUNEMR(-1))	-0.688262	0.655970	-1.049228	0.3005
C	11.64372	2.777884	4.191579	0.0002
@TREND	0.070690	0.020651	3.423142	0.0015

Mean dependent var	0.080320	S.D. dependent var	0.182844
S.E. of regression	0.097395	Akaike info criterion	-1.809621
Sum squared resid	0.369945	Schwarz criterion	0.136259
Log likelihood	199.1013	Hannan-Quinn criter.	-1.019112

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX G: BRICS PANEL AUTOREGRESSIVE LAG RESULTS

APPENDIX G1: GDP PER CAPITA MODEL

Dependent Variable: D(GDPPCC)
Method: ARDL
Date: 03/22/21 Time: 02:24
Sample: 1996 2018
Included observations: 115
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): ECI INF LIMPI LIND HHE___ LEMPL
Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
	Long Run Equation			
ECI	0.623318	0.329825	1.889841	0.0662
INF	0.008970	0.029609	0.302933	0.7636
LIMPI	-0.029025	0.228752	-0.126884	0.8997
LIND	8.120936	1.780731	4.560451	0.0000

HHE___	0.392926	0.041640	9.436345	0.0000
LEMPL	-7.515264	2.802609	-2.681524	0.0107
		Short Run Equation		
COINTEQ01	-0.484128	0.292499	-5.073966	0.0000
D(GDPPCC(-1))	0.339126	0.247269	1.371485	0.1781
D(ECI)	1.667073	1.589785	1.048615	0.3008
D(ECI(-1))	0.160092	1.178763	0.135813	0.8927
D(INF)	0.198016	0.057109	3.467337	0.0013
D(INF(-1))	0.112919	0.117215	0.963351	0.3413
D(LIMPI)	-0.250412	3.478282	-0.071993	0.9430
D(LIMPI(-1))	1.697663	1.046582	1.622103	0.1128
D(LIND)	-7.809979	10.81057	-0.722439	0.4743
D(LIND(-1))	7.912508	6.153824	1.285787	0.2061
D(HHE___)	-0.202496	0.178708	-1.133114	0.2641
D(HHE___(-1))	-0.163336	0.161337	-1.012388	0.3176
D(LEMPL)	-6.189081	32.42616	-0.190867	0.8496
D(LEMPL(-1))	49.34770	73.36690	0.672615	0.5052
C	5.666372	1.989952	2.847491	0.0070
@TREND	0.042415	0.044506	0.953017	0.3465

Mean dependent var	-0.009175	S.D. dependent var	3.070134
S.E. of regression	0.779525	Akaike info criterion	2.358288
Sum squared resid	23.69871	Schwarz criterion	4.304167
Log likelihood	-61.39297	Hannan-Quinn criter.	3.148796

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX G2: CURRENT ACCOUNT MODEL

Dependent Variable: D(LCA)
Method: ARDL
Date: 03/17/21 Time: 03:43
Sample: 1996 2018
Included observations: 115
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): ECI AGRICEX INF LIMPI LGOVEXP LEMPL
Fixed regressors: C
Number of models evaluated: 4
Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
ECI	0.496428	0.087284	5.687518	0.0000
AGRICEX	-0.046369	0.004908	-9.448510	0.0000
INF	0.034333	0.009589	3.580373	0.0009
LIMPI	0.792864	0.047874	16.56140	0.0000
LGOVEXP	-0.202875	0.036364	-5.579012	0.0000
LEMPL	0.158896	0.245673	0.646776	0.5216
		Short Run Equation		
COINTEQ01	-0.432299	0.231026	-1.871215	0.0688

D(LCA(-1))	0.146005	0.181618	0.803913	0.4263
D(ECI)	-0.162770	0.105607	-1.541280	0.1313
D(ECI(-1))	-0.094965	0.064346	-1.475857	0.1480
D(AGRICEX)	-0.061188	0.034312	-1.783295	0.0823
D(AGRICEX(-1))	0.008587	0.059853	0.143471	0.8867
D(INF)	-0.010172	0.005493	-1.851928	0.0716
D(INF(-1))	-0.002020	0.002961	-0.682250	0.4991
D(LIMPI)	0.422525	0.216731	1.949534	0.0584
D(LIMPI(-1))	-0.079504	0.165821	-0.479459	0.6343
D(LGOVEXP)	-0.883589	0.367583	-2.403784	0.0211
D(LGOVEXP(-1))	0.122157	0.383492	0.318537	0.7518
D(LEMPL)	2.539608	2.784645	0.912004	0.3674
D(LEMPL(-1))	-1.465146	2.063763	-0.709939	0.4820
C	9.061124	4.774217	1.897929	0.0651
@TREND	0.012061	0.006114	1.972668	0.0557

Mean dependent var	0.088569	S.D. dependent var	0.156234
S.E. of regression	0.057314	Akaike info criterion	-3.088774
Sum squared resid	0.128109	Schwarz criterion	-1.142894
Log likelihood	279.0484	Hannan-Quinn criter.	-2.298266

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX G3: FIXED INVESTMENT MODEL

Dependent Variable: D(LFINV)
Method: ARDL
Date: 04/09/21 Time: 14:40
Sample: 1996 2018
Included observations: 115
Maximum dependent lags: 2 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (2 lags, automatic): ECI INF FDI LIMPI LIND LUNEMR

Fixed regressors: C
Number of models evalulated: 4
Selected Model: ARDL(2, 2, 2, 2, 2, 2, 2)
Note: final equation sample is larger than selection sample

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
		Long Run Equation		
ECI	0.221309	0.033370	6.632009	0.0000
INF	-0.019129	0.010706	-1.786737	0.0818
FDI	0.018408	0.015719	1.171026	0.2487
LIMPI	0.787425	0.083552	9.424358	0.0000
LIND	1.868856	0.366863	5.094151	0.0000
LUNEMR	-1.215730	0.276409	-4.398295	0.0001
		Short Run Equation		
COINTEQ01	-0.459170	0.196344	-2.338595	0.0246
D(LFINV(-1))	0.141181	0.191639	0.736702	0.4657
D(ECI)	-0.083741	0.108150	-0.774302	0.4434
D(ECI(-1))	-0.035367	0.120818	-0.292731	0.7713
D(INF)	0.009030	0.006836	1.320880	0.1942
D(INF(-1))	0.014004	0.007361	1.902382	0.0645
D(FDI)	-0.006907	0.024262	-0.284679	0.7774

D(FDI(-1))	-0.011560	0.011518	-1.003624	0.3217
D(LIMPI)	0.167894	0.180307	0.931152	0.3575
D(LIMPI(-1))	-0.161915	0.143167	-1.130952	0.2650
D(LIND)	0.176429	0.988561	0.178471	0.8593
D(LIND(-1))	0.079519	0.515357	0.154299	0.8782
D(LUNEMR)	-0.153280	0.769113	-0.199294	0.8431
D(LUNEMR(-1))	0.081073	0.310808	0.260845	0.7956
C	8.361595	3.557332	2.350524	0.0239
@TREND	0.005331	0.004427	1.204171	0.2358

Mean dependent var	0.072428	S.D. dependent var	0.179396
S.E. of regression	0.057441	Akaike info criterion	-2.719681
Sum squared resid	0.128680	Schwarz criterion	-0.773801
Log likelihood	255.9801	Hannan-Quinn criter.	-1.929173

*Note: p-values and any subsequent tests do not account for model selection.

APPENDIX H: SELECTED SSA PANEL GRANGER CAUSALITY RESULTS

APPENDIX H1: GDP PER CAPITA MODEL

Pairwise Granger Causality Tests
Date: 03/22/21 Time: 15:38
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause GDPPCC	115	0.57801	0.5627
GDPPCC does not Granger Cause ECI		1.60014	0.2065
REER does not Granger Cause GDPPCC	115	2.15544	0.1207
GDPPCC does not Granger Cause REER		1.67263	0.1925
INF does not Granger Cause GDPPCC	115	2.04259	0.1346
GDPPCC does not Granger Cause INF		4.00387	0.0210
LEMPL does not Granger Cause GDPPCC	115	1.20046	0.3050
GDPPCC does not Granger Cause LEMPL		2.30293	0.1048
LIMPI does not Granger Cause GDPPCC	115	2.02902	0.1364
GDPPCC does not Granger Cause LIMPI		3.69139	0.0281
LIND does not Granger Cause GDPPCC	115	0.96678	0.3835
GDPPCC does not Granger Cause LIND		0.06874	0.9336
REER does not Granger Cause ECI	115	0.08124	0.9220
ECI does not Granger Cause REER		0.89869	0.4101
INF does not Granger Cause ECI	115	0.80770	0.4485
ECI does not Granger Cause INF		0.19291	0.8248
LEMPL does not Granger Cause ECI	115	0.13043	0.8779
ECI does not Granger Cause LEMPL		0.79626	0.4536
LIMPI does not Granger Cause ECI	115	0.12966	0.8785

