TRADE OPENNESS AND ECONOMIC GROWTH IN SELECTED WEST AFRICAN COUNTRIES

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A THESIS SUBMITTED TO THE POSTGRADUATE SCHOOL, BENUE STATE UNIVERSITY, MAKURDI IN PARTIAL FULFILLMENT OF THE EQUIREMENTS FOR THE AWARD OF DOCTOR OF PHILOSOPHY (PhD) IN ECONOMICS

AUGUST, 2019

DECLARATION

I solemnly declare that, I **Iorwuese Tyopev** personally undertook this research study for the purpose of obtaining a Doctor of Philosophy (PhD) in Economics of the Benue State University, Makurdi. All borrowed ideas and information used in this study are duly cited and acknowledged following established standards of procedure.

Iorwuese Tyopev **Sign:……………………….**

CERTIFICATION

We certify that the thesis titled "Trade Openness and Economic Growth in Selected West African Countries (1970 – 2016)" has been duly presented by **Iorwuese Tyopev** (BSU/ECO/PhD/13/6913) of the Department of Economics, Faculty of Social Sciences, Benue State University, Makurdi and has been approved by the examiners.

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ACKNOWLEDGEMENTS

This remarkable research work is a blessing to me, I thank God for this. However it could not have been easily achieved without support and guidance of many people worthy of acknowledging at this juncture. First of all, I am grateful to my family for their sacrifices and support over the long time I had to spend to complete my PhD project. I wish to say thank you to my wife, Ashi, and my five children (Henen, Emma, Yima, Fave and Fanen).

Secondly, to my supervisor Dr S. O. Ajegi; he has made me affirm that we all have the potential to acquire new knowledge any time we desire and work hard for it. He has been a mentor from whom I picked interest to read Economics ab initio, and has been very supportive of me at every stage of my PhD project. I owe him an immense debt of gratitude. Besides, my special thanks to my co-supervisor Dr D. T. Akighir for his constructive advice and promptness to guide me whenever I was in need of it. To both of them my wish is, may Almighty God grant them their heart desires all the times. I am deeply grateful to all the academic staff of the Department of Economics, Benue State University, Makurdi; Dr. AyilaNgutsav, Dr P. T. Abachi, Dr I. Okpe, Dr. G. Anjande, Dr C. O. Obute, Dr J. T. Andohol, Dr (Mrs) N. O. Doki, Dr S. T. Asom, Dr D. T. Nomor, Dr J. T. Sokpo, Dr S. Ominyi, Dr J. Fefa, Dr S. Akiri, Dr (Mrs) M. Ahemen, Mr Raymond Aor for their useful guidance.

I am grateful to Dr Vincent Gisaor for his comments and suggestions and to Paul Iorember for his useful suggestions and donation of Eviews 10.0 software. To my son, Yima for ICT support and my colleagues in the PhD class of 2014; Tordue Kpoughul, Joyce Ayaga, Emmanuel Ebele, Emmanuel Iorkase, Emmanuel Odiba - thank you for your support and team spirit.

I deeply appreciate the financial and moral support of my loving daughter Henen Tyopev, and many other friends and relations; Tsunuku Kungaba, Terlumun Geoffrey Gber, Dave Iorhemba, Mathew Jande, Chris Dondo Ioruse, Dr Richard Gbande, Dan Ashiekaa, Mr Paul Iorver, Hon. Terkimbi Ikyange. I am eternally grateful.

DEDICATION

To

My dear mother, ***Dookaan***

You had no privilege of education yet stood firm to educate me.

May your soul continue to rest in peace.

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ABSTRACT

This research examines the relationship between trade openness and economic growth in selected West African countries (Cote d'Ivoire, Ghana and Nigeria) using secondary data in a multivariate panel framework for the period 1970 - 2016. The relationship between trade openness and economic growth of West African countries has been extensively investigated but the results have been mixed and inconclusive. This might be attributed to the role of omitted variables or the methodologies employed. The main objective was to establish the effects of trade openness on economic growth in these countries. The Autoregressive Distributed Lag (ARDL) bound tests, VAR Granger Causality/Block Exogeneity Wald tests, Impulse Response Functions (IRFs) and Fixed Error Variance Decomposition (FEVD), Dumitrescu and Hurlin (2012) panel Granger causality test, as well as the fixed effect Least Squares Dummy Variable (LSDV) and other diagnostic tests were employed for data estimation. The results indicated long run relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria, and that this relationship is negative but insignificant for Nigeria and Cote d'Ivoire, but positive and significant for Ghana. In the short run, changes in RGDP are driven mostly by the error correction term and short run trade openness shocks for each country. Short run deviations from the long run equilibrium take from 1.291 years (Cote d'Ivoire), 2.189 years (Ghana), and as long as 7.498 years (Nigeria) to return back to equilibrium. The results also indicated heterogeneous non-causality (HENC) implying that causation between trade openness and economic growth exist in a subgroup of the panel. The combination of other macroeconomic variables like investment, human capital, net inflow of FDI and the exchange rate complements the contribution of trade to economic growth. Therefore, these countries should promote appropriate trade policies devoted to foster increased local production of manufactured and agricultural goods to reduce importation and stimulate exports, as a strategy to boost economic growth.

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

After the Second World War, many less developed countries (LDCs) followed the path of Import Substitution Industrialization (ISI); and most of these countries export primary commodities in general and agricultural goods in particular. The import substitution industrialization strategy by the LDCs required increased imports of machinery and technology, and this demands for more foreign exchange than the growth in export earnings. Consequently, the LDCs began to face balance of payment deficit. To finance their deficit, the LDCs became increasingly dependent on developed countries (DCs). In order to avert economic crises and experience high rate of growth, the LDCs were advised by the Bretton Woods institutions to open up their economies through liberalization of trade and economic policies (UNCTAD, 2016).

Trade liberalization started in 1947, after the Second World War with the inception of the General Agreement on Tariffs and Trade (GATT). The GATT was negotiated in 1947 by twenty three countries of which twelve were industrialized countries and eleven developing countries. The main purpose of the GATT was to lower trade barriers, and was later replaced by the World Trade Organization (WTO) in 1994 (UNCTAD, 2016). Most of the African countries adopted structural reforms enunciated in the GATT, which was made up of rapid and extensive liberalization, deregulation and privatization of economic activity to open up their economies in search of a solution to the stagnation and decline (UNCTAD, 2016).

Though the effect of trade openness on economic growth have been in the limelight since the existence of trade, attempts to establish statistical causation between trade openness and growth have had mixed success, or more accurately, as there is debate regarding the limits of some of the measures of trade openness on economic growth in cross-country studies. While trade theorists (Ricardo, 1817; Heckscher, 1949) considered trade openness as a catalyst to economic growth, economic growth theorist (Solow, 1956; Romer, 1989; Sarkar, 2005) explained growth in terms of factor productivity, with trade openness as a reinforcing factor towards income convergence at higher levels of capital flows. Although there is a near consensus about the positive effects of trade flows and economic growth in theoretical growth literature, these effects are very complicated in the most general case and the results are mixed as to how trade openness transmit economic growth.

Many economists such as Singer (1950) and Prebisch (1950) have questioned the correlation between economic growth and openness to trade, and have even gone ahead to argue that trade openness has been detrimental to the long-run growth of countries, especially in Africa. Some economists (Johnson, 2003; Osabuahein, 2007; Echekoba, Okwonkwo & Adigwe, 2015) have also suggested that trade reforms have led to the "deindustrialization" of developing countries.

Openness to trade reflects countries' integration into the world economy. It is generally assumed that small countries are more integrated (because of their domestic market size) than large countries (Kovarova, 2017). However, trade openness is influenced also by large number of other factors, such as structure of the economy, the level of financial development, domestic and foreign direct investment, quality of institutions, human capital, trade policy and resource endowment, among others. Therefore, identification of long-term trends in openness to trade of sub-regional countries is better than simple cross-country comparison common with openness-growth literature.

In West Africa, the beginning of export-oriented reforms of trade policies date back to early 1980s to when West African countries superseded the import-substitution policies. World's imports of goods and services into West Africa accounted for 19.9% of the total GDP in 1990 and 30.3% in 2008. Similarly, exports accounted for 19.8% of the total GDP in

1990 and 30.8% in 2008 (Kovarova, 2017). Furthermore, the International Monetary Fund (IMF, 2016) report indicated that an average West African country is today over 30 percent more open to international trade than in 1960 (as measured by the ratio of exports plus imports over GDP). West Africa, consisting of 16 countries – Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone and Togo are members of the Economic Community of West African States (ECOWAS) and has made significant progress in integration and cooperation since the 1990s.

1.2 Statement of the Research Problem

The relationship between trade openness and economic growth has been extensively investigated but the results have been mixed and inconclusive. This might be attributed to the omission of the role of gross capital formation, gross secondary school enrolment which is bedrock for education and skills acquisition that can absorb the technology from abroad, the level of financial development and the quality of foreign direct investment inflows. It therefore, remains an empirical argument whether the results from available literature can be substantiated in interaction of a panel group of West African countries. More so, that literature on openness to international trade does not tell us whether West African countries are better off or worse off in the comity of nations as they become more outwardly-oriented in their trade policies. In addition, trade openness-growth literature has not been able to draw out the similarities and differences between West African countries on the effect of trade openness on their economic growth nor established the level of resilience for growth or recovery from the effects of trade openness on these countries' individual economies.

The empirical analyses on the relationship between trade openness and economic growth are as inconclusive as the theoretical perspectives. Most of the studies carried out (Saibu, 2004; Aka, 2006; Alajeku, Ezeabasili & Nzotta, 2013; Asiedu, 2013; Zakari, 2013;

Arodoye & Iyoha, 2014; Echekoba, Okonkwo & Adigwe, 2015) were country-specific and limited to individual West African countries, while panel analyses (Redlin and Gries, 2012; Ulasan, 2015; Zahanago, 2016) did not categorize West African sub-region but lump them together under a broad title of 'sub-Saharan Africa' which does not take into consideration common sub-regional factors that may influence outcomes, even as outliers of better performing economies and worse performing economies were not separated. The results reported in these studies are also clearly sensitive to the variables employed, for example, population instead of human capital and also the theoretical framework assumed, that is, bivariate models and ad hoc production functions instead of an augmented neoclassical production function, and estimation techniques that fail to draw out individual country differences and similarities. In such situation, the cross-sectional homogeneity assumption is likely to be violated given the heterogeneity of economies in terms of institutions, government policy, financial development and other economic conditions.

Therefore, this study attempts to fill the empirical gap in the literature on the trade openness-growth nexus by assessing whether the relationship between trade and growth differs between the selected West African countries, using multivariate models in a theoretical framework of an augmented neoclassical production function with heterogeneous multi-country panel data approach where each country has its own model. The evidence from the results will enrich empirical analysis in ways that is not possible if we used only cross-section or time series data.

1.3 Research Questions

The study answered the following questions;

I. What is the long run effect of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria?

II. What is the causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria?

III. What is the transmission response of economic growth to impulse in trade openness in Cote d'Ivoire, Ghana and Nigeria?

IV. Are there comparative effects of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria?

1.4 Objectives of the Study

The broad objective of this research was to study the impact of trade openness on economic growth of West African countries, particularly, Cote d'Ivoire, Ghana and Nigeria.

The specific objectives include:

I. To examine the long run effect of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria.

II. To investigate the causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria.

III. To investigate the transmission response of economic growth to impulse in trade openness in Cote d'Ivoire, Ghana and Nigeria.

IV. To analyze the comparative effects of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria.

1.5 Research Hypotheses

The study shall test the following null hypotheses;

I. Ho: Trade openness has no significant effect on the economic growth in Cote d'Ivoire, Ghana and Nigeria in the long run.

II. Ho: There is non-causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria.

III. Ho: There is no transmission response of economic growth to impulse in trade openness in Cote d'Ivoire, Ghana and Nigeria.

IV. Ho: There is no significant comparative effect of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria.

1.6 Significance of the Study

The significance of this study to academic knowledge can be categorized into policy, theory and empirical contributions. On policy, the findings of this study will aid researchers, economists, public policy makers in understanding the responsiveness of trade openness on economic growth. This understanding will help them to formulate relevant and appropriate policies to keep openness to international trade at rates that can stimulate domestic production. It is desirable for policy makers not to be in doubt as many empirical studies on the relationship between trade openness and economic growth remain inconclusive.

To the government and the people of the selected West African countries, this research will widen their knowledge on recent developments and main effects of trade openness within their domestic economies including the prospects and problems of opening up their economies and efforts to be targeted at minimizing these problems. To firms and the private sector, this research intends to widen their understanding on how best business can thrive in this era of increased opening of domestic economies to international trade with regard to type of investment and diversification of manufacturing, industrialization, agricultural production and non-oil exports.

On theoretical and empirical perspectives, the study would add to the understanding of the theoretical debate between international trade theories and economic growth theories on the effects of trade openness on economic growth, and the degree to which Nigeria and Ghana are more open to international trade than Cote d’Ivoire, at least within the study area, which, to the best of the researcher’s knowledge, no comparative empirical analysis exist on the openness-growth nexus. Also, information provided in this research may stimulate other scholars to carry out further research on the openness-growth question with a view to complementing further discuss on the subject matter.

1.7 Scope of the Study

The study employed secondary data in a qualitative and quantitative research analysis of the impact of trade openness on economic growth in three selected West African countries of Cote d'Ivoire, Ghana and Nigeria. There are various measures of trade openness but this study focused on the ratio of trade as a percentage of GDP. The three countries were selected based on the World Bank (2015) classification of countries into 'moderately outward-oriented', 'moderately inward-oriented' and 'strongly inward-oriented countries'. In addition, they are all classified as 'lower middle income' countries by the IMF (2016) and had also embarked on trade liberalization policies from the 1980s till date. Ghana and Cote d'Ivoire are neighbouring countries with very similar natural, geographical, and demographic characteristics, like Nigeria-though physically separated, with the exception of the pre-independence colonizer. The three countries are founding and committed members of ECOWAS and signatories to the protocol on trade liberalization among member countries, and have been committed to the diversification of their domestic economies. The time frame for the data covers 1970 to 2016. The choice of the time frame is informed by the fact that this era witnessed trade policy and economic reforms in the three countries. Ghana adopted the International Monetary Fund (IMF) sponsored Structural Adjustment Programme (SAP) in 1983, while Nigeria followed three years later in 1986, and Côte d'Ivoire in 1987.

1.8 Organization of the S tudy

The study is divided into five (5) chapters: chapter one is the introduction chapter which contain the background to the study, statement of the research problem, research questions, objectives of the study, research hypotheses, significance of the study, the scope of the study, and the organization of the study.

Chapter two deals with the review of related literature which contains the conceptual framework, theoretical framework and empirical literature. Chapter three presents the research methodology which includes the study area, research design, nature and sources of data, theoretical model and model specification, description of variables, methods of data analysis and limitations of the study. Chapter four deals with presentation, analysis and interpretation of data, discussion of findings and testing of hypotheses. Chapter five concludes the study with summary and policy recommendations.

CHAPTER TWO

REVIEW OF RELATED LITERATURE

2.1 Conceptual Framework

The conceptual framework used to investigate the effect of trade openness was based on the international trade index, FDI inflows with their inherent benefits, particularly, in the transfer of technology; the level of domestic investment, human capital development in terms of education and skills and financial development implied in the foreign exchange management, while other determinants of economic growth like quality of institutions and government policy are assumed constant. The mechanisms and channels of trade openness will have significant effect on economic growth as depicted in Figure 2.1.

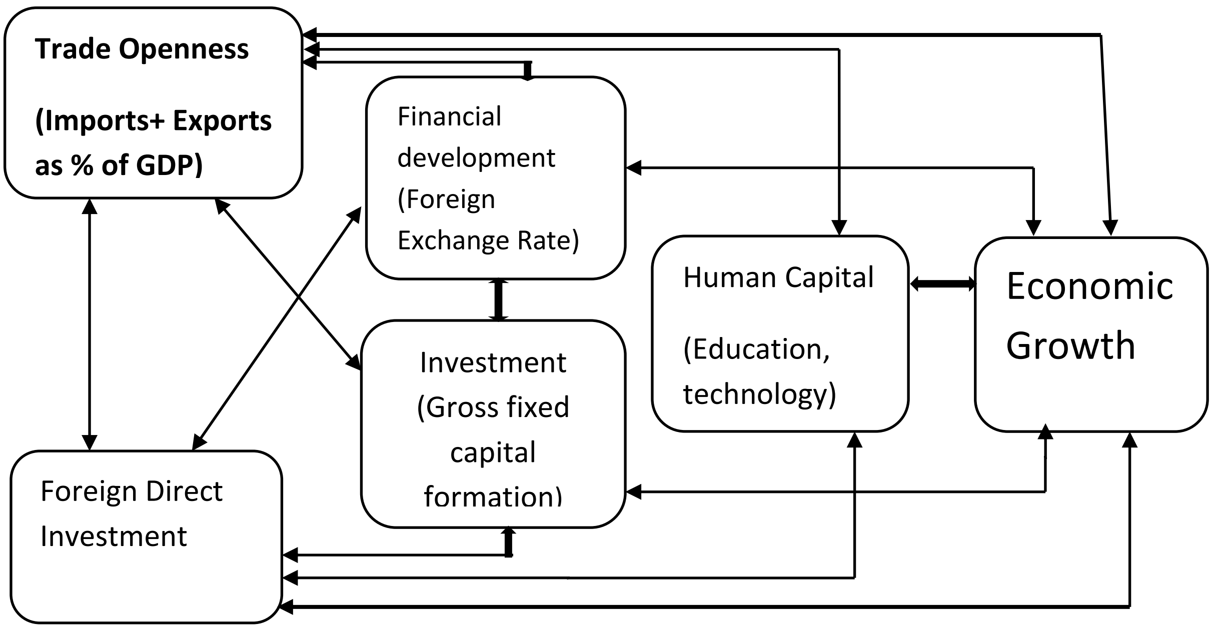

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Figure 2.1: Schematic Framework for Trade Openness-Economic Growth Relationship.

2.1.1 Trade Openness

Trade openness refers to the degree of dependence of an economy on international trade and financial flows (Romer, 1986). Trade openness is usually considered as the volume of a country's traded sectors in relation to total output (Edwards, 1998). Trade openness measures the international competitiveness of a country in the global market (Gwartney, Skipton & Lawson, 2001). Increased openness facilitates greater integration into global markets. Trade openness is interpreted to include import and export taxes, as well as explicit non-tariff distortions of trade, or in varying degrees of broadness, to cover such matters as exchange-rate policies, domestic taxes and subsidies, competition and other regulatory policies, education policies, the nature of the legal system, the form of government, and the general nature of institutions and culture (Baldwin, 2002). This theoretical definition is in line with several research studies, including Sachs and Warner (1995); Rodriguez & Rodrik (2001); and Wacziarg & Welch (2008).

Yannikaya (2003) simply defined trade openness as an economy's trade intensity. Yanikkaya (2003) opined that this definition has changed over time from one extreme to another to the idea of trade liberality. Pritchett (1996) defines trade openness as ''that set of policies such that the level and pattern of trade (and prices) are near what they would be under free trade''. On the other hand, Krueger (1997) argued that trade openness can be attained by implementing policies that lower the biases against the exports sector, for instance subsidizing exports or encouraging exports schemes. Harrison (1996), argued that trade openness could be synonymous with the idea of neutrality, the indifference between earning a unit of foreign exchange by exporting and saving a unit through exports substitution. It is crucial to understand this definition problem as there are several openness measures that are differently linked to economic growth.

The structure of trade policy over a lengthy period is vitally important, as short-term trade policy may be misleading indicator of openness over a long-term period. As Gwartney, Skipton and Lawson (2001) explained, it takes time for markets to respond to changes in openness of the economy. It also takes time for a change in policy to acquire credibility. Initially, decision makers may be unsure whether a policy change is temporary or permanent. Until credibility is acquired, the response of entrepreneurs, investors and other economic agents will be limited. As trade openness policies are maintained over a long time period, decision makers will eventually be convinced that the more liberal policies can be counted on to persist in the future. As this happen trade will expand, resources will move towards the production of goods and services that can be supplied domestically at low cost and away from those that can be supplied at high cost. When trading partners use their available resources producing things they do best, they are able to produce more efficiently by achieving larger output and higher gains from trade, and with it, standard of living, than would otherwise be possible. Economists referred to this as *the law of comparative advantage*. Open economies are therefore, more rewarding to research and development (R&D), and this is another reason why open economies have a higher investment rate.

In addition, openness encourages both innovation and efficient production (Romer, 1986; Edwards, 1998; Gwartney, Skipton & Lawson (2001). Increasingly, economic growth involves intellectual property rights, innovation and application of technology, and increased international competition. Trade openness may also exert an indirect effect on governance. It may encourage nations to adjust their portfolio of services (and the taxes used to fund them) or risk capital flight, or loss of competitiveness to its domestic suppliers, and ultimately, shrinkage in their tax base (Gwartney, Skipton & Lawson, 2001). Trade openness begets a greater importance of competitive institutions of governance (reflected in greater *economic* *freedom*) generally, resulting in long term economic growth (Edwards, 1998; Gwartney, Skipton & Lawson, 2001).

This study considered trade openness as a measure of the ratio of import and export to the real gross domestic product (GDP) or alternatively, the ratio of trade to GDP. Trade ratios contain the most widely used measure of trade openness and policy. Trade ratio measure of openness was calculated as (Exports plus Imports)/GDP). The measure preferred because data were readily available for many countries allows for comparability across studies.

Despite the vast literature that explores trade openness relationship with various economic variables, many authors find contrasting results due to the difficulty in measuring trade openness (Yanikkaya, 2003). Measuring trade openness has been an issue because empirical studies have explained trade openness in several different ways as well as using several ways to capture and measure the nature of trade. This in turn has resulted into having many approaches to measuring the degree of trade openness and trade policy.

Rose (2004) offered a useful taxonomy and groups these measures into seven groups; outcome based measures of trade ratios (trade as a GDP ratio); adjusted trade flows (also outcome based); price based (measures based on price outcomes); non-tariff barriers (incidence based measures); composite indices (combining tariff and non-tariff indicators with other economic and political indicators) and informal and qualitative measures. The above classification reveals the fact that the first three are outcome based and takes consideration of the trade flows and price levels, the rest of the measures are based on trade restrictions or rather, trade policies. Another literature include trade dependency ratio and export growth as outcome based trade openness measures (Balassa, 1982). Trade ratios contain the most widely used measure of trade openness and policy. Trade ratio measure of openness is most often calculated as (Exports plus Imports)/GDP).

2.1.2 Economic Growth

Todaro (2000) defined economic growth as an increase in the national output of goods and services or increase in the rate at which the annual output of goods and services grow in real terms. Economic growth is generally measured by the use of Gross Domestic Product (GDP), otherwise referred to as gross national income (GNI). The GDP is simply the monetary value of all the goods and services produced, within an economy over a specified period of time, usually one year. For the purpose of this study, economic growth is considered as a measure of the real gross domestic product. Real gross domestic product is a macroeconomic measure of the value of economic output adjusted for price changes (that is, inflation or deflation). This adjustment transforms the money-value measure, nominal GDP, into an index for quantity of total output. It is often referred to as ‘’constant dollar GDP’’, ‘’constant-price’’ or ‘’inflation-corrected GDP’’ (Todaro, 2000).

2.1.2.3 Macroeconomic Determinants of Economic Growth

The level of income in an economy at any point in time represents the accumulated growth in incomes over time, so investigating what produces higher incomes is really investigating the determinants of economic growth (Levine & Renelt, 1992). But that investigation is complicated by the fact that country’s experiences with growth are enormously varied and often confusing.

Numerous potential growth determinants have been identified over the years, but mapping reliable channels of growth has been a major problem for analysis (Romer, 1986). Economic outcomes are often confounded by many causes, and more explanations have been offered for per capita income as an outcome than there are economists, sociologists, and political scientists, not to mention politicians and policymakers. Fundamentals of demography, education, capital, and technology determine growth potential. Sometimes growth requires regulation or public investment or even redistribution, rather than laissezfaire, to remove the barriers that hinder growth. This section explores in some more detail the determinants of economic growth which include trade openness (as explained in the previous section), investment, net inflow of foreign direct investment, financial development, human capital development, technology, among others.

Savings and Investment: Capital accumulation results when some proportion of present income is saved and invested in order to augment future output and income. New factories, machinery, equipment, and materials increase the physical capital stock of a nation (the total net real value of all physically productive capital goods) and makes it possible for expanded output levels to be achieved (Todaro & Smith, 2009). These directly productive investments are supplemented by investments in social and economic infrastructure-roads, electricity, water and sanitation, communications and the like-which facilitates and integrates economic activities.

There is substantial evidence that expansion of trade is associated with a higher share of investment in national income (Levine & Renelt, 1992; Florax, Henri, Groot & Heijungs, 2002). Capital investment is usually financed primarily through national savings, and partly through net foreign investment. There has been very little empirical work directly linking trade with savings. Net investment in an economy is an aggregate of individual, firms and public investment in social, economic and infrastructure, including the effect of capital depreciation. Investment is one of the few economic variables that are positively and robustly related to economic growth. International trade allows for increased specialization and stimulates investment through the exploitation of economies of scale, and through technology transfer. Upfront investments can be substantial and a sufficiently large market is necessary for an innovating company to break even. Trade often provides the market opportunities needed for investing in R&D and introducing the resulting innovations in the marketplace.

Open economies are therefore more rewarding to R&D, and this is another reason why open economies have a higher investment rate.

Foreign Direct Investment: Foreign direct investment (FDI) has been a key element for economic growth efforts for developing countries in recent years. FDI is the driver for enhanced productivity and export levels, a means for acquiring new technology as well as provision of employment. According to Romer (1986), trade and FDI are linked in a number of ways. FDI may either substitute for trade (in the case of tariff-hopping investment) or be complementary to trade (in the case of intra-firm trade). Because of this, different researchers have obtained different results on the relationship between trade barriers and FDI, although lower barriers to FDI itself are associated with higher FDI. There is evidence that the growth effects of FDI may be stronger than those for domestically financed investment, which is consistent with the observation that foreign multinationals often possess technological advantages over host-country firms (UNCTAD, 2016).

Human Capital Development: There have been several empirical researches (Mankiw, Romer & Weil, 1992: Young 1994; Barro & Sala-i-Martin, 1995) on effects of trade on either the incentives to accumulate human capital (e.g., through schooling or on-the-job experience) or on the labor force participation rate. It is an established fact that education brings about higher incomes for individuals and societies. Education helps make investment more productive and leads to higher growth. Though the connection between economic growth and increases in human capital has been well established, the experience of the East Asian Tigers (Hong Kong, Korea, Singapore, and Taiwan) - which experienced rapid increases in labour force participation and schooling, unusually high rates of economic growth, and were relatively open compared to other developing countries - is suggestive of possible linkages among openness, human capital formation, and labor force participation (Barro, 1991).

Technological Progress: Technological knowledge can be defined as the design, or blueprint, of a new product, process or service. It can be embodied in a product and, therefore, it can be utilized and transported with it. For example, employing a foreign intermediate good in production involves an implicit usage of the design knowledge that was created with the R&D investment of the foreign inventor. One of the principal characteristics of technological knowledge is that, it can be transferred across countries. The stock of technological knowledge in a country is determined by domestic innovation and the international diffusion of technology. In developing countries, where domestic innovation is low, the international diffusion of technology acquires greater importance from the perspective of economic development (UNCTAD, 2016).

Open economies exchange more ideas. As shown above, accumulation of physical and human capital can only partially explain different income levels across countries. Differences in the way resources are utilized play a key role in determining income inequality among countries. One of the factors that explain such differences across countries is technological knowledge. Increased exposure to imports may enhance productivity by forcing less efficient firms to adopt new efficiencies, reduce their scale of operations, or exit the market. Such productivity effects have been found in some studies but not in others. There is evidence that the productivity-enhancing effects of technological knowledge spill partially across international borders but are partly retained in the inventing country. The strength of recognition of foreign intellectual property rights influences international technology payments and may - depending on the study - affect trade and FDI flows (UNCTAD, 2016).

Level of Financial Development: An additional channel through which trade affects the investment rate is trade in financial services. Trade in financial services improves the ability of the financial sector to mobilize and allocate resources for investment. Even when the market share of foreign banks is small and limited to narrow segments of the local market, these banks contribute to the development of the domestic financial sector through competitive pressure and the introduction of new products and technology (Levine, 1997).The existence of costs for access to information and transaction has motivated the establishment of a financial market with a primary role of mobilizing and allocating financial resources among different agents in capacity and/or needing a funding.

In economic literature, the debate on the effect of financial markets on growth was actually initiated by the comparative work of Goldsmith (1969) between the financial and macroeconomic statistics of some countries. For Levine (1997), a financial market that fulfils its duties, which are (i) facilitate trading, diversifying and pooling risk, (ii) allocate resources, (iii) exert corporate control, (iv) mobilize savings and (v) facilitate the exchange of goods and services, and (vi) promotes capital accumulation and technological innovation, will have in turn a positive effect on growth. In fact, the degree of financial development has been found to be a good predictor of future growth.

Rate of Population Growth: Population growth, and the associated eventual increase in the labour force, has traditionally been considered as a positive factor in stimulating economic growth (Todaro & Smith, 2009). A larger labour force means more productive workers, and a large overall population increases the potential size of domestic markets. Economic theory offers no consensus to policy makers on the relationship between population and economic growth. The supporters of endogenous growth theory claim that population growth stimulates supply of labour force and technological advancement; while classical economists argue that a rampant population growth possibly deteriorates GDP per capita. Thus, population growth could be beneficial or detrimental to economic growth.

Quality of Institutions: The quality of institutions has long been recognized as an important component of a well-functioning market. Two key questions about the quality of institutions are concerned with the kind of institutions that are relevant and whether trade or trade policy can have a positive effect on these institutions. A country's institutional setting is determined by a wide range of formal and informal rules of behaviour. While formal constraints might be quickly changed, the informal ones usually change only gradually. Any trade impact on institutions should in general, therefore, not be expected to be immediate (North, 1994).

The establishment of secure and stable property rights is considered as key to economic development. The rule of law is also important, including the ability to enforce contracts and secure payment of debts. A positive relationship seems to exist between the effective rule of law and openness to trade (Acemogolu, Johnson & Robinson, 2001). This can be illustrated by correlating openness and an indicator measuring the extent to which people have confidence in and abide by the rules of society. This indicator is a composite measure including perceptions of the incidence of both violent and non-violent crime, the effectiveness and predictability of the judiciary, and the enforceability of contracts.

The theory that institutions play an important role in growth rests on two arguments. First, economic freedom (property rights) reduces uncertainty and enhances entrepreneurship, among other things, and this leads to greater efficiency and higher growth. Second, political freedom (political liberties and democracy) allows for more sensible decisions because of greater checks and balances. However, the evidence for the second argument is decidedly mixed, indeed the opposite is often argued, and that authoritarianism helps growth, as shown by the strong growth example of East Asia. On the other hand, for every East Asian dictator whose economy produced high growth, there are 10 African and Latin American dictators whose did not (Acemogolu, Johnson & Robinson, 2001).

Government Intervention: It is important to analyze the contribution to growth of policy changes. There is general agreement that bad policy outcomes, such as high inflation, are a major handicap for higher growth. Another favourite policy recommendation for both developed and developing economies - one that is almost synonymous with the Washington

Consensus - is to reduce the fiscal deficit. The promised benefits are manifold, including greater efficiency in production, fewer losses in government undertakings, and less crowding out of private investment. Government deficits matter and their reduction are necessary for macroeconomic stability and sustained growth (Easterly & Rebelo, 1993). A related notion is that interest rates matter. High fiscal deficits, financed by higher government borrowing, translate into higher real interest rates, which may crowd out private investors. Easterly & Rebelo (1993) stressed that fiscal policy is an important explanatory variable in growth models that assess short time periods, say 5-10 years. The coefficient for fiscal policy is almost always significant and robustly so, and it has the correct sign. However, this variable is not significant for models that cover longer periods, say, 20 years or more. A simple explanation for the variable's significance in short-term models is that fiscal deficits increase by definition when growth falls and hence there is a robust negative association between growth and fiscal deficits (Easterly & Rebelo, 1993).

2.2 The Economy and Trade Policies in the Selected West African Countries

This section explores the economy and trade policies in Cote d'Ivoire, Ghana and Cote d'Ivoire.

2.2.1 The Economy of Côte d'Ivoire

Côte d'Ivoire, also known as Ivory Coast, is a French-speaking West Africa's largest economy and world's biggest Cocoa producer. Cote d'Ivoire got her independence in 1960. The country is located on the south coast of West Africa, and is bound by Liberia and Guinea to the West, Mali and Burkina Faso, to the North, Ghana to the East and the Atlantic Ocean to the south. The country has a total land area of approximately 322.5 square kilometres. Cote d'Ivoire is a southward sloping plateau and have three principal geographic regions: (1) the Lagoon region along the coast which is fringed by sandy beaches, (2) the central forest belt which lies between the coastal strips and the northern limits where the vegetation transforms to, (3) the grassy woodlands which is a savannah of grasses and scrubs. Cote d'Ivoire has a population of approximately 23 million and rank 55 in the world on the list of countries by population, with annual growth rate of 2.3% (United Nations: Statistics Division, 2017).

Cote d'Ivoire of is a leading producer of Cocoa beans, supplying 33% of the total world production. Other major exports are Rubber, Brazil nuts and Cashews; and top imports are Crude petroleum, Special purpose ships, Rice, Non-fillet frozen fish and packaged medicaments. The top export destination of Cote d’Ivoire is the United States, the Netherlands, France, Germany and South Africa. The top import origins are Nigeria, France, China, the Bahamas and India (World Bank, 2017).

According to the IMF (2017), the GDP of Cote d’Ivoire was USD 10.0 billion in 1980 and increased to USD 10.8 billion in 1990, USD 20.4 billion in 2007 and to an all-time high of USD34.6 billion in 2016, and was ranked at 96 globally. The GDP per capita was USD 1, 398.99 positioning Cote d'Ivoire at rank number 148 in the world in terms of economic development in 2016. The real GDP growth rate in Cote d'Ivoire was 5.2% in 1980, and started to decline, but increased sharply to 13.0% in 1993, and was 8.0% in 2016. The IMF (2016) showed that GDP per capita in Cote d'Ivoire in PPP terms was USD 87.1 billion which placed Cote d'Ivoire at rank 144 in the world. The 2016 estimate of the value of the Human Development Index for Cote d'Ivoire, released by the UNDP in March 2017 for 2015 was 0.474, and ranked 171 in the world.

Cote d’Ivoire had high and inclusive growth rates during the 1970s, which has been generally attributed to its peace and stability, policies for a productive labour force, and favourable term of trade (IMF, 2016). The 1980s brought with it a sharp decline in the terms of trade that led to significant real exchange rate overvaluation. The latter could not be corrected through internal adjustment thus bringing about a decade of declining income. The devaluation of the CFA franc in 1994, accompanied by complementary macroeconomic policies and structural reforms, helped to restore internal and external balances and provided the impetus for a pickup in economic growth. The resumption of growth subsequently slowed in the late 1990s when Cote d'Ivoire entered a period of political uncertainty, eventually leading to civil conflict and political tension that lasted from 2002 to 2011.

According to the IMF (2016), more than half of Cote d'Ivoire's GDP growth during 2012–2015 is explained by the growth-accounting residual, which likely reflects a catch-up in pent-up demand and a pick-up in capacity utilization, as well as improvements in productivity; the latter due to the government's efforts to narrow the infrastructure gap, and improve agricultural productivity and the business climate. At the same time capital accumulation turned positive and accounted for 0.8 percentage points of GDP growth during 2012–2015.

According to the World Bank (2017) the total value of imports of goods and services from the rest of the world into Cote d'Ivoire was 36.22%, while exports of goods and services from Cote d'Ivoire to the rest of the world were 39.49% of its GDP. For the export indicator, Cote d'Ivoire ranks at place 65 globally. The trade balance of Cote d'Ivoire, i.e. the value of exports minus imports, was 3.99% of GDP. Cote d'Ivoire was ranked 24th in the world on trade balance. An even more useful indicator is the Current Account balance which includes the trade balance as well as income received or sent by the country and gifts and foreign aid. The value for Cote d'Ivoire was -1.845% of GDP in 2016 and ranked 67 globally. The worlds' average Current Account Balance (percentage GDP) value was -4.12%; Cote d'Ivoire was 2.38 more than the average (IMF, 2017). Cote d'Ivoire was ranked 116 on international Competitiveness Index in the world with a value of 3.67 points; and also 112th most complexes economy according to the Economic Complexity Index (ECI); 142nd on the Ease-of-Doing-Business (World Bank, 2017).

The average value of trade openness measured as exports plus imports as percentage of GDP for Cote d'Ivoire during that period was 74.27%, with a minimum of 52.29% in 2016 and a maximum of 95.06% in 2006 (IMF, 2017). Foreign Direct Investment as percentage of GDP, average value for Cote d'Ivoire during the period from 1970 to 2016 was 1.24% with a minimum of -2.07% in 1992 and a maximum of 3.54% in 1997 (World Bank, 2017). Foreign direct investment net inflow into Cote d'Ivoire was 1.4% of GDP. Foreign direct investment (FDI) plays a key role in the Ivorian economy, accounting for between 40% and 45% of total capital in Ivorian firms. France was overwhelmingly the most important foreign investor. In recent years, French investment has accounted for about one-quarter of the total capital in Ivorian enterprises, and between 55% and 60% of the total stock of foreign investment capital (IMF, 2017). Cote d'Ivoire’s logistics performance index (LPI) in 2016 was ranked 95 with a score of 2.60.

The development of the banking system, a key part of the financial system of any country, is reflected in the level of credit to the private sector as a percentage of GDP. Credit allows firms to expand their production and to improve their technology. It also allows households to spread large expenses over time such as for a house, vehicles or education. The average value for the world for that indicator was about 45% of GDP in 2016. Values below 15% of GDP were considered very low whereas values in excess of 100% of GDP bring no additional benefit to the economy. According to the International Monetary Fund (2017), the value of that indicator for Cote d'Ivoire was 20.28%, and ranked 132 in the world. The other main component of the financial system is the stock market. Like banks, it serves to channel the free money in the economy (savings) to various business projects. The size of the stock market in Cote d'Ivoire is measured by its so-called capitalization, i.e. the number of outstanding shares times their prices, as percentage of GDP. For Cote d'Ivoire, that indicator had a value of 34.19% of GDP (IMF, 2017).

The capitalization of a stock market measures its volume but not necessarily its activity. Some countries have large stock markets where relatively few large companies are listed and whose shares are seldom traded. For the activity of stock markets we look at the so-called turnover ratio: the total value of shares traded during a period divided by the average market capitalization for that period. The turnover ratio in Cote d'Ivoire was 4.18%. As a reference, the stock market turnover ratio in the very active stock markets is about 100% or higher while in the least active stock markets it is below 20%. The stock market capitalization of listed companies in Cote d'Ivoire was $2,327 million in 2005 (World Bank, 2016).

The rule of law in Cote d'Ivoire was scored at 0.46 in 2016, and ranked 87 globally. The Transparency International Corruption Perception Index report for 2016 showed that the value of that indicator for Cote d'Ivoire was 34 which placed the country at 108th position in the world. The "Civil Liberties" index score for Cote d'Ivoire in 2015 was 4 with aggregate score of 51. As earlier stated in the previous section, the range is from 1(strong civil rights) to 7 (weak civil rights) (World Bank, 2016).

2.2.2.1 Trade Policy Features and Trends

Côte d'Ivoire has ratified the Uruguay Round Agreements. It has applied the General Agreement since 1947, first of all as a French Overseas Territory and then, since 1963, as a contracting party. In the Uruguay Round Agreements, Cote d'Ivoire bound all duties applicable to agricultural products at a ceiling rate. Only a few industrial products were bound. Cote d'Ivoire has only made modest commitments under the General Agreement on Trade in Services (GATS). The offer concerns certain professional services and other business services, certain construction and engineering services, certain tourism-related services (hotels, restaurants and travel agencies) and a few transport services (UNCTAD, 2013).

From the first decades of its independence in 1960, Cote d'Ivoire's trade policy objectives were grounded in economic liberalism and openness to the outside. This dual orientation was reflected in a policy of incentives and liberal measures to encourage both domestic and foreign investment, relying in particular on: (1) An incentive-based investment code; (2) a regime to encourage reinvestment; and (3) a customs tariff which favoured import substitution (UNCTAD, 2014).

Cote d'Ivoire is also committed to regional integration, and grants tariff preferences on many products to other members of the Economic Community of West African States (ECOWAS), subject to rules of origin. Cote d'Ivoire eliminated tariffs on most trade with ECOWAS members under the Community's Trade Liberalization Scheme. Cote d'Ivoire is also a member of the West African Economic and Monetary Union (WAEMU) with other French-speaking West African member nations of Benin, Burkina Faso, Guinea-Bissau, Mali, Niger, Senegal and Togo. The WAEMU member countries are working toward a greater regional integration with unified external tariff. Cote d'Ivoire is also eligible for trade benefits under African Growth and Opportunity Act (AGOA). As a member of the Organization of African Unity (OAU), Cote d'Ivoire remains committed to the formation of the African Economic Community, including the creation of a pan-African economic and monetary union. As a signatory to the ACP-EC Partnership Agreement (the successor to the Lomé Convention), Cote d'Ivoire receives non-reciprocal tariff and other preferences from the EU on many goods, as well as substantial financial assistance (IMF, 2015).

Cote d'Ivoire has concluded 34 bilateral trade agreements, which generally provide for a most favoured nation (MFN) regime. Cote d'Ivoire has signed a number of commodities agreements under the auspices of the United Nations Conference on Trade and Development (UNCTAD) including the agreements on coffee, cocoa, rubber and tropical timber. Cote d'Ivoire enjoys privileged access without reciprocity to the market of the European Union under the Lomé Convention. This regime allows access to the Community market for Ivorian exports of manufactures and some agricultural products free of any duty or quantitative restrictions (UNCTAD, 2003).

Cote d'Ivoire has implemented a comprehensive adjustment strategy under the International Monetary Fund (IMF) and the World Bank sponsored structural adjustment program (1988 - 1995). SAP was designed to effect long-term sound structural changes in the economy. Although the number of import levies is relatively high with at least four separate duties (customs duty, fiscal duty, stamp duty and a levy on imports carried by sea), their levels have been substantially reduced. After three decades of industrial protection, in 1994 Cote d'Ivoire initiated a trade liberalization programme. Economic reforms implemented by Cote d'Ivoire since January 1994 when the CFA franc was devalued by 50% created a better environment for investment and trade. Quantitative restrictions on most imported products were lifted or are being abolished, import duties were reduced by half and new laws are now in force to improve competition, thereby helping to attract foreign investment and manage the transfer of the State's assets in a large-scale privatization programme (IMF, 2015).

Coffee and cocoa play a major role in the economy because of the jobs, revenue and budgetary earnings they create. These products are exported by large international trading companies at prices guaranteed by the Agricultural Produce Price Stabilization and Support Fund (CSSPPA), irrespective of the trends in prices. Its stabilization role led to substantial losses for the State when prices fell at the end of the 1980s.

State participation in the production and distribution of energy is in the form of exclusive concessions granted to the private sector; the rates are usually negotiated in such a way as to guarantee the concessionaire stable remuneration whatever the trend in global prices for the goods and services concerned or for the inputs needed for their production. This is the case for the production of electricity, petrol refining and the supply of natural gas (World Bank, 2016).

Cote d'Ivoire has no legislation concerning anti-dumping or countervailing duties. Nevertheless, specific duties are levied on imports of certain meats and dairy products in order to offset the effect of the export subsidies granted by the European Union for its exports. The ad valorem duties have not varied since devaluation. Specific duties on coffee and cocoa were introduced. Cote d'Ivoire applies reference prices under Decree No. 90-444 of May 29, 1990, Decree No. 94-377 of July 1, 1994, Circular No. 749 of August 2, 1994, on rough timber and certain wood products for export. Cote d'Ivoire adopted a new Mining Code in 2014 in the hope of attracting foreign investors and increasing transparency (UNCTAD, 2016).

Cote d'Ivoire is a party to the Coffee Export Retention Plan set up in 1993, and the plan adopted by the International Cocoa Organization aimed at reducing over-production. Exports of bananas to the European Union are restricted to 155,000 tons per year under the terms of the Convention of Lomé. This quota was raised to 162,500 tons for a production potential of 250,000 tons (Regulation No. 3224/94 of December 1994). There are two export cartels: the Agricultural Produce Price Stabilization and Support Fund (CSSPPA) which controls exports of coffee and cocoa, and the Organization of Pineapple and Banana Producers and Exporters, which coordinates distribution of bananas and pineapples to the European Union. An export subsidy introduced in 1984 was intended to pay exporting companies a subsidy assessed at 40% of the added value of imported inputs. This subsidy has since been abolished (UNCTAD, 2003).

The temporary admission regime allows the import of raw materials as inputs for the manufacture of products which are subsequently exported. The duration of suspension is a maximum of 12 months (provisions under ordinary law). The guarantee required is 50% of the suspended duties. The principal agency responsible for export promotion is the Abidjan International Trade Centre (CCI-A) established by Decree No. 84-933 of July 27, 1984. The

CCI-A is a public agency of an industrial and commercial nature under the Ministry of Trade and Industry. Its activities consist of promoting and developing trade between Cote d'Ivoire and its foreign partners. The major law affecting foreign investment is the 2012 Investment Code (replacing the 1995 Investment Code). This code offers incentives, including tax reductions and in some cases exemptions from value added taxes (VAT), on equipment for private investors.

The Centre for the Promotion of Investment in Cote d'Ivoire (CEPICI), established by Decree No. 93-774 of September 29, 1993 and officially opened on March 8, 1995, is primarily intended to facilitate, firstly, the administrative procedures concerning the establishment and operation of enterprises and, secondly, completion of the formalities concerning the granting of investment-linked benefits, particularly those offered under the new Investment Code (UNCTAD, 2016).

Since 1991, prices of goods and services traded in Cote d'Ivoire have been freely determined by market forces. Nevertheless, prices of goods and services of prime necessity or general consumption may be regulated following an opinion of the Commission on Competition. Despite the introduction of a very liberal regulatory regime for foreign trade, particularly concerning exports and the adoption of a Sectorial Adjustment and Competitiveness Programme (PASCO), several elements of which include regulatory reforms with a direct impact on exports, there are still constraints which place a brake on exports. In general, price regulation in Cote d'Ivoire concerns goods and services for which the domestic and foreign trade is restricted, and is thus, aimed at preventing price abuses resulting from monopoly situations (UNCTAD, 2016).

2.3.2. The Economy of Ghana

Ghana, officially called the Republic of Ghana, is a low middle income country situated in West Africa. Ghana got her independence in 1957, and has ten defensive regions, including many Islands. Its west border is delineated by the Cote d'Ivoire, while to its north lies Burkina Faso. East of Ghana is bordered by Togo, while the south is bordered by the Atlantic Ocean and the Gulf of Guinea. The total surface area of Ghana is approximately 238, 540 square kilometres, according to the UN Statistics Division (2017). Savannahs filled with fauna and flora dominates the northern regions, while rich industrial minerals and fuels are a feature of western Ghana. Its fossil fuel wealth is particularly, rich in natural gas and petroleum. Ghana has a population of approximately 28 million with growth rate of 2.39% in 2016, according to the (UN Statistics Division, 2017), which ranked 48th in the world. Well acclaimed for its years of political stability, Ghana is a prized recipient for foreign direct investment in the region. In fact, Ghana has established itself as a prime destination for tourism, manufacturing and agro-processing, and constitutes together with Nigeria, the 'engines' of the Economic Community of West African States (ECOWAS).

The top exports of Ghana are Crude Petroleum, Gold, Cocoa Beans, Cocoa Paste, and Cocoa Butter. Its top imports are Refined Petroleum, Crude Petroleum, Gold, Rice, and Packaged Medicaments, with top destinations reaching Switzerland, China, France, India and the Netherlands. The top import origins are China, the Netherlands, the United States, Nigeria and India (IMF, 2017).

The growth record of Ghana has been one of unevenness. Growth was turbulent during much of the period since the mid-1960s and only began to stabilize by 1984. In 1972, 1975-1976, 1979, 1980-1983, the growth rate was negative. The years in which negative growth was experienced generally coincided with change in government and sometimes with policy changes or reversals. The lowest growth of -14% was experienced in 1975, coinciding with the oil-supply shock as well as a policy reversal from a market-oriented stance to an inward-looking protectionist regime. The period of turbulence, however, also had positive growth trends, with the highest peaks of growth rate reaching 9% in 1970 and 1978. The

Economic Recovery Program (ERP), under the International Monetary Fund and the World Bank, was instituted beginning in April of 1983, with actual implementation over 1983-1986. The ERP, a market-oriented program, was intended to halt the downward economic spiral and to stabilize the economy on a reasonable track. Starting in 1986, the ERP was supplemented with the Structural Adjustment Program (SAP), geared towards correcting a number of structural imbalances in order to engender a sustained healthy economic growth. The economy recovered from its negative growth rate of about 5% in 1983 to a hefty positive rate of 8% in 1984. This favourable growth appears to have continued since that time, with relatively little variance, though there seems to be a slight slowdown in the rate of growth since 1990 (World Bank, 2016).

The GDP of Ghana was USD 25.0 billion in 1980 and increased to a record USD 47.8 billion in 2013 and again started to decline to its current level of USD 42.8 billion in 2016, and ranked 87 globally. The GDP per capita was USD 1, 369.70 billion in 2016, positioning Ghana at ranked number 145 in the world in terms of economic development. The real GDP growth rate in Ghana was 0.5% in 1980, and increased to its highest level of 14% in 2011, and again started to decline to 3.3% in 2016 (IMF, 2017).

The IMF (2017) data also showed that GDP per capita in Ghana in PPP terms was USD120.8 billion in 2016, which places Ghana at rank 137 in the world. The 2016 estimate of 2015 value of the Human Development Index for Ghana was 0.579, ranked 139 in the world. Ghana has undertaken measures to ensure extensive reform with a view of putting its economy in good footing. The Ghanaian economy has been growing at above 7% since 2007. Growth has been driven mainly by the service and industrial sectors. The country registered a very remarkable growth of 15% in 2011 with the commencement of crude oil production. In 2015, the Ghanaian economy grew at an estimated 3.7%, down from 4% in 2014. The 2015 slowdown resulted from a number of economic challenges, most of which were in play in

2014. These include a 3-year power crisis, rising fiscal deficit and public debt levels, a significant external sector deficit and unpredictably low world market prices for the country's oil and gold exports (World Bank, 2016).

The total value of imports from the rest of the world into Ghana in 2015 was 55.4% of its GDP, while exports of goods and services from Ghana to the rest of the world were 43.85% of its GDP. For the exports indicator, Ghana ranked at place 80 globally. This indicates a relatively open economy. Ghana was the 92nd largest export economy in the world (World Bank, 2016). The trade balance of Ghana, that is, the value of exports minus imports, was -9.4% of GDP in 2016. An even more useful indicator is the Current Account balance which includes the trade balance as well as income received or sent by the country and gifts and foreign aid. The value for Ghana was -2.756% of GDP in 2016. This made Ghana No. 150 in world rankings according to Current Account Balance (US Dollars) in year 2016. Ghana was at rank 111 in the Global Competitiveness Index with a value of 3.71 points, and 108th in 2016 on the Ease-of-Doing-Business (World Bank, 2017).

The average value of trade openness measured as exports plus imports as percentage of GDP for Ghana during that period from 1970 – 2016 was 57.69% with a minimum of 6.32% in 1982 and a maximum of 116.05% in 2000 (IMF, 2017). Foreign direct investment into Ghana was 3.36 billion USD in 2014 which was 8.5% of GDP. In 2013, for example, apart from Nigeria (the largest oil producer in the sub-region), oil production in Ghana and Cote d'Ivoire attracted considerable investment from foreign transnational corporations (TNCs), Royal Dutch Shell (United Kingdom), ExxonMobil (United States), China National Offshore Oil Company (CNOOC) and China National Petroleum Corporation (CNPC), as well as from state-owned petroleum companies in Thailand and India (World Bank, 2017). Ghana's logistics performance index (LPI) in 2016 was 88 with a score of 2.66.

The development of the banking system, a key part of the financial system of any country, is reflected in the level of credit to the private sector as percentage of GDP. Credit allows firms to expand their production and to improve their technology. It also allows households to spread large expenses over time such as for a house, vehicles or education. The average value for the world for that indicator was about 45% of GDP. Values below 15% of GDP are considered very low whereas values in excess of 100% of GDP bring no additional benefit to the economy. According to the International Monetary Fund, the value of that indicator for Ghana is 18.84%, rank 136 in the world (IMF, 2017).

In terms of access to banking services, we can look at the number of ATMs per 100,000 people, an indicator in the IMF's database on financial development. For Ghana, the IMF reports 8.20 automated teller machines (ATM) per 100,000 people which placed Ghana at rank 128 globally (IMF, 2017). The Stock Exchange of Ghana was one of the largest in Africa, with a market capitalization of Ghanaian Cedi, GH¢ 57.2 billion or Chinese Yuan, CN¥ 180.4 billion in 2012 (IMF, 2017).

The rule of law in Ghana was scored at 0. 58 in 2016 rank 44 globally (World Bank, 2017). The Transparency International Corruption Perception index report for 2016 showed that the value of that indicator for Ghana was 48 which placed the country at 70th position in the world. The "Civil Liberties" index score for Ghana in 2015 was 4, with aggregate score of 83 (the range is from 1 (strong civil rights) to 7 (weak civil rights).

2.2.2.1 Trade Policy Features and Trends in Ghana

Ghana joined the General Agreement on Tariffs and Trade (GATT) in October 1957 after attaining independence in March 1957 and became a founding member of the World Trade Organization (WTO) in 1995. Ghana is committed to the tenets of the Multilateral Trading System (MTS) and steps are being taken to implement WTO-consistent policies. Ghana is also committed to regional integration, and grants tariff preferences on many products to other members of the Economic Community of West African States (ECOWAS), subject to rules of origin. Ghana eliminated tariffs on most trade with ECOWAS members by 1996, under the Community's Trade Liberalization Scheme. A customs union and common market among ECOWAS members are also planned.

As a member of the Organization of African Unity, Ghana remains committed to the formation of the African Economic Community, including the creation of a pan-African economic and monetary union. As a signatory to the ACP-EC Partnership Agreement (the successor to the Lomé Convention), Ghana receives non-reciprocal tariff and other preferences from the European Union on many goods, as well as substantial financial assistance.

Ghana receives generalized system preferences (GSP) treatment from industrialized economies, and participates in the Global System of Trade Preferences (GSTP) among developing countries. The 1973-1983 periods could be viewed as one of a breakdown of the system of controls. Various experiments with controls were tried during this period. These included: variable purchase taxes, selective import duties, ad-valorem license levies, differential credit restrictions for exports and imports, an outright prohibition of the importation of all textiles and textile goods in 1975 (UNCTAD, 2003).

The beginning of another import liberalization period began in 1983 with the introduction of the Economic Recovery Program (ERP), and the subsequent structural adjustment programme (SAP). ERP, covering roughly 1983-1986, was intended to stabilize the economy. On the other hand, SAP was designed to effect long-term sound structural changes in the economy. The era witnessed a dramatic devaluation of the effective exchange rate. For example, the ratio of parallel to the official exchange rate was 22 in October 1983; by December 1985, it had been reduced to 3 and to roughly 2 by January 1986 (World Bank, 1989).

The tariff remains Ghana's main trade policy instrument. The simple average tariff had fallen from 17% in 1992 to 13% on January 2000, when the highest duty rate, levied on consumer goods, was reduced from 25% to 20%. Although "temporary", no time limits were specified for the removal of the import tax. Doing so would improve Ghana's tariff structure by reducing average duty levels and narrowing relatively wide disparities across rates; the standard deviation of tariffs is currently 12%. Special import taxes have been a common feature of Ghana's tariff. The previous duty of 17.5% had only been abolished in March 1999.

Ghana's tariff structure, with rates of 5%, 10%, 20% and now 40% (with the special import tax), has "built-in" tariff escalation within certain manufacturing groups, especially textiles, leather, chemicals, basic metals, food, beverages, and tobacco. Lower, more uniform duties could improve the tariff structure. All tariff duties are ad valorem, thus aiding transparency. But the widespread use of discretionary exemptions, often administered under poorly specified authority, is non-transparent and risks providing "tailor made" protection to some industries.

The financial sector reform program (FINSAP) was implemented during 1989-1990, intended to strengthen and reform the banking system. A Stock Exchange was also begun in November 1990. From April 2000, Ghana replaced mandatory pre-shipment inspection with destination inspection, performed by two private contractors. Documentation requirements were also simplified and more targeted inspections introduced to facilitate imports. A 1% inspection fee on imports and an ECOWAS customs levy of 0.5 % apply. Ghana applies few formal non-tariff trade barriers. Imported motor vehicles older than ten years – previously subject to penalty tariffs – were banned in 2000. Certain import prohibitions and controls apply for environmental, health, public safety, and security reasons, and under international conventions. Ghana applies no trade embargoes, nor any local-content requirements for domestic production. Mandatory standards, set by the Ghana Standards Board, mainly in line with international norms, do not discriminate against imports. Ghana has no legislation on contingency protection measures, such as anti-dumping, countervailing, and safeguards. However, the special import tax appears to be used for these purposes (UNCTAD, 2003).

Export taxes are levied on cocoa and certain air-dried sawn timber. Gold and diamonds from small-scale mining are exported mainly by the Precious Minerals Marketing Corporation. Exports of logs were suspended in 1995, aimed mainly at promoting timber processing. Raw rattan (Manila) and bamboo exports are also prohibited. Ghana has no export quotas or voluntary export restraints, and no export subsidies. Products are also eligible for company income tax rebates tied to their export share: the maximum rebate of 75% – for companies exporting at least 25% of their production – also lowers their income tax rate to 8%. More generous income tax incentives, including an additional ten-year tax holiday, now apply to designated free-zone enterprises, which must export at least 7% of production. Benefiting firms can be located outside the free zones. Substantial leakage of domestic sales above the 30% permitted share appear to be arbitrarily undermining tariff protection to domestic industries, and facilitating tax evasion. Ghana has no production subsidies. Certain, mainly agricultural, activities are assisted by tax concessions, including on investment. Cocoa income is exempted from tax, and tax holidays of five years apply to most farm and fishing income and tree crops. Hotel income is taxed at a concessionary rate of 25% and hotels receive duty concessions on certain imported inputs. FDI, outside mining, fishing and forestry is no longer screened, but monitored by the Ghana Investment Promotion Centre, formed in 1994. Only a few activities, including petty trading and taxi services are reserved for Ghanaians, while joint ventures are optional (UNCTAD, 2003).

Cocoa production, a mainstay of the economy, is marketed by the statutory board, COCOBOD. Cocoa marketing is being further liberalized under the government’s efforts to revitalize the industry. Exports of logs are suspended and exports of certain sawn timber are taxed to promote value-added activities and conserve forests. Logging rates exceed sustainable levels, accentuated by substantial illegal felling. Offshore fishing licenses are granted only to fully domestic-owned boats using mainly Ghanaian crew, except for tuna vessels where minimum domestic ownership of 25% is required (UNCTAD, 2016).

Large-scale mining is open to foreign participation and there are no production subsidies. Joint ventures are not required, but the Government received 10% equity and could buy 20% equity at "fair market prices". Royalty rates and foreign currency retention allowances are negotiated on a mine-by-mine basis. Certain, mainly agricultural, activities are assisted by tax concessions, including on investment. Cocoa income is exempt from tax, and tax holidays of five years apply to most farms and fishing income, and of ten years for tree crops. Hotel income is taxed at a concessionary rate of 25% and hotels received duty concessions on certain imported inputs (UNCTAD, 2015).

Ghana generally applies its trade policies and measures on a non-discriminatory basis, granting at least most favoured nation (MFN) treatment to all its trading partners (UNCTAD, 2014). Pursuing MFN liberalization while expanding its bilateral arrangements and deepening regional integration, would maximize benefits, and help guard against any possible trade diversion. Government procurement is increasingly being decentralized away from the Ghana Supply Commission.

2.2.3. The Economy of Nigeria

Nigeria, officially known as the Federal Republic of Nigeria, is a country that is located in West Africa. Nigeria got her independence in 1960, and features thirty six (36) states and its federal capital territory, which is known as Abuja. Nigeria has a land mass of 923,768 sq.km, and is bordered to the north by the Republics of Niger and Chad; it shares borders to the west with the Republic of Benin, while the Republic of Cameroun shares the eastern borders right down to the shores of the Atlantic Ocean which forms the southern limits of Nigerian territory. The 800km of coastline confers on the country the potentials of a maritime power. Land is in abundance in Nigeria for agricultural, industrial and commercial activities. The total population of Nigeria is estimated at 187 million with growth rate of 2.63% in 2016, which ranked 7th in the world (World Bank, 2017). Nigeria is a middle income mixed economy and emerging market, with expanding manufacturing, financial services, communications, and technology and entertainment sectors.

Nigeria is one of Africa's largest economies and it's a leading oil exporter, with the largest natural gas reserves, and produces a large proportion of goods and services for the West African sub-continent. Other export commodities are cocoa, rubber, tobacco, processed foods, leather, aluminium alloys and other minerals. Nigeria’s top imports are military hardware, industrial equipment and machinery, electronics, automobiles, and refined petroleum products. Main export partners of Nigeria are India, Spain, the Netherlands, South Africa and Brazil; while its main import partners are China, the United States, India, Belgium and the Netherlands.

According to the International Monetary Fund (IMF, 2017) which publishes a range of time series data on a wide range of world economic and financial indicators, the Gross Domestic Product (GDP) of Nigeria increased from United States Dollars (USD) 60.1 billion in 1991 to USD 67.8 billion in 2000. In 2014, Nigeria recorded its highest GDP of USD568.50 billion, but declined to USD 493.8 billion in 2015 and USD 415.10 billion in 2016, ranking 26th in the world. The GDP per capita for Nigeria in 2016 was USD 2,640.29 positioning Nigeria at rank number 132 in the world in terms of economic development.

According to the World Bank (2017), the total value of imports of goods and services by Nigeria from the rest of the world was 11% of the country's GDP, the same as exports of goods and services from Nigeria to the rest of the world was also 11% of its GDP. For the exports indicator, Nigeria ranked 144 globally.

The Competitiveness index of the World Trade Organization (WTO) is used to measure international competitiveness. The index ranks countries on a 1 - 7 scale and reflects the stability of a country, its health, education, market efficiency, financial market sophistication, technological readiness, market size, and innovation. For that indicator, Nigeria was ranked 127 in the world with a value of 3.44 points (IMF, 2017).

The average value of trade openness measured as exports plus imports as percentage of GDP for Nigeria during that period 1970 – 2016 was 47.02%, with a minimum of 16.81% in 2016 and a maximum of 81.81% in 2001 (IMF, 2017). Foreign direct investment into Nigeria was USD 5.12 billion in 2016 which was 0.7% of GDP, which suggested that the country was an attractive foreign direct investment destination.

Logistics Performance Index (LPI) overall score reflects perceptions of a country's logistics based on efficiency of customs clearance process, quality of trade and transport-related infrastructure, ease of arranging competitively priced shipments, quality of logistics services, ability to track and trace consignments, and frequency with which shipments reach the consignee within the scheduled time. The index ranges from 1 to 5, with a higher score representing better performance. Nigeria was ranked 90 in 2016 with LPI score of 2.63.

The development of the banking system, a key part of the financial system of any country, is reflected in the level of credit to the private sector as percentage of GDP. Credit allows firms to expand their production and to improve their technology. It also allows households to spread large expenses over time such as for a house, vehicles or education. The average value for the world for that indicator was about 45% of GDP. Values below 15% of GDP are considered very low whereas values in excess of 100% of GDP bring no additional benefit to the economy. According to the International Monetary Fund, the value of that indicator for Nigeria was 14.49%, and ranked 145 in the world (World Bank, 2017).

In terms of access to banking services, we looked at the number of automated teller machines (ATMs) per 100,000 people, an indicator from the IMF's database on financial development. For Nigeria, the IMF reported 16.05 automated teller machines (ATM) per 100,000 people in 2014 which placed Nigeria at rank 115 globally (IMF, 2017).

The other main component of the financial system is the stock market. Like banks, it serves to channel the free money in the economy (savings) to various business projects. The size of the stock market in Nigeria is measured by its so-called capitalization, that is, the number of outstanding shares times their prices, as percentage of GDP. For Nigeria, that indicator had a value of 11.16% of GDP (IMF, 2017). The capitalization of a stock market measures its volume but not necessarily its activity. Some countries have large stock markets where relatively few large companies are listed and whose shares are seldom traded. For the activity of stock markets we look at the so-called turnover ratio: the total value of shares traded during a period divided by the average market capitalization for that period. The turnover ratio in Nigeria was 8.17%. As a reference, the stock market turnover ratio in the very active stock markets is about 100% or higher while in the least active stock markets it was below 20% in Nigeria (IMF, 2017).

The World Justice Project publishes a very useful index called "Rule of Law" that captures perceptions of the extent to which people in Nigeria and other countries have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. The index has been compiled for many years and is comparable across countries. It ranges from -2.5 (weak rule of law) to 2.5 (strong rule of law). The rule of law in Nigeria was scored at 0.44 in 2016, and ranked 96 globally (World Bank, 2016).

Transparency International is an NGO that has tracked the perceptions of corruption in many countries for many years. For each country, they collect data from multiple surveys and produce a composite measure: the "Transparency International Corruption Perceptions Index." The index ranges from 0 (pervasive corruption) to 100 (no corruption). Based on 2016 data, the value of that indicator for Nigeria was 28 which placed the country at position 136th in the world; and 169th in 2016 on the Ease-of-Doing-Business by the World Bank (World Bank, 2017).

The "Civil Liberties" index published annually by the Freedom House measures the freedom of expression and belief, associational and organizational rights, rule of law, and personal autonomy and individual rights. The range is from 1 (strong civil rights) to 7 (weak civil rights). On that count, the score for Nigeria in 2015 was 5; with aggregate score of 48 (a larger aggregate score indicates a greater level of freedom) (World Bank, 2016).

2.2.3.1 Trade Policy Features and Trends in Nigeria

Nigeria became a founding member of World Trade Organization (WTO) with the coming into effect of the Marrakech Agreement establishing the organization, in January 1995. However, Nigeria's involvement in the multilateral trading system dates back to 1960, when the country formally joined the then, General Agreement on Tariffs and Trade (GATT). The key objective of WTO is continuous liberalization of global trade rules which aimed at greater reduction of tariff and non-tariff barriers. WTO is guided by the principle of non-discrimination and increased tariff bindings. Nigeria is committed to regional integration, and grants tariff preferences on many products to other members of the Economic Community of West African States (ECOWAS), subject to rules of origin. Nigeria eliminated tariffs on most trade with ECOWAS members by 1996, under the Community's Trade Liberalization Scheme. A customs union and common market among ECOWAS members are also planned (UNCTAD, 2003).

The 1960s and early 1970s saw the application of tariff on exports such as cocoa, rubber, cotton, palm oil, palm kernel and groundnut. Trade policy between 1970 and 1976 assumed a less restrictive stance ostensibly because of demands necessitated by the post-war reconstruction. The central objective of trade policy was to provide protection for domestic industries and reduce the perceived dependence on imports. From 1986, Nigerian government took a significant shift in trade policy towards trade liberalization. This is attributable to the adoption of structural adjustment programmes (SAP). The period provided for a seven-year (1988-1994) tariff regime with the objective of achieving transparency and predictability of tariff rates. Imports under this regime attached ad valorem rates. A new seven-year (1995-2001) tariff regime succeeded the previous regime. Government introduced and continued to administer a number of far reaching economic measures and institutional support arrangements aimed at promoting non-oil exports. These measures among others include the following: (1) Exchange rate devaluation: the Nigerian currency was devalued to make her export cheaper in the international market. This was expected to increase the demand for these exports in the international market. (2) Other Institutional support: first, introduction of import duty drawback which allows importers to claim repayment of the import duty paid on raw materials used in producing export goods. Secondly, Manufacture-in-bond scheme which allows the clearance of imported raw materials for use in export production without repayment of import duty. Thirdly, in 1990, the Act establishing the Nigeria Export Promotion Council (NEPC) was passed. It was later established with the major role of provision of grants to exporters for export expansion. Fourthly, Nigerian Export Import Bank (NEXIM) was established in 1991 as an export credit agency with the broad objective of attaining overall export growth as well as structural balance and diversifying the composition and destination of Nigerian exports. Five, in 1991, the Federal Government promulgated Nigeria Export Processing Zone Decree No. 34. Later, the Export Processing Zone located in Calabar was established. To encourage investment, Nigeria provided a broad range of incentives nearly all of which were tax or import-tariff related and applied to enterprises producing for the domestic, as well as export markets. In addition, 11 export processing zones were established and are overseen by the Nigerian Export Processing Zone Authority (Echekoba, Okonkwo and Adigwe, 2015). Six, in order to improve services for investors the One-Stop-Investment Centre was opened in the Nigerian Investment Promotion Commission in March 2006. The Centre brings together the agencies responsible for the processes, procedures, and requirements for business entry permits, licenses, and authorizations in order to reduce the cost of a business entering and establishing in Nigeria by simplifying procedures and speeding up the processing of application forms. And lastly, Customs procedures have been simplified over the last six years (from 2010) with the introduction of improved systems and increased automation (World Bank, 2016).

From 2003 to 2007, Nigeria attempted to implement an economic reform program called the National Economic Empowerment Development Strategy (NEEDS). The purpose of the NEEDS was to raise the country's standard of living through a variety of reforms, including macroeconomic stability, deregulation, liberalization, privatization, transparency, and accountability. A related initiative on the state level is the State Economic Empowerment Development Strategy (SEEDS).

2.3 Theoretical Framework

The interrelationship of the theoretical paradigms of international trade based on the results of the Ricardian comparative advantage theory with its modification by the Heckscher-Ohlin factor-endowment hypothesis, and the Solow’s (1956) economic growth theory with its extension by the endogenous growth model is the theoretical framework on which this study is based. The international trade theories consider trade openness as a catalyst to economic growth, while economic growth theories approach the openness-growth nexus from the perspective of factor productivity.

2.3.1. The Ricardian Comparative Advantage Theory

Ricardo (1817) developed the theory of comparative advantage and showed rigorously in his published book *Principles of Political Economy and Taxation* (1817), that on assumptions of perfect competition and full employment of resources, countries can reap welfare gains by specializing in the production of those goods with the lowest opportunity cost over domestic demand. Ricardo further argued that even when one country has an absolute advantage in the production of two goods against another country; it might still be more beneficial to both countries if each of them specializes in the production of only one of the goods. Ricardo opined that a country can produce and export a particular commodity in which it has comparative advantage, while importing a commodity in which it has comparative disadvantage and thereby maximize its welfare. Such specialization and trade makes both countries potentially better off by expanding their consumption opportunity sets. In other words, the static gains from trade are measured by the excess cost of import substitution, by what is saved by not producing the imported good domestically. The resource gains can then be used in a variety of ways including increased domestic consumption of both goods.

The classical comparative advantage theory of free trade is a static model based strictly on a one-variable-factor (labour cost) - complete specialization approach to demonstrating the gains from trade. This nineteenth century free trade model, primarily associated with David Ricardo and John Stuart Mill, was modified and redefined in the 20th century by two Swedish economists, Heckscher and Ohlin in their study on *Interregional and International Trade* published in 1933, taking into account differences in factor supplies mainly; land, labour and capital on international specialization. The Heckscher-Ohlin (H-O) neoclassical (variable proportions) factors endowment trade theory also enables us to analyze the impact of economic growth on trade patterns, and the impact of trade on the structure of national economies and the differential returns or payments to various factors of production.

Unlike the classical labour cost model, however, where trade arises because of fixed but differing labour productiveness for different commodities and for different countries, the neoclassical factor endowment model, assumes away inherent differences in relative labour productivities by postulating that all countries have access to the same technological possibilities for all commodities (Heckscher, 1949). The H-O theory assumes that, if domestic factor prices were the same, all countries will use identical methods of production and will therefore have the same domestic product price ratios and factor productivities. The basis for trade arises not because of the inherent technological differences in labour productivity for different commodities for different countries but because countries are endowed with different factor supplies. Given relative factor endowments, relative factor prices will differ (e.g. labour will be relatively cheap in labour abundant countries), and so will domestic commodity price ratios and factor combinations. The H-O model conclude that, countries with cheap labour will have a relative cost and price advantage over countries with relatively expensive labour in commodities that make intensive use of labour (e.g. primary products). They should therefore focus on the production of these labour intensive products and export the surplus in return for import of capital intensive goods.

Conversely, countries well-endowed with capital will have a relative cost and price advantage in the production of manufactured goods, which tend to require relatively large inputs of capital compared with labour intensive products from labour abundant countries. Trade, therefore, serves as a vehicle for the nation to acquire large inputs of those resources while relieving its factor shortage through the importation of commodities that use large amount of its relatively scarce resources.

The Heckscher-Ohlin model just as the Ricardian type employed a *static* framework in the sense that resources and technology employed in production are exogenous in the models. Free trade is then seen to promote efficiency through the division of labour and redistribution of productive activity across countries, thereby, moving the world economy towards the international production frontier. Technology is ascribed a role in determining trade patterns, but the reverse arrow of causality is not taken into consideration by the neoclassical trade models. The emphasis is on the *effects* of technological disparities rather than its *causes* (Grossman & Helpman, 1995). This has, however, not totally invalidated the Heckscher-Ohlin model as the factor endowment theory makes the important prediction that international real wage rates and capital costs will gradually tend towards equalization. In recent years, many highly paid manufacturing workers in the more developed countries were worried that freer trade and greater international competition will drive their wages down to the LDCs.

One early study of the validity of the Heckscher-Ohlin theory was carried out in 1953 by Wassily Leontief, a Russian-born US economist. Leontief observed that the United States was relatively well-endowed with capital as compared to other countries. According to the theory, therefore, the United States should export capital-intensive goods and import labour-intensive goods. Leontief found out that the opposite was the case. United States exports were generally more labour-intensive than the type of products that the United States imports. Because his findings were opposite of those predicted by the H-O model, this discovery is popularly referred to as the **Leontief paradox**.

Although the comparative advantage tradition started being challenged as not fitting the reality as far back as in 1950's, more serious attacks increased and became relevant from 1980's. Theories under this tradition became inadequate in explaining some of the realities of international trade. This is based on the fact that their assumptions are simplified and they do not consider some issues such as the relevance of economies of scale which are very pertinent in explaining international trade patterns (Mbogela, 2015). Comparative advantage tradition relies on constant return to scale which is irrelevant to the fast global trade transactions.

The world trade volume is more concentrated between economies of similar size and technology, something which omits the relevance of trade explained by the comparative advantage tradition. Today trade between dissimilar economies accounts to a very small percentage of the total global transactions. Countries transact in similar kind of products, as taste and preference matters a lot in explaining the pattern of trade, and not comparative advantage any more. To a great extent the assumption that countries will produce and trade dissimilar products only is not a reality anymore.

Despite the criticism of the comparative advantage theories for failing to explain the current trend and patterns of international trade, they contain an explanation that is relevant to international trade; they only fail to explain the modern issues in international trade. Overtime there has been a number of modern international trade theories that have emerged that take into account such factors as government involvement and regulation. Researchers such as Grossman & Helpman (1995) and Krugman (1979) developed explanations in order to account for some facts like the increased ratio of global trade to GDP, and trade being more concentrated among industrialized countries and the fact that trade among industrialized countries is largely intra-industry trade. However, new trade theories or intra-industry theories were specifically developed to explain these facts particularly by introducing the concepts of economies of scale and imperfect competition. Imperfect competition may take the form of monopoly (a market with only one seller); or oligopoly where few sellers operate in the market. And these give rise to two kinds of models under intra-industry trade that can explain international trade taking place in similar economies. Therefore, though in countries with similar production characteristics, international trade in this sense makes countries better off due to, increasing returns, economies of scale by firms, just as consumers will be able to simultaneously consume more varieties of firms' products at lower cost.

2.3.2 Economic Growth Theories

The study of economic growth and development has been dominated by the traditional neoclassical growth theories. One of the principal strategies of development necessary for any take-off was the mobilization of domestic and foreign saving in order to generate sufficient investment to accelerate economic growth. The economic mechanism by which more investment leads to more growth can be described in terms of the Harrod-Domar growth model (Todaro & Smith, 2009).

2.3.2.1 Solow's Economic Growth Theory

Robert Solow, an American economist, in his treatise, *A contribution to the theory of economic growth* published in 1956, expanded on the Harrod-Domar formulation by adding a second factor, labour, and introducing a third independent variable, technology to the growth equation. Solow postulates a continuous production function linking output to the inputs of capital and labour which are substitutable. Unlike the fixed-coefficient, constant-return-to-scale assumption of the Harrod-Domar model, Solow's neoclassical growth model exhibited diminishing returns to labour and capital separately and constant returns to both factors jointly. Technological progress became the residual factor explaining long-term growth, and its level was assumed by Solow to be determined exogenously, that is, independently of all other factors.

The Solow's growth theory is a multi-factor productivity model which assumes only one commodity, output as a whole, whose rate of production is designated *Y (t*). This output can unambiguously be referred to as the community's real income. Part of each output produced at any given time is consumed and the rest is saved and invested. The fraction of output saved is constant, so that the rate of saving is $sY(t)$. The country's stock of capital $K(t)$ takes the form of an accumulation of the composite commodity. Net investment is then just the rate of increase of this capital stock dK/dt or K, so we have the basic identity at every instant of time:

$K = sY$ ………………………………………… *(2.*3)

Output is produced with the help of two factors of production, capital and labour, whose rate of input is $L(t)$. Technological possibilities are represented by a production function

$Y = f(K, L)$ …………………………………………. *(2.4)*

Output is to be understood as net output after providing for the depreciation of capital. Constant return to scale is the natural assumption of Solow's theory of growth.

The production function is homogeneous of first degree, as it shows constant return to scale. This amounts to assuming that there is no scarce non-augmentable resource like land. The scarce-land case would lead to decreasing returns to scale in capital and labour and the model become more Ricardian (Solow, 1956).

The Solow model is so straight forward. It does not include government, multiple goods, changes in employment, natural resources, geography and social institutions, globalization, which are main features the model ignores. It is, however, this simplification that allows us to better understand the role of capital, labour and knowledge in our study of economic growth.

Predictions of the model: If the Solow model is correct, and if growth is due to capital accumulation, we should expect to find that

(i) Growth will be very strong when countries first begin to accumulate capital, and will slow down as the process of accumulation continues, like the case of Japanese growth which was stronger in the 1950s and 1960s than it is now.

(ii) Countries will tend to converge in output per capita and in standard of living. As Hong Kong, Singapore, Taiwan, Thailand, Malaysia, accumulate capital, their standard of living will catch up with the initially more developed countries. When all countries have reached a steady state, all countries will have the same standard of living (at least if they have the same production function, which for most industrial goods is a reasonable assumption).

Certainly there is some evidence in favour of these predictions. However, there are some problems as well:

(i) The US growth rate was lower, at least on per capita basis, in the 19th century than in the 20th century.

(ii) The Soviet Union under Stalin saved a higher percentage of national income than the US. Because of the higher savings rate and because it started from a lower level of capital, it should have caught up very rapidly. It did not.

(iii) Less developed countries, with some exceptions such as Taiwan, Korea, Singapore and Hong Kong are not (in general) catching up to the developed countries. Indeed, in many cases, the gap is increasing.

But these facts do not necessarily mean that Solow's model is wrong, since increase in output per capita can be due to an increase in multi-factor productivity as well as an increase in capital per worker. The cornerstone of the traditional neoclassical theory of growth is the free-market assertion that liberalization (opening up) of national markets draws additional domestic and foreign investment and thus increases the rate of capital accumulation. In terms of GDP growth, this is equivalent to raising domestic savings, which enhances capital-labour ratios and per capita income in capital-poor developing countries.

According to the neoclassical growth theory, output growth results from one or more of three factors: increases in labour quantity and quality (through population growth and education), increases in capital (through saving and investment), and improvements in technology (Todaro & Smith, 2009). Closed economies (those with no external activities) with lower savings rates (other things beign equal) grow more slowly in the short run than those with high savings rates and tend to converge to lower per capita income levels. Open economies (those with trade, foreign investment, etc.), however, experience income convergence at higher levels as capital flows from rich countries to poor countries where capital-labour ratios are lower and thus return on investment are higher.

2.3.2.2 Endogenous Growth Theories

The endogenous growth theory holds that investment in human capital, innovation, and knowledge are significant contributors to economic growth (Romer, 1994). The theory also focuses on positive externalities and spillover effects of a knowledge-based economy which will lead to economic development. The endogenous growth theory primarily holds that the long run growth rate of an economy depends on policy measures. For instance, subsidies for research and development (R&D) or education increase the growth rate in some endogenous growth models by increasing the incentive for innovation.

The pioneering work by Mankiw, Romer and Weil (1992) (henceforth MRW) in the application of the neoclassical growth models in empirical specifications on cross-country analysis, contributed substantially to the neoclassical revival. MRW as an extension of the Solow (1956) framework introduced a variant model drawn from new "endogenous" growth literature that considers human capital, which enhances labour productivity and can boost growth. Abstracting from all detail and focusing on the simplest case with three factors of production, we have

$$Y_t = K_t^{\alpha} H_t A_t L_t^{1-\alpha-\beta} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2.5)}$$

where Y_t is output in time t, K_t is capital in time t, H_t is the stock of human capital in time t, A_t is the level of technology in time t, and L_t is labor in time t. MRW assume that $\alpha+\beta<1$,which means there is decreasing returns to all capital. (If $\alpha+\beta=1$, there are constant returns to scale in the reproducible factors). The steady state of capital-labour ratio is related positively to the rate of savings and negatively to the rate of population growth. The evolution of the economy is determined by

$k_t = s_k y_t$ - (n + g +δk_t)……………………… (2.6a)

$h_t = S_h y_t$ - (n + g + δh_t)………………………..(2.6b)

Where y = Y/AL, k = K/AL, and h = H/AL are quantities per effective unit of labour. S_k the fraction invested in human capital. L and A is assumed to grow exogenously at rates n and g, δ is the rate of depreciation of physical capital stock.

MRW used regression analysis to demonstrate that their specification of a human capital augmented Solow model provides an excellent description of cross-country data. The study concludes that allowing for human capital eliminates the worrisome anomalies-the high coefficients on investment and on population growth that arise when the textbook Solow model is confronted with data. MRW assume that the same production function applies to human capital, physical capital, and consumption. In other words, one unit of consumption can be transformed without incurring costs into either one unit of physical capital or one unit of human capital. In addition, MRW also assumed that human capital depreciates at the same rate as physical capital.

The MRW findings have generated a large body of subsequent empirical research that discusses the robustness of this result and, implicitly, the empirical relevance of the Solow model. The major counter-evidence, comes from a paper by Klenow & Rodriguez-Clare (1997) (henceforth KRC) who were motivated by endogenous growth theories of Romer (1990), Grossman & Helpman (1995) aimed at addressing cross-country income differences through differences in ideas/technology across countries; and the neoclassical studies of MRW (1992), Young (1994, 1995), Barro & Sala-i-Martin (1995) which suggested that physical and human capital can explain income differences. KRC reexamined the MRW's methodology of estimating human capital, and update their data and added data on primary and tertiary schooling which were not available earlier. As an input, KRC finds that production of human capital is more labour-intensive and less physical-capital intensive than is the production of other goods. This further narrows country differences in estimated human capital stock. The findings also indicate that differences in productivity explain the overwhelming majority of growth rate differences during 1960-1985 (the period of MRW study) in GDP per worker.

In a review of by Gundlach (2007), empirical results indicated that the former specification by KRC can summarize the data quite well by using a measure of institutional technology and treating the capital-output ratio as part of the regression constant. Gundlach opined that there are different possibilities to derive empirical specifications from the Solow model. A Cobb-Douglas production function with Harrod-neutral technology is an obvious possibility to begin with. Therefore, dividing equation (2.5) above by L with $Y / L = y$ and $K / L = k$, taking logs, and rearranging terms in a way to have the capital output ratio on the right-hand side gives

$lnY = lnA + \alpha\ (1\text{-}\alpha\ ) + \ln\ (k/y) + \varepsilon$ ……………………………. (2.7)

with ε as error term.

As already pointed out, one possible reinterpretation of equation (2.7) can be motivated by recent empirical studies of the role of institutions as a fundamental determinant of development (Hall & Jones, 1999; Acemoglu, Johnson & Robinson, 2001; Easterly & Levine, 2003; Rodrik, Subramanian & Trebbi, 2004). The institutional framework of a country may be considered as a "technology" that changes very slowly over time but differs substantially across countries. Given that the quality of institutions can be measured across countries, the variable A in equation (2.7) may be redefined to allow in principle for various country-specific "technology" variables, as informally suggested by Solow (2001). That is, A can be assumed to grow for each individual country i with the same constant rate g over time t (as in MRW), but at different levels which are determined by various factors X_i such that

$$A_{it}= A_o e^{gt} e^{\varphi Xik} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2.8)}$$

where A_o stands for the initial level of a narrow concept of technical knowledge that is the same for all countries, and X_k may capture factors k=1,...,I such as institutions and other potential determinants of development that differ across countries but remain fairly stable over time. Equation (2.8) suggests that persistent differences in X across countries would explain persistent differences across country-specific production functions, which in turn would shift over time due to the common constant rate g.