ECI does not Granger Cause LIMPI		0.39397	0.6753
LIND does not Granger Cause ECI	115	0.16887	0.8448
ECI does not Granger Cause LIND		0.16886	0.8448
INF does not Granger Cause REER	115	5.77381	0.0041
REER does not Granger Cause INF		1.26457	0.2864
LEMPL does not Granger Cause REER	115	0.23023	0.7947
REER does not Granger Cause LEMPL		0.28084	0.7557
LIMPI does not Granger Cause REER	115	1.72816	0.1824
REER does not Granger Cause LIMPI		1.67595	0.1919
LIND does not Granger Cause REER	115	1.92777	0.1504
REER does not Granger Cause LIND		1.25292	0.2897
LEMPL does not Granger Cause INF	115	0.11769	0.8891
INF does not Granger Cause LEMPL		0.04491	0.9561
LIMPI does not Granger Cause INF	115	0.47145	0.6253
INF does not Granger Cause LIMPI		0.36560	0.6946
LIND does not Granger Cause INF	115	3.12446	0.0479
INF does not Granger Cause LIND		1.47461	0.2334
LIMPI does not Granger Cause LEMPL	115	1.68321	0.1905
LEMPL does not Granger Cause LIMPI		0.84207	0.4336
LIND does not Granger Cause LEMPL	115	0.01465	0.9855
LEMPL does not Granger Cause LIND		0.24760	0.7811
LIND does not Granger Cause LIMPI	115	0.41613	0.6606
LIMPI does not Granger Cause LIND		2.04441	0.1343

APPENDIX H2: CURRENT ACCOUNT MODEL

Pairwise Granger Causality Tests
Date: 03/21/21 Time: 01:30
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause LCA	115	0.27405	0.7608
LCA does not Granger Cause ECI		0.51202	0.6007
AGRICEX does not Granger Cause LCA	115	5.50103	0.0053
LCA does not Granger Cause AGRICEX		2.53451	0.0839
INF does not Granger Cause LCA	115	0.87157	0.4212
LCA does not Granger Cause INF		0.39910	0.6719
LIMPI does not Granger Cause LCA	115	1.12613	0.3280
LCA does not Granger Cause LIMPI		5.34332	0.0061
LSAV does not Granger Cause LCA	115	3.08803	0.0496
LCA does not Granger Cause LSAV		0.10094	0.9041

LUNEMR does not Granger Cause LCA	115	0.00118	0.9988
LCA does not Granger Cause LUNEMR		1.86910	0.1591
AGRICEX does not Granger Cause ECI	115	0.69626	0.5006
ECI does not Granger Cause AGRICEX		0.64740	0.5254
INF does not Granger Cause ECI	115	0.80770	0.4485
ECI does not Granger Cause INF		0.19291	0.8248
LIMPI does not Granger Cause ECI	115	0.12966	0.8785
ECI does not Granger Cause LIMPI		0.39397	0.6753
LSAV does not Granger Cause ECI	115	0.35723	0.7004
ECI does not Granger Cause LSAV		1.08229	0.3424
LUNEMR does not Granger Cause ECI	115	0.73146	0.4835
ECI does not Granger Cause LUNEMR		0.09868	0.9061
INF does not Granger Cause AGRICEX	115	0.19233	0.8253
AGRICEX does not Granger Cause INF		1.40455	0.2498
LIMPI does not Granger Cause AGRICEX	115	0.54233	0.5829
AGRICEX does not Granger Cause LIMPI		1.53044	0.2210
LSAV does not Granger Cause AGRICEX	115	0.16372	0.8492
AGRICEX does not Granger Cause LSAV		0.32040	0.7265
LUNEMR does not Granger Cause AGRICEX	115	0.60242	0.5493
AGRICEX does not Granger Cause LUNEMR		0.22764	0.7968
LIMPI does not Granger Cause INF	115	0.47145	0.6253
INF does not Granger Cause LIMPI		0.36560	0.6946
LSAV does not Granger Cause INF	115	7.68329	0.0008
INF does not Granger Cause LSAV		0.07896	0.9241
LUNEMR does not Granger Cause INF	115	0.04294	0.9580
INF does not Granger Cause LUNEMR		0.03941	0.9614
LSAV does not Granger Cause LIMPI	115	0.40757	0.6663
LIMPI does not Granger Cause LSAV		0.12959	0.8786
LUNEMR does not Granger Cause LIMPI	115	0.25893	0.7723
LIMPI does not Granger Cause LUNEMR		0.78809	0.4573
LUNEMR does not Granger Cause LSAV	115	1.81499	0.1677
LSAV does not Granger Cause LUNEMR		0.52885	0.5908

APPENDIX H3: FIXED INVESTMENT MODEL

Pairwise Granger Causality Tests
Date: 03/08/21 Time: 15:43
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause LFINV	115	0.16815	0.8454
LFINV does not Granger Cause ECI		0.02309	0.9772

INF does not Granger Cause LFINV	115	1.26224	0.2871
LFINV does not Granger Cause INF		2.35365	0.0998
LIMP does not Granger Cause LFINV	115	0.91997	0.4016
LFINV does not Granger Cause LIMP		0.05936	0.9424
LIND does not Granger Cause LFINV	115	1.89435	0.1553
LFINV does not Granger Cause LIND		0.76851	0.4662
AGRICEX does not Granger Cause LFINV	115	1.05867	0.3504
LFINV does not Granger Cause AGRICEX		0.54828	0.5795
LUNEMR does not Granger Cause LFINV	115	0.09594	0.9086
LFINV does not Granger Cause LUNEMR		2.01388	0.1384
INF does not Granger Cause ECI	115	0.80709	0.4488
ECI does not Granger Cause INF		0.19291	0.8248
LIMP does not Granger Cause ECI	115	0.13063	0.8777
ECI does not Granger Cause LIMP		0.39397	0.6753
LIND does not Granger Cause ECI	115	0.16893	0.8448
ECI does not Granger Cause LIND		0.16886	0.8448
AGRICEX does not Granger Cause ECI	115	0.69517	0.5012
ECI does not Granger Cause AGRICEX		0.64740	0.5254
LUNEMR does not Granger Cause ECI	115	0.73434	0.4822
ECI does not Granger Cause LUNEMR		0.09868	0.9061
LIMP does not Granger Cause INF	115	0.47145	0.6253
INF does not Granger Cause LIMP		0.36560	0.6946
LIND does not Granger Cause INF	115	3.12446	0.0479
INF does not Granger Cause LIND		1.47461	0.2334
AGRICEX does not Granger Cause INF	115	1.40455	0.2498
INF does not Granger Cause AGRICEX		0.19233	0.8253
LUNEMR does not Granger Cause INF	115	0.04294	0.9580
INF does not Granger Cause LUNEMR		0.03941	0.9614
LIND does not Granger Cause LIMP	115	0.41613	0.6606
LIMP does not Granger Cause LIND		2.04441	0.1343
AGRICEX does not Granger Cause LIMP	115	1.53044	0.2210
LIMP does not Granger Cause AGRICEX		0.54233	0.5829
LUNEMR does not Granger Cause LIMP	115	0.25893	0.7723
LIMP does not Granger Cause LUNEMR		0.78809	0.4573
AGRICEX does not Granger Cause LIND	115	0.45673	0.6345
LIND does not Granger Cause AGRICEX		0.48021	0.6199
LUNEMR does not Granger Cause LIND	115	1.11743	0.3308
LIND does not Granger Cause LUNEMR		1.35864	0.2613
LUNEMR does not Granger Cause AGRICEX	115	0.60242	0.5493
AGRICEX does not Granger Cause LUNEMR		0.22764	0.7968

APPENDIX I: BRICS PANEL GRANGER CAUSALITY LAG RESULTS

APPENDIX I1: GDP PER CAPITA MODEL

Pairwise Granger Causality Tests
Date: 03/22/21 Time: 02:32
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause GDPPCC	115	2.25094	0.1101
GDPPCC does not Granger Cause ECI		0.26766	0.7657
INF does not Granger Cause GDPPCC	115	0.82598	0.4405
GDPPCC does not Granger Cause INF		2.14217	0.1223
LIMPI does not Granger Cause GDPPCC	115	5.44535	0.0056
GDPPCC does not Granger Cause LIMPI		6.97578	0.0014
LIND does not Granger Cause GDPPCC	115	6.43894	0.0023
GDPPCC does not Granger Cause LIND		1.12321	0.3289
HHE___ does not Granger Cause GDPPCC	115	4.66553	0.0114
GDPPCC does not Granger Cause HHE___		19.7655	5.E-08
LEMPL does not Granger Cause GDPPCC	115	2.45448	0.0906
GDPPCC does not Granger Cause LEMPL		0.06126	0.9406
INF does not Granger Cause ECI	115	0.23095	0.7942
ECI does not Granger Cause INF		0.42308	0.6561
LIMPI does not Granger Cause ECI	115	1.05303	0.3524
ECI does not Granger Cause LIMPI		0.98316	0.3774
LIND does not Granger Cause ECI	115	0.74868	0.4754
ECI does not Granger Cause LIND		0.33954	0.7128
HHE___ does not Granger Cause ECI	115	0.04182	0.9591
ECI does not Granger Cause HHE___		3.17273	0.0457
LEMPL does not Granger Cause ECI	115	2.26761	0.1084
ECI does not Granger Cause LEMPL		1.90363	0.1539
LIMPI does not Granger Cause INF	115	1.07404	0.3452
INF does not Granger Cause LIMPI		0.36362	0.6960
LIND does not Granger Cause INF	115	0.34557	0.7086
INF does not Granger Cause LIND		0.28225	0.7546
HHE___ does not Granger Cause INF	115	1.26593	0.2861
INF does not Granger Cause HHE___		1.19442	0.3068
LEMPL does not Granger Cause INF	115	0.96630	0.3837
INF does not Granger Cause LEMPL		2.16401	0.1197
LIND does not Granger Cause LIMPI	115	0.82275	0.4419
LIMPI does not Granger Cause LIND		0.92464	0.3997

HHE___ does not Granger Cause LIMPI	115	2.67218	0.0736
LIMPI does not Granger Cause HHE___		0.25124	0.7783
LEMPL does not Granger Cause LIMPI	115	0.96308	0.3849
LIMPI does not Granger Cause LEMPL		0.34180	0.7112
HHE___ does not Granger Cause LIND	115	0.48584	0.6165
LIND does not Granger Cause HHE___		7.33161	0.0010
LEMPL does not Granger Cause LIND	115	0.31255	0.7322
LIND does not Granger Cause LEMPL		0.63115	0.5339
LEMPL does not Granger Cause HHE___	115	1.25312	0.2897
HHE___ does not Granger Cause LEMPL		0.21307	0.8084

APPENDIX I2: CURRENT ACCOUNT MODEL

Pairwise Granger Causality Tests
Date: 03/17/21 Time: 03:57
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause LCA	115	2.83648	0.0629
LCA does not Granger Cause ECI		1.71822	0.1842
AGRICEX does not Granger Cause LCA	115	1.91761	0.1518
LCA does not Granger Cause AGRICEX		0.65789	0.5200
INF does not Granger Cause LCA	115	0.15026	0.8607
LCA does not Granger Cause INF		1.72437	0.1831
LIMPI does not Granger Cause LCA	115	3.28484	0.0412
LCA does not Granger Cause LIMPI		1.84941	0.1622
LGOVEXP does not Granger Cause LCA	115	1.37009	0.2584
LCA does not Granger Cause LGOVEXP		0.65681	0.5205
LHHE does not Granger Cause LCA	115	1.10516	0.3348
LCA does not Granger Cause LHHE		3.83596	0.0245
AGRICEX does not Granger Cause ECI	115	0.27271	0.7618
ECI does not Granger Cause AGRICEX		0.42082	0.6576
INF does not Granger Cause ECI	115	0.23095	0.7942
ECI does not Granger Cause INF		0.42308	0.6561
LIMPI does not Granger Cause ECI	115	1.05303	0.3524
ECI does not Granger Cause LIMPI		0.98316	0.3774
LGOVEXP does not Granger Cause ECI	115	0.01680	0.9833
ECI does not Granger Cause LGOVEXP		0.62088	0.5393
LHHE does not Granger Cause ECI	115	2.04254	0.1346
ECI does not Granger Cause LHHE		1.33260	0.2680
INF does not Granger Cause AGRICEX	115	4.54708	0.0127

AGRICEX does not Granger Cause INF		2.70992	0.0710
LIMPI does not Granger Cause AGRICEX	115	1.34130	0.2657
AGRICEX does not Granger Cause LIMPI		2.39400	0.0960
LGOVEXP does not Granger Cause AGRICEX	115	0.29319	0.7465
AGRICEX does not Granger Cause LGOVEXP		1.74949	0.1787
LHHE does not Granger Cause AGRICEX	115	4.13658	0.0185
AGRICEX does not Granger Cause LHHE		0.64318	0.5276
LIMPI does not Granger Cause INF	115	1.07404	0.3452
INF does not Granger Cause LIMPI		0.36362	0.6960
LGOVEXP does not Granger Cause INF	115	5.09709	0.0076
INF does not Granger Cause LGOVEXP		4.33489	0.0154
LHHE does not Granger Cause INF	115	2.02749	0.1366
INF does not Granger Cause LHHE		3.15105	0.0467
LGOVEXP does not Granger Cause LIMPI	115	1.43623	0.2422
LIMPI does not Granger Cause LGOVEXP		0.57590	0.5639
LHHE does not Granger Cause LIMPI	115	1.62308	0.2020
LIMPI does not Granger Cause LHHE		2.08317	0.1294
LHHE does not Granger Cause LGOVEXP	115	0.77369	0.4638
LGOVEXP does not Granger Cause LHHE		5.12946	0.0074

APPENDIX I3: FIXED INVESTMENT MODEL

Pairwise Granger Causality Tests
Date: 03/06/21 Time: 21:11
Sample: 1994 2018
Lags: 2

Null Hypothesis:	Obs	F-Statistic	Prob.
ECI does not Granger Cause FINV	115	3.16056	0.0463
FINV does not Granger Cause ECI		0.80827	0.4483
INF does not Granger Cause FINV	115	0.05597	0.9456
FINV does not Granger Cause INF		1.71348	0.1850
FDI does not Granger Cause FINV	115	0.03710	0.9636
FINV does not Granger Cause FDI		0.27904	0.7570
IMP does not Granger Cause FINV	115	2.77948	0.0664
FINV does not Granger Cause IMP		2.60279	0.0786
IND does not Granger Cause FINV	115	2.32882	0.1022
FINV does not Granger Cause IND		0.97432	0.3807
UNEMR does not Granger Cause FINV	115	0.46203	0.6312
FINV does not Granger Cause UNEMR		0.14264	0.8672
INF does not Granger Cause ECI	115	0.23095	0.7942
ECI does not Granger Cause INF		0.42308	0.6561

FDI does not Granger Cause ECI	115	0.39468	0.6748
ECI does not Granger Cause FDI		2.32556	0.1025
IMP does not Granger Cause ECI	115	1.41494	0.2473
ECI does not Granger Cause IMP		1.66819	0.1933
IND does not Granger Cause ECI	115	0.97887	0.3790
ECI does not Granger Cause IND		0.08344	0.9200
UNEMR does not Granger Cause ECI	115	1.37808	0.2564
ECI does not Granger Cause UNEMR		1.32461	0.2701
FDI does not Granger Cause INF	115	0.68046	0.5085
INF does not Granger Cause FDI		0.22803	0.7965
IMP does not Granger Cause INF	115	0.96764	0.3832
INF does not Granger Cause IMP		0.23242	0.7930
IND does not Granger Cause INF	115	0.63858	0.5300
INF does not Granger Cause IND		0.39296	0.6760
UNEMR does not Granger Cause INF	115	0.50196	0.6067
INF does not Granger Cause UNEMR		0.96935	0.3825
IMP does not Granger Cause FDI	115	0.94016	0.3937
FDI does not Granger Cause IMP		0.14188	0.8679
IND does not Granger Cause FDI	115	0.02855	0.9719
FDI does not Granger Cause IND		0.83509	0.4366
UNEMR does not Granger Cause FDI	115	1.04158	0.3563
FDI does not Granger Cause UNEMR		3.04863	0.0515
IND does not Granger Cause IMP	115	0.88354	0.4162
IMP does not Granger Cause IND		1.30053	0.2765
UNEMR does not Granger Cause IMP	115	0.77465	0.4634
IMP does not Granger Cause UNEMR		0.02905	0.9714
UNEMR does not Granger Cause IND	115	1.37484	0.2572
IND does not Granger Cause UNEMR		0.09099	0.9131

APPENDIX J: SELECTED SSA VARIANCE DECOMPOSITION RESULTS

APPENDIX J1: GDP PER CAPITA MODEL

Variance Decomposition of GDPPCC: Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	1.774323	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.002283	91.42646	0.049607	2.115615	0.467382	0.030091	2.536631	3.374216
3	2.127028	84.13758	0.208427	7.303314	1.337902	0.128924	3.755981	3.127870
4	2.207072	78.19604	0.313350	12.20678	1.288049	0.926058	4.145351	2.924376
5	2.252552	75.29341	0.425514	13.48834	1.244162	1.940239	4.464545	3.143789

6	2.273775	73.91144	0.525045	13.53359	1.399310	2.856205	4.674275	3.100135
7	2.286612	73.08414	0.633481	13.40485	1.472016	3.555824	4.765530	3.084159
8	2.295654	72.61578	0.712698	13.29963	1.491468	4.046319	4.774171	3.059936
9	2.302001	72.37451	0.766361	13.23756	1.486866	4.337509	4.754103	3.043095
10	2.306755	72.24330	0.794452	13.23127	1.482438	4.475073	4.735269	3.038200