With this modification of the technology term A and by imposing the alternative restriction that the capital output ratio is part of the regression constant, equation (2.7) can be rewritten as

$$lnY_i = lnA_o + gt + \alpha/(1-\alpha)\ ln(k/y) + \varphi_k x_{ik} + \varepsilon_i \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(2.9)}$$

which reproduces the basic structure of the regression equations used by Hall and Jones (1999), Acemogolu, Johnson & Robinson (2001), Easterly & Levine (2003), and Rodrik, Subramanian & Trebbi (2004). By implicitly imposing a cross-country restriction on the capital output ratio rather than on the technology term, these studies reproduce the non-parametric accounting result of KRC with a parametric methodology, namely that international differences in a broad concept of technology account for international differences in output per worker.

Gundlach (2007) concluded that notwithstanding all sorts of empirical estimation problems, it appears that this result is much closer to the basic message of the Solow model than the results presented by MRW. This is not to suggest that the MRW specification of the Solow model is falsely based on factor accumulation as the decisive explanatory variable as

Gundlach (2007) observes. Hence it is probably fair to say that the cross-country growth literature as pioneered by MRW provide a basic framework on how theoretical models of growth, and especially the Solow model, can be translated into empirical specifications.

The endogenous growth model brought important progress to the theory of growth that effectively consisted progression of productivity, which is determined by an unexplained technical evolution, through an endogenous (dependent) process, determined by market forces. In this models, openness to trade provide access to imported inputs, which embody new technology, increase the size of the market faced by the domestic producers, which raises the returns to innovation, and facilitates a country's specialization in research-intensive production (Sarkar, 2005). The endogenous growth theory implication is that policies that embrace openness, competition, change and innovation will promote growth. Conversely, policies that have the effect of restricting or slowing change by protecting or favouring particular existing industries or firms are likely, over time, to slow growth to the disadvantage of the community.

The 1970s saw several pioneering attempts at systematic multi-country investigation of trade policy and economic performance in the developing countries. Studies by Little, Scitovsky, and Scott (1971) (for the OECD), Balassa (1972), Bhagwati (1988) and Krueger (1997) calculated effective rates of protection for several developing countries. These studies concluded that post-World War II protectionist policies had artificially encouraged industrialization, suppressed agriculture, and reduced exports by moving countries' production away from cost-based comparative advantages. While these studies did not directly calculate impacts on the rate of economic growth, they did argue that developing-country protectionism had suppressed savings and induced large-scale unemployment of labour and underutilization of capacity, all factors which would be expected to have direct consequences for economic growth.

2.3.3 Theoretical Linkage

Economic literature is replete with several explanations of the relationship between trade openness and economic growth. It is, however, not plausible to choose only one of the theories as best explaining the trade openness-growth nexus in developing countries. The international trade theory of comparative advantage holds that trade results in output growth and distribution of welfare across countries thereby introducing international trade as a main cause of economic growth. It predicts growth gains from trade openness at the country level through specialization, investment in innovation, productivity improvement, or enhanced resource allocation.

While international trade theory considers trade openness as a catalyst to economic growth, economic growth theory approaches the openness-growth nexus from the perspective of factor productivity. Economic growth theorists led by Solow's growth theory holds that open economies (those with trade, foreign investment) experience output growth as capital flows from rich countries to poor countries. The Solow model, like the Ricardian comparative advantage approach is a simplification of the role of capital, labour, knowledge and trade in the study of economic growth. Solow's model considers technological change as exogenous and consequently, trade policies do not impact economic growth. However, the endogenous growth theories assume that technological change is an endogenous variable and that economic growth policies can be combined with that of international trade. The endogenous growth theories has expanded the analysis to include the role of government, multiple goods, changes in employment, natural resources, geography, social institutions and globalization which are main features the Solow's model and the Ricardian model ignores.

The recent and more complex issue of trade openness call for a more dynamic analysis of the true relationship between trade openness and economic growth, particularly, in developing countries. Thus the interdependency of nations on the path to economic growth, and international differences can best be explained by international trade theories and the growth theories. As such none of the theories alone can be adopted in isolation for this study; hence the research model is built on the variant postulations of the international trade and economic growth theories.

2.4 Empirical Review

Economic theory does not offer clear predictions on the relationship between openness and growth; it therefore remains an empirical question. Thus, Khobai, Kolisi and Moyo (2018) investigated the relationship between trade openness and economic growth for Ghana and Nigeria covering the period between 1980 and 2016 incorporating trade openness, investment, exchange rate and inflation as regressors. The study employed the Augmented Dickey-Fuller and Phillips and Perron unit root tests and the autoregressive distributed lag technique for data estimation. The findings suggested existence of a long-run relationship among the variables for both countries. The results also showed that trade openness have a positive and significant effect on economic growth in Ghana while trade openness indicated a negative but insignificant effect on economic growth in Nigeria. The results however, indicated that trade openness has positive and significant impact on economic growth for both countries in the short run. The study recommended imports reduction and exports promotion strategies for Nigeria. Though the findings in Khobai, Kolisi and Moyo (2018) advances the researcher’s thinking substantially on the effect of openness on growth in Nigeria and Ghana, the research has some limitations. First, the estimation method used is subject to the problem of omitted variables and endogeneity bias. The choice of variables in the study is not consistent with the international trade and new economic growth hypotheses which emphasize the role of human capital and capital flow (FDI) across countries. Second, the scope of the study is limited to Nigeria and Ghana. Therefore, another useful extension of this research would be to include other relevant variables like FDI, human capital, and also include Cote d'Ivoire in a multi-country heterogeneous panel analysis.

Tozoke, Cheong and Junjun (2018) estimated the effect of foreign direct investment (FDI) on economic growth of nine (9) West African countries (including Nigeria, Ghana and Cote d'Ivoire) during the period of 1995 to 2015 using panel data approach with FDI, trade openness, government final consumption and inflation as variables. The results showed that FDI has a positive and significant effect on economic growth, while trade openness has a positive but insignificant effect on economic growth in West African countries. While the focus of this study is to measure the effect of FDI on economic growth, it does not take into consideration individual country differences that may influence outcomes, even as outliers of better performing economies and worse performing economies were not separated resulting to ambiguous findings. The results reported in this study are also clearly sensitive to the variables employed, for example, government final spending instead of investment, inflation instead of financial development variables (foreign exchange, credit to private sector), even as human capital – key determinants of FDI inflow are not included in the study.

Egbulonu and Ezeocha (2018) examined the relationship between trade openness and economic growth in Nigeria from the period 1990 – 2015 using the Granger causality tests and autoregressive distributed lag approach. The results of Granger causality test indicated unidirectional causality from GDP to FDI, trade openness to FDI, gross fixed capital formation to trade openness and exchange rate to gross fixed capital formation. The results indicated a long-run relationship between trade openness, FDI and gross fixed capital formation and economic growth. The results also indicated a positive relationship between trade openness and economic growth, and a negative relationship between gross fixed capital formation and economic growth. The study therefore recommended trade openness regulation and promotion of exports and FDI inflow. While the scope of the study is limited to Nigeria, the non-inclusion of human capital as a regressor is not consistent with the new economic growth literature which emphasizes the role of human capital in growth analysis. Therefore, another useful extension of this research would be to include human capital, and also extend the research to include Ghana and Cote d'Ivoire in a panel analysis.

Keho (2017) examined the impact of trade openness on economic growth for Cote d'Ivoire over the period 1965 – 2014 in a multivariate framework including capital stock, labour and trade openness as regressors. The study used the autoregressive distributed lag bounds test to cointegration and the Toda Yamamoto Granger causality tests. The results indicated that trade openness has positive effects on economic growth both in the short-run and long-run. Evidence from the results also indicated bidirectional causality between capital formation and trade openness in promoting economic growth in Cote d'Ivoire. The study, therefore, recommended increased reduction in trade barriers by simplifying procedures and controls, promotion of investments in capital intensive sectors and development of human capital. Despite the promising results, this study suffers from some limitations. First, the analysis has been conducted using trade at the aggregate level instead of trade composition in terms of goods and services. Second, the estimation method used is subject to the problem of omitted variables bias and endogeneity of some regressors. Therefore, another useful extension of this research would be to include other relevant variables like FDI, human capital and foreign exchange rate, and extend the investigation to cover Nigeria and Ghana in a cross-section panel approach.

Zahanogo (2017) investigated how trade openness affects economic growth in 42 Sub-Saharan African countries (including Cote d'Ivoire, Ghana and Nigeria) using a dynamic model with data covering 1980 to 2012. The study employed the Pooled Mean Group (PMG) estimation technique for the heterogeneous panels. The empirical evidence indicated that a threshold exists below which greater trade openness has beneficial effects on economic growth and above which the trade effect on growth declines, and the evidence is robust to alternative trade openness measures. The results suggested that trade openness may impact economic growth favourably, but the effect is not linear which suggest that the benefits of trade are not automatic. The results also show that an increase in secondary school enrolment rate is associated with a higher growth rate. Suggesting that trade policies must be accompanied by complimentary policies aimed at encouraging the financing of new investment, enhancing the quality of institutions, and the ability to adjust and learn new skills. The general approach is plausible more so as Nigeria, Ghana and Côte d'Ivoire are among the countries examined. However, the PMG estimation technique fails to explain the effect of each individual unit (country) of the cross-section of 42 countries, but have drawn general conclusions. In such situation, the cross-sectional homogeneity assumption is likely to be violated given the heterogeneity of economic conditions, even as the sub-Saharan countries operate under distinct continental sub-regions.

Kovarova (2017) evaluated the effects of economic globalization on developing countries cooperating within the Economic Community of West African States (ECOWAS) within the period 1980-2010 using statistical indicators based on identification of polynomial trends to investigate long-term trends. The comparison of countries' openness to trade is based on their average rates of the openness to trade using data from World Trade Organisation, United Nations Conference on Trade and Development, World Bank, International Monetary Fund and European Commission. The statistical evidence indicated that Cape Verde, Cote d'Ivoire, Mauritania and Nigeria were the most open countries with identified rising openness to trade within the specified period. The results also indicated that countries' trade patterns revealed weaknesses typical for all poor developing countries – low diversification of exports and important share of primary commodities in these exports. Kovarova (2017) provides an insight on the hypothesis that openness to trade of West African countries will have tendency to raise with long term effects on economic growth, the study is limited as it does not take into account other variables with significant influence on countries' openness to trade. Therefore, another useful extension of this research would be to include other relevant variables like investment, FDI, human capital and foreign exchange rate.

Briguglio and Vella (2016) examined the relationship between trade openness and GDP growth volatility, using annual data for 172 countries spanning the years from 2010 to 2014, and keeping other relevant variables constant. The ordinary least squares regression (OLS) estimation reflect the possibility that GDP growth volatility is influenced by trade openness, economic governance and political governance, the latter variable also proxy the stage of development. The panel data analysis convincingly showed that openness does lead to economic growth volatility, but good governance could attenuate and even reverse this effect. The main implication of these results is that countries that are highly dependent on international trade, including most small states, would be exposed to GDP growth volatility, which has various downsides. While Briguglio and Vella (2016) advances the researcher's thinking substantially on the effect of openness on growth, the sample period of the study is 5 years which is rather limited to fully account for long run growth dynamics.

Nwinee and Olulu-Briggs (2016) examined the relationship between trade openness, financial development and economic growth in Nigeria using annual time series data for the period 1981 – 2013. The study employed Granger causality test, Johansen cointegration test and Vector Error Correction Model for data estimation. The evidence from the results indicated bi-directional causality between real effective exchange rate and total trade; and unidirectional causality from GDP to total trade and total trade to FDI. The result also indicated short-run and long-run relationship between trade openness, real exchange rate, FDI and economic growth, while impulse response and variance decomposition test indicated both positive and negative shocks. The study recommended flexibility in policies, regulations in the financial sector and reforms in foreign policies to attract inflow of FDI. Despite the study been country specific, and limited to Nigeria, the choice of the regressors is also limited to trade openness, FDI and real exchange rate contrary to the new economic growth framework.Therefore, another useful extension of this research would be to include other relevant variables like investment and human capital.

Mputu (2016) investigated the relationship between terms of trade, trade openness and economic growth in sub-Saharan African (SSA) countries using the fixed and random effects models on 13 countries from 1980 to 2011. The study employed OLS regression for estimation of data for individual countries, and panel data analysis for cross-country estimations. The results of the analysis indicated a positive relationship between terms of trade, gross fixed capital formation and GDP level in SSA, while trade openness have a negative relationship with the GDP implying openness to international trade was not beneficial to SSA. The study concludes that diversification in exports seems to be the ideal solution for sub-Saharan Africa. The general approach is plausible more so as Nigeria, Ghana and Côte d'Ivoire are among the countries examined. However, labour force, investment and terms of trade were the only variables considered in the study which is rather limited to fully reflect on openness-growth dynamics.

Muhammad and Jian (2016) studied the association between openness and economic growth for 25 selected Muslim countries (including Nigeria) to explore the relationship among economies having different religion, economic and social characteristics. Employing random and fixed effect method with Pedroni and Kao cointegration test on the sample data for the period from 1974 to 2013, the findings indicated a positive and significant long run effect of trade openness on growth in the economies of the selected countries. The study is limited only to Muslim countries, though Nigeria is included, Ghana and Cote d’Ivoire were not considered in the analysis. Hence, the need for further research to consider other West

African countries, especially Ghana and Cote d'Ivoire that are ranked as open economies in West Africa.

Dissa (2016) employed descriptive statistics, regression and correlation analyses to examine the relationship between globalization and economic growth in Mali for the period from 2000 to 2014 using OLS regression for estimation. The results indicated negative relationship between globalization proxied by trade openness and economic growth in Mali. The study recommended political and economic reforms, improvement in critical infrastructure, particularly, communications to facilitate links with the outside world. This study is country specific and limited to Mali, while exchange rate, money supply, fiscal deficit inflation and political stability were the variables studied, which is limited in explaining the openness-growth nexus. The new economic growth framework considers key variables like trade openness, investment, FDI and human capital.

Zafar, Sabri and Khan (2016) examined the impact of foreign direct investment (FDI) and trade openness on economic growth in Pakistan using time series data for the period 1994 to 2014.The Johansen Cointegration and error correction model (ECM) techniques were applied to estimate the short and long run relationship of FDI and trade openness on economic growth. The result revealed that FDI has a short term positive and significant effect on GDP growth, but openness has a negative long run effect on GDP growth in Pakistan. The study recommended import substitution strategy to reduce the negative impact of excessive imports. Though this study indicated that foreign direct investment and trade openness have positive effect on economic growth in Pakistan, but the argument is as to whether this finding can be substantiated when examined in a panel of group of West African countries.

Vogiatzoglou and Nguyen (2016) examined three channels of economic openness, namely FDI, imports, and exports, their short-run and long-run effects on the economic growth in the five founding member countries of the Association of Southeast Asian Nations

(ASEAN) over the period from 1980 to 2014. Using the VECM co-integration framework, the findings indicated a long-run equilibrium relationship between economic openness and GDP in all ASEAN-5 economies (Indonesia, Malaysia, the Philippines, Singapore, and Thailand). FDI, imports and exports also have a significantly positive short-run and long-run impact on the economic growth of the ASEAN countries. While Vogiatzoglou and Nguyen (2016) advances the researcher's thinking substantially on the effect of openness on growth, it remains an empirical question as to whether the explanatory variables (FDI imports and imports) employed in this work are sufficient in explaining trade openness-growth issue. The new economic growth framework considers other key variables like trade openness, investment and human capital.

Hakimi and Hamdi (2016) suggested that trade liberalization boosted the economies of Morocco and Tunisia by creating new employment opportunities, but liberalization has harmed the ecological environment. Using annual time series data for the period from 1971 to 2013, the study applied a VECM and co-integration tests for single country case study and a panel VECM and panel co-integration for both countries as a group. The findings indicated bidirectional causality between FDI and carbon dioxide (CO_2). This implies that the nature of FDI inflows to Morocco and Tunisia were not clean FDI. Though this study has shown that bidirectional causality exist between FDI and carbon dioxide (CO_2), this is an implicit relationship which is not sufficient in explaining the relationship between trade openness and economic growth, aside the scope of the study been limited to the two North African countries of Morocco and Tunisia.

Ulasan (2015) investigated openness-growth nexus in a dynamic panel data framework for 129 countries by using various openness indicators over the sample period from 1960 to 2000. The study employed first-difference and system generalized method moments (GMM) for data estimation to asses various openness indicators. The study concluded that all openness measures, namely current openness, real openness, collected import duties and fraction of open years based on the Sachs and Warner (1995) liberalization dates are not robustly and significantly associated with economic growth, implying that trade openness by itself does not boost economic growth. The general approach of this investigation is plausible; however, the empirical contention is whether this findings and conclusion are tenable in a panel study of group of West African countries.

Mullings and Mahabir (2015) found both cross-country and panel-data evidence of the causal factors driving the turnaround in Africa's growth, and take the unique approach of examining the separate growth impacts of Africa's trade with china, Europe and America for the sample period 1990 to 2009. The result indicated that trade with china has positive effect on economic growth in African countries; foreign aid and bilateral trade openness to Europe are found to have growth-reducing effects, while Africa-US trade has no statistically significant impacts. While Mullings and Mahabir (2015) findings provide insight on the effect of openness on growth, it is more concerned with Africa's trade with China, Europe and America without factoring intra-African trade and trade with other countries/regions.

Asfaw (2015) empirically assessed the link between trade policy and economic growth in 47 sub-Saharan Africa countries for the period 2000 to 2008. The study employed generalized least square (GLS) estimation method on a balanced panel data to examine how trade policies affect economic growth of the region? The result indicated a positive relationship between trade liberalization and economic growth. Besides, trade policies such as average weighted tariff rate and real effective exchange rate have both direct and indirect impact on economic growth in sub-Saharan African countries. The estimation support claims that openness to international trade stimulates both economic growth and investment, but the sample period of the study is less than 10 years which is rather limited to fully account for long run growth dynamics.

Fenira (2015) examined the effect of official development assistance, official aid and trade openness on economic performance in 82 developing countries for the period 1996 to 2012, two years after the Uruguay round and until 2010, employing the ordinary least squares dummy variables for estimation. The findings indicated that liberal policy measures in developing countries have a strong positive association between the official development assistance and official aid variable, and trade openness. Fenira (2015) argued that trade liberalization policies were largely motivated by the desire to obtain loans and aids from international organizations. Economic crisis faced by these countries during the 1970's and 1980's constrained them to resort to international organizations, like World Bank, IMF or WTO which support liberal orientations. The study concludes that trade policy liberalization have weakly contributed in improving economic growth in developing countries. The findings in Fenira (2015)contributes to the understanding of the challenges of free trade in developing countries, however, the results may be due to the explanatory variables employed (investment, inflation, foreign reserves, political stability and democracy) while trade share, FDI and human capital are not measured in the research, which is inconsistent with the new growth framework.

Zerbo (2015) applied Autoregressive Distributed Lag (ARDL) bound testing approach to co-integration to examine the long-run growth in Sub-Saharan Africa by exploring the role of energy, trade openness and financial development in six countries, namely Botswana, Cameroon, Kenya, Senegal, South Africa and Togo. The annual time series data from 1980 to 2011 was used, while Forecast error variance decomposition was applied for estimation. The findings indicated a compelling evidence of a significant role of investment and energy on output process in six sub-Saharan Africa (SSA) countries, namely Botswana, Cameroon, Kenya, Senegal, South Africa and Togo. The short term estimation highlights the significant role of trade openness in South Africa and Togo. The long-term results showed that trade openness and financial development have positive and significant effect on income per capita in South Africa and Kenya, respectively. A compelling evidence of positive impact of energy efficiency on growth is found in Togo. The short-term estimations highlight the significant role of investment and energy in output process in virtually all the countries and the role of trade openness in South Africa and Togo. The overall results confirmed a positive impact of trade openness on economic growth. The general approach of this investigation is plausible; however, the empirical argument is whether this findings and conclusion are tenable in a panel of group of West African countries.

Anyanwu and Yameogo (2015) analyzed the drivers of foreign direct investments (FDI) to West Africa using a panel data from 1970 to 2010. OLS and generalized moment method (GMM) techniques were used for the estimation. The results indicated a U-shaped relationship between economic development and FDI inflows to West Africa. Real per capita GDP, domestic investment, trade openness, first year lag of FDI, natural resources (oil and metals) endowment and exports, and monetary integration have positive and significant effect on FDI inflows to West Africa. The positive and significant effect of trade openness on FDI is consistent with the new growth theory which suggests that openness and FDI are complementary to economic growth. The result also suggests that improvement in human capital is positively related to FDI inflows in West Africa. Given the finding that domestic investment significantly increases FDI inflows to West African countries, achieving higher domestic investment must remain as an active goal of governments in the sub-region. Aside the focus of this study been limited to the determinants and effects of FDI on economic growth, it does not take into consideration individual country differeneces that may influence outcomes, even as outliers of better performing economies and worse performing economies were not separated resulting in ambiguous findings.

A study on economic openness and its impacts on the Algerian economy by Louail (2015) used data from 1970 to 2012 for its OLS regression estimation. The findings indicated a positive and significant relationship between trade openness and economic growth in Algeria. Aside the scope of the study been case specific, and limited to Tunisia, while inflation, exchange rate and telephone lines were the variables employed, trade share, FDI and human capital were not measured in line with new growth hypothesis.

Sakyi, Commodore and Opoku (2015) investigated the long run impact of foreign direct investment and trade openness on economic growth in Ghana (1970 – 2011), within the framework of the endogenous growth literature. The study adopted the autoregressive distributed lag bounds testing approach to cointegration. The results indicated that the interaction of FDI and exports has been crucial in fostering growth in Ghana. This result is consistent with the findings in Asiedu (2013) and Zakari (2013), but the empirical argument is whether this finding can be validated in a panel of group of West African countries.

Johnston and Ramirez (2015) investigated the impact of foreign direct investment (FDI) inflows on economic growth in Cote d'Ivoire during the period from 1975 – 2011. Using unit root test for stationarity and cointegration analysis, the result suggested that gross fixed capital formation has a short-term positive impact on economic growth, while FDI has a negative effect on economic growth in Cote d'Ivoire. The study concluded that the unexpected negative effect of FDI on economic growth may be due to the significant repatriation of profits and dividends the country has experienced in recent years. Though Johnston and Ramirez (2015) advanced the researchers' thinking substantially on the role of FDI and gross fixed capital formation in explaining trade openness, the focus of the study is, however, limited to the effect of FDI on economic growth, even as the scope is also limited to Cote d'Ivoire.

In an empirical investigation of the determinants and effects of trade openness on economic growth in Africa, Mbogela (2015) employed panel data technique using two-staged least squares (2SLS) and system generalized method moments (GMM) for estimation of data for the period from 1989 to 2008 on a sample of 49 African countries. The results indicated a positive and significant relationship between trade openness and economic growth in Africa. The Granger causality test indicated a unidirectional causality running from GDP to trade openness. The study concluded that comparatively, permanent economic growth shocks induce larger long-run trade openness level responses than the effect of permanent trade openness shocks on long-run economic growth. Though the research by Mbogela (2015) have shown a propensity of unidirectional causality running from GDP to trade openness in most African countries, the empirical question is whether this finding can be substantiated in a panel of group of West African countries. Furthermore, it does not take into consideration individual country differences that may influence outcomes resulting in ambiguous findings.

Hye and Lau (2015) employed a new endogenous growth model for India, using the auto regressive distributed lag (ARDL) approach and rolling window regression method. The results indicated that trade openness index negatively impacts on economic growth in the long term, while there was positive relationship in the short run in India. The result of the Granger causality test confirmed the validity of trade openness as positively related to economic growth in India. The findings may be as a result of the human capital and net fixed capital as trade openness indicators that are employed, which is inadequate as other variables like trade openness index and foreign direct investment are not considered in the study.

In another related study, Andrews (2015) revisited the highly debated export-led growth hypothesis using Liberia as a case study. The study investigates the Granger causality between exports, imports and economic growth in Liberia over the period 1970 to 2011.The results confirmed the bi-directional causation between GDP and imports and unidirectional causation from exports to GDP, thus, providing evidence of the positive effect of international trade on economic growth in Liberia. The focus of the study is limited to effect of exports and imports on growth, which is a component of trade openness. A broader analysis of trade openness will include FDI, investment and human capital as explanatory variables in line with the endogenous growth hypothesis.

Alaoui (2015) investigated the relationship between export, import and economic growth using annual time series data for the Moroccan economy over the period 1980-2013. The cointegration technique is employed to examine the long run equilibrium relationship among the variables. The results confirmed the existence of a long-run relationship among these variables. For the short-run causality, the findings suggested (i) bidirectional causality between economic growth and import, (ii) unidirectional causality that run from export to import, and (iii) no causality between economic growth and export. Aside the scope of the study been country specific, the empirical argument is whether this finding will still be tenable when a group of countries in the ECOWAS sub-region are used as sample countries in a panel.

Echekoba, Okonkwo and Adigwe (2015) examined the relationship between trade liberalization on economic development of Nigeria for the period from 1971 to 2012 using OLS technique. The result showed that imports and exports have positive effect on economic growth in Nigeria. The study concluded that trade liberalization is beneficial to the Nigerian economy. Aside the limitation of the study due to specificity of the scope, which is on Nigeria, an extension of the research will cover Ghana and Cote d'Ivoire in a panel analysis and include FDI, investment and human capital as explanatory variables in line with the endogenous growth hypothesis.

Chatterji, Mohan and Dastider (2014) examined the relationship between trade openness and economic growth of India for the period 1970 to 2010 using Augmented

Dickey Fuller unit root test, vector autoregression method and Granger causality test. The results indicated that growth in trade volumes accelerates economic growth in India, and therefore, recommend export promotion as strategic policy for the Indian economy. Though the finding in Chatterji, Mohan and Dastider (2014) is consistent with the endogenous growth hypothesis, the study is case specific on the Indian economy. Therefore, the empirical argument is whether these findings will still be tenable when examined in a panel of countries in West Africa.

Similarly, Sikwila, Ruvimbo and Mosikari (2014) carried out a long and short term regression analysis using quarterly data for the period 1994 through to 2013 to investigate the effects of trade openness on the South African economy. Applying cointegration and ECM, the results of the regression analysis indicated that there was an enormous long and short term influence of trade openness on growth and development in South Africa. Aside the scope of the study been country specific, the empirical argument is whether this finding will be validated when a group of countries in the ECOWAS sub-region are used as sample countries in a panel analysis.

Aboubacar, Dei and Ousseini (2014) in an investigation of the impact of trade openness and economic growth in Niger over the period of 1980 to 2013, used ordinary least squares method for econometric analysis of the sample data. The results indicated that there exist a long term relationship between trade openness and the real GDP growth rate in Niger. Aside the scope of the study been country specific, the limiting effect of not providing short run analysis is also present.

Hamad, Metangwa and Babiker (2014) examined the impact of trade liberalization on economic growth in Tanzania. The study adopted simple linear regression model using the OLS technique for its estimation from annual time series data for the period 1970 to 2010. The result indicated that trade liberalization had a positive and significant effect on economic growth in Tanzania. The study, therefore, recommend increased diversification of the economy to stimulate exports. Aside the scope of the study been country specific, and limited to Tanzania, the empirical argument is whether this finding will be validated when a group of countries in the West Africa sub-region are used as sample countries in a panel analysis.

Arodoye and Iyoha (2014) examined the nexus between foreign trade and economic growth in Nigeria using quarterly time-series data for 1981Q1 through 2010Q4. In order to fully account for feedbacks, a vector autoregressive model was utilized. The results indicated that there is a stable, long- run relationship between foreign trade and economic growth. The variance decomposition results show that the predominant sources of Nigeria's economic growth variation are due largely to "own shocks" and foreign trade innovations. Aside the scope of this study been limited to Nigeria, the short run analysis was not articulated in the work.

Birara (2014) provided evidence in support of the export-led growth (ELG) hypothesis in the study of the relationship between export and economic growth in Ethiopia. The analysis employed a bi-variate model which was estimated using co-integration tests and error correction method (ECM) from Ethiopian data for the period 1975-1976 and 2010-2011. The study recommended export promotion strategies to enhance economic growth of Ethiopia. Though Birara (2014) findings support the endogenous growth theory, the two-period (1975-1976 and 2010-2011) are short-term, while long-run analysis is not articulated in the study.

Kodjane (2013) examined the relationship between exports and economic growth in selected ECOWAS member states of Cote d'Ivoire, Ghana and Nigeria for the period from 1980 to 2011. Using the ordinary least squares estimation technique, the result indicated a positive and significant relationship between exports and economic growth in Nigeria, Ghana and Cote d'Ivoire. The study recommended export expansion programs for the three (3) countries which is desirable to stimulate growth in their respective economies. The focus of the study, like Andrew (2015) and Alaoui (2015), is limited to the impact of exports on economic growth. Furthermore, the conventional ordinary least squares approach is used in this study instead of heterogeneous panel techniques that are robust in the presence of non-stationarity, endogeneity and cross-section dependence.

Kassim (2013) used panel data technique and time series/cross sectional estimation techniques to investigate the impact of trade liberalization on export and import growth across 28 sub-Saharan African countries from 1981 to 2010. The results indicated that trade liberalization increases the growth of exports; however, imports grew faster by approximately two percentage points. In addition, the price elasticity of demand for exports is low in Sub-Saharan Africa, suggesting that exports in the region still consist mainly of agricultural commodities. Import duties expectedly have a significant negative impact on import growth, but no such significant relationship was found between export growth and export duties. The study concluded that trade balance deteriorated in the post-liberalization era in most of the 28 sub-Saharan African countries, which indicated a weak link between exports and growth in the region. The focus of the study like Kodjane (2013), Andrew (2015) and Alaoui (2015), is limited to the effect of exports on economic growth and terms of trade. Furthermore, the findings in Kassim (2013) are rather ambiguous as individual country differences are not accounted for in the study, even as exports and imports alone cannot explain growth. In line with the new economic growth framework, an extension of this investigation will consider other key variables like investment, FDI and human capital.

An empirical study by Hassen, Anis and Yorsra (2013) analyzed the impact of trade openness on economic growth in Tunisia using the OLS method on the data for the period 1975 to 2010. The findings indicated that trade openness, foreign direct investment, human capital represented by school enrollment and financial development exert long-term positive and significant effects on economic growth in Tunisia. Aside the scope of the study been country specific and limited to Tunisia, the limiting effect of not providing short run analysis is also present in this work.

Mercan, Gocer, Bulut and Dam (2013) examined the effect of trade openness on economic growth for the most rapidly developing countries (emerging markets; Brazil, Russia, India, China and Turkey, BRIC-T) via panel data analysis by using the annual data for the period from 1989 to 2010. As trade openness variable, the rate of external trade (Export + Import) to GDP was used. According to empirical evidence derived from the study it was found that the effect of openness on economic growth was positive and statistically significant in line with theoretical expectations. Though the general approach of this study is plausible, the scope of the study is, however, limited to the emerging economies of Brazil, Russia, India, China and Turkey. The empirical argument is whether this finding will be validated when a group of countries in the West Africa sub-region are used as sample countries in a panel analysis.

Alajeku, Ezeabasili and Nzotta (2013) investigated the effect of trade openness, stock market development on economic growth in Nigeria for the period of 1986 to 2011, using the Augmented Dickey Fuller test and Johansen cointegration which confirmed a long-run co-integrating relationship at 5% level of significance. The Pairwise Granger causality test indicated no causal relationship between stock market, trade openness and economic growth in Nigeria. The finding does not support the new growth hypothesis, and this may be as a result of the explanatory variables (stock market capitalization, stock traded ratio, turnover ratio in combination with trade openness index) employed which is not consistent with the new growth hypothesis that consider investment, FDI and human capital as key variables, aside the scope of the study been limited to Nigeria.

Adelowokan and Maku (2013) analysed the effect of trade openness and foreign investment on economic growth in Nigeria for the period from 1960 to 2011 using least sqares regression and Engel Granger cointegration test for data estimation. The results indicated a positive relationship between trade openness and economic growth, but a negative relationship between foreign direct investment and economic growth in Nigeria. Also, the results showed that the partial adjustment term, fiscal deficit, inflation and lending rate were growth increasing during the period examined. Further tests indicated a long run relationship between trade openness, foreign investment and economic growth in Nigeria. These findings contradict the finding in Saibu (2004) and Alajeku, Ezeabasili and Nzotta (2013), but in line with Arodoye and Iyoha (2014) and Echekoba, Okonkwo and Adigwe (2015). It is therefore, pertinent to examine the argument whether these findings can be substantiated in an interaction of a panel group of West African countries.

Asiedu (2013) explored the connection between trade liberalization and growth rate of real Gross Domestic Product (GDP) of Ghana using annual time series data covering the period 1986 to 2010, which coincides with the period of trade liberalization policy adopted as part of the Structural Adjustment Program (SAP). The Study used the Autoregressive Distributed Lag (ARDL) approach to estimate the long run and short run parameters for the specified model. Using trade openness as a proxy for liberalization, the study found a positive and significant relationship between trade liberalization and real GDP growth in the long-run in Ghana. In a related study, Zakari (2013) examined the trends of liberalization and GDP growth rate in Ghana for the period 1984 to 2011. Using the ordinary least squares regression, Augmented Dickey Fuller unit root test, VECM and Granger causality test. The findings indicated a long run relationship between trade liberalization and the growth rate of GDP in Ghana. This confirmed the position of Asiedu (2013), and is consistent with the new growth theory prediction. The scope of these studies is case specific and limited to Ghana, even as the period (1986 to 2010 and 1984 to 2011) examined almost coincide thereby making no difference in variation, while the short run analysis is not present in the studies.

Fargani (2013) investigated different aspects of the relationship between economic growth and mainstream macroeconomic variables in Libya for the period 1962 to 2009. Using ordinary least squares (OLS), co-integration test, vector error correction method (VECM), generalized method moments (GMM), and impulse response function (IRF), the results showed evidence that foreign direct investment and trade openness have a positive effect on both the short-run and long-run growth in the Libyan economy. Though the findings by Fargani (2013) support the endogenous growth hypothesis, the scope of the study is however, case specific and limited to Libya.

According to Amadou (2013), it is a priori difficult to establish the relationship between trade openness and economic growth in the West-African Economic and Monetary Union (WAEMU) countries. In the study on the casual relationship between trade openness and economic growth in WAEMU countries, Granger causality test was used to estimate a panel data set for the period 1962 to 2005. The result indicated that apart from Cote d'Ivoire (and at 10% level), trade openness does not cause economic growth in the WAEMU countries conversely; economic growth does not cause trade openness. The study concluded that, these results can be explained essentially by the fact that all the conditions are not yet assembled in the WAEMU countries so that trade openness can interact with economic growth. Amadou (2013) suggested that, openness is usually more profitable to countries that record quite high growth rates and whose industries have already reached maturity. The scope of the study is limited to WAEMU countries, while Nigeria and Ghana are non-member nations except Cote d'Ivoire.

Gnoufougou (2013) investigated the casual relationship between trade and GDP growth in Togo and applies the ADF unit root test, Pearson correlation, Granger causality test and multiple regression techniques based on annual data for the period of 30 years (1982-2012). The result indicated evidence of bi-directional causality between trade and GDP growth. The study concluded that there is evidence in support of the trade-led growth hypothesis in Togo. Though the finding of this study is consistent with the endogenous growth theory, the focus is on effects of imports and exports on economic growth which is rather limited in analysing trade openness-economic growth nexus, aside the specificity of the scope.

Seyoum, Wu and Lin (2013) used annual balanced panel data for 25 sub-Saharan African economies over the period 1977 to 2009 to investigate the Granger causality relationship between trade openness and FDI for the region. The empirical result of the study revealed a bi-directional causal relationship between trade openness and FDI in sub-Saharan economies. In the same vein, Sichei and Kinyondo (2012) carried out a panel data analysis of the determinants of foreign direct investment for a sample of 45 African countries over the period 1980 to 2009. The study identified a number of factors that affect international investment agreements including agglomeration economies, natural resources, real GDP growth and international investment agreements. The study also showed that the Africa-wide environment has become more conducive to FDI since the year 2000. The focus of Seyoum, Wu and Lin (2013) and Sichei and Kinyondo (2012) are limited to the effect of FDI on growth, while the effect of other relevant openness variables like human capital, domestic investment are not measured in these studies.

Sakyi, Villaverde, Maza and Chitteji (2012) investigated the extent to which trade openness has an impact on the levels of income and rates of growth in a sample of 115 developing countries for the period 1970 – 2009. The sample was broken down into three mutually exclusive groups of countries: low income, lower middle income and upper middle income countries. The main novelty of the study lies in the use of new trade openness measures and non-stationary heterogeneous panel cointegration techniques to examine the problem of cross-sectional dependence. The results indicated a bi-directional relationship between trade openness and income level in the long run. The results of the short run, that is the link between openness and economic growth, go in the same direction. The main conclusion was that short-run policies devoted to foster openness cannot have the desired effects, these prove to be very fruitful in the long-run, and therefore, they should be implemented by developing countries. The study, however, employed a single independent variable (openness) to estimate real per capita growth (the dependent variable). This is not consistent with the Solow's-inspired endogenous growth framework with multiple independent variables.

Redlin and Gries (2012) examined the short-term and long-run dynamics between per capita GDP growth and openness for 158 countries over the period 1970-2009. The study employed panel cointegration tests and panel error-correction models (ECM) in combination with generalized method moments (GMM) estimation technique to explore the causal relationship between these two variables. The results suggested a long-run relationship between openness and economic growth with a short-run adjustment to the deviation from the equilibrium for both directions of dependency. The result indicated a positive significant causality from openness to growth and vice versa, indicating that international integration is a beneficial strategy for growth in the long term. By contrast the short-run coefficient indicated a negative short-run adjustment, suggesting that openness can be painful for an economy undergoing short-term adjustments. In addition to the entire panel the data is subdivided into income-related sub-panels. While the long-run effect remains predominantly positive and significant, the short-run adjustment becomes positive when the income level increases. This result suggests that different trade structures in low-income and high-income countries have different effects on economic growth. Unlike the Solow’s-inspired endogenous growth theory that consider such explanatory variables like trade share, investment, human capital and FDI, Redlin and Gries (2012) focused only on trade share (trade openness index) as explanatory variable for economic growth.

Busse and Koeniger (2012) examined the empirical evidence of the effect of trade on growth. The panel dataset used in the study consists of up to 108 countries (of which 87 are developing countries) covering the period 1971-2005 for the GDP per capita variable. To reduce the impact of business cycles the study used a total of seven five-year averages for all variables, 1971-1975, 1976-1980 and so on, until 2005 using a dynamic panel estimation system generalized method moments (GMM) for estimation. They argued that growth depends crucially on the specification of trade. Both from a theoretical, as well as on empirical point of view, one specification is preferred: The volume of exports and imports as a share of lagged total GDP. For this trade measure, a positive and highly significant effect on economic growth can be found. The study concluded that the causal linkage between trade and growth is ambiguous. This may be due to lack of data for all the countries for the first period from 1971 – 2005 resulting to the panel data used in the study been slightly unbalanced, which cast doubts on the reliability of the findings in Busse and Koeniger (2012).

Yeboah, Naanwab, Saleem and Akuffo (2012) used the Cobb-Douglas production function to estimate the impact of FDI, exchange rate, capital-labour ratio and trade openness on GDP in 38 African countries for the period of 1980 to 2008.The continent on the whole exhibited a decreasing return to scale which is to be expected. The FDI/capita and capital-labor ratio coefficients showed negative signs implying no effects or reduction in GDP/capita with an increase in FDI or capital-labour ratio. However, exchange rate and trade-openness/capita exhibited positive and significant impacts on GDP/capita. Majority of the countries showed below average returns-to-scale with about 17 countries exhibiting above average growth. The study concluded that the effect of trade on productivity is much greater in outwardly-oriented economies than the inwardly-oriented nations. Though the finding in Yeboah, Naanwab, Saleem & Akuffo (2012) supports positive effect of trade on growth, the study failed to consider human capital in the analysis which is not consistent with the endogenous growth framework on trade openness-growth nexus. Furthermore, the findings of the research are rather ambiguous as it failed to account for individual country differences.

In another related investigation, Bruckner and Lederman (2012) studied causality issues on openness-growth relationship by using panel data and novel instrumental-variable estimations to identify the causal effect of trade openness on growth in sub-Saharan Africa for the sample period from 1960 to 2009. The use of panel data allowed the researchers to exploit within-country variations in countries' trade openness and GDP per capita, controlling for any time-variant country characteristics that affect both international trade and economic growth. The findings indicated that openness to international trade increases economic growth in sub-Saharan Africa. The instrumental-variable estimates suggested that, on average, a one percentage point increase in trade openness is associated with a short-run increase in GDP per capita growth of about 0.5% per year. The long-run effect is larger, reaching about 0.8% after ten years. Importantly, these results are robust to controlling for year effects and other growth correlates related to political institutions and intra-national conflict. They are quantitatively in line with the cross-sectional growth estimates reported, for example, by Frankel & Romer (1999), Feyrer (2009) and more recently by Ulasan (2012). While the approach of this investigation is plausible, it fails to provide deep insight on the West African economies on how international trade influence their economic growth.

Employing the difference-in-difference technique and the Sachs and Warner (1995) criteria to identify liberalization dates and episodes, Dava (2012) examined the effect of trade liberalization on growth of real GDP on a sample of seven SADC countries using a yearly data set from 1980 to 2008. The study used panel regression technique for estimation of data. The results indicated that trade liberalization had a positive and significant impact on the growth rate of the SADC countries. The finding in Dava (2012) is consistent with the endogenous growth hypothesis; however, the scope is limited to the SADC countries.

Ulaşan (2012) reviewed the empirical evidence on the relationship between trade openness and long-run economic growth over the sample period 1960-2000 in a cross country survey of 105 countries using ordinary least squares (OLS) and iteratively re-weighted least squares (IRLS). In contrast to previous studies focusing mainly on the period 1970-1990, the study reassessed the openness-growth nexus over a much longer sample period, enabling it better account both for trade policy stance and long-run growth dynamics. The study employed various openness measures suggested in the literature rather than relying on a few proxy variables. Three additional composite trade policy indexes were constructed directly measuring trade policy stance. The findings indicated that many openness variables are positively and significantly correlated with long-run economic growth. However, in some cases, this result is driven by the presence of a few outlying countries. Adding to the fragility of the openness-growth association, the significance of openness variable disappears once other growth determinants, such as institutions, population heterogeneity, geography and macroeconomic stability are accounted for. This is in line with the cross-sectional growth estimates reported, for example, by Frankel and Romer (1999), Feyer (2009) and more recently by Bruckner and Lederman (2012). While the approach of this investigation advances the researchers' thinking on the openness-growth nexus, an analysis of the short-run dynamics is not presented in Ulaşan (2012).

Falvey, Foster and Greenaway (2012) investigate whether an economic crisis at the time of trade liberalization affects a country's subsequent growth performance. The study employed annual data for a panel of (up to) 75 countries within the period 1960-2003, using threshold regression techniques on five crisis indicators to identify the “crisis values” and to estimate the differential growth effects in the crisis and non-crisis regimes. The estimated short-run coefficients generally supported the conclusion of a J-curve effect (whereby growth initially declines or remains stable following liberalization, and then increases after a period) found in the earlier literature. Although trade liberalization in both crisis and non-crisis periods raises subsequent growth, the findings indicates that an internal crisis implies a lower acceleration and an external crisis, a higher acceleration relative to the non-crisis regime. Though Falvey, Foster and Greenaway (2012) suggested the relationship between trade and economic performance, the focus of the investigation is not directly on the effect on trade openness on economic growth but on how economic crisis at the time of liberalization can affect economic performance.