Variance Decomposition of ECI:

Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	0.182682	0.038043	99.96196	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.246768	0.272784	98.37808	0.179441	0.318121	0.125017	0.347638	0.378919
3	0.288843	0.402363	97.13252	0.174066	0.253776	1.024478	0.524098	0.488700
4	0.322779	0.670445	94.94838	0.142861	0.217219	2.480905	0.981215	0.558970
5	0.350881	0.836335	92.30909	0.155342	0.197484	4.255354	1.574992	0.671401
6	0.374826	0.858334	89.56655	0.193344	0.208226	6.270611	2.128074	0.774859
7	0.395739	0.840274	86.87510	0.210424	0.237461	8.353009	2.611102	0.872627
8	0.413999	0.798880	84.44106	0.202085	0.270358	10.34598	3.013149	0.928487
9	0.429937	0.751869	82.31553	0.187406	0.310020	12.15225	3.330768	0.952159
10	0.443839	0.707159	80.51133	0.180851	0.356081	13.72630	3.570148	0.948127

Variance Decomposition of REER:

Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	18.73803	0.019626	0.066173	99.91420	0.000000	0.000000	0.000000	0.000000
2	22.75747	0.038253	0.079901	96.52613	0.000420	0.305286	1.839312	1.210695
3	23.79711	0.374348	0.481099	92.06174	3.245736	0.431644	2.291336	1.114093
4	24.58492	1.526820	1.024343	86.61281	6.724596	0.422670	2.502622	1.186138
5	24.98974	1.608677	1.569689	84.05420	8.185289	0.409546	2.712344	1.460250
6	25.19387	1.621445	2.125256	83.00515	8.496918	0.404485	2.802019	1.544723
7	25.33951	1.777161	2.581340	82.22706	8.598633	0.401564	2.804471	1.609771
8	25.43455	1.867959	2.941740	81.62697	8.686474	0.399990	2.788263	1.688600
9	25.51955	1.907859	3.217380	81.09628	8.754551	0.419166	2.769808	1.834959
10	25.59975	1.923497	3.428479	80.62388	8.774008	0.478100	2.756357	2.015678

Variance Decomposition of INF:

Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	10.68930	1.282241	0.126125	0.960575	97.63106	0.000000	0.000000	0.000000
2	11.20372	1.167319	0.132817	2.123460	96.04420	0.079863	0.406316	0.046030
3	11.69826	6.041051	0.124126	1.964416	91.18708	0.131320	0.398012	0.153996
4	11.84961	7.969991	0.124419	1.966554	89.12948	0.154444	0.395182	0.259933
5	11.94314	8.882839	0.124501	1.970317	88.13792	0.214528	0.406616	0.263281
6	11.98758	8.914629	0.124931	2.228930	87.68027	0.362464	0.413773	0.275002
7	12.02575	8.883883	0.126265	2.422162	87.21152	0.561727	0.415817	0.378624
8	12.04574	8.854724	0.127277	2.475421	86.92713	0.764864	0.414993	0.435587
9	12.05975	8.835219	0.128831	2.474440	86.72558	0.935293	0.414381	0.486256
10	12.07110	8.838805	0.129995	2.470124	86.56456	1.065819	0.417990	0.512710

Variance Decomposition of LGOVEX:

Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	0.218046	4.724288	0.625771	0.430774	0.332194	93.88697	0.000000	0.000000
2	0.311258	2.368644	1.584062	0.744370	0.247314	90.82540	0.127705	4.102507
3	0.370311	5.915062	2.417204	1.883961	0.179440	86.47085	0.104319	3.029159
4	0.412515	8.524710	2.995772	3.292456	0.215207	81.69077	0.484345	2.796744
5	0.446315	11.31086	3.764099	4.813057	0.184557	76.24743	1.290266	2.389730
6	0.471981	12.75000	4.599663	6.616025	0.167992	71.38600	2.336519	2.143800
7	0.493515	13.71515	5.479711	8.216373	0.189154	66.77362	3.523397	2.102593

8	0.511119	14.18724	6.355908	9.427648	0.234734	62.87472	4.747123	2.172629
9	0.526244	14.42989	7.206904	10.19613	0.322225	59.54438	5.933996	2.366478
10	0.539229	14.47578	8.002542	10.64184	0.455776	56.78231	7.041756	2.599989

Variance Decomposition of LHHE: Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	0.090426	15.09014	0.063289	1.268154	24.62976	0.057556	58.89110	0.000000
2	0.133561	16.54480	0.463849	1.658887	27.45757	0.370760	53.48208	0.022047
3	0.165368	18.27944	0.516065	1.125048	28.35880	0.348806	51.31434	0.057497
4	0.195884	19.79229	0.450984	1.411909	28.28456	0.265522	49.73905	0.055687
5	0.223514	20.74172	0.395211	1.975190	27.46391	0.205616	49.14085	0.077508
6	0.249052	21.57846	0.357758	2.516418	26.33094	0.208269	48.86903	0.139127
7	0.272560	22.05379	0.331965	2.998034	25.22719	0.296159	48.88312	0.209745
8	0.294372	22.19456	0.315307	3.404619	24.30857	0.468739	49.00539	0.302814
9	0.314523	22.07690	0.304154	3.727450	23.58521	0.713482	49.18750	0.405304
10	0.333183	21.82413	0.295916	3.953495	23.02662	1.007592	49.37803	0.514217

Variance Decomposition of LIMPI: Period	S.E.	GDPPCC	ECI	REER	INF	LGOVEX	LHHE	LIMPI
1	0.177800	3.544924	1.137520	3.473528	0.042865	26.03379	0.427548	65.33982
2	0.250673	7.142923	1.821610	3.004240	0.329831	32.09298	0.461692	55.14672
3	0.305080	7.785704	1.830430	2.029018	0.387178	32.60915	0.568106	54.79041
4	0.342118	9.065559	1.855382	1.881709	0.403037	32.84758	0.877721	53.06901
5	0.371496	9.820210	1.844943	2.105076	0.496952	32.22179	1.270492	52.24054
6	0.394518	10.67423	1.859882	2.395194	0.636715	31.35411	1.722526	51.35734
7	0.413198	11.24635	1.880153	2.678899	0.806374	30.34319	2.194873	50.85016
8	0.428028	11.65273	1.913488	2.935061	0.950498	29.39217	2.664872	50.49118
9	0.439936	11.87022	1.948713	3.147333	1.070369	28.53025	3.104608	50.32852
10	0.449528	11.99237	1.982218	3.297867	1.163721	27.78439	3.503016	50.27642

Cholesky Ordering: GDPPCC ECI REER INF LGOVEX LHHE LIMPI

APPENDIX J2: CURRENT ACCOUNT MODEL

Variance Decomposition of LCA: Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	0.117697	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.185296	91.88227	0.018938	4.619864	1.504235	0.035805	1.936978	0.001914
3	0.229480	88.01141	0.015467	7.466728	1.894472	0.063247	2.544151	0.004523
4	0.263694	84.92056	0.106270	10.36315	1.796839	0.110267	2.699484	0.003426
5	0.291978	82.05672	0.279955	13.04106	1.707278	0.185286	2.725275	0.004425
6	0.316731	79.24028	0.502056	15.61959	1.637977	0.294394	2.699708	0.005994
7	0.338784	76.56913	0.724333	18.03713	1.575337	0.431120	2.656670	0.006282
8	0.358748	74.06290	0.927897	20.29107	1.514317	0.592044	2.606144	0.005628
9	0.377020	71.72429	1.104276	22.38179	1.456371	0.773369	2.554023	0.005876
10	0.393900	69.54259	1.252289	24.31872	1.401963	0.972220	2.502888	0.009330

Variance Decomposition of ECI:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	0.183038	1.905851	98.09415	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.249425	1.267419	95.07023	0.807753	0.587404	0.912485	0.823904	0.530810
3	0.291393	0.963535	93.71657	0.917141	0.651030	1.215868	0.932630	1.603221
4	0.320551	0.824774	91.70669	1.149831	0.615777	1.486539	1.061463	3.154922
5	0.343639	0.744989	89.53924	1.277454	0.564059	1.700427	1.189277	4.984550
6	0.362955	0.702677	87.28234	1.344307	0.517982	1.886088	1.322740	6.943863
7	0.379796	0.686205	85.05642	1.349721	0.476584	2.049188	1.459576	8.922305
8	0.394844	0.692928	82.90898	1.316939	0.441207	2.192478	1.599147	10.84832
9	0.408541	0.720425	80.86599	1.261754	0.412504	2.319016	1.740723	12.67958
10	0.421168	0.767089	78.93573	1.197901	0.390500	2.430677	1.883226	14.39488