Marelli and Signorelli (2011) analyzed the economic growth of China and India in terms of their integration in the global economy using time series data for the period 1980 to 2006. The study employed panel data and two-staged least squares techniques for data estimation. The results indicated that opening up and integrating in the world economy has positive effects on the economic growth of China and India. Aside the specificity of the scope of the study, limited to China and India, the empirical argument is how these findings can be substantiated in interaction of a panel group of West African countries.

Matadeen, Matadeen and Seetenah (2011) scrutinized the relationship between trade liberalization and economic growth in Mauritius, using bi-annual data for the period 1989 to 2009, through a vector error correction model (VECM) and Granger causality test in the short-run. The results indicated existence of causality between trade liberalization and economic growth in the short run. Aside the scope of the study been country specific and limited to Mauritius, it fails to present the long run analysis of the relationship between trade liberalization and economic growth.

Using firm-level panel data, Njikam and Cockburn (2011) examined the effects of Cameroon's trade liberalization from the late 1980s to late 1990s on productivity growth in the manufacturing sector. The study applied the Olley and Pakes (1996) methodology, and firm indexes were derived which were examined via OLS regression framework. Results from the estimations showed that trade liberalization have positive and significant effect on productivity growth in Cameroon. The finding in Njikam and Cockburn (2011) support trade liberalization and economic performance, however the approach of this study differs from the endogenous growth theory approach that consider other variables like trade share and FDI. Aside, the scope of the study been country specific and limited to Cameroon, the long run analysis is not present in the work.

Effiom, Ubi, Okon and Itam (2011) analysed the implications of trade openness on human capital in Nigeria using annual data from 1970 – 2008. The study employed Vector Autoregressive technique for data estimation. The results indicated that human capital (proxied by literacy rates) had positive and significant impact on trade openness, as trade openness had positive and significant impact on economic growth in Nigeria. The study recommended increased funding of education, especially in science related disciplines. The estimation method used is subject to the problem of omitted variables bias and endogeneity of some regressors, therefore, another useful extension of this research would be to include other relevant variables like domestic investment and net inflow of FDI.

In a related study by Sun and Heshmati (2010) on the effect of trade liberalization on productivity growth, econometric and non-parametric approach is applied based on a 6-year balanced panel data of 31 provinces of China from 2002 to 2007. The study showed that increasing participation in the global trade helps China reap the benefits of liberalization, stimulating rapid national economic growth. Both international trade volume and trade structure towards high-tech exports result in positive effects on China's regional productivity.

Like Njikam and Cockburn (2011) in the study of Cameroon, Sun and Heshmati (2010) approach differs with the endogenous growth hypothesis approach that consider other variables like trade share and FDI in addition to human capital and investment. Aside, the scope of the study been country specific and limited to China, the long run analysis is not present in the study.

Ogbonna (2010) investigated the direct and indirect causal interactions between financial deepening, trade openness and economic growth in Benin Republic for the period, 1960 to 2008, using co-integration and Granger causality tests, as well as vector auto-regression and vector error correction method to estimate the time series data. The results indicated that the direction of causality between financial development and economic growth is sensitive to the choice of financial indicators in Benin Republic. In line with Levine (1997), the study concluded that financial development promotes economic growth which leads to openness of trade. While Ogbonna (2010) advances insight on the role of financial development and economic growth to trade openness, it could not provide an empirical answer as to whether trade openness has positive impact on economic growth.

N'guessan and Yue (2010) carried out an empirical study on the long-run impact of foreign direct investment and trade openness on economic growth in Cote d'Ivoire. The study used the bound testing co-integration approach and the VAR Granger causality/ Block Exogeneity Wald tests on a time series data set for the period from 1980 to 2007. The findings indicated evidence of a long-run relationship between FDI, trade openness and output. The Granger causality test also revealed a bidirectional causation running from trade openness, FDI to output, and from output to trade openness and FDI. Both FDI and trade openness are significant in explaining output growth in Cote d'Ivoire. The study concludes that Cote d'Ivoire have to streamline a strategic combination of domestic investment in physical infrastructure and institution building to attract more FDI into the economy. While the finding in N’guessan and Yue (2010) is consistent with a priori expectation, the scope of the study is case specific and limited to Cote d’Ivoire, even as it fails to present the short-run dynamics in the analysis.

Liu, Burridge and Sinclair (2010) employed a panel cointegration framework, using vector error correction (VECM) to test for the transmission effect between growth, exports, imports and FDI on a time series data from 1981 to 1997 in China. The study identified long run relationships between growth, exports, imports and FDI in China. The results indicated a bi-directional causality between economic growth, FDI and exports. Thus, economic development, exports and FDI were found to be mutually reinforcing under the open-door policy.Again the scope of the study is country specific, while the focus is on effect of exports and FDI on economic growth which does not fully explain the endogenous growth hypothesis.

Keita and Dakai (2010) performed an econometric analysis of data for the sample period from 1985 to 2008 using the Granger causality test to estimate the effect of FDI on economic growth in Guinea Republic. The results showed that the level of FDI is not significant in promoting economic growth for the Guinea Republic. The results indicated causality flowing from GDP to FDI, likewise from employment to FDI. The findings also indicated that school enrollment can increase the GDP and indirectly, the FDI. The study concludes that the Guinean government has to play the key role of employment promotion to attract investments from abroad. The finding in Keita and Dakai (2010) is in line with Seyoum, Wu and Lin (2013) and Sichei and Kinyondo (2012) but the focus of these studies is limited to the effect of FDI on growth, while the effect of other relevant openness variables like human capital, domestic investment are not measured in these studies.

Rattso and Stokke (2009) examinedthe relationship between trade openness and growth effects of investment on productivity in South Africa based on calibration of Ramsey growth model from 1960 to 2005. The study found that increased trade share of 10% points raises GDP level over time by about 15%. Separating the effects of openness between investment and productivity, the study also found that two-thirds of the increase in GDP is due to increased productivity, working directly or indirectly via investment profitability. Though the finding in Rattso and Stokke (2009) support the new growth theory, the study employed labour force, investment and trade share as explanatory variable while other key variables like FDI and financial development that define trade openness are not measured in the analysis. Again the scope of the study is case specific and limited to South Africa.

Wacziarg and Welch (2008) presented an updated data set of trade policy indicators and liberalization dates. The study revisited the evidence on the cross-country effects of Sachs & Warner's (1995) simple dichotomous indicator of outward orientation on economic growth, confirming the pitfalls of this indicator first identified by Rodriguez & Rodrik (2001). It showed that the Sachs-Warner dichotomous indicator effectively separates fast-growing from slow-growing countries in the 1980s and to a lesser extent in the 1970s, but fails to do so in the 1990s.

Using fixed effect regressions for its analysis, the new and robust evidence indicates that these dates of liberalization mark breaks in growth, investment, and openness within countries. Over the 1950–98 period, countries that liberalized their trade regimes experienced average annual growth rates that were about 1.5 percentage points higher than before liberalization. Post-liberalization investment rates rose from 1.5–2.0 percentage points, confirming past findings that liberalization fosters growth in part through its effect on physical capital accumulation. Liberalization raised the average trade to GDP ratio by roughly 5 percentage points, after controlling for year effects, suggesting that trade policy liberalization did indeed raise the actual level of openness of liberalizers. The study concluded that trade-centered reforms thus have significant effects on economic growth within countries. While Wacziarg & Welch (2008) advances our thinking substantially on the timing of liberalization in within-country setting to identify the changes in growth up to the late 1990s, further research will extend the empirical investigation on outward orientation and growth to year 2016 in a panel analysis of a group of West African countries.

According to Negem (2008) a significant relationship exists between free trade and economic growth of Egypt. The study quantified the effect of changes in economic policy, particularly trade liberalization on economic growth of Egypt during the period 1970 to 2006. The study applied the VECM, simultaneous equations model (SEM) for the empirical analysis. The findings indicated bidirectional causation between exports and economic growth. Though this work has shown that bidirectional causality exist between exports and economic growth, it remains an empirical question whether this finding can be substantiated in panel of group of ECOWAS countries.

Estiphanos (2008) employed autoregression distributed Lag (ARDL) bound test procedure in the estimation of the long-run relationship between trade liberalization and economic growth in Ethiopia, using the time series data during the period from 1971 to 2004. The results indicated that there exist a long-run relationship between real GDP per capita and trade openness in Ethiopia. The study concludes that the impact of trade liberalization on economic growth was positive and significant in Ethiopia. Though this finding is consistent with the prediction of new growth theory, the short run analysis is not present in the work, aside the scope of the study been case specific and limited to Ethiopia.

Osabuohein (2007) examined the impact of trade openness on economic performance of ECOWAS member states focusing on Ghana and Nigeria for the period 1975 to 2004. Time series data were analyzed employing Augmented Dickey-Fuller and Philip-Perron stationarity tests, co-integration and vector error correction techniques. The findings indicates evidence of a long run relationship between economic performance, trade openness, real government expenditure, labour force and real capital stock for Ghana and Nigeria. The study suggest that, for the countries to benefit satisfactorily from trade openness and have desirable level of economic performance, there is need to ensure that policies are initiated and implemented with deserved speed. Also efforts should be made to align their import and export components via appropriate policies that will reduce importation of consumer goods, and on the other hand their technologies should be enhanced in order to increase the value of their exports. The main limitation of this study is that the short run dynamics are not presented in the analysis. Further research will extend the analysis from 2004 and include Cote d'Ivoire in a heterogeneous panel analysis of the three (3) West Africa countries.

Taal (2007) applied the neoclassical growth model, using time series data from 1970 to 2014 to study the impact of trade liberalization on economic growth in the Gambia. The study employed OLS regression, cointegration and ECM for data estimation. The results indicated that the terms of trade in Gambia are not favorable as imports outweigh exports. The study concluded that there exists no significant impact of trade liberalization on the economic growth of The Gambia. The finding has shown that trade openness has negative effect on economic growth in the ECOWAS member states, but there is need to investigate if this argument is still tenable when interacted in a panel of group of Nigeria, Ghana and Cote d'Ivoire.

Baliamoune-Lutz and Ndikumana (2007) explored the argument that one of the causes for limited growth effects of trade openness in Africa may be the weakness of institutions. The study controlled for several major factors and in particular, for export diversification using the Arellano-Bond generalized method of moments (GMM) estimations on panel data for 39 African countries for the sample period from 1975 to 2001. The result showed that institutions play an important role in enhancing the growth effects of trade. The findings also indicated the joint effect of institutions and trade has a U-shape, suggesting that as openness to trade reaches high levels, institutions play a critical role in harnessing the trade-led engine of growth. This finding is consistent with the new growth hypothesis that postulates that institutions are crucial for the success of economic reforms in developing countries. But it remains an empirical argument as to what extent will the underscore be tenable, even as the analysis is focused on the role of institutions in influencing trade openness. Hence, further research will extend the analysis to focus on the effect of trade openness on economic growth in ECOWAS.

Using panel data set covering about 180 countries over the period 1960 to 2000, Billmeier and Nannicini (2007) investigated the effect of trade liberalization on economic growth. The study applied a transparent econometric method drawn from the treatment evaluation literature (matching estimators) to make the comparison between treated (that is, open) and control (that is, closed) countries explicit while remaining within a statistical framework. Matching estimators highlight that common cross-country evidence is based on rather far-fetched country comparisons, which stem from the lack of common support of treated and control countries in the covariate space. The study therefore, suggested paying more attention to appropriate sample restriction in cross-country macro research. The difference between the growth performance of the treated country and the synthetic control unit is assumed to reflect the impact of a liberalized trade regime. The findings indicated that trade liberalization, in most cases, has had a positive effect on per capita income growth in the Middle East and Central Asian countries. While Billmeier and Nannicini (2007) substantially advance the argument in support of positive effects of trade openness on economic growth, the analysis did not present how the underscore will be tenable in West African countries.

Aka (2006) examined the relationship between openness and globalization on economic growth in Cote d'Ivoire, using a three-variable vector autoregressive (VAR) model to investigate globalization, openness and growth for the sample period from 1969 to 2001. The study found that both increasing openness and globalization have not contributed positively to economic growth in the Cote d'Ivoire. The Granger causality test suggested that increasing openness does not cause economic growth. The study concludes that the results could be due to the lack of basic requirements like transfer of technology, education and training necessary to impact the long-run behaviour of the growth process in Cote d'Ivoire. While the scope of the study is case specific and limited to Côte d'Ivoire, it also remains an empirical question whether this finding can be substantiated in interaction of a panel group of West African countries.

Sarkar (2005) used indices of import per GDP, export per GDP and trade per GDP as a measure of trade liberalization to investigate the relationship between trade openness and real growth rates in India and Korea. Using annual data for the period from 1956 to 1999 for India and from 1956 to 2000 for Korea, and based on the application of ARDL approach to co-integration, the result did not indicate long run relationship between trade openness and growth in India and Korea. The study recommended future work in this field, and concluded that on a priori reasoning, an outward oriented strategy can be a drag on economic growth under the inexorable Prebisch (1950)-Singer (1950) law of secular decline in the terms of trade. The negative long-term relationship between trade openness and economic growth requires further investigation – whether the process of rapid growth causes declining importance of trade or a rising importance of trade leads to a deceleration in economic growth, even as the short run analyses are not present in the work.

Based on the 'endogenous' growth theory, Özdemir and Utkulu (2005) examined the effect of trade liberalization on long-run income per capita and economic growth in Turkey using annual data for the period from 1950 - 2000. The study employed multivariate co-integration and Granger causality tests. The causality evidence between the long-run growth and a number of indicators of trade liberalization confirms the anticipations of the 'new growth theory'. The study concludes that the overall effect of the possible breaks and/or policy change and unsustainable performance in the 1990s looks contradictory and deserves further investigation. Aside the specificity of the scope which is limited to Turkey, the short run dynamics are not present in the work.

Saibu (2004) examined direct and indirect effects of capital inflow, trade openness and economic growth in Nigeria. The study used the composite indicator derived from principal component analysis (PCA) in the autoregressive distributed lag (ARDL) bound testing model to explore the interactive effects of capital inflow and trade openness on economic growth for a country-specific case study using Nigeria's data series for the period 1960 to 2010. The results provided evidence that capital inflow and trade policy are complementary and growth enhancing in developing economies like Nigeria, and trade liberalization tend to enhance effectiveness of capital inflow and jointly promote higher economic growth. These findings contradict Alajeku, Ezeabasili and Nzotta (2013), but in line with Arodoye and Iyoha (2014), Echekoba, *et al* (2015) which supported the view that there exist a significant and positive relationship between trade and economic growth in Nigeria. It therefore, remains an empirical argument whether these findings can be substantiated in interaction of a panel group of West African countries.

Mbabazi, Milner and Morrissey (2004) employed ordinary least squares (OLS) and cross-section panel econometric techniques to investigate the links between growth, inequality and openness for a sample of 44 developing countries over the period from 1970 to 1995. The results indicated consistent evidence of positive and significant relationship between openness and economic growth in the developing sub-Saharan countries. The study concludes that Africa does appear to be different; especially poor sub-Saharan African growth performance can be explained by the combination of low levels of openness, high natural barriers to trade (especially high costs of transport to distant dynamic markets) and export dependence on primary commodities. The findings in Mbabazi, Milner and Morrissey (2004) have shown that there is the propensity of trade openness having a negative effect on economic growth in sub-Saharan Africa, and important to investigate if this argument is still tenable when a group of countries in the ECOWAS sub-region are used as sampled countries.

Parikh and Stirbu (2004) employed panel data analyses for 42 countries, regional panel for three regions (fixed effect and random effect models) and country by country analysis (OLS regression). The study regressed growth in real GDP on the liberalization dummy for the entire period, and three separate periods namely 1970-79, 1980-89 and 1990-99.These relationships suggest that liberalization promotes growth but growth itself has negative effect on trade balance for a large majority of countries. The findings indicated that trade balance obviously deteriorates with liberalization and economic growth and hence countries would have difficulty in reaching potential or planned growth in the subsequent periods after liberalization. Deterioration in trade balance could impact on economic growth in subsequent periods. Current account balances, however, did not deteriorate with the impact of liberalization and economic growth for many economies. The economic model underlying balance of payments constraint is the main limitation of the study, even as the conclusions drawn are spurious given that the model is static as lags in economic behaviour were not considered in the study.

Yanikkaya (2003) found that trade liberalization does not have a simple and straightforward relationship with growth using a large number of openness measures for a cross section of countries over the last three decades. The cross-country regressions was applied to a panel of over 100 developed and developing countries observed from 1970 to 1997 using the OLS and three-stage least square (3SLS) with instrumental variables for each equation. The study used two groups of trade openness measures. The regression results for numerous trade intensity ratios were mostly consistent with the existing literature. However, contrary to the conventional view on the growth effects of trade barriers, the estimation results show that trade barriers are positively and, in most specifications, significantly associated with growth, especially for developing countries. These findings are consistent with the theoretical growth and development literature. While Yannikaya (2003) substantially advance the argument in support of positive effects of trade openness on economic growth, the analysis did not present how the underscore will be tenable for a group of West African countries in a panel analysis.

Extant literature reviewed indicates that endogenous growth theories have led to a richer appreciation of the nature and role of technological change, the limited empirical evidence does not, however, clearly favour these theories over neoclassical growth theories. The results reported are clearly sensitive to the variables employed, e.g. investment instead of capital, population instead of labour force, and also to the theoretical framework assumed, i.e. bivariate models and ad hoc production functions instead of an augmented neoclassical production function.

One difficulty with much of the empirical literature on trade and growth is that there are a variety of measures of openness. These are based variously on ratios of trade to GDP, measures of tariffs and non-trade barriers (NTBs), measures of exchange rate distortion, subjective assessments of policies, survey data, and econometric measures of the difference between actual trade and statistically expected trade. These measures do not consistently agree with each other, with countries scored as “open” by one criterion appearing to be “closed” by another criterion. This suggests that there may be several types of openness and/or fragility in the available data.

Viewed from the diverse conclusions from the reviewed literature, it is evident that trade openness enhances export volumes that can be used to pay for an increased value of imports, which in most cases leads to a positive net value of exports. This results into higher local savings and higher accumulation of foreign exchange reserves which can be invested for further earnings. It is however, good to note that openness can also result from the level of economic growth of a country; among others. It is also evident from the empirics that economies experiencing rapid economic growth resulting from reasons other than openness are in a better chance to engage in international trade. These arguments imply that not all countries take advantage from trade openness, and that the level of development already attained by a country and the structure of its institutions critically determines if trade openness impacts positively on economic growth and development.

2. 5 Empirical Gaps in Reviewed Literature

Empirical studies on the subject of effects of trade openness/liberalization on economic growth in Nigeria include Saibu (2004), Alajeku, Ezeabasili & Nzotta (2013), Adelowokan & Maku (2013); Arodoye & Iyoha (2014); Echekoba, Okonkwo & Adigwe (2015), Nwinee & Olulu-Briggs (2016), among others. In the same vein Asiedu (2013), Zakari (2013), Sakyi, Commodore & Opoku (2015), among others, studied the effect of trade openness on economic growth in Ghana. While Aka (2006), N'guessan and Yue (2010), Keho (2017), studied the effect of trade openness on economic growth in Cote d'Ivoire. These studies have some limitations as the scope is country specific and limited to the individual countries - Côte d'Ivoire, Ghana and Nigeria, respectively.

Very few empirical studies have examined on comparative basis, the impact of trade openness on economic growth in Nigeria and Ghana (Osabuohein, 2007), Ghana and Cote d'Ivoire (Amadou, 2013). Kodjane (2013), examined the impact of exports on economic growth in Nigeria, Ghana and Cote d'Ivoire, but the focus of the study is limited to exports, just as the attempt by Yeboah, Naanwab, Saleem & Akuffo (2012). There are also several studies on the effect of trade openness on economic growth in developing countries/Sub-

Saharan African countries which includes Nigeria, Ghana and Cote d'Ivoire (Busse & Koeniger, 2012; Keho, 2015; Zahanogo, 2017; among several others), but none of these studies is specifically focused on West Africa countries of Nigeria, Ghana and Cote d'Ivoire, and the estimation methods used was subject to the problem of omitted variables bias and endogeneity of some regressors, even as outliers of better performing economies and worse performing economies were not separated.

Therefore, this study has filled the gap identified in the literature by employing a multi-country panel data approach where each country has its own model, while outliers of better performing economies and worse performing economies were separated. Thus, the result enriched empirical analysis in ways that is not possible if we used only cross-section or time series data, as is the case with most of the reviewed literature. To the best of the researcher's knowledge, no work has been undertaken recently to specifically investigate the effect of trade openness on economic growth amongst the selected countries by combining dynamic time series estimation techniques and the heterogeneous panel approach which facilitates validation of data through cross verification from various methodological sources.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1. The Study Area

The study area is the major economies of the West African sub-region which are Cote d'Ivoire, Ghana and Nigeria. The 2014 World Bank Trade Openness ranking indicates that Ghana ranked highest among the selected countries at rank 73(88.43), followed by Cote d'Ivoire at rank 80 (82. 80%), and Nigeria ranked 156 (30.98%). Several questions therefore arise: why does Ghana and Cote d'Ivoire (smaller countries in size, population and physical resources), more open to international trade than Nigeria (bigger country in size, population and physical resources)? What are the comparative effects of trade openness an economic growth in these countries? Why does Cote d'Ivoire have a higher GDP growth rate (8.0% in 2016) than Nigeria (-1.7 % in 2016)? What were the main engines of growth in these countries? All these characteristics make Cote d'Ivoire, Ghana and Nigeria ideal case for empirical investigation.

3.2 Research Design

Research design is generally categorized into qualitative and quantitative research designs depending on whether or not the research is purely descriptive (explanatory) or quantitative aimed at establishing causal effect or relationship. This study combined both descriptive and quantitative methods. The descriptive approach was used to examine descriptive statistical relationships, while the quasi-experimental (quantitative) approach was used to examine relevant secondary data used in investigating the impact of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria. The quasi-experimental approach is justifiable as model variables cannot, on any account, be held constant as in laboratory experiment to explain changes in the dependent variable.

3.3 Nature and Sources of Data

The nature of data used in this study is basically secondary data which were obtained from the World Bank website (www.worldbank.org) to measure the effect of trade openness on the growth of the three (3) West African countries for the period from 1970 to 2016. To ensure comparability, the study considered all monetary values in United States (US) dollar terms.

The real GDP at constant 2010 United States dollars (US$) corresponds to the real gross domestic product (RGDP) variable from the World Bank databank. Net inflow of FDI was calculated from each country's balance of payment (BOP), the value of exports expressed in constant 2010 US$ were obtained from the World Bank website (www.worldbank.org). Data on investment capital consists of outlays on additions to fixed assets of the economy plus net changes in the level of inventories, and is measured as gross fixed capital formation obtained from the World Bank website. Trade openness was calculated as the ratio of the sum of imports and exports to GDP for each country were obtained from the World Bank website (www.worldbank.org). Human capital development measured as gross secondary school enrollment (male and female) was obtained from the World Bank website. Data on official exchange rate for individual countries were also obtained from the Word Bank data bank (www.worldbank.org).

3.4 Theoretical Model and Model Specification

The study adopted the empirical framework of the augmented neoclassical growth theory as suggested by Mankiw, Romer & Weil (1992) (henceforth MRW) - which is an extension of the Solow (1956) framework - to present a variant model that considered human capital as additional variable to capital and labour. Abstracting from all details and focusing on the simplest case with three factors of production, we have

$Y_{ti} = K_{ti}^{\alpha}, H_{ti}, A_{ti,} L_{ti}^{1-\alpha-\beta}$……………………………..(3.1)

Where, Y_{ti} is output in time t in country i, K_{ti} is capital in country i, H_{ti} is the stock of human capital in country i, A_{ti} is technology in country i, and L_{ti} is amount of labour in country i, α and β are the production elasticities. We assume that $\alpha + \beta < 1$, which means there is decreasing returns to capital. If $\alpha + \beta = 1$, there is constant returns to scale in the reproducible factors.

This study considered such variables as economic characteristics (real GDP, level of domestic investment) and institutional characteristics (trade policy, foreign direct investment, human capital development, financial development). Drawing from the MRW (1992) framework, our augmented production function is:

$Y_{ti} = f(A_{ti}, OPNES_{t,i}, K_{t,I}, HK_{t,i}, FDI_{t,i}, EXR_{t,i})$... (3.2)

Where all other variables are as defined in equation (3.1) except, $OPNES_{t,I}$ is the openness index (exports plus imports as a percentage of GDP) at time t in country i, $FDI_{t,I}$ is the net inflow of FDI at time t in country i, and $EXR_{t,i}$ is the official exchange rate at time t in country i. Here, $A_{t,i}$ captures the total factor productivity of growth in output not accounted for by increase in capital and labour in country i. Applied in a cross-country context, it therefore imply that steady state differences in output per person are due to differences in technology. The institutional framework of a country may be considered as a "technology" that changes very slowly over time and differs substantially across countries, but remain fairly stable over time (Hall & Jones, 1999; Acemoglu, Johnson & Robinson, 2001; Easterly & Levine, 2003; Rodrik, Subramanian & Trebbi, 2004; Gundlach, 2007).

In this study, the dependent variable is economic growth measured by the real gross domestic product (RGDP), while the independent/explanatory variables established from literature to have some desired effect on economic growth due to trade openness include: openness index (total trade/GDP) (OPNES), capital (investment) proxied by gross fixed capital formation (INV), human capital development proxied by gross secondary school enrollment (HK), foreign direct investment (FDI) and official exchange rate (EXR). For robustness check, there are other factors related to openness that influence economic growth such as political stability, macroeconomic stability, level of international indebtedness, net transfer payments, geographic distance/economic location, that is accounted for as the error term in this model.

Translating this theory into empirical specification, the general formulation of equation (3.2) can be explicitly written in an econometric form. The benchmark model specification is:

$LnRGDPi,_{t}=\beta_O+\ln\beta_1 OPNES_{i,t}+\ln\beta_2 INV_{i,t}+\ln\beta_3 HK_{i,t}+\ln\beta_4 FDI_{i,t}+\ln\beta_5 EXR_{i,t}+\mu$…. (3.3)

Where:

RGDP= real gross domestic product (GDP)

OPNES= the degree of openness (sum of total exports and total imports to the GDP)

INV=rate of investment (gross fixed capital formation)

HK= human capital (% of gross secondary school enrollment ratio)

FDI= the foreign direct investment net inflow

EXR= real exchange rate

μ = stochastic error term

β_O = Intercept

ln = logarithm operator

The subscript *i,t* is time *t* in country *i*. *βi'*s (i = 1, 2, 3, 4 & 5), are the parameters to be estimated that measures the rate of change in the explanatory variables. The *a priori* expectations are algebraically summarized as; $\beta_1, \beta_2, \beta_3, \beta_4$ & $\beta_5 > 0$, this implies that all the independent variables are expected to be positively related to the dependent variable (RGDP).

From model (3.2) we can derive the relevant country-specific growth models for estimation as follows:

Country 1: Côte d’Ivoire

$$LnRGDPvt = \nu_0 + \nu_1 lnOPNES_t + \nu_2 lnINV_t + \nu_3 lnHK_t + \nu_4 lnFDI_t + \nu_5 lnEXR_t + \mu \text{ ---------------- } (3.4)$$

Where; $\mathbf{\nu_1 – \nu_5}$ are parameter coefficients to be estimated for Côte d’Ivoire, while $\mathbf{\nu_0}$ is the intercept. All the other variables are as earlier defined (3.3).

Country 2: Ghana

$$LnRGDP\omega t = \omega_0 + \omega_1 lnOPNES_t + \omega_2 lnINV_t + \omega_3 lnHK_t + \omega_4 lnFDI_t + \omega_5 lnEXR_t + \mu \text{ ----------- } (3.5)$$

Where; $\boldsymbol{\omega_1} - \boldsymbol{\omega_5}$are parameter coefficients for Ghana, while $\boldsymbol{\omega_0}$ is the intercept. All the other variables are as earlier defined in (3.3).

Country 3: Nigeria

$$lnRGDP_{ņt} = ņ_0 + ņlnOPNES_t + ņ_2 lnINV + ņ_3 lnHK_t + ņ_4 lnFDI_t + ņ_5 lnEXR_t + \mu \text{ --------------- } (3.6)$$

Where; $ņ_1 - ņ_5$ are parameter coefficients to be estimated for Nigeria, while $ņ_0$ is the intercept. All the other variables are as earlier defined in (3.3).

3.5 Description and Measurement of Variables

On account of theoretical and empirical literature reviewed, the growth conditioning variables account for fiscal, monetary and trade policies’ force.

Real domestic gross product: Economic growth is generally measured by the use of Gross Domestic Product (GDP). The GDP is simply the monetary value of all the goods and services produced within an economy over a specified period of time, usually one year. In this analysis, we measure growth in terms of the growth of real GDP in 2010 constant prices, which we denote as RGDP. The RGDP will be used to tally with the independent variables. We employ the difference of (log) real GDP, as we are interested in the dynamic impact of trade openness over time, not only in its one-off effects on the individual country income level.

Investment: All theories of growth suggest that investment is an important determinant of growth (Harrod, 1939; Domer, 1946; Solow, 1956; Romer, 1986). This includes not only investment by the private sector but also public infrastructure capital. In our growth equation, we include total investment, private plus public, and call it INV. Government expenditure in creating infrastructure and running efficient institutions is a driving force for economic growth. The fiscal policy is proxied by government expenditure (Easterly & Rebelo, 1993). The role of private sector investment in stimulating economic growth has been captured by Romer's (1986) endogenous growth model. The model assumes that private investment positively contributes to technological change, ensuring increasing returns to scale and growth in the steady-state. The gross fixed capital formation (a proxy for capital stock) in current US$, is expected to positively affect real GDP growth.

Trade openness: Trade policy is proxied by trade openness, which is trade measured by the sum of exports and imports as a percentage of GDP at 2010 constant prices. Trade openness (or trade intensity) is used as benchmark measure of trade integration given its broad availability across countries and across time (Mankiw, Romer & Weil, 1992; Yanikkaya, 2003). Trade openness enhances competition, promotes large markets, technology transfer and hence efficiency in production and it is expected to have a positive relationship with real GDP growth. Trade openness index (called OPNES) will be used to estimate the cross-country differences and its impact on economic performance of Nigeria, Ghana and Côte d'Ivoire.

Human capital development: Human capital is a key determinant of technology adoption as permitted by trade openness (Romer, 1986; Mankiw, Romer & Weil, 1992; Yanikkaya, 2003). Endogenous growth theory emphasizes that economic growth results from the increasing returns associated with new knowledge. The effect of human capital is, therefore, captured by the gross secondary school enrollment ratio for both sexes, and is used as a proxy for human capital development, which measures the quality of labour.

Foreign direct investment: Foreign direct investment measures the investment made in a country by the external sector. FDI net inflows are computed from the Balance of Payments (BoP) in current US$. This variable is expected to have a direct or positive relationship with economic growth in the domestic economy. The coefficient of FDI is expected to be positive since FDI complement domestic investment which is expected to increase total investment and hence increase in total output and growth.

Exchange rate: Exchange rate refers to the official rate at which the national currencies are exchanged with foreign currencies like the United States dollar, Japenese Yen, Chinese Yuan, euro and Pound Sterling. Depreciation (increase) of real effective exchange rate, all things being equal, will increase economic growth, while appreciation (decrease) decreases economic growth. The data for official exchange rate is based on annual rate for ease of computation and analysis.

3.6 Time Series Data Estimation

Time series analysis comprises methods for analysing time series data in order to extract meaningful statistics and other characteristics of the data. A time series data consists of observations on a variable or several variables over time (Wooldridge, 2016). The variables initial conditions were converted into natural logarithm before its usage in order to ensure that the data is normally distributed and properly skewed. It is appropriate to mention that all the empirical estimations for this study were carried out using the time series econometrics package Eviews 10.0 Version.

3.6.1. Descriptive Statistics

In descriptive statistics, summary statistics were used to summarize the set of observations in order to communicate the largest amount of information which gave a simple description of the data. Summary statistic used include measures of central tendency including the arithmetic mean, median and mode; measures of location like minimum value, maximum value, range, standard deviation; and tests for normality like skewness, kurtosis and Jarque-Bera tests. The table of summary statistics made it easier to interpret the coefficient estimates in the estimation results, as it emphasizes the unit of measurement of the variables.

3.6.2 Unit Root Test

The Augmented Dickey Fuller (ADF) unit root test was conducted to determine their univariate time series behaviour in the basic unit of observation. The essence of this test is to be sure that the variables are stationary (Dickey and Fuller, 1979). The regression equation of the test is of the form;

$$\Delta X_t = \alpha_1 + \alpha_2 X_{t-1} + \alpha_2 \Delta X_{t-1} + \alpha_3^{1} + e_t \ldots\ldots\ldots\ldots\ldots\ldots \text{(3.7)}$$

Where X is time series, t is a linear time trend, $\mathbf{\Delta}$ is the first difference operator, $\alpha_1$is a constant and e is the random error term. The test on the coefficient of X_{t-1} in the ordinary least squares openness model is the test for the ADF unit root. The null hypothesis of the existence of a unit root is given as:

$$Ho: X_{t-1}\ (1) \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \text{(3.8)}$$

The Mackinnon critical values give the critical values for the determination of the order of integration. The values of the Mackinnon and the ADF test statistics were compared and decision either to accept or reject the null hypothesis were taken.

3.6.3 Autoregressive Distributed Lag (ARDL) Bounds Test

In regression analysis involving time series data, if the regression model includes not only the current but also the lagged (past) values of the explanatory variables the (*X's*), it is called a distributed-lag model. If the model includes one or more lagged values of the dependent variable among the explanatory variables, it is called autoregressive model. To examine the long-term relationship between trade openness and economic growth, the study used the bound testing approach to co-integration, which was developed by Pesaran, Shin & Smith (2001). The model was developed within the framework of Autoregressive Distributed Lag (ARDL). In the case where the variables in the long-run relation of interest are trend stationary, the general practice has been to de-trend the series and to model the de-trended series as stationary distributed lag or autoregressive distributed lag (ARDL) models (Pesaran, Shin & Smith, 2001).

The bound testing procedure has many advantages, which includes: (1) it is more appropriate for a small sample or finite sample data, (2) the long run and short run parameters of the model are estimated simultaneously, (3) all the variables are assumed to be endogenous. The procedure generally provides unbiased estimates of the long run model and valid t-statistics as even the regressors are endogenous. Pesaran, Shin and Smith (2001) have shown that the inclusion of the dynamics may help correct the endogeneity bias; and (4) the method does not require that the variables in a time series regression equation are integrated of order one. This implies that bound test could be conducted regardless of whether the underlying regressors are I (0), or I (1), or fractionally integrated. This is different from the general bivariate or multivariate co-integration frameworks, which require that time series in co-integrating equation should have the same order of integration. In other words, the ARDL approach circumvents the problem of the order of integration associated with the Johansen likelihood methodology.

Following Pesaran, Shin and Smith (2001), we apply the bound test method as they modeled the long run equation (3.3) as a general vector autoregressive (VAR) of order *p* in Z_t.

$$Z_t = \beta_0+\alpha_t +\Sigma\beta_1 Z_{t-i} +\mu_t =1, 2, 3,\ldots\ldots,T \qquad (3.9)$$

Where Z_t is the vector of both X_t and Y_t, where Y_t is the dependent variable (RGDP) and X_t is the vector matrix which represents a set of explanatory variables (OPNES, INV, HK, FDI and EXR). β_0 represents $(k + 1)$ – a vector of intercept (drift)

α represents $(k + 1)$ – a vector of trend coefficients, μ_t is the white noise error term.

Pesaran, Shin and Smith (2001) postulates that the dependent variable must be I(1) variable, but the explanatory variables can be either I(0) or I(1). Pesaran, Shin & Smith (2001) further derived a Vector Error Correction Model (VECM) corresponding to (3.10) as follows:

$$\Delta Z=\mu + \alpha t + \lambda Z_{t-1} + \Sigma\gamma i\Delta Y_{t-i} + \Sigma\gamma j\Delta X_{t-j} + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots.. (3.10)$$

Where, $\Delta = 1 - L$ and $\alpha[\alpha y,\alpha x]$.

The VECM procedures described above are important in at most, one cointegrating vector between dependent variable Y_t and a set of regressors X_t. Following the assumptions made (unrestricted intercepts and no trends), and restrictions imposed ($\lambda_{xy} = 0$, $\mu = 0$ and $\alpha = 0$) by Pesaran, Shin & Smith (2001). We reformulated equation (3.11) to derive the following unrestricted error correction model (UECM) to examine the long run relationship between real GDP and trade openness. Thus, equation (3.3) can be transformed into ARDL model of the form:

$$\Delta LRGDP_{\alpha} = \alpha \sum_{i=1}^{p} \alpha_{1i} \Delta LRGDP_{t-1}$$
$$+ \sum_{i=1}^{p} \alpha_{2i} \Delta OPNES_{t-1} + \sum_{i=1}^{p} \alpha_{3i} \Delta INV_{t-1} + \sum_{i=1}^{p} \alpha_{4i} \Delta HK_{t-1}$$
$$+ \sum_{i=1}^{p} \alpha_{5i} \Delta FDI_{t-1} + \sum_{i=1}^{p} \alpha_{6i} \Delta EXR_{t-1} + \lambda ECM + \phi \dots\dots\dots\dots\dots\dots\dots (3.11)$$

Where λ is the speed of adjustment parameter and ECM is the residuals obtained from model (3.3).

Equation (3.11) is the benchmark ARDL model, where *L* represent the natural logarithm transformation which can reduce the problem of heteroscedasticity because it compresses the scale in which the variables are measured, thereby reducing a tenfold difference between two values to a two-fold (Gujarati & Porter , 2009).

Again, the country-specific equations of the ARDL were derived as follows:

$$\Delta LRGDP_{\nu} = \nu \sum_{i=1}^{p} \nu_{1i} \Delta LRGDP_{t-1} + \sum_{i=1}^{p} \nu_{2i} \Delta OPNES_{t-1} + \sum_{i=1}^{p} \nu_{3i} \Delta INV_{t-1} + \sum_{i=1}^{p} \nu_{4i} \Delta HK_{t-1}$$
$$+ \sum_{i=1}^{p} \nu_{5i} \Delta FDI_{t-1} + \sum_{i=1}^{p} \nu_{6i} \Delta EXR_{t-1} + \lambda ECM + \phi \dots\dots\dots\dots\dots\dots\dots (3.12)$$

Where; ν_1 - ν_6 are parameter coefficients to be estimated for Cote d'Ivoire, while ν_0 is the intercept. All the other variables are as earlier defined in equation (3.3).

$$\Delta LRGDP_w = \eta \sum_{i=1}^{p} w_{1i} \Delta LRGDP_{t-1}$$
$$+ \sum_{i=1}^{p} w_{2i} \Delta OPNES_{t-1} + \sum_{i=1}^{p} w_{3i} \Delta INV_{t-1} + \sum_{i=1}^{p} w_{4i} \Delta HK_{t-1}$$
$$+ \sum_{i=1}^{p} w_{5i} \Delta FDI_{t-1} + \sum_{i=1}^{p} w_{6i} \Delta EXR_{t-1} + \lambda ECM + \phi \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.13)$$

Where; ω_1 - ω_6 are parameter coefficients for Ghana, while ω_0 is the intercept. All the other variables are as earlier defined in equation (3.3).

$$\Delta LRGDP_\eta = \eta \sum_{i=1}^{p} \eta_{1i} \Delta LRGDP_{t-1} + \sum_{i=1}^{p} \eta_{2i} \Delta OPNES_{t-1} + \sum_{i=1}^{p} \eta_{3i} \Delta INV_{t-1} + \sum_{i=1}^{p} \eta_{4i} \Delta HK_{t-1}$$
$$+ \sum_{i=1}^{p} \eta_{5i} \Delta FDI_{t-1} + \sum_{i=1}^{p} \eta_{6i} \Delta EXR_{t-1} + \lambda ECM + \phi \ldots\ldots\ldots\ldots\ldots\ldots\ldots (3.14)$$

Where; η_1 - η_6 are parameter coefficients to be estimated for Nigeria, while η_0 is the intercept. All the other variables are as earlier defined in equation (3.3)

This approach will facilitate in answering the first research question: What is the long run effect of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria?

3.6.3.1 ARDL Diagnostic Tests

The ARDL diagnostic tests were conducted mainly to confirm the reliability of the bound test and to see if the *F*-Statistic is higher than the lower and upper bound. The tests suggested by Pesaran, Shin & Smith (2001) are autocorrelation, model specification and heteroscedasticity tests.

The Ramsey's (1969) regression specification error test (RESET) has proven to be useful in detecting general form misspecification. The Breusch-Godfrey Serial Correlation Lagrange Multiplier (LM) statistic is derived from constrained optimization, and relies on the

Gauss-Markov assumptions of Best Linear Unbiased Estimator (BLUE) that justify the *F*-statistics in large numbers (Breusch & Pagan, 1979) is useful to test for correlation.

The Breusch & Pagan, 1979; and Godfrey, 1978 (BPG) heteroscedasticity test is chi-squared test used to test for heteroscedasticity. If the test statistic has a *p*-value below an appropriate threshold (e.g. $p < 0.05$) then the null hypothesis of homoscedasticity is rejected and heteroscedasticity is assumed (Wooldrige, 2016).

3.6.4 Vector Autoregression Model

Vector autoregression (VAR) is a stochastic process model used to capture the linear interdependencies among multiple time series. A VAR model describes the evolution of a set of *k* variables (called endogenous variables) over the same sample period (t = 1, …, T) as a linear function of only their past values. The variables are collected in a $k \times 1$ vector y_t, which has the i^{th} element, $y_{i,t}$, the observation at time *t* of the i^{th} variable (Hatemi, 2004). For example, if the i^{th} variable is GDP, then $y_{i,t}$ is the value of GDP at time *t*.

A p-th order VAR, denoted VAR (p), is

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \ldots + A_p y_{t-p} + e_t, \qquad \ldots\ldots\ldots\ldots \qquad (3.15)$$

where the *e*'s are the stochastic error terms, called impulses or innovations or shocks in the language of VAR (Gujarati & Porter, 2009), the *I*-periods backed observation y_{t-1} is called the *I*-lag of y, c is a $k \times 1$ vector of error terms satisfying

1. $E(e_t) = 0$ - every error term has mean zero;
2. $E(e_t e^{l}_{t}) = \Omega$ - the contemporaneous covariance matrix of error terms is Ω (a $k \times k$ positive semi-definite matrix)
3. $E(e_t e^{l}_{t-k}) = 0$ for any non-zero*k* – there is no correlation across time; in particular, no serial correlation in individual error terms (Hatemi, 2004).

VARs are good at capturing co-movements of multiple time series (Stock & Watson, 2001). The properties of the VAR model are usually summarized using Granger causality, impulse responses, and forecast variance decompositions. But Granger causality may not tell us a complete story about the variables of a system. In applied econometrics, it is often of interest to know the response of one variable to an impulse in another variable in a system that involves a number of other variables as well.

3.6.4.1 Lag Selection Criteria

One of the assumptions of the classical linear regression model (CLRM) is that the regression used in the analysis is "correctly" specified. Friedman (1953), cited in Gujarati & Porter (2009), notes that "the only test of validity of a hypothesis (model) is comparison of its predictions with experience" (p.468). Thus, it is important to include lagged values of the dependent variable in running regression on times series data. In econometric literature, there are several criteria that have been used to select the lag period for forecasting purposes. These include: (1) Akaike Information Criteria (AIC), (2) Schwatrz Information Criterion (SIC), (3) Final Prediction Error (FPE), and (4) Hannah-Quinn, among several other criteria.

There is no consensus view on the superiority of one criterion over the others, as they may sometimes give conflicting result. In econometric literature, Akaike Information Criterion (AIC), Final Prediction Error (FPE) and Schwartz Information Criterion (SIC) are considered as most useful in determining lag length if the number of observations is below 60. Where the number of observations is above 60 and below 120, then Hannah-Quinn and Log Likelihood are superior to the other criteria (Gujarati & Porter, 2009). The current study has a sample size of 47, which is below 60 observations, hence SIC was used for lag selection.

One advantage of SIC, is that, the criterion is useful not only for lag selection, but also for testing performance of the regression model for in-sample forecasting (which tells us how the chosen model fits the data in a given sample) and Out-of-Sample forecasting (which is concerned with determining how a fitted model forecasts future values of the regressand, given the values of the regressors).

3.6.4.2 The VAR Granger Causality/Block Exogeneity Wald Test

The Granger Causality test is a statistical hypothesis test for determining whether one time series is useful in forecasting another (Granger, 1969). Ordinarily, regressions reflect mere correlations, but Granger argued that there is an interpretation of a set of tests as revealing something about causality.

A time series X is said to Granger-cause Y if it can be shown, usually through a time series of t-tests and F-tests on lagged values of X (and with lagged values of Y also included), that those X values provide statistically significant information about future values of Y (Granger, 1969). The test of Granger causality works by first doing a regression of ΔY. (Here ΔY is the first difference of the variable Y – that is, Y minus its one-period-prior value. The regressions are performed in terms of ΔY rather than Y, if Y is not stationary but ΔY is). The next step is to find the set of significant lagged values for ΔY via t-statistic or p-values, and then the regression is augmented with lagged levels of ΔX. Any particular lagged values of ΔX is retained in the regression if (1) it is significant according to a t-test, and (2) it, and the other lagged values of ΔX jointly add explanatory power to the model according to an F-test. Then the null hypothesis of no Granger causality is retained if and only if no lagged values of ΔX have been retained in the regression (Granger, 1969).

Mathematically, the test for null hypothesis that X does not Granger-cause Y, can be expressed as

$$Y_t = \alpha_0 + \alpha_1 Y_t\text{-}1 + \alpha_2 Y_{t-2} + \ldots\ldots + \alpha_m Y_{t-m} + \text{residual}_t \qquad \ldots\ldots\ldots\ldots\ldots\ (3.16)$$

Here Y_t is retained in the regression if and only if it has a significant *t*-statistic; *m* is the greatest lag length for which the lagged dependent variable is significant.

Next, the auto regression is augmented by including lagged values of *X*:

$$Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 Y_{t-2} + \ldots.. + \alpha_m Y_{t-m} + b_p X_{t-p} + \ldots. + b_q X_{t-q} + \text{residual}_t \ldots\ldots \quad (3.17)$$

We retained in regression (3.16) all lagged values of *X* that are individually significant according to their *t*-statistics, provided that collectively they add explanatory power to the regression according to an *F*-test. The null hypothesis that *X* does not Granger cause *Y* is accepted if and only if no lagged values of *X* are retained in the regression.

There exists bidirectional (bilateral) causation if *X* Granger cause *Y*, and at the same time *Y* Granger cause *X*. But a unidirectional causation exists if *Y* Granger cause *X*, and *X* does not Granger cause *Y*. And independence exists if *X* does not Granger cause *Y*, and *Y* does not Granger cause *X*.

In applied econometrics, Granger causality modeling has received considerable attention. Sometimes it is difficult to use Granger causality (or non-causality) to establish exogeneity. In other words, Granger Causality is necessary (but not sufficient) condition to imply strong exogeneity (true causality). If both *X* and *Y* is driven by a common third process with different lags, one might still accept the alternative hypothesis of Granger causality.

This study employed VAR Granger Causality/Block Exogeneity Wald (BEW) test whose difference with the Granger causality is that (1) its statistic is Chi-square while Granger causality test statistic is *F*-statistic (2) BEW causality test is multivariate while pairwise causality is bivariate. Granger causality is designed to handle pairs of variables, and may produce misleading results when the true relationships involve Granger causality and exogeneity. We have to separate, and treat the former as a useful descriptive tool for the time series data of the 3 countries under study. This approach will facilitate in answering the second research question: What is the causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria?

3.6.4.3 Impulse Response and Forecast Error Variance Decomposition

The impulse response functions (IRFs) show the effects of shocks on the adjustment path of variables. For example, consider the first-order case (i.e., with only one lag, with equation of evolution)

$$y_t = Ay_{t-1} + e_t \qquad \text{………………………… (3.18)}$$

for evolving (state) vector *y* and vector *e* of shocks. To find, say, the effect of the

j-th element of the vector of shocks upon the *i*-th element of the state vector 2 periods later, which is a particular impulse response,

$$y_{t-1} = Ay_{t-2} + e_{t-1} \qquad \text{……………………… (3.19)}$$

Using this in the original equation to obtain

$$y_t = A^2y_{t-2} + Ae_{t-1} + e_t; \qquad \text{………………………(3.20)}$$

then repeat using the twice lagged equation, to obtain

$$y_t = A^3y_{t-3} + A^2e_{t-2} + Ae_{t-1} + e_t. \qquad \text{……………………….(3.21)}$$

From this the effect of the *j*-th component of e_{t-2} upon the *i*-th component of y_t is the *i*, *j* element of the matrix A^2.

It can be seen from the induction process that any shock will have an effect on the elements of *y* infinitely far forward in time, although the effect will become smaller over time assuming the autoregression process is stable – that is, that all the *eigen values* of the matrix A are less than *1* in *absolute value* (Lutkepohl, 2007). While impulse response functions trace the effects of a shock to one endogenous variable onto the other variables in the VAR, variance decomposition separates the variation in an endogenous variable into the component innovation (shock, impulse) to the VAR. The forecast error variance decomposition (FEVD) is used to aid in the interpretation of a VAR model once it has been fitted (Lutkepohl, 2007). FEVD measured the contribution of each type of shock to the forecast error variance (that is, it assesses the pass-through of external shocks to each economic variable). Suppose we model y_t as follows,

$$y_t = A_0 + A_1 y_{t-1} + A_2 y_{t-2} + \ldots A_p y_{p-1} + e_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3.22)$$

This can be changed to a VAR (1) structure by writing in companion form

$$Y_t = V + AY_{t-1} + E_t \qquad \ldots\ldots\ldots\ldots\ldots\ldots (3.23)$$

Where

$$A = \begin{bmatrix} A_1 & A_2 & \ldots & A_{P-1} & A_P \\ I_k & 0 & \ldots & 0 & 0 \\ 0 & I_k & \ldots & 0 & 0 \\ : & : & : & : & : \\ 0 & 0 & \ldots & I_k & 0 \end{bmatrix} \quad Y = \begin{bmatrix} y_1 \\ : \\ \\ y_p \\ \\ \end{bmatrix} \quad V = \begin{bmatrix} \nu \\ 0 \\ 0 \\ : \\ 0 \end{bmatrix} \quad \text{and } U_t = \begin{bmatrix} \mu_t \\ 0 \\ : \\ 0 \end{bmatrix} \ldots\ldots (3.24)$$

Where y_t, ν and μ are k dimensional column vectors, A is kp x kp dimensional matrix and Y, V and E are kp dimensional column vectors (Lutkepohl, 2007).

The mean squared error of the *h*-step forecast of variable*j* is

$$\text{MSE } [y_{j,t}(h)] = \Sigma\Sigma(e^{l}_{j}\Phi_i e_k)^2 = (\Sigma\Phi_i\ \Phi_i^{l})_{jj} = (\ \Sigma\varphi_i\ \Sigma_e\ \varphi_i^{l})_{jj}\ , \qquad \ldots\ldots\ldots\ldots (3.25)$$

And where

1. $e_j$is the j^{th} column of I_k and the subscript *jj* refers to that element of the matrix
2. $\Phi_i = \varphi_i P$, where *P* is a lower triangular matrix obtained by a *Cholesky decomposition* of Σ_e such that $\Sigma_e = PP^l$, where Σ_e is the covariance matrix of the errors e_t
3. $\varphi_i = JA^i J^l$**,** where $J = [\ I_k \ \ 0 \ \ \ldots \ \ 0]$, so that *J* is *k* x *kp* dimensional matrix (Lutkepohl, 2007).

The amount of forecast error variance of variable *j* accounted for by exogenous shocks to variable *k* is given by $\omega_{jk,h}$,

$$\omega_{jk,h} = \Sigma(e_j^1 \Phi_i e_k)^2 / MSE[y_{j,t}(h)] \qquad \text{……………………. (3.26)}$$

This study adopted both computations in assessing how shocks in economic variables reverberate through the system and thus, provided ananswer to the third research question: What is the response of economic growth to an impulse in trade openness in Cote d'Ivoire, Ghana and Nigeria?

3.7 Panel Data Analysis

Panel data analysis was used in this study because of its ability to exploit both the time series and cross-sectional dimensions of data, which proved to provide efficient estimations of parameters by considering wider sources of variation. In addition, the use of panel data, which means combining the time series dimension with the cross-sectional dimension, availed a richer set of information to explore the relationship between the dependent and independent variables. If estimates of the parameters of the model turn up with magnitudes and signs (number) not in conformity with economic theory, they will be rejected unless there is a good reason to believe that, in that particular instance, economic theory does not hold. In addition to the entire panel, the data set is segmented into 3 sub-panels for Cote d'Ivoire, Ghana and Nigeria, respectively.

3.7.1 Panel Unit Root test

The Im-Pesaran-Shin (2003) (hereafter, IPS) test and the Fisher-type test by Madalla & Wu (1999) and Choi (2001) were used to check the stationarity of the variables;

Formally, the test equation of both tests is

$$\Delta y_{i,t} = \mu_i + \beta_i y_{i,t-1} + \varepsilon_i \qquad (3.27)$$

With the null hypothesis that each cross-section series in the panel has a unit root, and the alternative hypothesis that, at least one cross-section in the panel is stationary (Wooldridge, 2016). Additionally, the formulation allows β_i differ cross-sections so that both tests allow for heterogeneity.

$$H_0: \beta_i = 0, \quad \text{for all } i \qquad (3.28)$$

$$H_1: \beta_i < 0, \quad i=1, 2, \ldots, N_1, \ \beta_i=0 \ i=N_1+1, N_2+1, \ldots N \qquad (3.29)$$

Wooldridge (2016) explained that the IPS is a t-bar statistic based on the Augmented Dickey Fuller (ADF) statistic. This statistic is computed by the sample mean of the individual unit root tests for each of the *N* cross section units. The main idea of the Fisher-type unit root test is to combine p-values from the unit root test applied to each of the *N* cross-section units in the panel. While both IPS and the Fisher-type test combines information based on individual unit root tests, the crucial difference between the two is that, the IPS test combines the test statistics while the Fisher-type test combines the significance levels of the individual tests.

3.7.2 Panel Cointegration Tests

The panel cointegration tests allows for heterogeneity in the panel data by permitting heterogeneous slope coefficients, fixed effects and individual specific deterministic trends (Pedroni, 1999). The hypothesized cointegrating equation takes the form:

$$\Delta y_{it} = \alpha_I + \delta_{it} + \beta_{1i}x_{1i} + \beta_{2i}x_{2i} + \ldots\ldots + \beta_{mi}x_{mi,t} + e_{i,t} \qquad \text{.................} \ (3.30)$$

for t = 1,.., T; i =1,..,N; m = 1,.., M; where y and *x* are assumed to be integrated of order one I(1). The parameters α_i and δ_i are individual and trend effects which were set to zero.

Under the hypothesis of no cointegration, the residuals $e_{i,t}$ will be I(1), that is, $p_i = 1$. Pedroni describes two alternative hypotheses: the homogenous alternative, $(p_i = p) < 1$ for$i$ (which Pedroni terms the with-dimension test or panel statistics test), and the heterogenous alternative, $p_i < 1$ for all *i* (also referred to as the between-dimension or group statistics test).

Pedroni (2004) suggested that the panel cointegration tests contain seven cointegration statistics, the first four based on pooling the residuals along the "within-dimension" which assume a common value for the unit root coefficients, and the subsequent three based on pooling the residuals along the "between-dimension" which allow for different values of the unit root coefficients. The common idea of both classes is to first estimate the hypothesized cointegration relationship separately for each group member of the panel, and then pool the resulting residuals when constructing the test for the null hypothesis of no cointegration.

The Kao (1999) residual co-integration is based on whether or not there exists a long run relationship among variables in a model. It is essentially a supportive test to the Pedroni (1999) co-integration test, but specifies cross-section specific intercepts and homogenous coefficients on first-stage regressors. The Kao test depends on the ADF *t*-statistic and whether its probability is significant.

Johansen's Fisher panel co-integration tests is a system based co-integration test for a whole panel set, unlike Pedroni (1999) and Kao (1999) cointegration tests which are residuals taken from Engel & Granger (1987) two-step test. Fisher (1932) test is employed in this study as robustness check for cointegration as the test accommodates as much heterogeneity as is possible, while Pedroni and Kao tests are residual-based but assumes cross sectional dependence. Madalla & Wu (1999) employed Fisher (1932) test to derive a combined test that uses the results of the individual dependent tests to testing for co-integration in panel data by combining tests from individual cross-sections to obtain the full statistic for the full panel.

3.7.3 Panel Data Procedure

Panel data (also known as longitudinal or cross sectional time-series data) is a dataset in which the behaviour of entities is observed across time. Panel data was employed to conduct a cross-country analysis of the effect of openness on economic growth in Côte d'Ivoire, Ghana and Nigeria. The pooled cross-section included variables at different levels of analysis (i.e, RGDP, OPNES, INV, HK, FDI, EXR) suitable for multilevel or hierarchical modelling.

Panel data allowed the study to control for variables which cannot be observed or measured like cultural factors or geographical distance across countries; or variables that change over time but not across entities (i.e. national policies, federal regulations, international agreements, etc.). Thus, it accounts for individual countries' heterogeneity. The study focused on two techniques used to analyze panel data: fixed effects and random effects techniques.

Employing the Gujarati & Porter (2009) approach, the fixed effect regression is specified as;

$$RGDP_{it} = \alpha_0 + \alpha_{1i}OPNES_{it} + \alpha_{2i} INV_{it} + \alpha_{3i}HK_{it} + \alpha_{4i} FDI_{it} + \alpha_{5i}EXR_{it} + \mu_{it} \text{ .... } (3.\ 31)$$

In literature, model (3.31) is known as the fixed effect (regression) model (FEM). The term 'fixed effect' is due to the fact that, although the intercept may differ across individuals (here, across the 3 countries), each individual's (country's) intercept does not vary over time; that is, it is *time-invariant.* Notice that, if we were to write the intercept as α_{1t}, it will suggest that the intercept of each country or individual is *time variant.* To allow the (fixed effect) intercept to vary between countries, we use dummy variable technique, particularly, the differential intercepts dummies. Therefore, we write (3. 31) as;

$$RGDP_{it} = \delta_0 + \delta_1 D_{1i} + \delta_2 D_{2i} + \mu + \delta_3 OPNES_{it} + \delta_4 INV_{it} + \delta_5 HK_{it} + \delta_6 FDI_{it} + \delta_7 EXR_{it} + \mu_{it} \text{...} \quad (3.32)$$

All other variables in equation (3.32) are as previously defined in equation (3.3), except $D_{1i} = 1$**,** if the observation belong to country 2 (Ghana), *0* otherwise; $D_{2i} = 1$ if the observation belong to country 3 (Cote d'Ivoire), *0* otherwise. Since we have 3 countries, we have used only two dummies to avoid falling into the dummy-variable trap (that is, the situation of perfect collinearity). Here there is no dummy for country 1 (Nigeria). In other words, $\boldsymbol{\delta_0}$represent intercept of country 1 (Nigeria) and $\boldsymbol{\delta_1}$and $\boldsymbol{\delta_2}$, the differential intercept coefficients**,** which tell by how much the intercepts of Ghana and Cote d'Ivoire differ from the intercept of Nigeria. In short, Country 1 (Nigeria) becomes the comparison country (though one is free to choose any other individual (country) as the comparison individual (country) as explained by Gujarati & Porter (2009).

Since we are using dummies to estimate the fixed effect, in the literature, model (3. 32) is also known as the Least Squares Dummy Variable (LSDV) model. Just as we use the dummy variables to account for individual (country) effect, we can allow time effect in the sense that the openness-growth function shifts over time because of factors such as technological changes, changes in trade policies, and changes in governance, conflicts, and other macroeconomic factors.

On the other hand, the rationale behind random effect model (REM) is that, unlike the FEM, the variation across entities (countries) is assumed to be random and uncorrelated with the predictor or independent variables included in the model. An advantage of REM is that, we can include time-invariant variables (e.g. gender, culture, geographical distance, etc.). In the FEM, these variables are absorbed by the intercept. REM allows us to generalize the inferences beyond the sample used in the model.

Transforming (3.32) we can specify the REM as;

$$RGDP_{it}= \alpha_{0i}+\alpha_{1i}OPNES_{it}+\alpha_{2i}INV_{it}+\alpha_{3i}HK+\alpha_{4i}FDI_{it}+\alpha_{5i}\, EXR_{it} + \varepsilon_{it}+\mu_{it}\ldots\ldots\ldots(3.33)$$

All the variables are as defined in (3.3) and (3.32) above except ε_{it} which is the *within-entity (country) error* term and μ_{it} is *between-entity (country) error* term**.** ε_{it} and μ_{it} are known as the idiosyncratic term in econometrics literature because it varies over cross-section as well as time (Gujarati & Porter, 2009).

Pooling, or combining, all the 141 observations, these error terms were summed up into a composite error term as follows;

$$RGDP_{it} = \alpha_{0i} + \alpha_{1i}OPNES_{it} +\alpha_{2i}\, INV_{it} + \alpha_{3i}\, HK_{it}+FDI_{it}+ \alpha_{5i}\, EXR_{it} + \omega_{it} \ldots.. (3.34)$$

Where, $\omega_{it} = \varepsilon_{it} + \mu_{it}$ ……I =1, 2, 3, t=1,………., 138. *i* stand for the cross-sectional unit (country) also known as cross-sectional identifier, and *t* for the t^{th} time period or time identifier. In the current study, we have 3 countries (cross-sectional units) or 141 observations and a maximum period of 47 years (1970 - 2016). Each country (cross-sectional unit) has the same number of observations. This type of panel data, according to Wooldridge (2016), is known as balanced panel. Model (3.34) can also be referred to as the pooled Ordinary Least Squares (OLS) regression equation.

3.7.3.1 Hausman Correlated Random Effects Test

To decide between FEM and REM, Hausman (1978) correlation test was conducted where the null hypothesis is that the preferred model is random effect versus the alternative, the fixed effect.The Hausman test was performed using the outputof the random effects estimation. It is basically a test on whether unique errors are correlated with the regressors. The null hypothesis is, they are not. The Decision Ruleis at 5% level of significance: Ho: REM is appropriate, H_1: FEM is appropriate.

3.7.5 Panel Diagnostic Tests

There are basic assumptions surrounding panel data analysis. According to Gujarati & Porter (2009), panel framework assumes absence of functional misspecification, serial correlation and heteroscedasticity. With these limiting assumptions, tests for cross-sectional dependence and normality test were conducted using the Breusch & Pagan (1980) Langrange Multiplier (LM) test, Pesaran (2004) Scaled LM test and Pesaran (2004) Cross-sectional Dependence (CD) test jointly. These three tests were computed from the panel pooled effects model estimated by OLS. The result of these tests facilitated in taking a decision on the null hypothesis of no cross-section dependence.

3.7.6 The Dumitrescu-Hurlin Granger Panel Causality Test

As discussed in Granger (1969), it is highly probable that if a causal relationship exists for a country or an individual in a group, it is also exist for some other countries or individuals. Dumitrescu & Hurlin (2012) (henceforth D-H) suggested that, in this case, the causality can be more efficiently tested in a panel context with N individuals and T samples. However, the use of cross-sectional information involves taking into account the heterogeneity of individuals in the definition of the causal relationship. The D-H test for non-causality for heterogeneous panel data models is based on the individual Wald statistics of Granger non-causality averaged across the cross-section units. First, this statistic is shown to converge sequentially as standard normal distribution. Second, the semi asymptotic distribution of the average statistic is characterized for a fixed T sample. Hence D-H proposed a standard statistic based on an approximation of the moments of Wald statistics. The choice of lag selection is based on Akaike information criterion (AIC), Schwarz information criterion, or the Hannan-Quinn information criterion.

Dumitrescu & Hurlin (2012) denote dx and y, two stationary variables observed for N individuals on T periods. For each individual $i = 1, ..., N$, at time $t = 1, ..., T$, they consider the following linear model

$$y_{i,t} = \alpha_i + \sum_{k=1}^{K} \gamma_i^{(k)} y_{i,t-k} + \sum_{k=1}^{K} \beta_i^{(k)} x_{i,t-k} + \varepsilon_{i,t} \text{.......}(3.35)$$

The D-H test is a fixed coefficients model with fixed individual effects based on the following assumptions:

Assumption (A_1) For each cross section unit i = 1, .., N, individual residuals $\varepsilon_{i,t,}\ \varphi_{t\,=}$ 1, ..,T are independently and normally distributed with E ($\varepsilon_{i,t}$) = 0 and finite heterogeneous variances

E ($\varepsilon^2_{i,t}$) = $\sigma^2\varepsilon_{,i}$.

Assumption (A_2) Individual residuals $\varepsilon_I = (\varepsilon_{i,1,\ ...,}\ \varepsilon_{i,T})'$ are independently distributed across groups. Consequently, E ($\beta\varepsilon_{I,t}\varepsilon_{j,s}$) = 0, $Ə_i \neq$ j and Ə(t,s).

Assumption (A_3) both individual variables $x_i = (x_{i,1, \ldots,} x_{i,T})'$ and $y_i = (y_{i,1, \ldots,} y_{i,T})'$, are covariance stationary with E $(y^2_{i,t}) < \infty$ and E $(x^2_{i,t}) < \infty$. Besides, E $(x_{i,t}x_{j,z})$, E $(y_{i,t}y_{j,z})$ and E $(y_{i,t}x_{j,z})$ are only function of the difference $t - z$, where E $(x_{i,t})$ and E $(y_{i,t})$ are independent of t.

Given these assumptions, equation (3.35) can be used to test whether x causes y based on an F-test with the following null hypothesis of heterogeneous non-causality (*HNC*) defined as:

$$Ho: \beta_i = 0 \quad _i = 1,.., N \tag{3.36}$$

with $\beta_i = (\beta_i^{(1)},..., \beta_i^{(k)})'$. Additionally, β_i may differ across groups under the alternative (model heterogeneity). If *Ho* is rejected, it implies that causality from x to y exists. The x and y variables can be interchanged to test for causality in the other direction, and it is also possible to observe bidirectional causality (also called feedback).

D-H hence distinguished between the heterogeneity of the regression model and that of the causal relationship from x to y. The first one, denoted *Homogeneous Non Causality* (*HNC*) hypothesis, implies that no individual causality relationship from x to y exists. The symmetric case is the *Homogeneous causality* (*HC*) which occurs when N causality relationship exists, and when the individual predictors of y obtained conditionally on the past values of y and x are identical. Under the *Heterogeneneous Causality* (*HEC*) hypothesis, D-H model assume that N causality relationship exist, as in the *HC* case, but the dynamics of y is heterogenous, though the heterogeneity does not affect the causality result. Finally, under the *Hetergeneous non causality* (*HENC*) hypothesis, they assume that there exists a causal relationship from x to y for a subgroup of individuals. Symmetrically, there is at least one and at most $N - 1$ non causal relationship in the model. It is clear that in the hetergeneous process that the heterogeneity deals with causality from x to y.

In this context, D-H proposed a simple test of the *HNC* hypothesis. Under the null hypothesis, there is no causal relationship for any of the units of the panel, while the alternative hypothesis is the *HENC*, which implies that there is a causal relationship from *x* to *y* for a subgroup of individuals. The D-H procedure has been shown through Monte Carlo simulations to produce unbiased results even in the presence of cross sectional dependence. Monte Carlo simulations (experiments) are computational alogarithms that rely on repeated random sampling used in econometrics for optimization, numerical integration, and generating draws from probability distribution (Dumitrescu & Hurlin, 2012).

3.8 Justification of the Methodologies Adopted

The cross-country trade openness-growth literature is still far from settled since the findings of these literatures have been subject to an important debate in terms of robustness. Strong results in favour of trade openness may arise from limited scope, model misspecification and/or openness measures and variables selected. In a nutshell, it is not out of place to say most of the cross-country studies suffer from lack of robust and convincing evidence on the relationship between trade openness and economic growth.

Applying the Mankiw, Romer & Weil (1992) framework made it convenient to augment the Solow's (1956) growth model on the cross-country analysis with related macroeconomic variables which helped to better explain the openness-growth question. Summary statistics helped to summarize the set of observations, in order to communicate the largest amount of information which gave a simple description of the data. The Augmented Dickey Fuller unit root test was employed due to its simplicity in determining stationarity in time series. The ARDL has a dual function of checking for cointegration through the bound testing technique and measure of long run and short run relationships, and if a variable have statistically significant short run and long run components, then the particular variable has strong causal effect on the dependent variable, but if it is only the short run that indicate statistical significance, then it has a weak causal effect.

Vector Auto regression estimates are good at capturing co-movements of multiple time series, and its properties are usually summarized using Granger causality, impulse responses, and forecast variance decompositions. In applied econometrics, it is often of interest to know the response of one variable to an impulse in another variable in a system that involves a number of other variables as well. Granger causality is designed to handle pairs of variables, and may produce misleading results when the true relationships involve Granger causality and exogeneity. The VAR Granger causality/Block exogeneity Wald test separates exogeneity and treat Granger causality as a useful descriptive tool for the time series analysis. The Dumitrescu-Hurlin Granger causality model therefore, serve as a robustness check in cross-section analysis, as it takes into account two dimensions of heterogeneity: the heterogeneity of the regression model used to test the Granger causality and the heterogeneity of the causality relationships.

In practice, there is an econometric problem of parameter estimates bias in models with fixed effects models (FEM) for estimating dynamic panel data models. Nickell (1981) argue that even if FEM is used, lagged dependent variable will still be correlated with the error term resulting to bias. To deal with the problem Hsiao (1986) suggests first-difference of the data to remove the error term, and then instrument for the dependent variable. In this study, the mixture of fixed effects with dummies reduced this problem, and does not require instrumental variables as the model has the additional benefit of providing the researcher with diagnostic information about the extent of heterogeneity in the panel. Notably, it is often difficult to find good instruments, which can itself create problems for the estimation, even as Kiviet (1995) has shown that panel data models that use instrumental variables estimation often lead to poor finite sample efficiency and bias. On the overall, the methodological triangulation approach employed has provided qualitative research by increasing the credibility and validity of the results.

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND INTERPRETATION

4.1 Descriptive Statistics

The summary of descriptive statistics of the macroeconomic variables used to measure the effect of trade openness on economic growth for Cote d'Ivoire, Ghana and Nigeria derived from the raw data in Appendix 3 as displayed in Table 4.1, indicates wide variations. For instance, the average GDP (constant 2010 US$) was greater in Nigeria as compared with Ghana and Cote d'Ivoire from 1970-2016. Specifically, the result indicated average GDP of US$195 billion in Nigeria, US$19 billion in Cote d'Ivoire and US$18.4 billion in Ghana. Furthermore, the mean value of trade openness (OPNES) in Cote d'Ivoire was 74.27% compared with 57.7% in Ghana and 47.02 % in Nigeria, for the period 1970 to 2016. This implies that Cote d'Ivoire and Ghana are relatively more open to international trade during the period as compared with Nigeria. The gross fixed capital formation (INV), however, shows average of US$3.45billon in Nigeria, US$2.63billion in Ghana and US$1.97billion in Cote d'Ivoire. Human capital development (HK) proxied by the total number of secondary school enrolment (male and female) average 7.22 million in Ghana, 3.68 million in Cote d'Ivoire and 3.52 million in Nigeria. Ghana and Cote d'Ivoire exhibited greater average secondary school enrolment (HK) than Nigeria, which implies a wide variation in the gross secondary school enrolment ratio to total population of Nigeria relative to Ghana and Cote d'Ivoire. Furthermore, the net inflow of foreign direct invest (FDI) average US$6.76 billion in Ghana, US$6.68% in Nigeria and US$1.99 billion in Cote d'Ivoire. And the official exchange rate of domestic currencies (EXR), indicated CFA416.09 West African CFA franc to the US$ in Cote d'Ivoire, ₦58.72 Nigerian naira to US$ in Nigeria and GH₵0.58 Ghanaian Cedi to US$ in Ghana. The wide variation in the exchange rate indicated the relative strength of the domestic currencies in the foreign exchange markets. The Ghanaian cedi, for instance, was at par with the United States dollar from 1970 – 1984, and continue to exhibit relative strength to the dollar, as compared with the Nigerian Naira and the West African CFA franc.

The mean to median ratio for the data sets of individual countries is within the unit proximity except for RGDP which indicated wide variation in all the countries, while EXR indicated wide variation in Nigeria and Ghana. The range of the distribution (difference between minimum and maximum values) is positive for all the data sets for the three countries. Again, after summing up the time series for 47 years, the standard deviations were quite low, even with the large sample, indicating minimal fluctuations in the individual country time series. The result of skewness, however, indicated all the time series having positive value, which implies that the distribution is skewed to the right. Since measurement of most of these variables have a lower bound and are not multi-modal, it does not affect there reliability. The kurtosis for standard normal distribution is three. For this reason, most of the time series reported negative kurtosis (OPNES, INV and EXR) in Nigeria, (OPNES and EXR) in Ghana and (OPNES, HK, FDI and EXR) in Cote d'Ivoire, while excessive kurtosis is reported in Ghana (INV and EXR), and (RGDP and INV) in Cote d'Ivoire. The Jarque Berra test for the data sets for all the countries also reported significant probabilities at 5% level for most of the variables except, OPNES, INV and HK in Nigeria, OPNES in Ghana and OPNES, HK and FDI in Cote d'Ivoire.

The summary statistics indicated that most of the classical statistical tests do not satisfy the normality assumptions. The first approach employed was to transform the data using lognormal technique which is based on distribution rather than normality. However, the sample is higher than 30, therefore, normality on the basis of central limit theorem is ignored, more so, as normality is a desirable but not necessary condition for dynamic regression analysis using Autoregressive Distributed Lag (ARDL) bound testing, Vector Error Correction Method (VECM) and panel regression employed for this study.

Table 4.1: Descriptive Statistics for Cote d'Ivoire, Ghana and Nigeria.

COTE D'IVOIRE	RGDP	OPNES	INV	HK	FDI	EXR
Mean	1.99E+10	74.27553	1.97E+09	3685135.	1.99E+08	416.0951
Median	1.81E+10	75.27000	1.39E+09	2909815.	1.65E+08	447.8100
Maximum	3.68E+10	95.07000	7.53E+09	10395400	4.94E+08	733.0400
Minimum	9.89E+09	52.59000	3.27E+08	535249.0	14653230	211.2800
Std. Dev.	5.58E+09	11.18576	1.72E+09	2666249.	1.60E+08	152.6530
Skewness	0.816702	0.057792	2.040827	0.795530	0.370226	0.245990
Kurtosis	4.105976	2.282383	6.481187	2.604705	1.604856	1.873203
Jarque-Bera	7.620254	1.034653	56.35801	5.263467	4.885447	2.960444
Probability	0.022145	0.596112	0.000000	0.071954	0.086924	0.227587
Sum	9.35E+11	3490.950	9.24E+10	1.73E+08	9.37E+09	19556.47
Sum Sq. Dev.	1.43E+21	5755.577	1.36E+20	3.27E+14	1.18E+18	1071935.
Observations	47	47	47	47	47	47
GHANA	**RGDP**	**OPNES**	**INV**	**HK**	**FDI**	**EXR**
Mean	1.84E+10	57.69809	2.63E+09	7226491.	6.76E+08	0.586596
Median	1.38E+10	56.67000	1.15E+09	5703639.	71000430	0.060000
Maximum	4.82E+10	116.0500	1.30E+10	17519200	3.49E+09	3.910000
Minimum	8.34E+09	6.320000	1.43E+08	3171527.	2000000.	0.000000
Std. Dev.	1.15E+10	30.14140	3.61E+09	4059522.	1.20E+09	0.947058
Skewness	1.306244	0.110250	1.659526	1.275700	1.542215	2.067810
Kurtosis	3.574818	1.852568	4.509837	3.403419	3.566288	6.938100
Jarque-Bera	14.01288	2.673554	26.03745	13.06677	19.25902	63.86514
Probability	0.000906	0.262691	0.000002	0.001454	0.000066	0.000000
Sum	8.67E+11	2711.810	1.24E+11	3.40E+08	3.18E+10	27.57000
Sum Sq. Dev.	6.04E+21	41791.18	5.99E+20	7.58E+14	6.60E+19	41.25826
Observations	47	47	47	47	47	47
NIGERIA	**RGDP**	**OPNES**	**INV**	**HK**	**FDI**	**EXR**
Mean	1.95E+11	47.02511	3.45E+10	35222864	6.68E+08	58.72043
Median	1.37E+11	47.39000	2.64E+10	30417463	70869950	21.88000
Maximum	4.64E+11	81.81000	8.27E+10	97441488	3.47E+09	253.4900
Minimum	9.05E+10	16.81000	1.20E+10	2468780.	2000000.	0.550000
Std. Dev.	1.13E+11	16.87853	2.06E+10	27032376	1.19E+09	70.65071
Skewness	1.277560	0.014963	0.612371	0.845809	1.540202	0.820466
Kurtosis	3.139190	2.095273	2.080736	3.013642	3.564621	2.385414
Jarque-Bera	12.82319	1.604709	4.592370	5.604270	19.20671	6.012820
Probability	0.001642	0.448272	0.100642	0.060680	0.000068	0.049469
Sum	9.16E+12	2210.180	1.62E+12	1.66E+09	3.14E+10	2759.860
Sum Sq. Dev.	5.90E+23	13104.70	1.95E+22	3.36E+16	6.48E+19	229610.0
Observations	47	47	47	47	47	47

Source: Extracts using Eviews 10.0

4.2 Analysis of Augmented Dickey Fuller Unit Root Test

The Augmented Dickey Fuller (henceforth ADF) (Dickey & Fuller, 1981) unit root test was applied to examine if the time series data set exhibit unit root properties, that is, if the data set is stationary. A stationary time series process is one whose probability distributions are stable over time (Wooldridge, 2016). Stationarity is an underlying stochastic process, and a stochastic process that is not stationary is said to be a non-stationary process. It has to be noted that a non-stationary time series data set produces spurious results. The null hypothesis is defined as the presence of a unit root and the alternative hypothesis is either stationarity or trend stationarity or explosive root depending on the test used (Dickey & Fuller, 1979). If the data sets are not stationary at level, it will require testing the data at first difference for unit root properties. In case the first differenced data are non stationary, the Zivot-Andrews test is required to check for structural breaks. But if the differenced data is stationary, the next step is to test for cointegration and Granger causality.

The lag length selected was based on Schwarz information criterion and was determined automatically with maximum lag as 9 (as set by Eviews 10.0). The hypothesis of ADF test are Ho: process has unit root versus H_1: process has no unit root. If *t*-statistic > ADF critical value → accept null hypothesis, that is, unit root exists (mean data is non stationary); and if *t*-statistic < ADF critical value → reject null hypothesis, that is, unit root does not exist (mean data is stationary).

Since the distribution of the test statistic under the null hypothesis differs across a constant, a constant and linear trend, or neither models in the test regression, all the models were individually specified. Though the results of the test statistics marginally differ among the three possible test regression options, they all indicated unit root in the first difference. The result reported in this analysis is considered from the "Constant" option in the test regression.

The result of the unit root test using ADF test in Appendix A4, B4 and C4 for Cote d'Ivoire, Ghana and Nigeria, respectively, is summarized in Table 4.2. Column 5 reports the result for Nigeria which showed ADF test statistic for RGDP as 0.824075 with Mackinon (1996) one sided p-value of 0.2793. The next step is to compare the ADF test statistic with the critical values under Ho. The test critical value is given with: 1% level: -3.581152; 5% level: -2.926622; and 10% level: -2.601424. Since the ADF *t*-statistic (tau statistic) is higher than all the critical values, Ho is rejected. So it is concluded at high level of probability of making an error that RGDP has no unit root, which implies that RGDP is non stationary at level.

The next step is to test unit root of RGDP at first difference. The output of the ADF test reported ADF test statistic for RGDP as -5.751398 with p-value of 0.0000. The test critical values were given with: 1% level: -3.584743; 5% level: -2.928142; and 10% level: -2.602225. The ADF test statistic is smaller than all the critical values in magnitude, and with same sign (-), Ho can't be rejected. So it is concluded at low level of probability of making an error that RGDP has unit root, which implies that RGDP is I(1) stationary at first difference.

An alternative approach is to check the output of the Mackinon (1996) one sided p-value reported with ADF test statistic, if it is not significant at 1% or 5% level the null hypothesis is rejected; but if it is significant at 1% or 5% level, the null hypothesis can't be rejected which implies existence of unit root. Using the same ADF unit root test procedure for all the other variables in the model, the results indicated that all the time series became stationary at first difference.

The results of the unit root test for Cote d'Ivoire, Ghana and Nigeria in Appendix A4, B4 and C4 are summarized in Tables 4. 2. Columns 3, 4 and 5 for Cote d'Ivoire, Ghana and Nigeria, respectively. The ADF test indicated evidence that the time series were non-stationary at level I(0), but became stationary I(1) at first difference.

Table 4.2: ADF Unit Root Test for Cote d'Ivoire, Ghana and Nigeria.

		Cote d'Ivoire	Ghana	Nigeria
Variable	Order of Integration	ADF Test Statistic	ADF Test Statistic	ADF Test Statistic
RGDP	I(0)	-0.693609 (0.8382)	2.208345 (0.9999)	0.824075 (0.9934)
D(RGDP)	I (I)	-4.343136 (0.0012)	-4.551305 (0.0006)	-5.751398 (0.0000)
OPNES	I(0)	-1.544273 (0.5025)	-1.541158 (0.5039)	-1.876940 (0.3400)
D(OPNES)	I(I)	-6.081941 (0.0000)	-5.070461 (0.0001)	-7.881562 (0.0000)
INV	I(0)	-1.534390 (0.5075)	1.617770 (0.9724)	-2.369591 (0.1557)
D(INV)	I(I)	-7.731196 (0.0000)	-6.543822 (0.0000)	-7.046121 (0.0000)
HK	I(0)	-2.015606 (0.2793)	1.315105 (0.9984)	-2.155839 (0.2248)
D(HK)	I(1)	-3.814504 (0.0054)	-10.04270 (0.0000)	-2.994229 (0.0437)
FDI	I(0)	1.188621 (0.6713)	-0.433149 (0.8946)	-0.501832 (0.8814)
D(FDI)	I(1)	-10.66204 (0.0000)	-6.676365 (0.0000)	-6.974681 (0.0000)
EXR	I(0)	-1.172960 (0.6782)	-1.255709 (0.6421)	-0.142156 (0.9383)
D(EXR)	I(1)	-5.943180 (0.0000)	-6.288066 (0.0000)	-5.421016 (0.0000)

Note: probability values in parenthesis; I(0)-Not integrated at level; I(1)-Integrated at first difference

Source: Extracts using Eviews 10.0

4.3 Analysis of Autoregressive Distributed Lag (ARDL) Model

The outcome of unit root testing matters for the empirical model to be estimated. The results of ADF unit root test in the previous section indicated that all the time series were integrated of I(1) in all the countries. Under this scenario, the series are assumed to be non-stationary. One special feature of these series is that they are of the same order of integration. To verify further the relevance of the individual country model, there is need to test for cointegration. That is, a long run relationship in the model is assumed despite the fact that the series are drifting apart or trending either upward or downward. According to Arshed (2014), "we cannot estimate conventional ordinary least squares (OLS) on the variables if any one of them or all of them is I(1) because these variables will not behave like constants which are required in OLS" (p.1). The simple reason is that most of the variables are changing in time so OLS will mistakenly show high *t*-values and significant result, but in reality it would be inflated because of common time component resulting in spurious regression where R^2 of the model becomes higher than the Durbin Watson Statistic. So we move to a new set of models which can work on I(1) variables.

In the literature, prominent test for cointegration for 1(1) series for linear (single equation) models is the Engel-Granger cointegration test developed by Engel & Granger (1987). But there are two important shortcomings of the Engel-Granger (EG) cointegration test approach. First, the test does not say anything about which of the variables can be used as regressors and why, and the problem becomes more complicated when we have more than two variables to test. A second problem is that, when there are more than two variables there may be more than one cointegrating relationship which means a number of cointrgrating vectors, and the EG procedure using residual from a single relationship cannot treat this possibility (Asteriou & Hall, 2007). In such circumstance the appropriate cointegration test is the one proposed by Pesaran, Shin & Smith (2001) defined as bounds cointegration test.

The next step is to determine the appropriate number of lags to be selected for model estimation and duration of lag which provides the smallest critical value and efficient parameter coefficients. In line with Gujarati & Porter (2009), the maximum lag *k* must be specified in advance, and the best approach is to start with a very large value of *q* [the lag length] and then seeing whether the fit of the model deteriorates significantly when it is reduced. Gujarati & Porter (2009) argued that choosing fewer lags will lead to “omission of relevant variables bias,” whose consequences can be very serious. On the other hand, choosing more lags than necessary will lead to “inclusion of irrelevant variable bias,” whose consequences are less serious (p.648). The lag length selected was based on Schwarz information criterion and was determined automatically with maximum lag as 4 both for the dependent and the endogenous variables (as set by Eviews 10.0).

Having selected the lag for ARDL estimation, the next step is to estimate the long-run equilibrium relationship. The ARDL cointegrating and long run form was used as short-run equation in line with Pesaran, Shin & smith (2001). Usually the error correction form generated from specification is over-parameterized, however, Eview 10.0 automatically processes the re-parameterization and reports the parsimonious encompassing ARDL models as (4, 1, 0, 0, 2, 0), (1, 1, 3, 2, 0, 2) and (1, 0, 0, 0, 1) for Cote d'Ivoire, Ghana and Nigeria, respectively. The importance of the result of the cointegration form is the significance and magnitude of the error correction term (CointEq.). This is expected to be significant, negative and not less than -1 (between 0 and -1). We take the inverse of the absolute values of the unrestricted ECT (-1) to determine the number of years it will take to correct disequilibrium from the short-term to the long-term.