Variance Decomposition of AGRICEX:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	4.031397	0.224541	6.857376	92.91808	0.000000	0.000000	0.000000	0.000000
2	4.547063	1.839687	5.399615	92.41414	0.022319	0.284604	0.003404	0.036232
3	5.044603	1.843458	4.511088	92.94396	0.378859	0.269439	0.011530	0.041666
4	5.340506	1.953552	4.028374	93.21691	0.435600	0.314266	0.012014	0.039286
5	5.573509	1.898625	3.713573	93.54882	0.457267	0.327987	0.016177	0.037553
6	5.747498	1.833013	3.546977	93.73038	0.465175	0.351611	0.030240	0.042600
7	5.884857	1.761495	3.456261	93.83789	0.468336	0.372758	0.050446	0.052814
8	5.994120	1.699604	3.414914	93.88250	0.466006	0.394541	0.077941	0.064490
9	6.082681	1.650802	3.399045	93.88807	0.460618	0.414853	0.111447	0.075163
10	6.155156	1.616312	3.396919	93.86504	0.453787	0.433836	0.150622	0.083480

Variance Decomposition of INF:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	9.818023	0.221126	0.001060	1.284661	98.49315	0.000000	0.000000	0.000000
2	9.959105	1.536812	0.150665	1.292593	96.67630	0.271893	0.030616	0.041125
3	10.10280	1.543261	0.253978	2.592591	94.82010	0.304315	0.057587	0.428164
4	10.17383	1.573378	0.250535	3.207773	93.59594	0.300851	0.141774	0.929746
5	10.22823	1.585891	0.248592	3.685977	92.60709	0.299658	0.190172	1.382618
6	10.27158	1.603654	0.250342	4.026951	91.82725	0.301977	0.239081	1.750744
7	10.30921	1.614088	0.259886	4.318895	91.16080	0.302869	0.287823	2.055640
8	10.34112	1.622114	0.273908	4.548847	90.60366	0.304101	0.338926	2.308445
9	10.36808	1.628119	0.291884	4.727449	90.13785	0.305388	0.390532	2.518775
10	10.39096	1.632680	0.312714	4.863209	89.74725	0.306734	0.442833	2.694582

Variance Decomposition of LIMPI:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	0.174348	42.03296	0.008389	0.106242	0.081612	57.77079	0.000000	0.000000
2	0.255185	55.88682	0.082805	2.608214	0.731009	40.16528	0.525455	0.000417
3	0.311990	56.92700	0.120253	4.326559	0.915246	36.69334	1.014312	0.003285
4	0.354058	56.97766	0.305966	5.666321	0.860899	35.06862	1.098726	0.021815
5	0.387758	56.40752	0.628094	6.803440	0.812337	34.17831	1.107957	0.062346
6	0.415608	55.69366	1.018675	7.804969	0.782604	33.50442	1.083569	0.112104
7	0.439069	54.94697	1.424180	8.686524	0.758376	32.97459	1.049114	0.160249
8	0.459031	54.23584	1.815814	9.459651	0.735768	32.54161	1.010923	0.200398
9	0.476153	53.58039	2.181349	10.14084	0.714649	32.17991	0.972615	0.230246
10	0.490929	52.98622	2.516215	10.74470	0.695037	31.87205	0.935872	0.249904

Variance Decomposition of LSAV:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR

1	0.301894	0.009358	0.218234	0.407034	31.79857	3.190318	64.37649	0.000000
2	0.386799	0.530167	0.731309	0.343504	28.43938	2.348989	67.38351	0.223135
3	0.454104	0.607590	1.031278	0.884007	24.67945	2.617612	69.97200	0.208066
4	0.510870	0.752614	1.049521	1.461350	22.92255	2.622708	71.02685	0.164406
5	0.563421	0.881240	1.002891	2.081963	21.96453	2.598155	71.30705	0.164179
6	0.611975	1.011785	0.947202	2.749082	21.30438	2.535064	71.22386	0.228625
7	0.657603	1.135383	0.896936	3.466070	20.77903	2.460237	70.90482	0.357526
8	0.700944	1.254889	0.855328	4.214997	20.34778	2.375804	70.40987	0.541330
9	0.742449	1.370857	0.823499	4.979745	19.97923	2.286640	69.79131	0.768716
10	0.782393	1.483772	0.801498	5.747557	19.65200	2.195753	69.09013	1.029298

Variance Decomposition of LUNEMR:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LSAV	LUNEMR
1	0.088490	2.796837	0.084216	0.384048	0.615433	0.859415	1.202658	94.05739
2	0.148240	2.899814	0.721344	0.900058	0.779429	2.108276	3.147219	89.44386
3	0.194459	2.868304	2.364982	2.064768	0.931749	2.495317	4.090959	85.18392
4	0.231458	2.533096	4.484851	3.375070	1.035807	2.676924	4.759691	81.13456
5	0.262669	2.143292	6.820586	4.676139	1.122343	2.727838	5.324984	77.18482
6	0.289959	1.799802	9.106583	5.845446	1.195953	2.710831	5.816912	73.52447
7	0.314401	1.532981	11.19043	6.845668	1.261127	2.656368	6.252869	70.26055
8	0.336610	1.341838	13.00578	7.672428	1.321435	2.584424	6.644938	67.42915
9	0.356981	1.215577	14.54506	8.341084	1.379343	2.505864	7.003298	65.00978
10	0.375789	1.142060	15.82945	8.873234	1.436175	2.426720	7.335569	62.95679

Cholesky Ordering: LCA ECI AGRICEX INF LIMPI LSAV LUNEMR

APPENDIX J3: FIXED INVESTMENT MODEL

Variance Decomposition of LFINV:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	0.180223	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.259149	96.32261	0.176964	1.795537	0.197076	0.892905	0.483899	0.131004
3	0.314545	94.77831	0.139950	2.183768	0.154174	0.987389	1.570310	0.186100
4	0.356848	93.84110	0.113075	2.422816	0.119857	0.827745	2.464423	0.210983
5	0.392682	92.95907	0.093412	2.420449	0.102888	0.683703	3.504884	0.235593
6	0.424429	92.10605	0.079972	2.319313	0.102528	0.610289	4.516617	0.265233
7	0.453278	91.21019	0.070643	2.166958	0.115939	0.593545	5.542869	0.299861
8	0.479795	90.27231	0.064665	2.005105	0.144304	0.613662	6.562745	0.337208
9	0.504416	89.29216	0.061968	1.848743	0.186544	0.655004	7.580086	0.375493
10	0.527437	88.28610	0.062278	1.705505	0.242095	0.706245	8.584209	0.413567

Variance Decomposition of ECI:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	0.189040	0.891325	99.10867	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.258879	0.938152	97.75400	0.434569	0.564451	0.019579	0.164303	0.124943
3	0.307911	1.203756	97.09237	0.349877	0.763931	0.014938	0.118852	0.456279
4	0.344156	1.418462	96.13398	0.298228	1.082215	0.021613	0.098160	0.947337
5	0.373587	1.551847	95.06857	0.254435	1.390745	0.051267	0.120192	1.562945
6	0.397970	1.626741	93.87356	0.224253	1.726449	0.104867	0.169778	2.274349
7	0.418765	1.667145	92.57162	0.203328	2.056485	0.183085	0.253142	3.065191
8	0.436761	1.684341	91.18167	0.189294	2.378405	0.287541	0.357747	3.921005

9	0.452582	1.684046	89.72884	0.180472	2.681289	0.418099	0.479670	4.827589
10	0.466647	1.670002	88.23739	0.175144	2.960675	0.573522	0.611877	5.771390

Variance Decomposition of INF:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	10.13447	23.57509	0.154893	76.27002	0.000000	0.000000	0.000000	0.000000
2	10.30794	22.83335	0.193842	76.87459	0.001906	0.000974	0.062881	0.032452
3	10.85422	21.57686	1.703166	70.42755	0.005319	0.573102	5.480576	0.233425
4	11.14410	21.09630	2.216427	67.12998	0.035382	1.081396	7.906029	0.534477
5	11.40255	20.43305	2.646573	64.71714	0.038122	1.343769	10.03914	0.782203
6	11.58169	20.01041	2.928198	63.20861	0.053913	1.474679	11.32762	0.996568
7	11.73478	19.66997	3.194830	61.99687	0.069246	1.551382	12.33768	1.180022
8	11.85762	19.42420	3.417977	61.05203	0.090924	1.602649	13.06939	1.342830
9	11.95951	19.23163	3.610255	60.29481	0.114235	1.637449	13.62569	1.485930
10	12.04262	19.08356	3.770350	59.69596	0.140035	1.661161	14.03672	1.612222

Variance Decomposition of LIMP:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	0.182719	16.54479	1.157411	5.887587	76.41021	0.000000	0.000000	0.000000
2	0.259774	16.93328	1.661365	9.157187	69.49566	0.194733	2.460595	0.097186
3	0.311649	17.26839	1.677947	10.77597	66.73294	0.239109	3.188791	0.116857
4	0.350572	17.33691	1.495938	11.48452	65.50386	0.197653	3.858772	0.122349
5	0.381309	17.40105	1.324558	11.90702	64.67973	0.172921	4.387495	0.127231
6	0.406602	17.52143	1.178259	12.08464	64.01183	0.184053	4.883822	0.135965
7	0.427762	17.69103	1.064973	12.13656	63.39303	0.221614	5.343508	0.149288
8	0.445721	17.88537	0.984736	12.10901	62.78792	0.274530	5.791280	0.167151
9	0.461111	18.09073	0.936986	12.03727	62.17967	0.334385	6.231602	0.189349
10	0.474417	18.29928	0.920080	11.93742	61.56309	0.395205	6.669057	0.215859