The *F*-statistic for the bound test in all the countries was found to be larger than the upper bound indicating cointegration of all the variables. Therefore, three diagnostics test were conducted (model specification, autocorrelation and heteroscedasticity). Since the ARDL is sensitive to recursive residuals that occur due to structural breaks I(2), the CUSUM and CUSUMSQ were conducted to check for stability of the recursive residual in terms of mean and variance, respectively.

4.3.1 ARDL Bound/Cointegration Test

The summary of results of the bound tests for the three (3) countries in Appendix A5, B5 and C5 for Cote d'Ivoire, Ghana and Nigeria, respectively, are presented in Table 4.3. The critical values used in this study are extracted from the model estimation results using Eviews 10.0 software. The regression reported the calculated *F*-statistic of 11.16951, 5.699050 and 6.635122 for Cote d'Ivoire, Ghana and Nigeria, respectively. Given the upper bound critical value of 3.38 which is less than the *F*-statistic for all the three countries, the null hypothesis of no co-integration is rejected for all the countries, implying that long-run co-integration relationship exist amongst the variables. This leads to the estimation of the long run relationship and the associated short-run dynamics.

Table 4.3: Summary of Result of the ARDL Bound Test

Country	SIC Lags	*F*-statistics	Alpha Level	Critical Bounds Lower Bound	Critical Bounds Upper Bound	Decision
Cote d'Ivoire	4	11.16951	5%	2.39	3.38	Co-integrated
Ghana	4	5.699050	5%	2.39	3.38	Co-integrated
Nigeria	4	6.635122	5%	2.39	3.38	Co-integrated

Source: Extracts using Eviews 10.0

4.3.2 Long-run ARDL Result for Cote d'Ivoire

The result of the long-run estimates of the ARDL in Appendix A5 is summarized in Table 4.4 column 4 for Cote d'Ivoire. The regression reported negative but not significant coefficient for OPNES, -0.041290 (0.2757), negative and significant FDI, -0.042835 (0.0028), while INV, HK and EXR, 0.100789 (0.0000), 0.244746 (0.0000) and 0.138782 (0.0000), respectively, which are positive and significant.

Surprisingly, the findings of this investigation are considerably different from predictions of theoretical studies. For instance, regression results reported a negative and insignificant estimated coefficient, -0.04129 (0.2757), for OPNES, indicating that a 1% increase in trade share would lead to 0.04% decrease in RGDP growth. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive long run effect on economic growth in Cote d'Ivoire. The evidence of this finding is not consistent with the earlier findings in N'guessan & Yue (2010) using ARDL technique, which indicated positive long run relationship between OPNES and RGDP in Cote d'Ivoire. Our evidence is however, consistent with the finding in Ulasan (2015) and Fenira (2015), Amadou (2013) which suggested that openness is usually more profitable to countries that record quite high growth rates and whose industries have already reached maturity. These results can be explained essentially by the fact that all the conditions are not yet assembled in the WAEMU countries (including Cote d'Ivoire) so that trade openness can interact with economic growth. The evidence in the findings of a negative effect of FDI on economic growth in Cote d'Ivoire is consistent with the finding in Johnston & Ramirez (2015) which suggested that the unexpected negative effect may be due to significant repatriation of profits and dividends the country has experienced in recent years. The result is however, not consistent with Keho (2015), Anyanwu & Yameogo (2015) and N'guessan & Yue (2010). The result also showed a positive relationship between INV which is in line with Johnston & Ramirez (2015) which showed evidence of a positive impact of investment on economic growth in Cote d'Ivoire.

Consistent with a number of empirical studies, as reviewed in Zahanogo (2016) and Anyanwu & Yameogo (2015), human capital indicated evidence of positive and significant relationship with economic growth in Cote d'Ivoire. Combining this result with the raw data reported via descriptive statistics in Table 4.1 Column 5 for Cote d'Ivoire provides some insight into the relationship between HK and RGDP. For instance, the average secondary school enrolment (male and female) ratio of 3.68 million to total population indicated that Cote d'Ivoire consider education as a vital sector in the economy. In line with theoretical expectation, the elasticity coefficient of 0.138782 for exchange rate implies that 1% depreciation in the West African CFA franc relative to the US Dollar will cause RGDP to increase by 0.138%.

4.3.3 Long-run ARDL Result for Ghana

The result of the long-run estimates of the ARDL in Appendix B5 is summarized in Table 4.4 column 3 for Ghana. The estimated coefficients for OPNES, INV, HK and EXR, 0.143927 (0.0001), 0.225874 (0.0053), 0.471711 (0.0005) and 0.032459 (0.0043), respectively, are all significant and positive, while FDI, -0.020484 (0.2803), is negative but not significant.

Consistent with empirical findings as reviewed in Sakyi, Villaverde, Maza & Chitteji (2012), Asiedu (2013), Zakari (2013), Sakyi, Commodore & Opoku (2015) and Khobai, Kolisi & Moyo (2018), our results reported a significant and positive coefficient, 0.143927 (0.0001), for OPNES, implying that a 1% increase in OPNES will lead to 0.14% increase in real GDP in the long run. Hence, our results provide substantial evidence to support the hypothesis that trade openness measured using trade shares has a long run positive and significant effect on economic growth in Ghana for the period from 1970 to 2016.

One of the channels, suggested by new growth theory, by which trade enhances growth, is that a country can obtain advanced technology which drives productivity, raise employment and export levels through foreign multinationals. To test this hypothesis in this study, we use the FDI variable. Given the complementary role of FDI to trade openness and economic growth the estimated coefficient is expected to be positive in Ghana. The regression result in row 4 showed that FDI have negative effect on economic growth in Ghana. The evidence of this finding is, however, in line with Keho (2015), Fenira (2015) and Yeboah, Naanwab, Saaleem & Akuffo (2012) which indicated that FDI does not substantially explain economic growth in Ghana. While Sakyi, Commodore & Opoku (2015) suggested that interaction of FDI and exports has been crucial in fostering growth in Ghana. The results, however, indicated a positive relationship between HK and RGDP in Ghana. Combining this result with the raw data reported via descriptive statistics in Table 4.1 column 5 for Ghana, provides some insight into the relationship between HK and RGDP which is consistent with theoretical growth literature. For instance, the average secondary school enrolment (male and female) ratio of 7.22 million to total population indicated that Ghana consider education as a vital sector in the economy. Consistent with empirical studies reviewed in Asfaw (2015) and Yeboah, Naanwab, Saleem & Akuffo (2012), the elasticity coefficient of 0.032459 for exchange rate implies that 1% depreciation in the Ghanaian Cedi relative to the US Dollar will cause RGDP to increase by 0.032%.

4.3.4 Long-run ARDL Result for Nigeria

The result of the long-run estimates of the ARDL in Appendix C5 as summarized in Table 4.4 column 2, reported a negative and significant estimated coefficient of -0.341842 (0.0459) for OPNES, a negative but not significant estimated coefficient of -0.082376 (0.4089) for FDI and -0.299543 (0.2222) for HK. The results also reported positive and significant estimated parameters for INV and EXR of 0.399834 (0.0175) and 0.431304 (0.0345), respectively.

Surprisingly, unlike the literature on the growth effects of trade openness, findings of this investigation are considerably different from predictions of theoretical studies. For instance, the regression reported a negative and significant parameter, -0.341842 (0.0459), for OPNES, implying that a 1% increase in trade share will lead to 0.34% reduction in real GDP growth. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive long run effect on economic growth in Nigeria. These finding are consistent with Fenira (2015), Ulasan (2015), and Mputu (2016), but contradicts earlier findings in Saibu (2004), Mohammed & Jian (2016) and more recently in Khobai, Kolisi & Moyo (2018) and Egbulonu & Ezeocha (2018), which reported a positive relationship between trade openness and economic growth in Nigeria using the ARDL approach. Fenira (2015) argued that trade liberalization policies in most developing countries were largely motivated by the desire to obtain loans and aids from international organisations, like the World Bank, IMF, European Union or World Trade Organisation which support liberal orientations. Fenira (2015) concludes that trade liberalization have weakly contributed to improving economic growth in developing countries.

The result is also not consistent with the finding in Anyanwu & Yameogo (2015) on the relationship between investment, FDI and economic growth which suggested that domestic investment significantly increases FDI inflows to West African countries. However, the result indicated that INV is positive (0.399834) while FDI is negative (-0.082376). Based on theoretical premise, OPNES and FDI are complementary to economic growth, thus, a negative effect of OPNES may occur as a result of negative effect of FDI, and vice versa. The reason is related with the tariff jumping theory which postulates that multinational enterprises (MNEs) that seek to serve local markets may decide to set up subsidiaries in that country. As expected, the result indicated evidence of positive coefficient, 0.399834, for INV (gross fixed capital formation) which is in line with Mputu (2016). Contrary with empirical findings as reviewed in Effiom, Ubi, Okon & Itam (2011), evidence from the result indicated a negative but not significant coefficient, -0.299543 for HK, implying that HK has a negative impact on economic growth in Nigeria. Combining this result with the raw data reported via descriptive statistics in Table 4.1 column 5 for Nigeria, provides some insight into the relationship between HK and RGDP. For instance, the average secondary school enrolment (male and female) ratio of 3.52 million indicated a wide variation to total population of Nigeria for the period from 1970 to 2016.

Consistent with empirical findings as reviewed in Nwinee & Olulu-Briggs (2016) the elasticity coefficient of 0.431304 for exchange rate implies that 1% depreciation in the Nigeria Naira relative to the US Dollar will cause RGDP to increase by 0.43%.

Table 4.4 Estimated ARDL Long-run Coefficients for Cote d'Ivoire, Ghana and Nigeria.

	Cote d'Ivoire	**Ghana**	**Nigeria**
Variable	Coefficient (*p*-value)	Coefficient(*p*-value)	Coefficient(*p*-value)
OPNES	-0.041290 (0.2757)	0.143927 (0.0001)	-0.341842 (0.0459)
INV	0.100789 (0.0000)	0.225874 (0.0053)	0.399834 (0.0175)
HK	0.244746 (0.0028)	0.471711 (0.0005)	-0.299543 (0.2222)
FDI	-0.042835 (0.0000)	-0.020484 (0.2803)	-0.082376 (0.4089)
EXR	0.138782 (0.0000)	0.032459 (0.0043)	0.431304 (0.0345)

Note: Probability values in parenthsis

Source: Extracts using Eviews 10.0

4.3.5 Short-run Error Correction ARDL for Cote d'Ivoire

The results of the short-run dynamics associated with the ARDL (4, 1, 0, 0, 2, 0) in Appendix A5 presented in column 2 of Table 4.5 for Cote d'Ivoire revealed the coefficient of the lagged error correction term, -0.774855, which is the speed of adjustment from the short-run to the long-run equilibrium. The magnitude of the coefficient implies that about 77.48% of the disequilibrium caused by previous year's shocks converges back to equilibrium in each time period. This high speed of adjustment implies that it will take approximately 1 year and 3months (1.291 years) to correct all errors/deviations and bring the economy back to equilibrium. The coefficient of multiple determination (R^2) of 0.780779 indicating that about 78.08% of total variation or a change in the present value of RGDP growth is explained by changes in the explanatory variables in the model while the remaining 21.92% is explained by other factors not explicitly captured in the model. The sum of squares residual (SSR) is 0.02 which confirms the overall fitness of the model, indicating that the regression function explains a greater amount of total variation of the dependent variable (RGDP). The regression reported a negative but not significant estimated coefficient for lagged OPNES, -0.031994 (0.3849) and a negative and significant estimated coefficient for lagged FDI, -0.033191 (0.0144). The results also reported positive and significant estimated parameters for contemporaneous INV, HK and EXR of 0.078097 (0.0000), 0.189643 (0.0000) and 0.107536 (0.0001), respectively.

Surprisingly, unlike the literature on the growth effects of trade openness, findings of this investigation are considerably different from predictions of theoretical studies. For instance, the regression reported a negative but not significant estimated coefficient of -0.031994 (0.3849), for OPNES, which implies that a 1% increase in trade share will lead to 0.032% reduction in real GDP growth in Cote d'Ivoire. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive long run effect on economic growth in Cote d'Ivoire. The evidence of this finding is not consistent with the earlier findings in N'guessan & Yue (2010) using ARDL technique, which indicated positive long run relationship between OPNES and RGDP in Cote d'Ivoire. Our evidence is however, in line with the finding in Fenira (2015) and Amadou (2013) which suggested that openness is usually more profitable to countries that record quite high growth rates and whose industries have already reached maturity. These results can be explained essentially by the fact that all the conditions are not yet assembled in the WAEMU countries (including Cote d'Ivoire) so that trade openness can interact with economic growth as argued by Amadou (2013). The evidence in the findings of a negative and significant effect of FDI on economic growth in Cote d'Ivoire is not consistent with Keho (2015), Anyanwu & Yameogo (2015) and N'guessan & Yue (2010), but in line with the finding in Johnston & Ramirez (2015) which suggested that the unexpected negative effect may be due to significant repatriation of profits and dividends the country has experienced in recent years. As expected, gross fixed capital formation showed a positive and significant coefficient, which is in line with Johnston & Ramirez (2015) which showed evidence of a positive short-term impact of investment on economic growth in Cote d'Ivoire.

Consistent with a number of empirical studies, as reviewed in Zahanogo (2016) and Anyanwu & Yameogo (2015), human capital development indicated evidence of positive and significant relationship with economic growth in Cote d'Ivoire. Combining this result with the raw data reported via descriptive statistics in Table 4.1 provides some insight into the relationship between HK and RGDP. Also in line with theoretical expectation, the elasticity coefficient of 0.107536 for exchange rate implies that 1% depreciation in the West African CFA franc relative to the US Dollar will cause RGDP to increase by 0.11% in the short run.

4.3.6 Short-run Error Correction ARDL for Ghana

The results of the short-run dynamics associated with the ARDL (1, 1, 3, 2, 0, 2) in Appendix B5 as presented in column 3 of Table 4.5 revealed the coefficient of the lagged error correction term as -0.456823. The magnitude of the coefficient implies that about 45.68% of the disequilibrium is corrected in each time period. The low speed of adjustment implies that it will take approximately 2 years and 2 months (2.189 years) to correct all errors/deviations and bring the economy back to equilibrium. The coefficient of multiple determination (R^2) is 0.726729 indicating that about 72.67% of total variation or a change in the present value of RGDP growth is explained by changes in the explanatory variables in the model while the remaining 27.33% is explained by other factors not explicitly captured in the model. The sum of squares residual (SSR) is 0.024, thereby, confirming the high R^2, implying that the regression function explains a greater amount of the total variation in the dependent variable (RGDP). The regression result reported a positive and significant estimated coefficient of 0.65749 (0.0007) for lagged OPNES, implying that a 1% change in OPNES index will lead to 0.65% increase in the growth rate of real GDP in Ghana in the short run. Hence, the results provide substantial evidence to support the hypothesis that trade openness has positive and significant effect on RGDP in the short-run in Ghana which is consistent with the findings in Khobai, Kolisi & Moyo (2018).

The estimated coefficients of differenced INV, HK and EXR were 0.0349475 (0.1325), 0.300828 (0.0255) and -0.004013 (0.6520), respectively. While the coefficient for contemporaneous FDI, -0.0009358 (0.2572), is negative but not statistically significant, which is consistent with the evidence in Keho (2015), Fenira (2015), Yeboah, Naanwab, Saaleem & Akuffo (2012) and Mbabazi, Milner & Morrissey (2004). The evidence in the result for INV and HK are consistent with the predictions of theoretical studies and the conventional issue on the positive effect of physical and human capital on economic development and in line with Anyanwu and Yameogo (2015) and Mputu (2016). Consistent with empirical studies reviewed in Asfaw (2015) and Yeboah, Naanwab, Saleem & Akuffo (2012), the elasticity coefficient of -0.004013 for exchange rate implies that 1% depreciation in the Ghanaian Cedi relative to the US Dollar will cause RGDP to decrease by 0.004% in the short run.

4.3.7 Short-run Error Correction ARDL for Nigeria

The results of the short-run dynamics associated with the ARDL (1,0,0,0,0,1) in Appendix C5 as presented in column 4 of Table 4.5 indicated that the coefficient of the lagged error correction term, -0.133369, to be negative and statistically significant at conventional levels. The ECT (-1) of -0.133369 is the speed of adjustment from the short-run equilibrium to the long-run equilibrium. The magnitudes of the coefficient show that about 13.33% of the disequilibrium caused by previous year’s shocks converges back to equilibrium in each period. This low speed of adjustment implies that it will take approximately 7 years and 5 months (7.498 years) to correct all errors/deviations and bring the economy back to equilibrium. The coefficients of all the variables except contemporaneous INV and lagged EXR were negative and not significant at conventional levels, implying that they have negative effect on RGDP in the short run.

The coefficient of multiple determination (R^2) is 0.433740 indicating that about 43.37% of total variation or a change in the present value of RGDP growth is explained by changes in the explanatory variables in the model while the remaining 56.63% is explained by other factors not explicitly captured in the model. Notably, the relatively low R^2 is not uncommon in cross-sectional analysis. The sum of squares residual (SSR) is 0.121876, confirming that the regression functions explains a substantial amount of total variation in the dependent variable. Arshed (2014) suggests that the SSR can be used to compare the performance of two or more ARDL models. Since there are lags in the model, there is no need to interpret the Durbin-Watson statistic as the serial autoregressive test has cleared the presence of autocorrelation in the first ARDL estimation. The regression result reported a negative but insignificant estimated coefficients of -0.045591 (0.1241) for OPNES, -0.039950 (0.0975) for HK and -0.010986 (0.03385) for FDI. Also the result reported a positive but not significant estimated parameter of 0.053325 (0.0823) for contemporaneous INV and a positive and significant estimated parameter, 0.057523 (0.0003) for lagged EXR (Note: probability in parenthesis).

Surprisingly, findings of this investigation are considerably different from predictions of theoretical studies as reviewed in Khobai, Kolisi & Moyo (2018) and Egbulonu & Ezeocha (2018). For instance, the regression results reported a negative and significant estimated coefficient, -0.045591 (0.1241), for OPNES, implying that a 1% increase in trade share would lead to 0.045% decrease in RGDP growth. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive short run effect on economic growth in Nigeria. The evidence of this finding is, however, in line with Mputu (2016), Fenira (2015) and Mbabazi, Milner & Morrissey (2004) which argued that short-run policies devoted to foster openness cannot have the desired effects because it takes time for a change of policy to acquire credibility for the positive response of economic agents (investors, entrepreneurs). Even as Fenira (2015) argued that trade liberalization policies in most developing countries have weakly contributed to economic growth because they were largely motivated by the desire to obtain loans and aids from donor agencies which support liberal orientations.

The regression results showed that both INV and lagged EXR have positive, but not significant coefficients, which implies a positive relationship with RGDP in Nigeria in the short run. However, HK and FDI are shown to be negatively related to RGDP in the short-run. The estimated coefficients for HK and FDI are -0.039950 (0.0975) and -0.010986 (0.3385), respectively. As expected, the result indicated evidence of positive coefficient, 0.053325, for INV (gross fixed capital formation) which is in line with Mputu (2016), but contradicts the finding in Egbulonu & Ezeocha (2018). Contrary to empirical findings as reviewed in Effiom, Ubi, Okon and Itam (2011), evidence from the result indicated a negative but insignificant coefficient, -0.039950 for HK, implying that HK has a negative impact on economic growth in Nigeria. Anyanwu & Yameogo (2015) argued that improvement in human capital is positively related with FDI inflows. The evidence of a negative effect of FDI on RGDP in Nigeria in the short and long run is consistent with Keho (2015) which suggested that the quality of FDIs in terms of manufacturing and service delivery standards, profit repatriation and employment of expatriates has negative effect on economic growth of developing Sub-Saharan countries. Consistent with empirical findings as reviewed in Nwinee & Olulu-Briggs (2016) the elasticity coefficient of 0.057523 for exchange rate implies that 1% depreciation in the Nigerian Naira relative to the US Dollar will cause RGDP to increase by 0.057%.

Table 4.5 Error Correction Regression for Cote d'Ivoire, Ghana and Nigeria.

	Cote d'Ivoire	Ghana	Nigeria
Variable	Coefficient (*p*-value)	Coefficient (*p*-value)	Coefficient (*p*-value)
OPNES	-	-	-0.045591 (0.1241)
OPNES(-1)	-0. 031994 (0.3849)	0.065749 (0.0077)	-
INV	0.078097 (0.0000)	-	0.053325 (0.0823)
D(INV)	-	0.039475 (0.1325)	-
HK	0.189643 (0.0000)	-	-0.039950 (0.0975)
D(HK)	-	0.300828 (0.0255)	-
FDI	-	-0.009358 (0.2572)	-0.010986 (0.3385)
FDI(-1)	-0.033191 (0.0144)	-	-
EXR	0.107536 (0.0001)	-	-
EXR(-1)	-	-	0.057523 (0.0003)
D(EXR)	-	-0.004013 (0.6520)	-
CointEq(-1)	-0.774855 (0.0000)	-0.456823 (0.0000)	-0.133369 (0.0000)
R-squared	0.780779	0.726729	0.433740
Sum squared resid	0.020082	0.024537	0.121876
Durbin-Watson stat	2.159631	1.856679	2.170786
Schwarz criterion	-4.218983	-3.879864	-2.929056
Selected ARDL model	[4, 1, 0, 0, 2, 0]	[1, 1, 3, 2, 0, 2]	[1, 0, 0, 0, 0, 1]
Adjustment (years)	1.291	2.189	7.498

Source: Extracts using Eviews 10.0

4.3.8 ARDL Diagnostic Tests for Cote d'Ivoire, Ghana and Nigeria

The ARDL is a linear regression model; therefore, the underlying assumptions of Classical Linear Regression Model (CLRM) have to be verified. The assumptions are linearity, homoscedasticity, serial correlation and normality among others. These tests reported the outcomes of *F*-tests and *p*-values which are useful in determining evidence against null hypothesis (*Ho*). A small *p*-value is evidence against *Ho*. The *p*-value nicely summarizes the strength or weakness of the empirical evidence against the null hypothesis in order to determine whether to reject or not reject at conventional critical value (Wooldridge, 2016).

Table 4.6 displays results of the ARDL diagnostics tests for Cote d'Ivoire, Ghana and Cote d'Ivoire. The Ramsey's (1969) regression specification error test (RESET) has proven to be useful in detecting general form misspecification. The Ramsey RESET reported test t-statistic, 0.365705 and *F*-statistic, 0.133740 with insignificant *p*-value of 0.7172 for Cote d'Ivoire, *t*-statistic value of 0.1.623340 and *F*-statistic value of 2.635233 with insignificant *p*-value of 0.1157 for Ghana, and *t*-statistic value of 0.601274, *F*-statistic value of 0.361531 with insignificant p-value of 0.5513 for Nigeria, implying that at 5% level, we fail to reject the null hypothesis, indicating that the functional form of the model is correct for Ghana and Cote d'Ivoire, which simply means that the models are correctly specified. This implies that the coefficients on the powers of the fitted value, that is, the model is correctly specified.

To check if the specification suffers from autocorrelation problem, the Breusch-Godfrey (BG) Serial Correlation Lagrange Multiplier (LM) statistic was used. The BG-LM statistic is derived from constrained optimization, and relies on the Gauss-Markov assumptions of Best Linear Unbiased Estimator (BLUE) that justify the *F*-statistics in large numbers (Breusch, 1978 and Godfrey, 1978). The null hypothesis of the test is that there is no serial correlation in the residuals up to the specified lag order. The BG-LM serial correlation test reported *F*-statistic value of 2.599707 with insignificant *p*-value of 0.092 for Cote d'Ivoire. We therefore, fail to reject the null hypothesis which implies that the model is free from serial correlation. The BG-LM serial correlation test also reported *F*-statistic value of 0.475942 with insignificant *p*-value of 0.6264 for Ghana, and *F*-statistic value of 1.800403 with insignificant *p*-value of 0.1798 for Nigeria. Again, we fail to reject the null hypothesis which implies that the models for Ghana and Cote d'Ivoire are free from serial correlation. In other words, there is no serial correlation as the probability values are not significant at 5% level.

Another diagnostic test is the Breusch-Pagan-Godfrey Heteroscedasticity test which is chi-squared test. If the test statistic has a probability value below an appropriate threshold (e.g. $p < 0.05$) then the null hypothesis of homoscedasticity is rejected and heteroscedasticity is assumed (Wooldrige, 2016). The heteroscedasticity test reported an *F*-statistic value of 1.581199 and insignificant p-value of 0.1507 for Cote d'Ivoire. We therefore, fail to reject the null hypothesis which implies that the variances of the model are homoscedastic (constant). The heteroscedasticity test also reported *F*-statistic value of 0.3933834 and insignificant p-value of 0.5368 for Ghana, *F*-statistic value of 0.326594 and insignificant *p*-value of 0.9371 for Nigeria. Again, we fail to reject the null hypothesis which implies that the variances of the models are homoscedastic (constant).

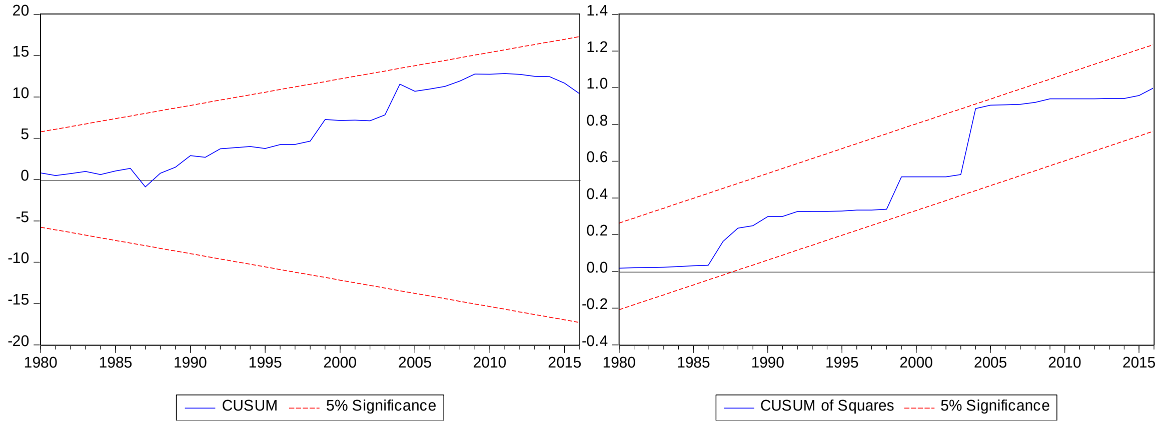
Table 4.6 ARDL Diagnostic Tests for Cote d'Ivoire, Ghana and Nigeria

Test	*F*-statistic	P-value	Decision
Cote d'Ivoire			
Ramsey RESET	0.133740	0.7172	Cantreject Ho
Breusch-Godfrey Serial Correlation LM	2.599707	0.0921	Cant reject Ho
Heteroscedasticity Test: Breusch-Pagan-Godfrey	1.581199	0.1507	Cant reject Ho
Ghana			
Ramsey RESET	2.635233	0.1157	Cant reject Ho
Breusch-Godfrey Serial Correlation LM	0.498392	0.6264	Cant reject Ho
Heteroscedasticity Test: Breusch-Pagan-Godfrey	0.933834	0.5368	Cant reject Ho
Nigeria			
Ramsey RESET	0.361531	0.5513	Cant reject Ho
Breusch-Godfrey Serial Correlation LM	1.800403	0.1798	Cant reject Ho
Heteroscedasticity Test: Breusch-Pagan-Godfrey	0.326594	0.9371	Cant reject Ho

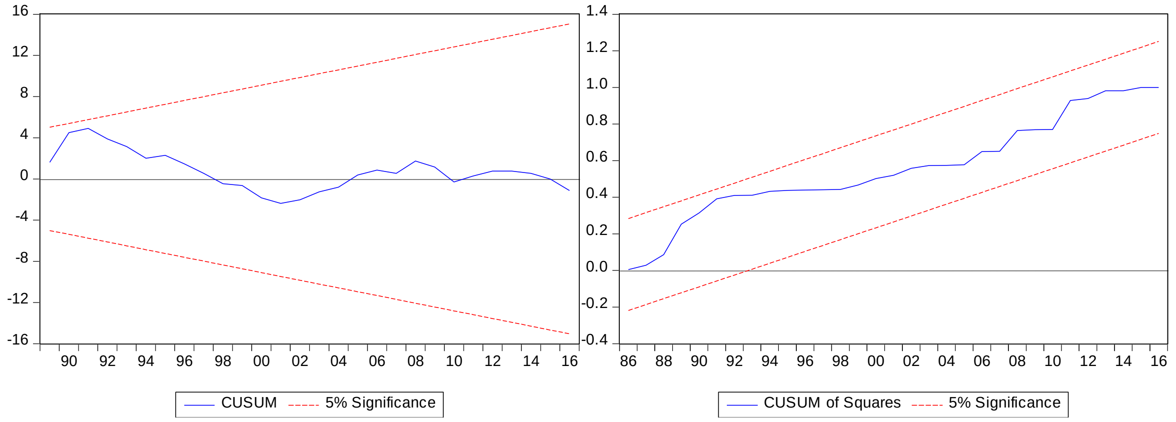
Note: t-statistic values in bracket
Source: Extracts using Eviews 10.0

To test whether the parameters of the ARDL model are stable across various subsamples of the time series data, the cumulative sum (CUSUM) and cumulative sum of squares (CUSUMSQ) tests were used. In statistical quality control, the cumulative sum (CUSUM) control chart is a sequential technique typically used to monitor change detection (Page, 1954).

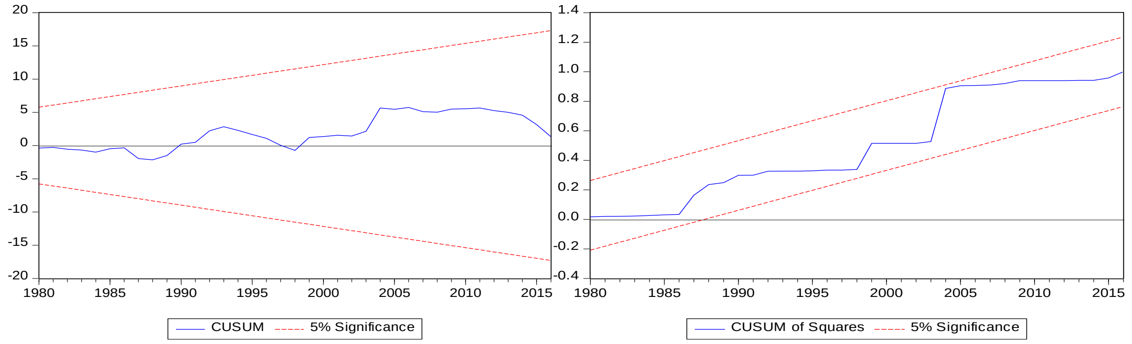
The Cumulative Sum (CUSUM) is particularly good at detecting systematic departure of the β_i coefficients that results in a systematic sign on the first step ahead forecast error. It is derived from the residual of the recursive estimation known as recursive residuals. Under the null hypothesis of perfect parameter stability, the CUSUM and CUSUMSQ statistics is zero (see figure 4.1). Given that the expected value of disturbance is always zero, a set ± 2 standard error bands is usually plotted around zero and any statistic lying outside the band is taken as evidence of parameter instability. Page (1954) concludes that the blue line must not cross the red and the green lines for any of the charts. Plots of CUSUM and CUSUMSQ tests at 5% level show that both statistics fall within the critical bounds implying that there is no issue of recursive residual in terms of mean (in first CUSUM chart) and in terms of variance (in second CUSUMSQ chart), indicating that all the coefficients of the estimated model for Cote d'Ivoire, Ghana and Nigeria are stable over time.



Cote d'Ivoire



Ghana



Nigeria

Figure 4.1: Plots of CUSUM & CUSUMSQ for Cote d'Ivoire, Ghana and Nigeria

4.4 Analysis of VAR Granger Causality/Block Exogeneity Wald Test

The aim of the Granger causality test for this study is to infer that trade openness has a causal effect on real GDP growth. Basically, real GDP growth is said to be 'Granger-caused' by trade openness if trade openness helps in the prediction of real GDP, that is if the coefficient in the lagged trade openness are statistically significant at 5% level. The direction of causality between the various sources of real GDP growth signifies important policy implications.

The Vector Autoregressive (VAR) Granger causality/Block Exogeneity Wald (BEW) test was fitted to the time series to perform the multivariate Granger causality test. According to Clarke and Mirza (2006), when we test for no cointegration, then decide on a VAR or a VECM model, and then apply a Granger non-causality test, the properties of the VECM will indicate some distortions in the significance level (and hence the power) of the final test. Granger causality is necessary (but not sufficient condition) to establish strong exogeneity. As the maximal integrated order of the series is 1, the VAR Granger causality/BEW test which separates exogeneity and treats Granger causality as a useful descriptive tool for the time series analysis was used. Thus, the Granger causality tests are based on the appropriate level VAR model specified and estimated for each of the three West African countries. The optimal lag length in Appendix 7 is determined using four statistics: Akaike Information Criterion (AIC), Scharz Information Criterion (SIC), Hannan-Quinn Information Criterion (HQ) and Final Prediction Error (FPE). The optimal lag selected is p = 1 based on Schwartz Information Criterion SIC). The Granger causality test results in Appendix A8, B8 and C8 for Cte d'Ivoire, Ghana and Nigeria, respectively, are summarized in Table 4.7. The VAR Granger causality/BEW test was conducted to test if the selected endogenous variables should not be treated as endogenous. Notably, the "excluded" row for each equation excludes all lags that are not the autocorrelation coefficient in an equation. It is a test between autoregressive specifications (null) against the VAR specification for the equation (alternate).

4.4.1 Analysis of VAR Granger Causality/BEW Test for Cote d'Ivoire

The result of VAR Granger Causality/BEW test in Appendix A8 for Cote d'Ivoire is displayed in column 4 of Table 4.7. Surprisingly, unlike the literature on the growth effects of trade openness, findings of this Granger causality investigation are considerably different from predictions of theoretical studies. Evidence from the Granger causality tests indicated non causality between RGDP and all the explanatory variables as the *p*-values of all the chi-square statistics for all the variables are not significant. The Granger causality test indicated non-causality from OPNES to RGDP as the coefficient on the lagged OPNES is statistically different from zero and the set of estimated coefficient on the lagged OPNES coefficient is statistically different from zero in Cote d'Ivoire. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 0.054225 (0.9773), is statistically not significant. On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 5.368760 (0.0643), is statistically not significant (10%). This is Consistent with empirical findings reviewed in Aka (2006) and Amadou (2013). However, we can describe this finding as a "weak" unidirectional causation from RGDP to OPNES. It can be concluded on the basis of this result that there is non-Granger causality between trade openness and RGDP growth in Cote d'Ivoire within the period from 1970 - 2016.

In contrast with empirical findings reviewed in N'guessan & Yue (2010) and Keho (2015) which established bidirectional causation between net inflow of FDI and economic growth in Cote d'Ivoire, our finding indicated independence between FDI and RGDP, which suggest that the sets of FDI and RGDP coefficients is not statistically significant in both the regressions in Cote d'Ivoire. It can be concluded on the basis of this result that there is non-causal relationship between net inflow of FDI and RGDP. The Granger causality test also, indicated non causality between INV, HK, EXR and RGDP.

The evidence of this result contradict the findings in N'guessan & Yue (2010) which indicated feedback, or bidirectional causality which suggests that the sets of OPNES and RGDP coefficients are statistically different from zero in both regressions in Cote d'Ivoire within the period of the study. N'guessan & Yue (2010) employed the VAR Granger Causality/BEW test for the period from 1980 to 2007. However, the absence of causality between trade openness, FDI and economic growth in Cote d'Ivoire could be attributed to the number of lag terms included (which was based on the SIC optimal lag 1) as the outcome of Granger causality test is sensitive to lags introduced in the model. However, evidence from theory as reviewed in Mputu (2016) and Fenira (2015) suggested that trade liberalization have weakly contributed to improving economic growth in developing countries. This reason is related with the tariff jumping theory which postulates that multinational enterprises (MNEs) that seek to serve local markets may decide to set up subsidiaries without benefitting the host country, which may rather be detrimental to the host economy.

4.4.2 Analysis of VAR Granger Causality/BEW Test for Ghana

The result of VAR Granger Causality/BEW test in Appendix B8 for Ghana is displayed in column 5 of Table 4.7. The result indicated unidirectional causality from OPNES to RGDP as the estimated coefficients of the lagged OPNES are statistically different from zero and the set of lagged RGDP is not statistically different from zero in Ghana. From the output, the value of the test statistic is 7.843898 and the associated asymptotic *p*-value is 0.0198. Notably, the probability value indicated significance at conventional levels. So we reject the null hypothesis, which means the sample support the notion that OPNES Granger causes RGDP growth in Ghana. This result is in line with empirical findings reviewed in Zakari (2013) and Sakyi, Villaverde, Maza & Chitteji (2012) which indicated feedback, or bi-directional causality in developing sub-Saharan countries.

The Granger causality test also indicated unidirectional causality from HK to RGDP as the results suggest that the direction of causality is from HK to RGDP, since the chi-square statistic, 7.258769 (0.0265), is significant at the 5% level. On the other hand, there is no reverse causation from RGDP to HK, since the chi-square statistic, 0.858841 (0.6509), is statistically not significant. In the same vein, the result indicated unidirectional causality from RGDP to EXR in Ghana, which suggest that the direction of causality is from RGDP to EXR, since the chi-square statistic, 19.72604 (0.0001), is significant at the 5% level. On the other hand, there is no reverse causation from EXR to RGDP, since the chi-square statistic, 1.670443 (0.0.4338), is statistically not significant, implying that the rate of official exchange rate was influenced by the growth of real GDP in Ghana for the period from 1970 – 2016. Contrary to empirical findings reviewed in Keho (2015) which showed evidence of bidirectional causation between FDI and GDP, our results of the causality test indicated independence between FDI and RGDP. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that FDI Granger causes RGDP growth, since the chi-square statistic, 2.095574 (0.3507), is statistically not significant. On the other hand, there is no reverse causality from RGDP to FDI, since the chi-square statistic, 1.117251(0.5720), is statistically not significant. It can be concluded on the basis of this result that there is non-Granger causality between net inflow of FDI and RGDP in Ghana within the period from 1970 – 2016.

The result also indicated independence between INV and RGDP, which means the sample does not support the notion that INV Granger causes RGDP growth, since the chi-square statistic, 0.605196 (0.07389), is statistically not significant. On the other hand there is no reverse causality from RGDP to INV, since the chi-square statistic, 0.386589 (0.8242), is statistically not significant. It can be concluded on the basis of this result that there is non-

Granger causality between net inflow of FDI and RGDP in Ghana within the period from 1970 – 2016.

4.4.3 Analysis of VAR Granger Causality/BEW Test for Nigeria

The result of VAR Granger Causality/BEW test in Appendix C8 for Nigeria is displayed in column 6 of Table 4.7. Consistent with empirical findings reviewed in Alajeku, Ezeabasili & Nzotta (2013), the result indicated independence between OPNES and RGDP which suggested that the sets of OPNES and RGDP coefficients are statistically not significant for both regressions. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 2.82602 (0.2434), is statistically not significant (Note: probability in parenthesis). On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 2.012789 (0.3655), is statistically not significant. It can be concluded on the basis of this result that there is non-Granger causality between trade openness and RGDP growth in Nigeria within the period from 1970 - 2016. The result however, contradict the finding in Saibu (2004) which indicated a unidirectional causation running from trade openness to real GDP, and Nwinee & Olulu-Briggs (2016) which indicated a bidirectional causation between trade openness and real GDP. Unlike empirical result reviewed in Nwinee & Olulu-Briggs (2016) and Egbulonu & Ezeocha (2018), the Granger causality test indicated independence between FDI and RGDP, since the chi-square statistic, 2.231898 (0.3276), is statistically not significant, implying that FDI does not Granger cause RGDP. On the other hand, there is no reverse causation, since chi-square statistic, 2.928859 (0.2312), is statistically not significant. However, the absence of causality between trade openness, FDI and economic growth in Nigeria may be because of the number of lag terms included (which is based on SIC optimal lag 1), as the outcome of Granger causality test is sensitive to lags introduced in the model. However, evidence from theory as reviewed in Mputu (2016) and

Fenira (2015) suggested that trade liberalization have weakly contributed to improving economic growth in developing countries. This reason is related with the tariff jumping theory which postulates that multinational enterprises (MNEs) that seek to serve local markets may decide to set up subsidiaries without benefitting the host country.

The Granger causality test, however, indicated feedback or bidirectional causality from INV to RGDP as the sets of lagged INV and RGDP coefficients are statistically different from zero in both regressions. These result suggest that the direction of causality runs from INV to RGDP, since the chi-square statistic, 148.4183 (0.0000), is significant at the 5% level. On the other hand, there is reverse causation from RGDP to INV, since the chi-square statistic, 11.42508 (0.0033), is statistically significant at 5% level. The Granger causality test also indicated unidirectional causality from HK to RGDP as the estimated coefficients on the lagged HK is statistically different from zero and the set of the lagged RGDP coefficients is statistically different from zero. These results suggest that the direction of causality is from HK to RGDP, since the chi-square statistic, 7.953232 (0.0187), is significant at the 5% level. On the other hand, there is no reverse causation from RGDP to HK, since the chi-square statistic, 3.390501 (0.1836), is statistically not significant. Consistent with the empirical evidence in Nwinee & Lulu-Briggs (2016) the Granger causality test indicated unidirectional causality which runs one-way from EXR to RGDP, since the chi-square statistic, 10.17147 (0.0006), is significant at 5% level, while there is no reverse causation from RGDP and EXR, since the chi-square statistic, 0.268731 (0.2312) is statistically not significant.

Table 4.7: VAR Granger Causality/BEW Tests for Cote d'Ivoire, Ghana and Nigeria

			Cote d'Ivoire	Ghana	Nigeria
Dependent Variable	Excluded	d.f.	Chi-square	Chi-square	Chi-square
RGDP	OPNES	2	0.054225 (0.9733)	7.843898 (0.0198)	2.82602 (0.2434)
OPNES	RGDP	2	5.368760 (0.0683)	1.854799 (0.3956)	2.01278 (0.3655)
RGDP	INV	2	0.585954 (0.7457)	0.605196 (0.7389)	148.4183 (0.6193)
INV	RGDP	2	5.572767 (0.0616)	0.386589 (0.8242)	11.42508 (0.0000)
RGDP	HK	2	2.346207 (0.3094)	7.258769 (0.0265)	7.953232 (0.0187)
HK	RGDP	2	6.741037 (0.0692)	0.858841 (0.6509)	3.390501 (0.1836)
RGDP	FDI	2	0.021072 (0.9895)	2.095574 (0.3507)	2.231898 (0.3276)
FDI	RGDP	2	2.085370 (0.6616)	1.117251 (0.5720)	2.928859 (0.2312)
RGDP	EXR	2	0.053390 (0.9737)	1.670443 (0.4338)	10.17147 (0.0062)
EXR	RGDP	2	11.15866 (0.0890)	19.72604 (0.0001)	0.268731 (0.8743)

Note: probability values in parenthesis
Source: Extracts using Eviews 10.0

4.5 Analysis of Impulse Response Functions

The result of Vector Error Correction method (VECM) indicates the exogeneity or endogeneity of a variable in the system and direction of Granger-causality within the sample period. However, it does not provide the dynamic properties of the system. The analysis of the dynamic interactions among the variables in the post-sample period is conducted through impulse response and variance decomposition. Impulse response functions (IRFs) show the effects of shocks on the adjustment path of the variables, while Forecast error Variance decompositions measure the contribution of each type of shock to the forecast variance. The IRFs traces out how the changes in one variable impact on current and future values of the endogenous variable (Asmah, 2013). The IRFs and FEVD provides an intuitive way to interpret the variables in the VECM, and were used in assessing how shocks to economic variables reverberate through the system in the three West African countries.

The result of IRFs in Appendix A10, B10 and C10 for Cote d'Ivoire, Ghana and Nigeria, respectively, as summarized in Table 4.8 reported the IRFs of the log of first differences of OPNES, INV, HK, FDI and EXR for Cote d'Ivoire, Ghana and Nigeria. The

IRFs was used to produce the time path of RGDP in the VECM, to shocks from OPNES, INV, HK, FDI and EXR. The following conclusions emerged from the examination of the impulse response functions for Cote d'Ivoire. The transmission effect of OPNES to RGDP in event of policy shock in the short-term was 0.03%. This effect increased to 0.08%in the medium-term, and further increased to 1.17% in the long-term. This indirectly means that the transmission effect of OPNES to RGDP in Cote d'Ivoire was permanent and will continue to have positive impact on the economy in the long-term. The evidence from the IRFs indicated that the effect of INV was 0.81% in the short-term, and continues to increase to 0.9% in the medium-term and 0.2% in the long-term, indicating that the positive effect from the policy shock is decreasing and may require stabilization measures to sustain the positive impact on the economy. For HK, the unanticipated shock had a positive effect in the short-term, 0.66%, which increased to 1.86% in the medium-term and 1.89% in the long-term, indicating that the shock is permanent. Evidence from the IRFs result also indicated that the positive effect of policy shock on FDI in the short-term was 0.04%, and increased to 0.07% in the medium-term, but declined to 0.05% in the 10^{th} year, indicating that the shock will have a positive impact on the economy over the 10-year forecast period. Evidence from results of the IRFs, however, indicated short-term positive effect for EXR of 0.15%, which decreased to -0.9% in the medium-term, and -0.8% in the 10^{th} year, indicating that the shock is temporary, but took 6 years for the positive effect to fizzle out.

In Ghana, the transmission effect of OPNES to RGDP in event of policy shock was 2.57% in the short-term, and increased to 4.94% in the medium-term, while it again rose to 6.45% in the long-term, indicating that the shock is permanent. This indirectly means that the transmission effect of OPNES to RGDP has positively increased over the 10-year forecast period, with positive effect on RGDP growth for Ghana in the long-term. The evidence from the IRFs, however, indicated temporary shocks for INV as unanticipated shock was 0.146%

in the short-term, and continue to increase to 0.92% in the medium-term and 1.2% in the long-term, indicating that the shock was permanent. For HK, the unanticipated shock had a positive effect in the short-term, 1.9%, which increased to 2.8% in the medium-term and 3.4% in the long-term, indicating that the shock is permanent. Evidence from the IRFs result also indicated that the negative effect of policy shock on FDI in the short-term was -0.18%, but became positive, 2.16% in the medium-term, and increased to 2.96% in the 10^{th} year, indicating that the shock is temporary and took 6 years for the negative effect to fizzle out. Evidence from result of the IRFs, however, indicated short-term negative effect for EXR of -1.47%, which decreased to -2.27% in the medium-term, and -3.05% in the 10^{th} year, indicating that the shock is permanent.

In Nigeria, the IRFs of RGDP to an unexpected shock to OPNES, INV, HK, FDI and EXR was reducing and persistent over the time horizons (10-year forecast period) in Nigeria. The transmission effect of OPNES as a prime variable to RGDP in an event of policy shock in the short term was -1.08%. This negative effect decreased to -2.27% in the medium term, and further decreased to -3.73% in the long term indicating that the transmission effect of OPNES to RGDP will have negative effect in the long-term in Nigeria. The evidence from the IRFs, however, indicated temporary shocks for INV as unanticipated shock was 0.58% in the short-term, and continue to decrease to 0.24% in the long-term. For HK, unanticipated shock had a negative effect in the short-term, -1.29%, which declined to -4.5% in the medium-term and -6.08% in the long-term. Evidence from the IRFs result also indicated that the negative effect of policy shock on FDI in the short-term was -1.16% but declined to -0.95% in the medium-term, but the effect became positive, 0.73% in the 10^{th} year, indicating that the shock is temporary, but took 10 years for the negative effect to fizzle out. And for EXR, the IRFs indicated short-term negative effect of -2.14%, which decreased to -3.21% in the medium-term, and -3.96% in the long-term, indicating that the shock is permanent.

Table 4.8 Impulse Response Functions for Cote d'Ivoire, Ghana and Nigeria *(RGDP is Dependent.)*

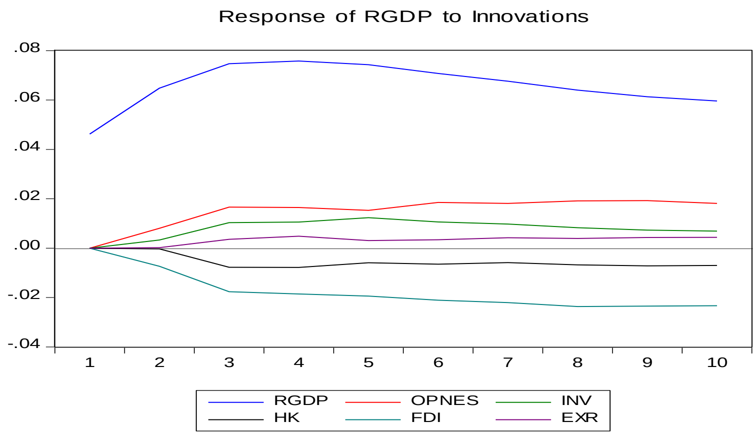
Period	Effect	RGDP	OPNES	INV	HK	FDI	EXR
	Cote d'Ivoire						
3 Year	Short Term	0.060971	0.003072	0.008141	0.006697	0.000408	0.001596
6 Year	Medium Term	0.030806	0.008683	0.009004	0.018632	0.007084	-0.009279
10 Year	Long Term	0.004561	0.011725	-0.002375	0.018904	0.005556	-0.008348
Decision		**Decreasing**	**Increasing**	**Fluctuating**	**Increasing**	**Fluctuating**	**Fluctuating**
	Ghana						
3 Year	Short Term	0.043726	0.025701	0.001463	0.019736	-0.001893	-0.014790
6 Year	Medium Term	0.045558	0.049405	0.009284	0.028762	0.021658	-0.022798
10 Year	Long Term	0.047822	0.064506	0.012036	0.034773	0.029689	-0.030599
Decision		**Increasing**	**Increasing**	**Increasing**	**Fluctuating**	**Increasing**	**Decreasing**
	Nigeria						
3 Year	Short Term	0.078586	-0.010859	0.005799	-0.012949	-0.011650	-0.021498
6 Year	Medium Term	0.085509	-0.022715	0.002573	-0.045395	-0.009597	-0.032119
10 Year	Long Term	0.085475	-0.037326	0.002448	-0.060885	0.007362	-0.039663
Decision		**Fluctuating**	**Decreasing**	**Decreasing**	**Decreasing**	**Increasing**	**Decreasing**

Source: Extracts using Eviews 10.0

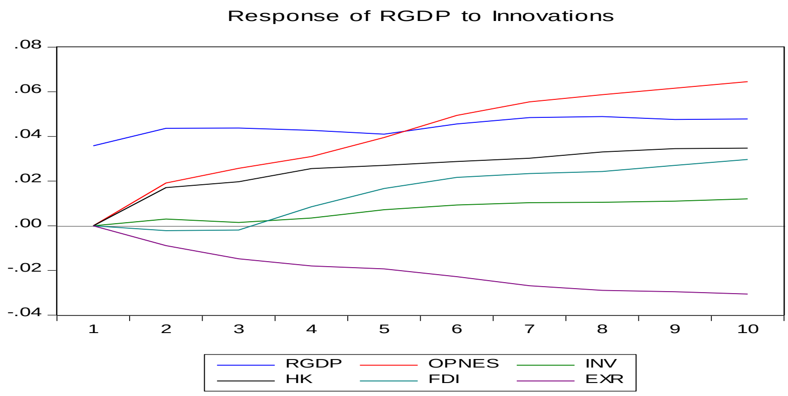
Figures 4.4 display the graphical representation of IRFs of the log of first differences of OPNES, INV, HK, FDI and EXR to Chelosky one standard deviation structural shocks. The combined graphs derived from Appendix A10, B10 and C10 for Cote d'Ivoire, Ghana and Nigeria, respectively, are based on the output of the vector error correction estimates with analytic response standard error over 10-year period and the Chelosky degrees of freedom adjusted, which show the response to Chelosky one standard deviation innovations. Each graph includes a point estimation of IRFs as well as lower and upper bounds for a 95% confidence interval. The solid lines depict the variable percentage change in response to a standard deviation of one in the respective macro variables (RGDP, OPNES, INV, HK and EXR), whereas the dotted lines represent the 95% error bands.

The response of RGDP to innovative shocks in OPNES is contemporaneously weak and steadily decreasing over the 10-year forecast period in Cote d’Ivoire. This means that any unanticipated increase in the real GDP persistently reduces the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values in Cote d’Ivoire. While in Ghana, the response of RGDP to Cholesky innovations shows that the response of RGDP to its own shocks is contemporaneously more stable and gradually subsiding towards the end of the period. This means that any unanticipated increase in the real GDP may reduce the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values.

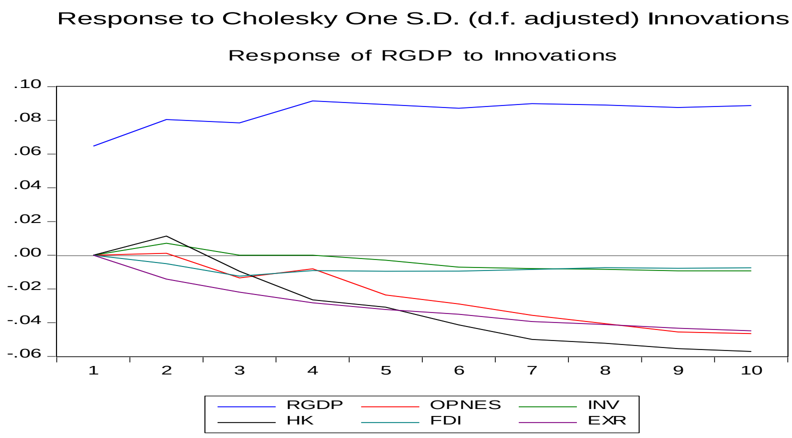
The response of RGDP to its own innovative shocks is contemporaneously weak and fluctuating towards the end of the period in Nigeria. This means that any unanticipated increase in the real GDP increases the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values.



Cote d'Ivoire



Ghana



Nigeria

Figure 4.2: Plots of Impulse Response Functions for Cote d'Ivoire, Ghana and Nigeria

4.9 Analysis of Forecast Error Variance Decomposition

Impulse response functions trace the effects of a shock to one endogenous variable on other variables in the VAR (in this case VECM), while the alternative variance decomposition technique measures the proportion of forecast error variance in one variable explained by innovations in it and other variables (Asmah, 2013). Thus, from the Forecast Error Variance Decomposition (FEVD) for Nigeria, Ghana and Cote d'Ivoire we can identify orthogonalized innovations in RGDP for the individual countries and the dynamic responses to such innovations; hence the variance-covariance matrix of the VECM was factorized using the Chelosky decomposition. The results of the FEVD of the endogenous variables, at various terms (short-, medium- and long-term) generated by the six variables, derived from VECM in Appendix A11, B11 and C11 for Nigeria, Ghana and Cote d'Ivoire, respectively, are summarized in Table 4.9.

In general, own series shocks explain most of the error variance, although the shock will also affect other variables in the system. As expected, the results show that the percentage of variance explained by own shock account for 92.43% in the short-term and continue falling until it ends with an average around 67.63% at the end of the 10th period for Nigeria. This implies that economic growth is explained predominantly by its own innovative shocks (67.63%) while innovative shocks of trade openness, investment, human capital, net inflow of FDI and official rate of foreign exchange contribute to GDP by 5.49%, 0.28%, 17.14%, 0.65% and 8.8%, respectively, at the end of the 10-year forecast period. This shows that international trade is a weak driver of economic growth in Nigeria. The evidence of the results is consistent with empirical findings as reviewed in Arodoye & Iyoha (2014) in which the variance decomposition established that the predominant sources of Nigeria's economic growth variation are largely to "own shocks".

In the same vein, the percentage of variance explained by own shock for RGDP in Ghana declines to about 48.38% in the medium term and continue falling until it ends with an average of 35.12% at the end of the 10^{th} period. This implies that economic growth is explained predominantly by innovative shocks in trade openness (36%), followed by own innovative shocks (35.12%), HK (12.9%), EXR (8.6%), FDI (6.3%) and INV (1.13%), respectively, at the end of the 10-year forecast period. This shows that international trade is a major driver of economic growth in Ghana. On the other hand, evidence from the FEVD results in Appendix B10 indicated that OPNES explains 83.6% of its own innovative shock, 27.5% proportion of gross fixed capital formation (INV) by its innovative shocks and 14.9% proportion of FDI by its innovative shock in Ghana. This finding implies a causal relationship between OPNES, INV and FDI and consistent with Granger causality analysis as reported in Appendix B7.

For Cote d'Ivoire, the percentage of variance explained by own shock account for 98.54% in the short-term and continue falling until it ends with an average around 78.39% at the end of the 10^{th} period. This implies that economic growth is explained predominantly by its own innovative shocks (78.4%) while innovative shocks of trade openness, investment, human capital, net inflow of FDI and official rate of foreign exchange contribute to GDP by 3.4%, 2.2%, 12%, 1.3% and 2.8%, respectively, at the end of the 10-year forecast period. This shows that international trade is a weak driver of economic growth in Cote d'Ivoire.

The FEVD results demonstrate the significant role played by the nominal variables. For instance, OPNES as a prime variable indicated a forecast error variance of 0.67% in the short-term which increased to 5.49% at the end of the 10^{th} year in Nigeria. INV indicated a forecast error variance of 0.85% in the short-term which decreased continuously to 0.28% in the long-term, while the fraction of HK forecast error variance attributable to variations in RGDP increased steadily from 1.37% in the short-term to 17.14% in the long-term, which was next to own shock variation in Nigeria. FDI indicated a forecast error variance of 0.85% in the short-term which increased marginally to 0.86% in the medium-term, but declined to 0.64% in the long-term, and the fraction of EXR forecast error variance attributable to RGDP increased steadily from 3.8% in the short-term to 8.87% in the long-term in Nigeria.

In Ghana, OPNES as a prime variable indicated that forecast error variance attributable to variations in RGDP increased steadily over the 10-year period to 36%, which was higher than own shock variation in RGDP in Ghana. INV indicated a forecast error variance of 0.15% in the short-term which increased steadily to 1.13% at the end of the 10th year. In the same vein, the fraction of HK forecast error variance attributable to variations in RGDP increased steadily from 0.11% in the short-term to 6.29% in the long-term, and the fraction of EXR forecast error variance attributable to RGDP increased from 4.17% in the short-term to 8.5% in the long-term. And, FDI indicated a forecast error variance of 0.11% in the short-term which increased continuously over the 10 year forecast period to 6.2%.

And in Cote d'Ivoire, the FEVD results indicated that the fraction of OPNES forecast error variance attributable to variations in RGDP increased from 0.14% in the short-term to 3.38% in the long term, while the fraction of HK forecast error variance attributable to variations in RGDP increased steadily from 0.54% in the short term to 17.14% in the long term, which was next to own shock variation. INV indicated a forecast error variance of 0.7% in the short-term which increased to 2.4% in the medium-term, and declined to 2.2% at the end of the 10th year. Evidence of the result of the FEVD also indicated that the fraction of FDI forecast error variance attributable to variations in RGDP increased steadily from 0.001% in the short-term to 1.26% in the long term, and the fraction of EXR forecast error variance attributable to RGDP increased continuously over the 10-year forecast period from 0.47% in the short-term to 2.7% in the long term in Côte d'Ivoire.

The overall findings confirm the importance of nominal variables in contributing to real GDP growth in Nigeria, Ghana Cote d'Ivoire. The FEVD results indicated that OPNES variation on RGDP in Nigeria, Ghana and Cote d'Ivoire tends to increase from the short term to the medium and long term, and hence may be of positive effect on the economy in the long run. The FEVD result also indicated that Ghana has more stable trade policies which has resulted to, a relatively, higher increasing positive variations as compared with Nigeria and Cote d'Ivoire. Nigeria and Cote d'Ivoire may require borrowing policy ideas from Ghana to stimulate positive trade openness effects on RGDP growth.

Table 4.9 Forecast Error Variance Decomposition for Nigeria, Ghana and Cote d'Ivoire
(Normalized Variable is GRGDP)

Period	Effect	RGDP	OPNES	INV	HK	FDI	EXR
	Nigeria						
3 Year	Short Term	92.43312	0.677715	0.854222	0.371517	0.857557	3.805871
6 Year	Medium Term	80.83157	2.066323	0.535488	8.932031	0.861782	6.772808
10 Year	Long Term	67.63620	5.496858	0.280063	17.14263	0.647134	8.797118
Decision		**Decreasing**	**Increasing**	**Decreasing**	**Increasing**	**Fluctuating**	**Increasing**
	Ghana						
3 Year	Short Term	71.56295	14.40674	0.159179	9.576581	0.117167	4.177383
6 Year	Medium Term	48.38467	27.13555	0.729821	13.13333	3.752926	6.863704
10 Year	Long Term	35.12368	36.00424	1.133974	12.85637	6.292428	8.589308
Decision		**Decreasing**	**Increasing**	**Increasing**	**Increasing**	**Increasing**	**Increasing**
	Cote d' Ivoire						
3 Year	Short Term	98.54424	0.145538	0.712465	0.548196	0.001861	0.477401
6 Year	Medium Term	90.81359	0.918779	2.475399	4.502690	0.554483	0.735061
10 Year	Long Term	78.39139	3.383773	2.228587	11.95499	1.264248	2.777011
Decision		**Decreasing**	**Increasing**	**Fluctuating**	**Increasing**	**Increasing**	**Increasing**

Source: Extracts using Eviews 10.1

4.8 Panel Data Analysis

4.8.1 Panel Unit Root Tests

Recent literature (Levin, Lin and Chu, 2002) suggests that panel-based unit root have higher power than unit root tests based on individual time series. The null hypothesis for panel unit root test is that all panels contain a unit root, and since they are smaller than 0.01, we can reject the null hypothesis at 1% level of statistical significance. This means there are no unit root in the panels under the given test conditions (included panel mean and time trend). To check for the stationarity of the time series in the panel framework, the study employed two types of unit root tests. While the Levin, Lin & Chu (2002) unit root test assume common unit root process, the Im-Pesaran & Shin Weighted-Statistic, the Augmented Dickey Fuller (ADF)-Fisher Chi-Square and Philips-Perron (PP)-Fisher Chi-Square assume individual unit root process. The test statistics are compared with the probability values for decision on whether the series are stationary or not. To obtain consistent estimates by correcting standard errors, HAC (heteroscedasticity- and autocorrelation-consistent) standard errors or simply Newey-West standard errors was employed (Newey & West, 1994). The nearest integer of 1 was selected as the lag length, and the probabilities for ADF-Fisher tests were computed using asymptotic Chi-square distribution, while all other tests assume asymptotic normality.

The panel unit root test results in Appendix 13 summarized in Table 4.10 indicated that all the independent variables were not stationary at level. Since the variables were not found to be stationary at level, it prompted the panel unit root test at first difference. The process reported by Levin, Lin & Chu test, Im-Pesaran and Shin test, ADF-Fisher Chi-Square test and PP-Fisher Chi-Square test p-values at 1% level of significance, show that all the variables were stationary at first difference. The result of the panel unit root test is consistent with the conventional ADF unit root earlier carried out separately for the three (3) West

African countries where all the variables were not stationary at level but became stationary at first difference.

Table 4.10: Panel Unit Root Tests at Levels and First Difference

Variable	Levin, Lin and Chu Test Stat.	Prob.	Im-Pesaran & Shin W-Test Stat	Prob.	ADF-Fisher Test Stat.	Prob.	PP-Fisher Chi-Square Test Stat.	Prob.	Overall Test Decision
RGDP	3.68815	0.9999	4.71225	1.0000	0.16241	0.9999	0.51460	0.4811	Accept
OPNES	0.35959	0.6404	-0.06252	0.4751	4.32232	0.6331	5.50308	0.4839	Accept
INV	5.33333	0.7031	-0,54337	0.0000	4.61533	0.5940	5.10430	0.5305	Accept
HK	-1.74856	0.0402	0.23584	0.5932	4.79186	0.5708	12.0522	0.0608	Accept
FDI	0.73200	0.7679	1.67927	0.9535	1.21159	0.9763	2.40894	0.8785	Accept
EXR	0.20661	0.5818	0.81313	0.7919	2.77346	0.8367	2.58736	0.8586	Accept
First Difference									
Variable	**Levin, Lin and Chu Test Stat.**	**Prob.**	**Im-Pesaran & Shin W-Test Stat**	**Prob.**	**ADF-Fisher Test Stat.**	**Prob.**	**PP-Fisher Chi-Square Test Stat.**	**Prob.**	**Overall Test Decision**
RGDP	-2.71337	0.0033	-4.00238	0.0000	27.6701	0.0000	72.9280	0.0000	Reject
OPNES	-5.09566	0.0000	-5.17859	0.0000	38.5477	0.0000	73.3745	0.0000	Reject
INV	-10.6801	0.0000	-8.65487	0.0000	68.5759	0.0000	93.7412	0.0000	Reject
HK	-6.28572	0.0000	-5.93475	0.0000	44.4355	0.0000	98.3807	0.0000	Reject
FDI	-7.98370	0.0000	-7.91068	0.0000	63.7840	0.0000	91.5877	0.0000	Reject
EXR	-4.78118	0.0000	-5.6086	0.0000	42.1293	0.0000	70.0859	0.0000	Reject

Source: Extracts using Eviews 10.0

4.8.2 Panel Cointegration Tests

Time series are non-stationary when they have a mean or variance that varies over time. The notion of cointegration, which was given a formal treatment in Engel & Granger (1987) is based on an examination of the residuals of a spurious regression performed using I(1) variables. If the variables are cointegrated then the residuals should be I(0). On the other hand, if the variables are not cointegrated then the residuals should be I(1). Pedroni (1999, 2004) and Kao (1999) extended the Engle-Granger framework to tests involving panel data. Pedroni (1999) proposed several residual-based null of no cointegration in panel cointegration test statistics. In this study eight within-dimension-based (panel v-Statistic, Panel rho-Statistic, Panel PP-Statistic, Panel ADF-Statistic, Panel v-Weighted Statistic, Panel rho-Weighted Statistic, Panel PP-Weighted Statistic and Panel ADF-Weighted Statistic) and between-dimension-based (Group rho-Statistic, Group PP-Statistic and Group ADF-Statistic). Between-dimension-based statistics are merely the group mean approach extensions of the within-dimension-based statistics.

To compute the relevant panel cointegration test statistics, the Newey-West kernel estimation was used as recommended in Newey & West (1994). The nearest integer of 2 was selected as lag length based on Schwarz information criterion (SIC) for different observations over the 47 year time period from 1970 – 2016.

4.8.3.1 Pedroni Panel Cointegration Tests

The Pedroni panel cointegration test results in Appendix A14 as summarized in Table 4.11 based on the assumption of no deterministic trend indicated that Panel v-Statistic, Panel PP-Statistic, Panel v-Weighted Statistic, Panel PP-Weighted Statistic and Group PP-Statistic have probabilities at 1% and 5% levels of significance. The numbers in parentheses are the probabilities for the test statistics. Pedroni’s cointegration test based on the assumption of deterministic intercept and trend indicated that Panel v-Statistic, Panel PP-Statistic, Panel v-Weighted Statistic, Panel PP-Weighted Statistic and Group PP-Statistic have probabilities at 1% and 5% levels of significance, which is consistent with the result of no deterministic trend test. The result therefore, confirms the existence of at least four cointegrating equations in the model, which implies the existence of long run relationship of all the variables in the pooled regression equation. The overall result indicated that Panel rho-Statistic; Panel ADF-statistic, Panel rho-Weighted Statistic, Panel ADF-Weighted Statistic, Group rho-Weighted Statistic and Group ADF-statistic have insignificant probabilities. However, Pedroni (2004) argued that the six statistics which do not reject the null hypothesis may have a very low power in the case of small time dimension. Therefore, we conclude that our variables are panel cointegrated.

Table 4.11 Panel Cointegration Tests

Pedroni test		
Test Statistc	No Deterministic Trend	Deterministic Trend and Intercept
Panel V-Statistic	0.783985 (0.2165)	5.531036 (0.0000)
Panel rho-Statistic	-0.560847 (0.2875)	-0.288356 (0.3865)
Panel PP Statistic	-2.177412 (0.0147)	-2.045776 (0.0204)
Panel ADF- Statisric	0.435919 (0.6686)	-1.027742 (0.1520)
Panel V-Weighted Stat	1.630290 (0.0515)	3.019173 (0.0013)
Panel rho-Weighted Stat	-0.673579 (0.2503)	-0.242859 (0.4041)
Panel PP-Weighted Stat	-2.249628 (0.0122)	-2.023276 (0.0215)
Panel ADF-Weighted Stat	-0.449168 (0.3267)	-1.087427 (0.1384)
Group rho-Statistic	-0.127277 (0.4494)	0.332542 (0.6303)
Group PP-Statistic	-2.288546 (0.0111)	-1.886246 (0.0296)
Group ADF-Statistic	-0.411682 (0.3403)	-0.767124 (0.2215
Kao test		
ADF-statistic	-3.76277 (0.0001)	
Johansen Fisher test		
Null hypothesis	Trace	max-eigen
r = 0	75.96 (0.0000)	51.23 (0.0000)
r ≤ 1	30.59 (0.0000)	13.18 (0.0329)
r ≥ 2	21.99 (0.0012)	11.08 (0.0491)

Note: probability values in parenthesis

Source: Extracts using Eviews 10.0

4.8.3.2 Kao Residual Cointegration Test

The Kao (1999) panel cointegration test is also residual-based and follows the same basic approach as the Pedroni tests, but specifies cross-section specific intercepts and homogeneous coefficients on the first stage regressors. The Kao test proposed the residual-based null hypothesis of no cointegration among the variables in the long run based on the assumption of no deterministic trend. The Kao test depends on the ADF *t*-Statistic and probability value. The result of the Kao residual cointegration test in Appendix B14 summarized in Table 4.11 indicated long run cointegration of the time series as the ADF *t*-statistic, 3.762777 is significant at 1% level.

4.8.3.3 Johansen's Fisher Panel Cointegration

Johansen's Fisher panel co-integration tests is a system based co-integration test for a whole panel set, unlike Pedroni (1999) and Kao (1999) cointegration tests which are residuals taken from Engel & Granger (1987) two step test. Fisher (1932) test is employed in this study as a robustness check for panel cointegration as the test accommodates as much heterogeneity as is possible, while Pedroni and Kao tests are residual-based but assumes cross sectional dependence. Madalla & Wu (1999) used Fisher (1932) test to derive a combined test that uses the results of the individual dependent tests to testing for co-integration in panel data by combining tests from individual cross-sections to obtain the full statistic for the panel. The results of the Johansen's Fisher panel co-integration tests in Appendix C14 summarized in Table 4.11, are fairly conclusive: Fisher's tests, no matter with the Mackinnon, Haug & Michelis (1999) p-values for Johansens co-integration trace test statistics and maximum eigenvalue test statistics, support the presence of a cointegrated relation among the variables at the 1% significance level. The probabilities were computed using asymptotic chi-square distribution. Given that the probability values of trace statistics and maximum eigenvalues of the Fisher's tests for three equations (None, Atmost 1 and Atmost 2) are less than 0.05, the null hypotheses are rejected implying that there are three co-integrating equations in the system. It was, therefore, concluded from the results of the Johansen's Fisher panel co-integration test, that there is long run equilibrium relationship among the variables (RGDP, OPNES, INV, HK, FDI and EXR) of the panel data set.

4.9 Heterogeneous Panel Regression Analysis

To further explore the empirical evidence of the links between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria, heterogeneous panel data analysis was conducted by pooling the three cross-section time series data sets. Heterogeneous panel data model is a model in which all parameters (slope coefficients and error variances) differ across individual countries. Heterogeneous panel data model is an intermediate estimator between fixed effects, random effects and pooled ordinary Least squares (OLS). This approach is appropriate for drawing conclusions on dynamic heterogeneous panels by considering long-run equilibrium relationships and the magnitude of short-run effects of changes in the index of OPNES on RGDP growth. To compute standard errors that are robust against serial correlation and heteroscedasticity (Arellano (1987) and White (1980)), White period was selected as the coefficient method with no *d.f* correction for the coefficient covariance method in line with Wooldridge (2016).

The results of fixed effect model (FEM), random effect model (REM) and pooled ordinary least squares (OLS) estimation in Appendix 15 summarized in Table 4.12 presents the panel framework to facilitate in selection of a model that best explains the relationship between trade openness and economic growth in the three countries. The numbers in parentheses are the probability values. The result of the fixed effects indicated a positive sign for OPNES coefficient, which implies a positive relationship between OPNES and RGDP, though not statistically significant at conventional levels. The random effects and panel (pooled) OLS, however, indicated negative and statistically significant coefficient, which implies that a negative relationship between OPNES and RGDP exist in the selected West African countries. The result of the fixed effect also indicates a negative relationship between HK and RGDP, while INV, FDI and EXR show positive relationship with RGDP. The random effects and pooled least squares also show a negative relationship between FDI and RGDP, while INV, HK and EXR are positively related to RGDP.

From the result displayed in Table 4.12, R^2 is 0.995452 for FEM, 0.958440 for REM, and 0.96003 for pooled OLS, which clearly show that the FEM better explains the variation in the regression than the random and pooled effects models. The probability of *F*-statistic is significant at 1% level which confirms the overall fitness of the FEM, REM and pooled OLS, while the sum of squares residual (SSR) is much lower for the FEM at 0.87, 7.99 for REM and 7.88 for pooled OLS. A low SSR is ideal, and is used to compare the performance of the panel models. Since there are lags in the panel models, there is no need to interpret the Durbin-Watson statistic as the serial autoregressive estimations have cleared the presence of autocorrelation in the models.

However, these statistical requirements are desirable but not sufficient condition for selecting the most preferred model. Notably, the pooled OLS estimation is simply an OLS technique run on panel data. Therefore, all individually specific effects are completely ignored, which violates a lot of basic assumptions like orthogonality of the error term. REM solves this problem by implementing individual specific intercept in the panel framework, which is assumed to be random and implies full exogeneity of the model. Since almost every model has some endogeneity issues, the fixed effect estimation is usually preferred and provides the best consistent estimates but the individual specific parameters will vanish (Wooldridge, 2016). Therefore, to select the most preferred model from the two (Fixed and Random) models in terms of efficient parameter coefficients, the Hausman test is used as a criterion to check if random effect is an appropriate model to be applied.

Table 4.12 Fixed Effects, Random Effects and Pooled Models *(Dependent Variable is RGDP)*

Regressors	**Fixed Effect**	**Random Effect**	**Pooled OLS**
C	20.50003 (0.0000)	10.25236 (0.0000)	10.18759 (0.0000)
OPNES	0.031634 (0.31634)	-0.207723 (0.0000)	-0.161962 (0.0000)
INV	0.084016 (0.0020)	0.490994 (0.0000)	0.483837 (0.0000)
HK	-0.049999 (0.3659)	0.319841 (0.0000)	0.336078 (0.0000)
FDI	0.141844(0.0000)	-0.061456 (0.0000)	-0.073896 (0.0000)
EXR	0.013275 (0.3176)	0.068976 (0.0000)	0.073618 (0.0000)
R-squared -	0.995452	0.958440	0.964003
Sum of squared resid	0.874305	7.990106	7.88251
F-statistic (prob.)	359.3158 (0.0000)	622.6606 (0.0000)	723.0659 (0.0000)
Durbin-Watson stat.	0.704609	0.420721	0.420721
Hausman test: Chi-square	120.178110 (0.0000)		

Note: Probability values in parentheses
Source: Extracts using Eviews 10.0

4.9.2 Hausman Test for Correlated Random Effects

The central assumption in random effects estimation is that the random effects are uncorrelated with the explanatory variables. In order to select the appropriate model between random effects or fixed effects model for the linear panel regression, the correlated Hausman (1978) test was conducted to determine if random effects model should be applied. The Hausman test was performed using the output of the random effects estimation. Random effects (RE) are preferred under the null hypothesis due to higher efficiency, while under the alternative hypothesis fixed effect (FE) is at least as consistent and thus preferred.

The results of the Hausman correlation test in Appendix 17 summarized in the last row of Table 4.12 indicated evidence that the test summary clearly rejects the null hypothesis, as the estimated Chi-square value of 120.178110 for 5*d.f* with *p*-value of 0.0000 is significant. If the null hypothesis were true, the probability of obtaining a chi-square value as much as 120.18 or greater would be practically zero. As a result, the null hypothesis that the random effect is more appropriate is rejected, and thus, the FEM is preferred. Incidentally, the last part of Appendix 17 compares the FEM and REM (ECM) coefficients of each variable and, as the last column shows the differences are statistically significant except OPNES.

4.9.3 Fixed Effects Least Squares Dummy Variable (LSDV) Model

The traditional view of the fixed effects approach is to assume that unobserved effect, α_i, (in equation 3.31) is a parameter to be estimated for each *i* (country). The way to estimate an intercept for each country is to put in a dummy variable for each cross-sectional observation, along with the explanatory variables (Wooldridge, 2016). This method is usually referred to as dummy variable regression. Therefore, the fixed effect estimator was obtained by the year dummy variable regression. A dummy variable separates the observations into two disjoint groups; a dummy variable equals 1 for one group (country) and 0 for the other group (countries). Since the analysis employs dummies to estimate the fixed effects, in the literature the model presented in Table 4.13 is also known as least squares dummy variables (LSDV).

Results of the LSDV panel least squares in Appendix 16 summarized in Table 4.13 indicated that the intercept values of the three (3) countries are statistically different; being *C* for Nigeria, *D2* and *D3* for Ghana and Cote d’Ivoire, respectively, representing the 3 countries with values being: 15.00318 for Nigeria, 20.03314 (=15.00318+ 5.029961) for Ghana, and 17.653167 (=15.00318+ 2.653167) for Cote d’Ivoire. This, according to Gujarati & Porter (2009, p.597) is used to show the different intercepts for the individual countries selected for the study. These differences in the intercepts may be due to unique features of each country not accounted for by other factors which were assumed constant in the FEM, as time is held invariant. The results of the LSDV show that the effect of trade openness and other macroeconomic variables on economic growth varies across the three (3)countries. OPNES being the prime variable, results from the regression indicated that a negative relationship exist between OPNES and RGDP in Nigeria and Cote d'Ivoire, while a positive relationship exist between OPNES and RGDP in Ghana. Evidence from the regression results showed that a unit change in OPNES amongst the countries causes a reduction in RGDP growth of -0.12% in Nigeria and -0.053% in Cote d' Ivoire, while it increases RGDP by 0.27% in Ghana. The LSDV results further validates the ARDL results in Section 4.3 above.

The result also indicated that a unit change in INV leads to 0.28% increase in RGDP growth in Nigeria, a decrease of -0.12% in Cote d'Ivoire, and a decrease of -0.26% in Ghana. For HK, a unit change causes 0.59% increase in RGDP in Ghana, 0.2% in Nigeria, and increase of 0.02% in Cote d'Ivoire. Consistent with findings in Tozoke, Cheong & Junjun (2018) as reviewed in literature, the results also indicated that a unit change in FDI will cause an increase of 0.07% in RGDP growth in Nigeria. While a unit change in FDI reduces RGDP growth by -0.05% in Ghana and -0.08% in Cote d'Ivoire. And a unit change in the official rate of foreign exchange (EXR) positively raises RGDP in Nigeria by 0.05% and 0.04% in Cote d'Ivoire, but reduce RGDP by - 0.02% in Ghana.

The R^2 from the dummy variable regression is high, but this is accounted for by the inclusion of a dummy variable for each cross-sectional unit (country), which explains much of the variation in the data. The result indicated R^2 = 0.994, which cannot be considered exciting, but is not surprising that much of the variation in RGDP is explained by the year dummy variables.

Table 4.13 Fixed Effect LSDV Model (*with individuality intercepts and heterogeneity coefficients, dependent variable is RGDP)*

Regressors	**Cote d' Ivoire**	**Ghana**	**Nigeria**
	Coefficients	Coefficients	Coefficients
C	***17.65348***(0.1610)	***20.03314***(0.0141)	15.00318 (0.0000)
OPNES	-0.052585 (0.4886)	0.265518 (0.0005)	-0.114659 (0.1078)
INV	-0.120278 (0.1199)	-0.262133 (0.0007)	0.279391 (0.0004)
HK	0.016773 (0.7994)	0.587191 (0.0000)	0.184851 (0.0079)
FDI	-0.078606 (0.0393)	-0.045498 (0.1592)	0.072118 (0.0301)
EXR	0.038491 (0.5387)	-0.018357 (0.6976)	0.046987 (0.3208)

R-squared	0.99428		
Sum squared resid	1.099179	Schwarz criterion	-1.384563
F-statistic	1258.267	Durbin-Watson stat	0.882784
Prob(F-statistic)	0.000000		

Note: Probability values in parentheses

Source: Extracts using Eviews 10.0

Pooled cross sections can be very useful for evaluating the impact of a certain event or policy. For instance, the results indicated that, though negative relationship of trade openness and RGDP growth is established in Nigeria and Cote d'Ivoire, it is at no conventional levels of significance. Surprisingly, unlike the literature on the growth effects of trade openness, findings of this investigation are considerably different from predictions of theoretical studies. However, the evidence from the panel regression is consistent with some empirical findings as reviewed in Fenira (2015) and Ulasan (2015) which concluded that trade openness by itself does not boost economic growth of developing countries (including Nigeria and Cote d'Ivoire). But consistent with new growth hypothesis as reviewed in Mputu (2016), Mullings & Muhabir (2015), Bruckner & Lederman (2012) and Mbabazi, Milner & Morrissey (2004), the result indicated a positive relationship between trade openness and RGDP in Ghana using the LSDV approach.

It is evident from the findings that, trade openness has a negative impact on economic growth in Nigeria and Cote d'Ivoire; while the result indicated that Ghana is faring better in terms of the effect of trade openness on the growth of RGDP. The LSDV model has therefore, distinguished the heterogeneity (individuality or uniqueness) of the three countries on the response of their real GDP to trade openness and other macroeconomic variables studied. While Nigeria and Cote d'Ivoire may need to emulate trade policies from Ghana, Ghana and Cote d'Ivoire may need to emulate Nigeria's policies in harnessing inflow of FDI to stimulate economic growth.

In summary the fixed effects model was interacted with the dummies to produce the LSDV model for the parameter estimates for each of the countries in the cross-section. This allowed for the changes observed in the coefficients in the panel to underscore the importance of the existence of true variation of coefficients for comparative purposes. To achieve this objective, with an attempt to offer a snapshot of fixed effects LSDV estimation on the openness-growth nexus in Nigeria, Ghana and Côte d'Ivoire as summarized in Table 4.14.

Table 4.14 Summary of Ranking of Cote d'Ivoire, Ghana and Nigeria.

Variable	**1st Position**	**2nd Position**	**3rd Position**
	Coefficients(prob)	Coefficients(prob)	Coefficients(prob)
OPNES	GHA: 0.2655 (0.0005)	CIV: -0.0525 (0.4886)	NIG: -0.1146 (0.1708)
INV	NIG: 0.2793 (0.0004)	GHA: -0.2621(0.0007)	CIV: -0.1202(0.1199)
HK	GHA: 0.5871 (0.0000)	NIG: 0.1848 (0.0079)	CIV: 0.0167 (0.7994)
FDI	NIG: 0.0721 (0.0301)	CIV: 0.0786 (0.0393)	GHA: -0.0454(0.1592)
EXR	NIG: 0.0469 (0.3208)	CIV: 0.0384 (0.5387)	GHA: -0.0183(0.6976)

Source: Extracts using Eviews 10.0

4.9.4 Panel Diagnostic Tests

There are basic assumptions surrounding panel data analysis. According to Gujarati and Porter (2009), panel framework assumes absence of functional misspecification, serial correlation and heteroscedasticity. Ignoring cross-sectional dependence in estimation can have serious consequences, with unaccounted for residual dependence resulting in estimator efficiency loss and invalid test statistics. Some of the tests for cross-section dependence in literature include Breusch & Pagan (1980) Langrange Multiplier (LM) test statistic, Pesaran

(2004) Scaled Langrange Multiplier (LM) test statistic and Pesaran (2004) Cross-sectional Dependence (CD) test. These three (3) tests were computed from the panel pooled effects model estimated by OLS.

Output of the regression results of residual cross-section dependence tests in Appendix 17 is summarized in Table 4.15. The first line contains the results for the Breusch-Pagan LM, and the test statistic results of 6.841394 were well into the upper scale of the test statistic (Chi-square). With 3 d.f., the *p*-value of obtaining a chi-square value 6.841394 is 0.0771 (10%), a weak evidence not to reject the null hypothesis of no correlation at conventional levels of significance. The next line presents the Pesaran Scaled LM, again the result of 1.568243 fail to reject the null hypothesis at conventional levels of significance. Taken together, these results suggest that the null hypothesis of no cross-sectional dependence should not be rejected.