Variance Decomposition of LIND:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	0.083220	16.53536	0.012295	0.789843	1.478651	81.18385	0.000000	0.000000
2	0.115031	12.52775	0.290583	0.462666	0.824420	84.98873	0.590766	0.315087
3	0.129728	10.14422	0.921073	0.676477	0.717066	85.75919	0.908403	0.873568
4	0.137047	9.109520	1.341624	1.006747	0.676083	85.36488	1.093555	1.407592
5	0.141064	8.615410	1.503497	1.247147	0.643883	84.85960	1.325989	1.804468
6	0.143449	8.359467	1.552005	1.399288	0.622698	84.39531	1.595816	2.075412
7	0.144941	8.218167	1.561010	1.511974	0.613177	83.95685	1.875344	2.263480
8	0.145902	8.136687	1.557757	1.604372	0.612817	83.55125	2.136974	2.400140
9	0.146546	8.088853	1.550735	1.682057	0.618638	83.18495	2.371452	2.503317
10	0.146995	8.061154	1.543319	1.746208	0.628196	82.86192	2.575860	2.583347

Variance Decomposition of AGRICEX:

Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	4.076784	0.033289	5.007515	4.030521	0.173774	0.363298	90.39160	0.000000
2	4.626849	0.576055	3.919140	3.901833	1.101054	1.057754	89.23151	0.212652
3	5.243649	0.935683	3.492536	5.457545	0.963571	1.227410	87.57081	0.352446
4	5.608684	1.085822	3.203281	5.927432	1.090524	1.236609	86.95825	0.498079
5	5.925725	1.195261	3.052563	6.352715	1.109165	1.151462	86.53361	0.605221
6	6.166081	1.311026	2.929988	6.606458	1.154680	1.072152	86.23109	0.694611
7	6.365797	1.436815	2.840851	6.818963	1.184732	1.006161	85.94746	0.765020
8	6.528543	1.568730	2.769799	6.977452	1.219163	0.958107	85.68228	0.824470
9	6.665033	1.704355	2.714328	7.103706	1.252606	0.925405	85.42426	0.875339
10	6.779976	1.842978	2.669405	7.202321	1.288076	0.905768	85.17128	0.920166

Variance Decomposition of LUNEMR: Period	S.E.	LFINV	ECI	INF	LIMP	LIND	AGRICEX	LUNEMR
1	0.089777	1.643457	0.253940	0.125954	1.012178	0.120190	0.340852	96.50343
2	0.151148	2.764990	0.107298	0.923430	1.605646	0.250425	0.593343	93.75487
3	0.200849	2.861113	0.063887	1.734263	1.908079	1.012991	1.125783	91.29388
4	0.241430	2.669149	0.069142	2.302401	2.062479	2.013184	1.581350	89.30230
5	0.275431	2.397162	0.101318	2.670456	2.188235	3.055825	1.944472	87.64253
6	0.304669	2.121852	0.146061	2.915763	2.313279	4.064614	2.222868	86.21556
7	0.330358	1.871360	0.195948	3.085812	2.448112	5.011433	2.432520	84.95481
8	0.353297	1.655787	0.246973	3.210750	2.595150	5.886204	2.585134	83.82000
9	0.374036	1.478884	0.297238	3.308170	2.754801	6.686325	2.690762	82.78382
10	0.392962	1.341930	0.345726	3.388607	2.926519	7.413338	2.757248	81.82663

Cholesky Ordering: LFINV ECI INF LIMP LIND AGRICEX LUNEMR

APPENDIX K: BRICS VARIANCE DECOMPOSITION LAG RESULTS

APPENDIX K1: GDP PER CAPITA MODEL

Variance Decomposition of GDPPCC: Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	2.596248	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	2.864520	93.31019	0.429632	0.106384	3.169242	0.169090	2.060727	0.754738
3	2.958616	90.94648	1.308122	0.140267	4.287410	0.564937	1.986915	0.765865
4	2.997176	89.55720	1.879793	0.175971	4.573478	1.127574	1.936154	0.749826
5	3.024448	88.31824	2.366503	0.210014	4.616198	1.821475	1.901946	0.765627
6	3.046481	87.12566	2.766838	0.240583	4.607407	2.584655	1.876423	0.798430
7	3.066454	85.99884	3.078088	0.266318	4.570215	3.378303	1.858809	0.849426
8	3.085430	84.94718	3.307599	0.288106	4.520644	4.173618	1.847090	0.915765
9	3.103637	83.96712	3.474498	0.306835	4.468955	4.952385	1.838501	0.991703
10	3.121108	83.05236	3.596114	0.323180	4.419110	5.704121	1.831823	1.073294

Variance Decomposition of ECI: Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	0.153888	1.211330	98.78867	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.197522	3.492752	95.10463	0.222356	0.264092	0.010890	0.744831	0.160453
3	0.221154	4.611356	93.09503	0.632764	0.224792	0.149316	0.669401	0.617341
4	0.234428	5.033420	91.88350	0.923933	0.204227	0.266953	0.625089	1.062876
5	0.242354	5.331323	90.95540	1.075220	0.234786	0.339263	0.617696	1.446312
6	0.247232	5.413528	90.31649	1.148319	0.330027	0.382305	0.625574	1.783760
7	0.250363	5.375834	89.87333	1.187116	0.455559	0.408740	0.629217	2.070201
8	0.252499	5.302521	89.53375	1.209942	0.582947	0.425496	0.628640	2.316701
9	0.254064	5.237438	89.23681	1.224559	0.701954	0.436247	0.626320	2.536671
10	0.255297	5.199074	88.95125	1.234645	0.809749	0.443192	0.623277	2.738815

Variance Decomposition of INF: Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL

1	6.943727	9.121627	0.050775	90.82760	0.000000	0.000000	0.000000	0.000000
2	7.417071	8.388698	0.224947	90.13027	0.046374	0.567571	0.524856	0.117280
3	7.555504	8.800522	1.320672	88.18860	0.061421	0.750063	0.765306	0.113418
4	7.639239	9.345575	2.383525	86.50128	0.063620	0.782147	0.812703	0.111149
5	7.697066	9.843105	3.109845	85.26675	0.063046	0.785580	0.821644	0.110034
6	7.732449	10.20002	3.509788	84.50800	0.063494	0.783326	0.825601	0.109769
7	7.752084	10.42186	3.707422	84.08721	0.066014	0.780474	0.827555	0.109465
8	7.762351	10.54772	3.799396	83.86683	0.070106	0.778437	0.828319	0.109191
9	7.767539	10.61464	3.839742	83.75512	0.074751	0.777667	0.828467	0.109612
10	7.770117	10.64745	3.855964	83.69956	0.079302	0.778200	0.828348	0.111171

Variance Decomposition of LIMPI:

Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	0.167889	28.71978	1.186051	4.363176	65.73100	0.000000	0.000000	0.000000
2	0.268153	42.11507	0.697597	4.875584	50.41371	0.114390	0.244642	1.539003
3	0.330844	46.11590	0.463461	5.214658	44.16848	0.120378	0.703203	3.213915
4	0.377849	48.47087	0.438719	5.301463	40.64420	0.098087	0.917557	4.129098
5	0.415807	50.02626	0.481004	5.271864	38.49989	0.081437	1.042993	4.596553
6	0.447919	51.13409	0.551765	5.207142	37.06656	0.078332	1.120827	4.841282
7	0.475566	51.92438	0.638853	5.140473	36.06229	0.090321	1.168724	4.974959
8	0.499684	52.49315	0.736451	5.077982	35.33382	0.118214	1.197374	5.043009
9	0.520935	52.90591	0.840161	5.019322	34.78941	0.162651	1.214138	5.068409
10	0.539804	53.20502	0.946785	4.963748	34.37289	0.223948	1.223099	5.064517

Variance Decomposition of LIND:

Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	0.030776	7.542488	1.818593	0.002358	5.312235	85.32433	0.000000	0.000000
2	0.045489	8.064234	1.121179	0.001704	3.745239	87.03977	0.027055	0.000822
3	0.055862	6.201313	1.020982	0.004617	3.260203	89.46983	0.026322	0.016734
4	0.064464	4.981371	1.045664	0.014023	3.254557	90.51297	0.113868	0.077550
5	0.071978	4.166335	1.127414	0.017684	3.307915	91.05013	0.179222	0.151296
6	0.078705	3.573660	1.247134	0.016752	3.305897	91.40704	0.220789	0.228729
7	0.084827	3.115313	1.377492	0.014580	3.266213	91.65589	0.255528	0.314988
8	0.090469	2.754312	1.504183	0.012980	3.213093	91.81399	0.288458	0.412987
9	0.095712	2.466192	1.623359	0.012705	3.154000	91.90301	0.319397	0.521337
10	0.100613	2.232974	1.735262	0.014051	3.090622	91.94064	0.348240	0.638213

Variance Decomposition of HHE___:

Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	2.947525	54.80852	2.912456	4.379312	3.851984	3.527205	30.52053	0.000000
2	3.329449	62.65819	2.625920	3.703822	3.019253	2.821212	24.29354	0.878064
3	3.571498	62.94135	4.151110	3.225166	3.900534	2.598486	21.85970	1.323652
4	3.647126	61.42431	5.317716	3.145723	4.812437	2.858973	21.07500	1.365844
5	3.681221	60.53246	6.033805	3.130400	4.980494	3.294355	20.68655	1.341936
6	3.704118	59.85280	6.482778	3.121301	4.972277	3.793847	20.43472	1.342277
7	3.723092	59.25255	6.798648	3.109588	4.935274	4.322898	20.23072	1.350322
8	3.740126	58.71487	7.016836	3.095736	4.893106	4.862652	20.05275	1.364049
9	3.755909	58.23077	7.160115	3.080890	4.852089	5.400221	19.89222	1.383691
10	3.770669	57.78963	7.250417	3.065820	4.814907	5.926423	19.74502	1.407781

Variance Decomposition of LEMPL:

Period	S.E.	GDPPCC	ECI	INF	LIMPI	LIND	HHE___	LEMPL
1	0.015551	11.86465	0.804407	10.28418	0.533037	0.375462	0.076057	76.06221
2	0.024111	11.89694	0.414711	9.776799	0.481033	0.165920	0.077028	77.18757

3	0.030417	11.79348	0.446868	8.959664	0.439034	0.288475	0.121853	77.95063
4	0.035658	11.59787	1.248276	8.462937	0.356854	0.453983	0.211213	77.66887
5	0.040314	11.18018	2.683012	8.285551	0.279398	0.567312	0.249420	76.75513
6	0.044592	10.46028	4.419072	8.299925	0.258365	0.633361	0.269140	75.65985
7	0.048598	9.590803	6.179804	8.397584	0.283952	0.671232	0.290650	74.58598
8	0.052376	8.714460	7.818203	8.523173	0.332657	0.694808	0.315982	73.60072
9	0.055949	7.901321	9.280575	8.653207	0.391631	0.712157	0.342801	72.71831
10	0.059332	7.175572	10.55655	8.778281	0.455230	0.727749	0.369539	71.93708

Cholesky Ordering: GDPPCC ECI INF LIMPI LIND HHE___ LEMPL

APPENDIX K2: CURRENT ACCOUNT MODEL

Variance Decomposition of LCA:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.150779	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.225784	98.34356	0.456618	0.346921	0.030350	0.289960	0.149274	0.383318
3	0.277660	95.53283	2.282170	0.263080	0.032240	0.787573	0.201254	0.900850
4	0.318090	92.27493	4.778683	0.240652	0.049753	1.250796	0.243216	1.161965
5	0.352120	89.02324	7.209971	0.426820	0.100760	1.664931	0.319799	1.254476
6	0.382020	85.89758	9.307863	0.821511	0.181576	2.071346	0.436830	1.283289
7	0.408929	82.92940	11.02456	1.396110	0.279898	2.498883	0.580488	1.290663
8	0.433524	80.12693	12.37945	2.121525	0.388708	2.957660	0.737589	1.288140
9	0.456273	77.47975	13.41455	2.969497	0.505636	3.450159	0.901216	1.279198
10	0.477534	74.96578	14.18032	3.912784	0.629614	3.977538	1.067908	1.266056

Variance Decomposition of ECI:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.154122	3.022715	96.97728	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.196232	4.339450	93.94777	0.017499	0.207120	1.467927	0.019788	0.000445
3	0.215819	4.969455	92.32693	0.018510	0.477766	2.170421	0.017247	0.019676
4	0.225441	5.170616	91.54312	0.017247	0.624909	2.590302	0.016487	0.037317
5	0.230386	5.186897	91.16541	0.016661	0.690877	2.859980	0.018125	0.062047
6	0.233067	5.139768	90.95102	0.016842	0.724182	3.032637	0.030544	0.105005
7	0.234652	5.083946	90.78595	0.017359	0.744640	3.145204	0.053208	0.169696
8	0.235703	5.038963	90.62572	0.017890	0.758782	3.223113	0.082832	0.252700
9	0.236488	5.007619	90.45710	0.018233	0.769250	3.281174	0.117125	0.349497
10	0.237133	4.986908	90.27817	0.018339	0.777561	3.327467	0.154575	0.456985

Variance Decomposition of AGRICEX:

Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.373268	3.459016	2.544794	93.99619	0.000000	0.000000	0.000000	0.000000
2	0.499545	4.593689	2.979168	90.76203	0.248632	0.020925	1.369725	0.025829
3	0.589331	4.745811	3.190779	88.79306	0.347156	0.452061	2.233817	0.237312
4	0.660936	4.426189	3.141049	87.07978	0.404953	1.547907	2.686326	0.713798
5	0.722518	4.007440	3.020223	85.24328	0.482323	3.035535	2.967727	1.243472
6	0.777364	3.608737	2.880283	83.22374	0.588219	4.726126	3.200187	1.772709
7	0.827249	3.256629	2.729690	81.07011	0.710387	6.521360	3.409991	2.301832
8	0.873203	2.954366	2.574036	78.86754	0.837438	8.346347	3.597333	2.822939
9	0.915834	2.698788	2.420268	76.69301	0.963812	10.13919	3.762938	3.321994
10	0.955528	2.484129	2.273813	74.60018	1.087131	11.85607	3.910293	3.788381

Variance Decomposition of INF:								
Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	6.652932	0.944024	0.000247	1.298795	97.75693	0.000000	0.000000	0.000000
2	7.446600	1.405944	0.318785	2.091683	92.26527	0.065806	3.003741	0.848767
3	7.616559	2.244155	2.045410	2.106578	88.59090	0.069642	2.996094	1.947218
4	7.681556	2.585202	3.035708	2.072243	87.11726	0.087954	3.090780	2.010852
5	7.709338	2.629618	3.281754	2.057503	86.51466	0.236478	3.250490	2.029493
6	7.727161	2.620091	3.318655	2.049612	86.13287	0.434801	3.343744	2.100227
7	7.740613	2.611191	3.319271	2.050666	85.85665	0.596218	3.416757	2.149247
8	7.751927	2.604108	3.313343	2.058772	85.63561	0.716147	3.492279	2.179744
9	7.761988	2.597735	3.305812	2.071773	85.44383	0.808720	3.569768	2.202362
10	7.770985	2.591916	3.298339	2.089159	85.27350	0.882438	3.644121	2.220530

Variance Decomposition of LIMPI:								
Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.175348	77.53865	0.313626	0.646677	2.075158	19.42589	0.000000	0.000000
2	0.264767	80.67243	0.173508	1.061138	2.487667	15.15974	0.092703	0.352813
3	0.324665	82.12983	0.263702	0.970390	2.609986	13.19295	0.164423	0.668715
4	0.368021	82.94068	0.724586	0.792043	2.534314	11.93646	0.165966	0.905948
5	0.401490	83.34268	1.399351	0.667653	2.385492	10.92687	0.141722	1.136233
6	0.428616	83.42125	2.153842	0.637752	2.226156	10.03838	0.129449	1.393173
7	0.451439	83.24446	2.896397	0.714272	2.075483	9.248725	0.142351	1.678308
8	0.471222	82.86763	3.572055	0.898621	1.937763	8.557464	0.183142	1.983328
9	0.488794	82.32580	4.156028	1.186158	1.814016	7.965048	0.251805	2.301144
10	0.504728	81.63825	4.643474	1.568730	1.704596	7.470598	0.347205	2.627144

Variance Decomposition of LGOVEXP:								
Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.043293	9.184178	0.343835	2.555396	30.85769	1.602788	55.45611	0.000000
2	0.066823	5.822540	1.233546	2.760371	23.17836	4.543746	58.21031	4.251131
3	0.081667	4.423691	2.526973	2.251940	19.14110	6.022798	57.89149	7.742001
4	0.091435	3.934475	3.216192	1.808147	17.34375	6.195353	58.37986	9.122225
5	0.098824	3.910277	3.348818	1.604407	16.44706	5.789451	59.47320	9.426788
6	0.105100	4.138673	3.224247	1.639689	15.82306	5.262886	60.56166	9.349780
7	0.110689	4.478614	3.018260	1.896831	15.27596	4.780041	61.39613	9.154167
8	0.115775	4.846191	2.799776	2.358841	14.76789	4.373982	61.93642	8.916896
9	0.120492	5.196327	2.594613	3.000930	14.29397	4.038239	62.21202	8.663901
10	0.124930	5.504506	2.413773	3.791419	13.85209	3.758056	62.26855	8.411611

Variance Decomposition of LEMPL:								
Period	S.E.	LCA	ECI	AGRICEX	INF	LIMPI	LGOVEXP	LEMPL
1	0.015013	2.561464	1.843672	0.228531	11.20916	6.306287	1.886932	75.96395
2	0.023747	2.859872	1.373194	0.354085	13.31141	6.302469	6.201699	69.59727
3	0.029176	2.520913	0.911179	0.494525	13.73392	5.781849	8.597388	67.96022
4	0.033117	2.076801	0.866174	0.783893	13.61207	5.244475	9.343223	68.07336
5	0.036513	1.715902	1.008741	1.195200	13.35682	4.786778	9.297520	68.63904
6	0.039615	1.461983	1.166457	1.652101	13.10484	4.396415	8.964848	69.25336
7	0.042459	1.302431	1.298240	2.103215	12.87520	4.049691	8.535660	69.83556
8	0.045068	1.223576	1.403131	2.526970	12.65881	3.733923	8.069803	70.38379
9	0.047477	1.213934	1.484292	2.913159	12.44985	3.445310	7.593354	70.90010
10	0.049718	1.263741	1.545310	3.254890	12.24680	3.183289	7.124181	71.38179

Cholesky Ordering: LCA ECI AGRICEX INF LIMPI LGOVEXP LEMPL

APPENDIX K3: FIXED INVESTMENT MODEL

Variance Decomposition of LFINV:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.169488	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.282003	98.47532	0.578228	0.017520	0.421603	0.186559	0.268900	0.051873
3	0.364191	96.97146	1.289803	0.092491	0.441400	0.323005	0.666039	0.215800
4	0.426602	95.14986	2.364413	0.193326	0.430457	0.364166	1.063433	0.434347
5	0.476966	93.00293	3.752682	0.298478	0.430769	0.370286	1.464924	0.679931
6	0.519771	90.59232	5.344496	0.404887	0.457024	0.358657	1.886264	0.956355
7	0.557604	88.02290	7.009417	0.512302	0.513578	0.338507	2.337545	1.265748
8	0.592033	85.37490	8.654187	0.621153	0.602919	0.313826	2.823896	1.609115
9	0.624063	82.70486	10.21700	0.731714	0.725419	0.287527	3.347807	1.985670
10	0.654374	80.04790	11.66139	0.844270	0.879871	0.262237	3.910238	2.394092

Variance Decomposition of ECI:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.155310	6.622314	93.37769	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.199740	10.88301	87.94566	0.087517	0.566692	0.214780	0.073607	0.228735
3	0.223587	13.65965	84.33418	0.164397	0.980608	0.289121	0.111600	0.460438
4	0.237805	14.84150	82.42541	0.197475	1.464591	0.330135	0.138968	0.601912
5	0.246534	15.14509	81.44243	0.214249	1.952791	0.365684	0.176880	0.702873
6	0.252055	15.05655	80.90295	0.226720	2.399655	0.394682	0.232051	0.787390
7	0.255700	14.82641	80.56948	0.238296	2.780309	0.415819	0.306716	0.862966
8	0.258261	14.57582	80.31863	0.250095	3.091610	0.428872	0.401774	0.933200
9	0.260204	14.35949	80.08382	0.262633	3.340657	0.435047	0.517753	1.000601
10	0.261804	14.19692	79.82998	0.276280	3.538426	0.436031	0.654969	1.067389

Variance Decomposition of INF:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	6.295740	1.486278	0.474790	98.03893	0.000000	0.000000	0.000000	0.000000
2	7.204953	12.87200	0.362641	83.42116	0.073713	2.954692	0.021866	0.293930
3	7.533468	16.90196	2.064967	76.83410	0.135148	3.741806	0.046684	0.275332
4	7.737832	18.37372	3.949828	72.91890	0.206081	4.185912	0.044881	0.320680
5	7.852425	19.11346	4.735898	70.85605	0.378200	4.435121	0.060733	0.420537
6	7.932144	19.53416	5.044280	69.48392	0.608197	4.694535	0.086166	0.548749
7	7.991441	19.76730	5.138089	68.49651	0.844836	4.964634	0.114795	0.673838
8	8.039791	19.88133	5.142757	67.71192	1.071220	5.255856	0.144907	0.792004
9	8.081537	19.91980	5.110150	67.04888	1.277376	5.565425	0.175929	0.902439
10	8.119503	19.90943	5.065689	66.45679	1.461364	5.892966	0.207373	1.006394

Variance Decomposition of FDI:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.989485	0.057651	0.000841	0.381231	99.56028	0.000000	0.000000	0.000000
2	1.116644	0.136195	2.716561	0.372431	96.07724	0.577114	0.112321	0.008140
3	1.182230	0.203570	3.418593	0.336774	95.27121	0.559079	0.168232	0.042542
4	1.213236	0.193329	4.131817	0.324986	94.49132	0.590284	0.227560	0.040706

5	1.230846	0.201732	4.521098	0.316532	93.85139	0.770650	0.295036	0.043562
6	1.241962	0.237480	4.807228	0.310930	93.20251	1.015633	0.370279	0.055934
7	1.250000	0.283545	4.998381	0.307178	92.55931	1.328644	0.449815	0.073125
8	1.256407	0.328737	5.131845	0.304919	91.93100	1.679003	0.531186	0.093308
9	1.261900	0.365742	5.224390	0.303885	91.32536	2.054162	0.612662	0.113796
10	1.266826	0.392473	5.290255	0.303817	90.74576	2.441351	0.693141	0.133200

Variance Decomposition of LIMPI:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.165654	59.73457	0.003004	1.620264	0.979893	37.66227	0.000000	0.000000
2	0.265585	74.55896	0.211051	0.748077	0.494064	22.77434	0.031430	1.182083
3	0.339554	77.89025	0.885901	0.585466	0.628176	18.59793	0.167197	1.245076
4	0.394913	78.90729	1.440823	0.564878	0.804358	16.76359	0.332003	1.187058
5	0.438581	78.79998	2.053142	0.590694	1.009377	15.94955	0.504182	1.093077
6	0.474560	78.20246	2.688904	0.631584	1.235348	15.55642	0.687737	0.997551
7	0.505260	77.33212	3.326120	0.680127	1.484110	15.38234	0.888516	0.906665
8	0.532139	76.31205	3.937441	0.733386	1.751662	15.32996	1.110426	0.825077
9	0.556163	75.20111	4.508456	0.790275	2.034289	15.35430	1.355763	0.755804
10	0.577995	74.03251	5.031185	0.850259	2.328096	15.43082	1.625950	0.701175

Variance Decomposition of LIND:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.029575	4.522283	2.453807	0.647013	3.073569	4.092954	85.21037	0.000000
2	0.043488	2.847813	1.407711	0.349081	2.758395	3.155748	87.53637	1.944881
3	0.054059	1.870037	1.759347	0.235478	1.949061	3.563475	87.53986	3.082741
4	0.062817	1.387722	1.995602	0.176763	1.445137	3.715009	87.66384	3.615924
5	0.070503	1.123423	2.082662	0.144171	1.253124	3.833074	87.87931	3.684230
6	0.077474	0.962102	2.053655	0.126381	1.275154	3.926132	88.12656	3.530015
7	0.083954	0.854084	1.974825	0.119444	1.426797	4.029517	88.32311	3.272221
8	0.090081	0.776441	1.876957	0.121691	1.649209	4.152243	88.44556	2.977899
9	0.095951	0.718268	1.775873	0.132533	1.907657	4.300735	88.48194	2.682997
10	0.101631	0.673866	1.678360	0.151732	2.182326	4.477385	88.42790	2.408429

Variance Decomposition of LUNEMR:

Period	S.E.	LFINV	ECI	INF	FDI	LIMPI	LIND	LUNEMR
1	0.078817	21.22869	3.516149	5.722339	0.339942	2.316559	2.577938	64.29839
2	0.125619	25.19945	4.183622	5.171330	0.346415	0.919430	3.117549	61.06220
3	0.161996	23.97156	3.009672	5.486446	0.479783	0.591024	3.710330	62.75119
4	0.191728	21.64712	2.159242	5.918337	0.651790	0.505973	4.241395	64.87614
5	0.217791	19.07378	1.769277	6.337661	0.887094	0.564535	4.703096	66.66456
6	0.241832	16.64354	1.749074	6.696657	1.194516	0.726285	5.107555	67.88238
7	0.264774	14.48722	1.956991	6.989194	1.574374	0.976202	5.467020	68.54900
8	0.287093	12.63398	2.271561	7.221865	2.015856	1.302865	5.793286	68.76059
9	0.309054	11.06389	2.610892	7.404975	2.503972	1.699202	6.095506	68.62157
10	0.330804	9.740115	2.926357	7.548547	3.022705	2.159764	6.380444	68.22207

Cholesky Ordering: LFINV ECI INF FDI LIMPI LIND LUNEMR