Moreover, since the sample size (T) of the panel data is relatively large, the focus is on the results of the asymptotically standard normal Pesaran CD test which are presented in the final line of Table 4.18. While the test statistic value of 0.406812 is significantly below that of the Breusch-Pagan LM and the Pesaran scaled LM, the Pesaran CD test also failed to reject the null at conventional levels of significance. The standard Breusch-Pagan LM test statistic is not appropriate for testing in large sample (T) and large group (N) settings. To address this shortcoming, Pesaran (2004) proposed a standardized version of the LM statistic which is asymptotically standard normal as $T \rightarrow \infty$ and then $N \rightarrow \infty$ (where the arrow points to direction of infinity). But Pesaran notes one shortcoming of the Breusch-Pagan LM which is that, the statistic is likely to exhibit size distortion for small T, and that the distortion will worsen for larger N. To address the size distortion of the Breusch-Pagan LM and the Pesaran scaled LM, Pesaran (2004) proposed an alternative statistic based on the average of the pairwise coefficient, which is asymptotically standard normal for $T \rightarrow \infty$ and then $N \rightarrow \infty$, so that the CD test is likely to have good properties for both *N* and *T*, and the study provided Monte Carlo evidence to support this claim. It is therefore, plausible to conclude that the disturbances in the panel for this study are cross-sectionally independent (no serial correlation in residuals).

Table 4.15 Panel Diagnostic Tests

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	6.841394	3	0.0771
Pesaran scaled LM	1.568243		0.1168
Pesaran CD	0.406812		0.6841

Source: *Extracts using Eviews 10.0*

4.10 Pairwise Dumitrescu-Hurlin Panel Causality Test

To determine the causal relationship between trade openness and economic growth in a panel framework for the three countries, the Dumitrescu & Hurlin (2012) Granger causality test was conducted on the pooled cross-section time series for the period from 1970 - 2016. The Dumitrescu-Hurlin test takes into account two dimensions of heterogeneity: the heterogeneity of the regression model used to test the Granger causality and the heterogeneity of the causality relationships. Under the null hypothesis Dumitrescu-Hurlin (D-H) test assumes that there is no causal relationship for any of the units of the panel. This assumption is called the homogeneous Non-Causality (HNC) hypothesis. The alternative hypothesis is specified as Heterogeneous Non-causality (HENC) hypothesis. D-H allows coefficients to differ across individuals (entities) but is assumed time-invariant. The test consists of asymptotic and semi-asymptotic distributions. The asymptotic distribution is valid when $T>N$, which fits the current panel data set with 141 observations (*T*) and 3 countries (*N*). The D-H Granger causality test depends on the individual Wald statistic of Granger non-causality averaged across the cross-section units.

As in Granger (1969), the basic idea is that if past values of index of OPNES are significant predictors of the current value of RGDP even when past values of RGDP are been included in the model, then OPNES exerts a causal influence on RGDP. The null hypothesis is OPNES does not Granger cause RGDP at the panel-level for the three countries. If the null hypothesis is rejected, it is concluded that causality from OPNES to RGDP exists. Since D-H test is designed to detect causality at the panel-level, rejecting *Ho* does not exclude that there is no causality for some individual countries. The appropriate lags were determined to be five (5) based on Schwarz information criterion, and the lag order (k) is identical for all the countries and the panel is balanced. The lag selection procedure is in line with Gujarati & Porter (2016) who stressed that, choosing fewer lags will lead to "omission of relevant variables bias," whose consequences can be very serious. On the other hand, choosing more lags than necessary will lead to "inclusion of irrelevant variable bias," whose consequences are less serious (p.698). Gujarati & Porter (2009) argued that the number of lagged terms introduced in the causality tests is an important question. The direction of causality may depend critically on the number of lagged terms included.

For robustness, the study calculates and reported the results for 1, 2, 3, 4 and 5 lags in Table 4.16 as extracted from Appendix 18. Using 1, 3 and 4 lags, the results overwhelmingly fail to reject the null hypothesis of homogenous non-causality, which implies that no individual causality relationship from OPNES to RGDP exists. Using lags 1, 3 and 4, the D-H test for causality between RGDP and OPNES reported Wald statistic of 2.42868, 1.21669 and 6.0177, respectively and p-values at 10% (which is above the selected levels at 1% and 5%). And on the reverse causality from OPNES to RGDP the D-H test reported Wald statistic of 0.64443, 4.84493 and 7.30620 with insignificant p-value for lags 1, 3 and 4, respectively. The results for lags 1, 3, and 4 indicates homogenous non causality (HNC), implying that no individual causality relationship between OPNES and RGDP exist.

However, the result for lag 2 and 5 reported Wald statistic 5.50201 with significant p-value, 0.0080, and 10.0079 with p-value, 0.0332, respectively, which suggest that causality runs from RGDP to OPNES. On the reverse causation, lag 2 and 5 reported Wald statistic 4.39312 with significant p-value, 0.0741 (which is insignificant at 10%) and 8.61228 with p-value, 0.1357, respectively, indicating that heterogeneous non causality (*HENC)* exist as the causality relationship is heterogenous since OPNES causes RGDP only for a sub-group of the 3 countries.

Table 4.16 Dumitrescu-Hurlin Panel causality lags selection

Test	**OPNES → RGDP**	**RGDP → OPNES**
	Wald Statistic	Wald Statistic
Panel A : Lags(k) = 1	0.64443 (0.5193)	2.42868 (0.1205)
Panel A : Lags(k) = 2	4.39312 (0.0741)	5.50201 (0.0080)
Panel A : Lags(k) = 3	4.84493 (0.2969)	6.01778 (0.0760)
Panel A : Lags(k) = 4	7.30620 (0.1078)	7.50790 (0.0865)
Panel A : Lags(k) = 5	8.61228 (0.1357)	10.0079(0.0332)

Notes:→ *Arrow indicates direction of causality; Probability values in parenthesis*

Source: *Extracts using Eviews 10.0*

The results of the selected lag 2 for the D-H Granger non causality test displayed in Table 4.17, indicated causality from RGDP to INV, since the Wald statistic, 5.49392 (0.0082), is significant at the 5% level. On the other hand, there is no reverse causation from INV and RGDP, since the Wald statistic, 2.50195 (0.7569), is statistically insignificant, implying that heterogenous non causality exist. The D-H test also indicated causality from RGDP to FDI, since the Wald statistic, 8.79458 (0.0000), is statistically significant. On the other hand, there is no reverse causation from FDI and RGDP, since the Wald statistic, 1.67051 (0.7344), is statistically insignificant, implying that heterogenous non causality exist. In the same vein, the D-H test also indicated causality from RGDP to EXR, since the Wald statistic, 6.01582 (0.0023), is statistically significant. On the other hand, there is no reverse causation from EXR to RGDP, since the Wald statistic, 4.01238 (0.1366), is statistically insignificant, again this implies that heterogenous non causality exist.

Symmetrically, the D-H test indicated that there exist at least one and at most *N-1* non causal relationships in the model as there is supporting evidence from the result of the VAR Granger causality Block Endogeneity Wald (BEW) tests in section 4.4. The D-H Granger causality test depends on Wald statistic, while the VAR Granger causality/Block Endogeneity Wald (BEW) tests depend on Chi-square statistic. The Dumitrescu-Hurlin Granger causality test thus reinforces evidence of the findings using the BEW tests for this investigation.

The BEW test result indicated unidirectional causality from OPNES to RGDP in Ghana, but no evidence of causality from RGDP to OPNES in Nigeria and Cote d'Ivoire. This result is consistent with the D-H hypothesis of heterogeneous causality (HEC) implying a causal relationship between OPNES and RGDP for a subgroup of the 3 countries (Ghana). The result of the BEW test also show supporting evidence of bidirectional causality from INV to RGDP in Nigeria, non-causality between INV and RGDP in Ghana and Cote d'Ivoire, which also implies heterogeneous non causality (HENC) as the result indicated causal relationship from INV to RGDP for a subgroup of countries (Nigeria). In the same vein, the BEW test also show supporting evidence of unidirectional causality from HK to RGDP in Nigeria and Ghana, and non-causality between INV and RGDP in Cote d'Ivoire, which also implies heterogeneous non causality (HENC) as the result indicated causal relationship from HK to RGDP for a subgroup of countries (Nigeria and Ghana). The BEW test also show supporting evidence of unidirectional causality from EXR to RGDP in Nigeria, RGDP to EXR Ghana, and non-causality between EXR and RGDP in Cote d'Ivoire, which also implies heterogeneous non causality (HENC) as the result indicated causal relationship between HK to RGDP for a subgroup of countries (Nigeria and Ghana).

But surprisingly, unlike the result of the BEW test which indicated evidence of independence between FDI and RGDP in the 3 West African countries, the result of the D-H test suggest causality from RGDP to FDI, implying heterogeneous non causality exist. These findings could be due to the number of lags selected which may have an impact on the conclusion of the results. Another reason could be due to heterogeneity of individual effects and/or heterogeneity of the individual FDI and RGDP parameters which directly affects the paradigm of the representative agent and hence the conclusions with respect to causality relationship.

Table 4 .17 Pairwise Dumitrescu-Hurlin Causality Tests

Lags: 2

Dependent Variable	Excluded	W-Stat.	Prob.	D-H
OPNES	RGDP	4.39312	0.0741	HENC
RGDP	OPNES	5.50201	0.0080	
INV	RGDP	2.50195	0.7569	HENC
RGDP	INV	5.49392	0.0082	
HK	RGDP	2.91062	0.5296	
RGDP	HK	4.25838	0.0929	HENC
FDI	RGDP	1.67051	0.7344	HENC
RGDP	FDI	8.79458	0.0000	
EXR	RGDP	4.01238	0.1366	HENC
RGDP	EXR	6.01582	0.0023	

Source: *Extracts using Eviews 10.0*

Summary of findings of the relationship between trade openness and real GDP growth in Nigeria, Ghana and Cote d'Ivoire are displayed in Table 4.18. This is a cross verification from the various methodological sources and attempt to fully explain, the richness and complexity of the trade openness-growth phenomenon studied from different standpoints, and hence facilitates validation of findings.

Table 4.18 Summary of findings of the relationship between Trade Openness and RGDP

Methodology	ARDL	VAR Granger Causality	IRFs	FEVD	Fixed effects LSDV	D-H panel Causality
Nigeria	Negative (insignificant) SR & (significant) LR relationship	Independence (non causality)	Weak & negative Trend	Positive effect*	Negative (insignificant) LR relationship	Heterogeneous non causality (HENC)
Ghana	Positive (significant) SR & LR relationship	Unidirectional causality	Strong & Positive trend	Positive effect***	Positive (significant) LR relationship	Heterogeneous causality (HEC)
Cote d'Ivoire	Negative (insignificant) SR &LR relationship	Independence (non causality)	Stable & positive trend	Positive effect*	Negative (insignificant) LR relationship	Heterogeneous non causality (HENC)

*low effect **moderate effect ***strong effect

Source: Author's Compilation

4.11 Test of Hypotheses

i. Ho: Trade openness has no significant effect on economic growth in Cote d'Ivoire, Ghana and Nigeria in the long run.

Evidence from the ARDL regression results reported a negative and insignificant estimated coefficient, -0.041290 (0.2757), for OPNES, indicating that a 1% increase in trade share would lead to 0.04% decrease in RGDP growth in Cote d'Ivoire. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive long run effect on economic growth in Cote d'Ivoire. In the same vein, evidence of the results of the ARDL long run regression reported a negative and significant parameter, -0.341842 (0.0459), for OPNES, implying that a 1% increase in trade share will lead to 0.34% reduction in real GDP growth in Nigeria. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has positive long run effect on economic growth in Nigeria. The evidence from the findings, however, indicated a significant and positive coefficient 0.143927 (0.0001) for OPNES, implying that a 1% increase in OPNES will lead to 0.14% increase in real GDP in the long-run in Ghana. Hence, our results provide substantial evidence to support the hypothesis that trade openness measured using trade shares has a long run positive and significant effect on economic growth in Ghana for the period from 1970 to 2016.

ii. Ho: There is non-causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria.

The results of the Granger causality test indicated non-causality from OPNES to RGDP in Cote d'Ivoire. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 0.054225 (0.9773), is statistically not significant. On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 5.368760 (0.0643), is statistically not significant at 10%. It can be concluded on the basis of this result that there is non-Granger causality between trade openness and RGDP growth in Cote d'Ivoire for the period 1970 - 2016.

In the same vein, the VAR Granger Causality/BEW test results indicated independence between OPNES and RGDP for Nigeria which suggested that the sets of OPNES and RGDP coefficients are statistically insignificant for both regressions in Nigeria. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 2.82602 (0.2434), is statistically not significant. On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 2.012789 (0.3655), is statistically not significant (probability in parenthesis). It can be concluded on the basis of this result that there is non-Granger causality between trade openness and RGDP growth in Nigeria for the period 1970 - 2016. The BEW Granger causality test, however, indicated unidirectional causality from OPNES to RGDP as the estimated coefficients of the lagged OPNES are statistically different from zero and the set of lagged RGDP is not statistically different from zero in Ghana. From the output, the value of the test statistic is 7.843898 and the associated asymptotic *p*-value is 0.0198 which indicated significance at conventional levels. So we reject the null hypothesis, which means the sample support the notion that OPNES Granger causes RGDP growth in Ghana for the period 1970 - 2016.

The evidence of these findings is corroborated by the results of the Dumitrescu-Hurlin Granger causality tests for panel data, which indicated heterogeneous causality (HEC) and heterogeneous non-causality (HENC) for a subgroup in the panel data set, implying existence of causality between trade openness and real GDP for a subset of the panel for the period from 1970 - 2016.

iii. Ho: There is no response of economic growth to impulse in trade openness in Cote d'Ivoire, Ghana and Nigeria.

In Cote d'Ivoire, the response of RGDP to innovative shocks in OPNES is contemporaneously weak and steadily decreasing over the 10-year forecast period. This means that any unanticipated increase in the real GDP persistently reduces the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values in Cote d'Ivoire.

In Ghana, the response of RGDP to Cholesky innovations shows that the response of RGDP to its own shocks is contemporaneously more stable and gradually subsiding towards the end of the period. This means that any unanticipated increase in the real GDP may reduce the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values. The response of RGDP to its own innovative shocks is contemporaneously weak and fluctuating towards the end of the period in Nigeria. This means that any unanticipated increase in the real GDP increases the deviation between the short-term equilibrium values of real GDP level and its long-run equilibrium values. The FEVD indicated that own series shocks explain most of the error variance in Nigeria, Ghana and Cote d'Ivoire. While the contribution of innovative shocks of trade openness to GDP at the end of the 10-year forecast period was 5.49% in Nigeria and 3.4% in Cote d'Ivoire, indicating that international trade is a weak driver of economic growth in Nigeria and Cote d'Ivoire. The FEVD results, however, indicated that the contribution of innovative shocks of trade openness to RGDP growth at the end of the 10-year period was 36% in Ghana indicating that economic growth is explained substantially by innovative shocks in trade openness in the long-term in Ghana. We therefore, reject the null hypothesis, based on the results of the impulse response functions and forecast error variance decomposition, and conclude that there exist transmission response of RGDP to impulse in trade openness in all the selected West African countries for the period from 1970 – 2016.

iv. Ho: There is no significant difference in the effect of trade openness on economic growth in Cote d'Ivoire, Ghana and Nigeria.

The results of the LSDV show that the effect of trade openness on economic growth varies across the three (3) countries. The results from the regression indicated that a negative but insignificant relationship exist between trade openness and RGDP growth in Nigeria and Cote d'Ivoire, while a positive and significant relationship exist between trade openness and RGDP in Ghana. Evidence from the regression results showed that a unit change in OPNES amongst the countries causes a reduction in RGDP growth of -0.12% in Nigeria and -0.053% in Cote d' Ivoire, while it increases RGDP growth by 0.27% in Ghana. This finding is consistent with the results of the autoregressive distributed lag cointegration test, the VAR

Granger causality BEW test, the IRFs and FEVDs as well as the Dumestrusci-Hurlin Granger causality test which clearly indicated differences in the effects of trade openness on economic growth amongst the three (3) countries in the estimation results .

To test the null hypothesis that there is no significant difference in the effect of trade openness on economic growth in Nigeria, Ghana and Cote d'Ivoire, the Wald coefficient *F*-statistic test result in Appendix 12 was used. The first step is to set the null hypothesis; H_0: $\beta = 0$ against alternative hypothesis; H_a: $\beta > 0$. The results of the Wald test show *F*-statistic value of 3.084029 (0.0298) with significant probability value at 1% level. We therefore, reject the null hypothesis since the probability value of the *F*-statistics is less than 0.05, and conclude that there are significant differences in the effect of trade openness on economic growth in Nigeria, Ghana and Cote d'Ivoire for the period from 1970 – 2016.

On the whole, all the four null hypotheses stated are accepted or rejected depending on country specific results and there heterogeneity, indicating a non-linear relationship between trade openness and economic growth in Nigeria, Ghana and Cote d'Ivoire considering the country-specific differences that exists within individual countries.

4.12 Discussion of Findings

This research was undertaken to investigate the effects of trade openness on economic growth in three (3) selected West African countries of Nigeria, Ghana and Cote d'Ivoire employing several econometric techniques to achieve the research objectives. The ADF unit root test was applied to examine if the time series data set exhibit unit root properties, that is, if the data set is stationary. Having established stationarity of all the time series, the next step was to select the number of lags for the ARDL estimation. The Autoregressive Distributed Lag (ARDL) bound test was employed to investigate the long run co-integrating relationship between trade openness and real GDP growth. This was followed by Granger causality test to investigate the causal relationship between trade openness and real GDP. The IRFs and

FEVDs were employed in examining the response of the dependent variable (RGDP) to impulse in trade openness and other explanatory variables. The fixed effects LSDV estimator and the pairwise Dumitrescu-Hurlin panel Granger causality test were used to investigate the heterogeneity of individual countries in the balanced panel data.

The discussion of the findings is therefore, presented on the basis of the specific research objectives as follows:

i. Objective One: To examine the long run effect of trade openness on economic growth in Nigeria, Ghana and Cote d'Ivoire.

This of course, prompted the estimation of the autoregressive distributed lag (ARDL) model for both short-run and long-run dynamics. All the post-tests (diagnostic tests) conducted confirmed the reliability of the findings. Specifically, the ARDL models were found to be correctly specified, free from serial correlation and homoscedastic. Also, plots of CUSUM and CUSUMSQ at 5% significance level indicated that both statistics fall within the critical bounds implying that all the coefficients of the estimated model for Cote d'Ivoire, Ghana and Cote d’Ivoire are stable over time.

First, the result of the ARDL test confirms the existence of long-run equilibrium relationship between trade openness and economic growth in Nigeria, Ghana and Cote d’Ivoire. Surprisingly, unlike the literature on the growth effects of trade openness, findings of this investigation are considerably different from predictions of theoretical studies. The regression reported a negative and significant relationship between trade openness and economic growth in Nigeria and Cote d’Ivoire. The long-run LSDV elasticity of trade openness (OPNES) with respect to economic growth (RGDP), is below unity (-0.11465) and (-0.05258), indicating that a 1% increase in trade openness index means decrease in RGDP by 0.12% and 0.053% for Nigeria and Cote d’Ivoire, respectively. Hence, the result fail to provide substantial evidence to support the hypothesis that trade openness measured using trade shares has long run effect on economic growth in Nigeria and Cote d’Ivoire. This result is similar to the findings by Fenira (2015), Ulasan (2015) and Mputu (2016), but contradict earlier findings in Saibu (2004), Effiom, Ubi, Okon & Itam (2011), Mohammed & Jian (2016) and more recently in Khobai, Kolisi & Moyo (2018) and Egbulonu & Ezeocha (2018), which reported a positive relationship between trade openness and economic growth in Nigeria using the ARDL approach. The evidence of our finding of a negative relationship between trade openness and economic growth is not consistent with the earlier findings in N’guessan and Yue (2010) using ARDL technique, which indicated positive long run relationship between OPNES and RGDP in Cote d’Ivoire. Our evidence is however, consistent with the finding in Amadou (2013), Ulasan (2015) and Fenira (2015) which suggested that openness is usually more profitable to countries that record quite high growth rates and whose industries have already reached maturity. These results can be explained essentially by the fact that all the conditions are not yet assembled in the WAEMU countries (including Cote d’Ivoire) so that trade openness can interact with economic growth. Fenira (2015) argued that trade liberalization policies in most developing countries were largely motivated by the desire to obtain loans and aids from international organisations, like the World Bank, IMF, European Union or World Trade Organisation which support liberal orientations. Fenira (2015) concludes that trade liberalization have weakly contributed to improving economic growth in developing countries.

Consistent with a number of empirical studies, as reviewed in Sakyi, Villaverde, Maza & Chitteji (2012), Asiedu (2013), Zakari (2013), Sakyi, Commodore and Opoku (2015) and Khobai, Kolisi and Moyo (2018), our regression results indicated positive and significant relationship between trade openness and economic growth in Ghana in the long-run and short-run. The long-run LSDV elasticity of trade openness (OPNES) with respect to economic growth (RGDP) is also below unity (0.265518) but positive and statistically significant, indicating that a 1% increase in trade openness index means increase in RGDP by 0.27% in Ghana. Hence, our results provide substantial evidence to support the hypothesis that trade openness measured using trade shares has a long-run positive and significant impact on economic growth in Ghana for the period from 1970 to 2016.

The short-run elasticities using error correction regression for each of the three West African countries indicated that the dynamic encompassing parsimonious models ((1, 0, 0, 0, 0, 1), (1, 1, 3, 2, 0, 2) and (4, 1, 0, 0, 2, 0) for Nigeria, Ghana and Cote d'Ivoire, respectively) fits to the data quite well, with the magnitude of R^2 ranges from 0.4337 in the case of Nigeria to 0.7267 for Ghana and 0.7807 for Cote d'Ivoire. The results of the short-run regressions indicated the lagged error correction term as -0.1333369, -0.456823 and -0.774855 for Nigeria, Ghana and Cote d'Ivoire, respectively, implying that about 13.33%, 45.68% and 77.48% of the disequilibrium caused by previous year's shocks converges back to equilibrium in each period in the respective countries. This indirectly means that, when a deviation from long-run equilibrium does occur, it can take as long as over 7 years and 5 months (7.498 years) (Nigeria) to return back to equilibrium, or as low as approximately 2 years and 2 months (2.189 years) (Ghana), and as little as 1 year and 3 months (1.291) (Cote d'Ivoire). Generally speaking, changes in RGDP are driven partly by movements back to long-run equilibrium and partly by short-run trade openness shocks. This demonstrates the importance of the error correction term in adjustments to equilibrium.

ii. Objective Two: To investigate the causal relationship between trade openness and economic growth in Cote d'Ivoire, Ghana and Nigeria.

To achieve this objective, the VAR Granger Causality/BEW test was used. The results indicated unidirectional causality that runs from trade openness to real GDP in Ghana, while the result indicated non causality between trade openness and economic growth in Nigeria and Cote d'Ivoire.

Consistent with empirical findings reviewed in Alajeku, Ezeabasili and Nzotta (2013), the result indicated independence between OPNES and RGDP which suggested that the sets of OPNES and RGDP coefficients are statistically not significant for both regressions in Nigeria. We therefore, fail to reject the null hypothesis, which means the sample does not support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 2.82602 (0.2434), is statistically not significant. On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 2.012789 (0.3655), is statistically not significant (Note: probability in parenthesis). It can be concluded on the basis of this result that there is non-Granger causality between trade openness and RGDP growth in Nigeria within the period from 1970 - 2016. The result however, contradict the finding in Saibu (2004) which indicated a unidirectional causation running from trade openness to real GDP, and Nwinee & Olulu-Briggs (2016) which indicated a bidirectional causation between trade openness and real GDP. Unlike empirical findings reviewed in Nwinee & Olulu-Briggs (2016) and Egbulonu & Ezeocha (2018), the Granger causality test indicated independence between FDI and RGDP, implying that FDI does not Granger cause RGDP. The Granger causality test, however, indicated feedback or bidirectional causality between gross fixed capital formation (INV) and RGDP, unidirectional causality from human capital (HK) to RGDP. Consistent with the empirical evidence in Nwinee & Olulu-Briggs (2016) the Granger causality test indicated unidirectional causality which runs one-way from foreign exchange rate (EXR) to RGDP.

The evidence of the results of VAR Granger Causality/BEW tests indicated unidirectional causality from OPNES to RGDP in Ghana. We therefore, reject the null hypothesis, which means the sample support the notion that OPNES Granger causes RGDP growth, since the chi-square statistic, 7.843898 and the associated asymptotic *p*-value of 0.0198 is statistically significant. On the other hand there is no reverse causation from RGDP to OPNES, since the chi-square statistic, 1.854799 and the associated asymptotic p-value 0.3956, is statistically not significant. We conclude on the basis of this result that there exist a causal relationship between trade openness and RGDP growth in Ghana within the period from 1970 - 2016. This finding is in line with empirical findings reviewed in the literature by Zakari (2013) and Sakyi, Villaverde, Maza & Chitteji (2012) which indicated feedback, or bidirectional causality in Ghana. The Granger causality test also indicated unidirectional causality from human capital to RGDP as the results suggest that the direction of causality is from HK to RGDP, RGDP to foreign exchange rate (EXR) in Ghana, implying that the rate of official exchange rate was influenced by the growth of real GDP in Ghana for the period from 1970 – 2016. Contrary to empirical findings reviewed in Keho (2015) which showed evidence of bidirectional causation between FDI and GDP, our result of the causality test indicated independence between FDI and RGDP. We conclude on the basis of this result that there is non Granger causality between net inflow of FDI and RGDP growth in Ghana within the period from 1970 – 2016. The result also indicated independence between INV and RGDP, which means the sample does not support the notion that INV Granger causes RGDP growth in Ghana within the period from 1970 – 2016.

Surprisingly, unlike the literature on the growth effects of trade openness, findings of the Granger causality investigation for Cote d'Ivoire are considerably different from predictions of theoretical studies. Evidence from the Granger causality tests indicated non causality between RGDP and all the explanatory variables as the p-values of all the chi-square statistics for all the variables are not significant at 5% level. This finding is consistent with empirical findings reviewed in Aka (2006) and Amadou (2013) which indicated non-Granger causality between trade openness and RGDP growth in Cote d'Ivoire. The Granger causality test also, indicated non causality between INV, HK, EXR and RGDP. However, the BEW Granger causality test indicated evidence of weak unidirectional causality from RGDP to OPNES, INV, HK and EXR at 10% level of significance (which is above the selected 5% level) similar to empirical findings reviewed in N'guessan & Yue (2010) and Keho (2015, 2017) which established bidirectional causation between trade openness, net inflow of FDI and economic growth in Cote d'Ivoire.

However, the absence of causality between trade openness and economic growth in Nigeria and Cote d'Ivoire could be because of the number of lag terms included (which was based on the SIC optimal lag 1) as the outcome of Granger test is sensitive to lags introduced in the model. However, evidence from theory as reviewed in Mputu (2016) and Fenira (2015) suggested that trade liberalization have weakly contributed to improving economic growth in developing countries. It therefore, means the Nigerian and Ivorian economies seems to be weak in absorbing negative shocks from increased trade openness.

The evidence of the results of VAR Granger Causality/BEW tests which indicated unidirectional causality in Ghana is corroborated by the result of the Dumitrescu-Hurlin Granger causality test for panel data, which indicated heterogeneous causality (HEC) for a subgroup in the panel data set, implying existence of causality between trade openness and real GDP amongst the three countries for the period from 1970 - 2016. The result also, indicated independence (non-causality) between trade openness and real GDP growth in Nigeria and Cote d'Ivoire, which is also corroborated by the result of the Dumitrescu-Hurlin Granger causality test, which indicated heterogeneous non causality (HENC) for a subgroup in the panel data set.

iii. Objective Three: To investigate the transmission response of economic growth to impulse of trade openness in Cote d'Ivoire, Ghana and Nigeria.

To achieve this objective, the impulse response functions (IRF) and fixed effect variance decomposition (FEVD) were employed. Results from the IRFs indicated transmission response of RGDP to impulse in trade openness in all the selected West African countries.

In Cote d'Ivoire, the transmission effect of OPNES to RGDP in event of policy shock was permanent and will continue to have positive impact on the economy in the long-term. The evidence from the IRFs also indicated that the effect of innovations of INV on RGDP was temporary as the positive effect declines over the 10-year period, which may require stabilization measures to sustain the positive impact on the economy. For HK, the unanticipated shock was permanent and continues to have positive impact over the 10-year forecast period. Evidence from the IRFs result also indicated permanent policy shock of FDI with positive impact on RGDP in the long-term. The results however, indicated temporary shock of EXR with positive effect on RGDP in the short-term, but took 6 years for the positive effect to fizzle out over the 10-year forecast period.

In Ghana, the transmission effect of OPNES to RGDP in event of policy shock is permanent and will continue to have positive effect in the long-term. The evidence from the IRFs, however, indicated temporary shocks for INV as unanticipated shock has positive effect in the long-term. For HK, the shock is permanent with positive effect over the 10-year forecast period. Evidence from the IRFs result also indicated that the negative effect of policy shock on FDI in the short-term was -0.18%, but became positive, 2.16% in the medium-term, and increased to 2.96% in the 10^{th} year, indicating that the shock is temporary and took three (3) years for the negative effect to fizzle out.

The transmission response of OPNES as a prime variable to RGDP in an event of policy shock indicated that the shock is permanent and will have negative effect in the long-term in Nigeria. The evidence from the IRFs, however, indicated temporary shocks for INV as the unanticipated shock is temporary and will have a positive effect in the short-term which will fizzle out in the long-term. The transmission response of RGDP to shocks in HK is permanent and will continue to have negative effect in the 10^{th} year, while the response of RGDP to shock in INV is temporary with positive effect in the long-term. And for EXR, the IRFs indicated long-term negative effect, implying that the shock is permanent.

In Cote d'Ivoire, the percentage of variance explained by own shock account for 98.54% in the short-term and continue falling until it ends with an average around 78.39% at the end of the 10^{th}period. This implies that economic growth is explained predominantly by its own innovative shocks (78.4%) while innovative shocks of trade openness, investment, human capital, net inflow of FDI and official rate of foreign exchange contribute to GDP by 3.4%, 2.2%, 12%, 1.3% and 2.8%, respectively, at the end of the 10-year forecast period. This shows that international trade is a weak driver of economic growth in Cote d'Ivoire.

In the same vein, the percentage of variance explained by own shock for RGDP in Ghana declines to about 48.38% in the medium term and continue falling until it ends with an average of 35.12% at the end of the 10^{th} period. This implies that economic growth is explained substantially, by innovative shocks in trade openness (36%), followed by own innovative shocks (35.12%), HK (12.9%), EXR (8.6%), FDI (6.3%) and INV (1.13%), respectively, at the end of the 10-year forecast period. This shows that international trade is a major driver of economic growth in Ghana. On the other hand, evidence from the FEVD results in Appendix B10 indicated that OPNES explains 83.6% of its own innovative shock, 27.5% proportion of gross fixed capital formation (INV) by its innovative shocks and 14.9% proportion of FDI by its innovative shock in Ghana. This finding implies a causal relationship between OPNES, INV and FDI, and is consistent with Granger causality analysis as reported in Appendix B7.

In Nigeria the response of RGDP to Cholesky innovations of OPNES indicated a negative decreasing trend, while the FEVD indicated that transmission effect of trade openness to real GDP growth will marginally increase over the 10-year forecast period. This implies that economic growth is explained predominantly by its own innovative shocks (67.63%), while innovative shocks of trade openness, investment, and human capital, net inflow of FDI and official rate of foreign exchange contribute to GDP by 5.49%, 0.28%, 17.14%, 0.65% and 8.8%, respectively. This shows that international trade is a weak driver of economic growth in Nigeria. The evidence of this finding is consistent with empirical findings as reviewed in Arodoye & Iyoha (2014) in which the variance decomposition established that the predominant sources of Nigeria's economic growth variation are largely to "own shocks".

iv. Objective Four: To analyze the comparative effects of trade openness on economic growth amongst Cote d'Ivoire, Ghana and Nigeria.

To achieve this objective the LSDV model was employed for heterogeneity analysis and robustness check on the evidence of the results of the ARDL cointegration, VAR Granger causality BEW tests, IRFs, FEVD and the D-H Granger causality tests were employed in this study. Country specific OPNES elasticities estimated from the LSDV model were below unity, negative and statistically not significant at 1% level, except for Ghana which was positive and significant at 1% level. The magnitude of the impact ranges from -0.05258, -0.1146 and 0.2655 in Cote d'Ivoire, Nigeria, and Ghana respectively. The results of the LSDV, also show that the effect of trade openness and other macroeconomic variables on economic growth varies across the three (3) countries. The evidence of the findings of the LSDV supports the results of the ARDL cointegration test which indicated negative but insignificant relationship between trade openness and economic growth in Nigeria and Cote d'Ivoire, while a positive and significant relationship between trade openness and economic growth was established in Ghana. The findings of the LSDV model also supports the results of the VAR Granger causality/BEW tests which established non causality between trade openness and economic growth in Nigeria and Cote d'Ivoire, while a unidirectional causality was established running from OPNES to RGDP in Ghana. The findings of the LSDV model is also in tandem with the IRFs and FEVD, indicating a weak but positive transmission response of RGDP to innovations in OPNES in Nigeria and Cote d'Ivoire; and a strong and positive transmission response of RGDP to innovative shocks in OPNES in Ghana. And the evidence from the results of the D-H Granger causality test indicating heterogenous non causality in a subgroup of a panel of three (3) countries is consistent with the results of the LSDV model. These findings by the various methodological approaches, therefore, validates and confirm the individual country differences on the impact of trade openness and economic growth in the three West African countries.

The results of the LSDV model also indicated that INV has positive relationship with economic growth in Nigeria, while it has negative relationship with economic growth in Ghana and Cote d'Ivoire which is also in tandem with evidence of all the other methodologies employed. Surprisingly, INV indicated negative effect on economic growth in Ghana and Cote d'Ivoire, which is contrary to the predictions of new growth hypothesis and empirical literature as reviewed in Anyanwu & Yamego (2015) and Keho (2017) given the finding that domestic investment significantly increases FDI in flows to West African countries. But Johnston and Ramirez (2015) argued that gross fixed capital formation has a short-run positive impact on the Ivorian economy, though the result could not confirm a long run relationship.

Similar with Zahanago (2017), the LSDV estimation indicating a positive relationship between human capital (HK) and economic growth in Nigeria, Ghana and Cote d'Ivoire is consistent with all the methodologies used, except for Nigeria. This finding is consistent with the Granger causality test, FEVD and D-H Granger causality tests for Nigeria, but contradicts the evidence of results of the ARDL cointegration which indicated a negative but insignificant relationship between HK and RGDP in Nigeria, and the IRFs which indicated a temporary shock of innovations of HK which had negative effect on RGDP while it was fizzling out over the 10-year forecast period.

Evidence from the results of the LSDV model also indicated a positive and significant relationship between FDI and economic growth in Nigeria, which is consistent with findings in Tozoke, Cheong & Junjun (2018) as reviewed in literature, while it showed negative relationship between FDI and economic growth in Ghana and Cote d'Ivoire. Again, the result is consistent with all the methodologies employed except for Nigeria. This finding is not consistent with the results of the ARDL which showed a negative but insignificant coefficient -0.082376 for Nigeria, but consistent with the IRFs of innovative shocks of FDI to RGDP which was temporary and negative in the short-term but became positive at the end of the forecast period, FEVD which was positive but fluctuating and the D-H test which indicated heterogeneous causality (HEC).

This finding is not consistent with findings in Yeboah, Naanwab, Saleem & Akuffo (2012), Keho (2015) and Sakyi, Commodore & Opoku (2015) which found long run relationship between FDI and economic growth in Ghana. It is however, convenient to explain this based on the theoretical finding in Johnston & Ramirez (2015) indicating that the quality of FDIs seem to have negative impact on the economy in most developing countries. Johnston and Ramirez (2015) explained that "the unexpected negative effect of FDI on economic growth, may be due to the significant repatriation of profits and dividends Cote d'Ivoire has experienced in recent years" (p. 45). Johnston & Ramirez (2015) concluded that FDI is not a significant driver of economic growth in Cote d'Ivoire. Again, the finding that a negative relationship exist between FDI and economic growth contradict the finding in Keho

(2015) which indicated strong evidence of bidirectional causality between FDI and economic growth in Ghana. Overall, the results suggest that trade openness is less effective in attracting FDI in these West African countries. A plausible explanation for the poor response of FDI to trade openness is that foreign investors always perceive trade reforms in Africa as transitory and non-credible. According to Keho (2015, p. 217), most of the time Sub-Saharan African countries embark on reforms as part of aid conditionality, where a donor, such as the World Bank or European Union, offers temporary aid or facilities during reforms.

And evidence from the results of the LSDV model indicated positive but insignificant relationship between EXR and RGDP in Nigeria and Cote d'Ivoire, while the results showed a negative relationship between EXR and RGDP in Ghana. This finding is consistent with the ARDL results, VAR Granger causality BEW test, IRFs, FEVD and the D-H test which indicated heterogeneous causality (HEC) between EXR and RGDP in the panel estimation. However, the negative relationship between EXR and RGDP established by the LSDV model for Ghana is not consistent with the ARDL cointegration regression results which can be attributed to number of lags selected either for the LSDV or the ARDL regression. The finding of a negative relationship between official exchange rate and economic growth in Ghana, contradict *a priori* expectation, even as Yeboah, Naanwab Saleem & Akuffo (2012) found a positive impact of real exchange rate on the West African economies. However, this finding can be explained by the over-dependence of Ghana on revenues from the exportation of Cocoa and mineral resources which raise the possibility of the vulnerability of the economy to external commodity price fluctuations which lead to unstable exchange rate regime.

It is therefore, evident from these findings that the dynamics of OPNES is heterogeneous between Cote d'Ivoire, Ghana and Nigeria. Nigeria depends on a high degree of imported refined petroleum products for its energy needs, as well as food and textiles for its teeming population while prices of her major export and revenue earner – crude oil – in the international market is volatile. This situation exposes the economy to a high degree of vulnerability to external shocks with inadequate resilience framework as much of the productive sector, as well as the service sector, like telecommunication and banking are controlled by foreign investors that repatriate profits, with its attendant negative effect on the GDP growth. According to Kavarova (2017), Nigeria has a large population with a high domestic demand and a booming domestic trade, which is a potential source of low level of export volumes, and another plausible reason for the relatively low index of trade openness.

However, taking two main points (i) evidence from the descriptive statistic reported in Appendix A3 indicated that average trade openness index for Cote d'ivoire was 74.27% which is higher than Ghana and Nigeria (ii) the use of nonlinear transformation with lag of integratrated regressors and dependent variables, Zahanogo (2017) found the presence of Laffer Curve of trade (inverted U) and confirmed that trade openness has a positive and significant effect on economic growth in sub-Saharan Africa countries but only up to a threshold; above this threshold, the effect declines. To check the robustness regarding these issues is left for further research. However, Zahanago's finding provides an insight into the Ivorian economy which is found to be weak in absorbing negative shocks from increased trade openness.

In terms of ranking, Ghana is better-off followed by Cote d'Ivoire, while Nigeria seems to be worse-off in terms of the effects of trade openness on economic growth. The confirmation of these findings may help to explain the "small state paradox" referred to in Brigugolio & Vella (2016), meaning that highly-open economies like Ghana and Cote d'Ivoire can generate high GDP growth in spite of the fact that trade openness by itself, tends to generate volatility, which is often considered to be harmful to growth. The results also indicated that though Nigeria, a comparatively larger country, highly depends on economic conditions in other countries which expose its economic situation to permanent external shocks, leading to negative impact on economic growth.

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary

This study was set to empirically investigate the impact of trade openness on economic growth in the selected West African countries of Cote d'Ivoire, Ghana and Nigeria over the period from 1970-2016. The extension of this objective also sought to ascertain the precise causal effects between trade openness and economic growth, the response of economic growth to impulse in trade openness and the differences in the effect of trade openness on economic growth in West Africa. The study employed several econometrics tests including ARDL bound test, Vector Error Correction Method (VECM) to estimate the Impulse Response Functions (IRFs), Forecast Error Variance Decomposition (FEVD) and Vector Autoregressive (VAR) Granger causality/Exogeneity Wald tests, as well a multi-country panel analysis using the LSDV model and the Dumitrescu-Hurlin Granger causality tests to examine the four (4) research questions. Furthermore, the study also addressed potential statistical problems inherent in cross-sectional time series and to interpreting these results. A number of robustness tests were carried out including pre-tests: Augmented Dickey Fuller unit root test, lag selection criteria, panel unit root test and panel co-integration tests; and post-tests: ARDL diagnostic tests, CUSUM and CUSUMSQ tests and panel diagnostic tests. The use of several heterogeneous panel cointegration techniques was robust in the presence of non-stationarity, endogeneity and cross-section dependence and thereby offering more reliable results than conventional techniques. The results do not seem to be sensitive to the different statistical methods, specifications, and time series and residuals problems. The panel regression also allowed the researcher to explore how the growth effects of openness to international trade vary across the three (3) countries.

The result from ARDL test confirms the existence of long run relationship between trade openness and RGDP in Nigeria, Ghana and Cote d'Ivoire. Evidence of the result from the ARDL long run regression reported a negative and significant coefficient, -0.341842, for OPNES, implying that a 1% increase in trade share will lead to 0.34% reduction in real GDP growth in Nigeria. In the same vein, the regression results reported a negative and insignificant estimated coefficient, -0.041290, for OPNES, indicating that a 1% increase in trade share would lead to 0.04% decrease in RGDP growth in Cote d'Ivoire. The evidence from the findings, however, indicated a significant and positive coefficient 0.14392, for OPNES, in the long-run in Ghana. Hence, our results provide substantial evidence to support the hypothesis that trade openness measured using trade shares has a long run positive and significant effect on economic growth in Ghana, but negative effect on economic growth in Nigeria and Cote d'Ivoire for the period from 1970 to 2016.

In the short-run elasticities as expected, are smaller than the long-run values. By adding a particular variable's contemporaneous value with its lagged values, the coefficient on trade openness is positive and significant for Ghana and Cote d'Ivoire, while the contemporaneous value of the coefficient of trade openness is negative but insignificant for Nigeria. The estimated coefficient of one period of lagged Error Correction Term (ECT) is negative and statistically significant at 1% level for each country. This demonstrate the importance of the ECT (-1) in adjustments to the equilibrium. The adjustment speed is calculated as the inverse of the absolute value of the ECT and represents, in years, how long it takes for deviations from disequilibrium will return back to equilibrium. The regression results indicated that, when a deviation from long term equilibrium does occur, it can take as long as over 7 years (7.498 years) (Nigeria) to return back to equilibrium, or as low as approximately 2 years (2.189 years) (Ghana), and as little as 1 year (1.291 years) (Cote d'Ivoire). Generally speaking, changes in RGDP are driven partly by movements back to long-term equilibrium and partly by short-term trade openness shocks.

Evidence of the result of the VAR Granger Causality/BEW tests established a unidirectional causation running from trade openness to economic growth in Ghana, while the result could not establish any causal link between trade openness and RGDP in Nigeria and Cote d'Ivoire. Evidence from the result of the VAR Granger causality/BEW test corroborates the finding of the pairwise Dumitrescu-Hurlin panel Granger causality test which indicated heterogeneous causality (and non-causality) between OPNES and RGDP, implying that the dynamics of OPNES is heterogeneous between Nigeria, Ghana and Cote d'Ivoire. And results from the IRFs show a negative and decreasing trend over the 10-year forecast period for Nigeria, while it indicated a positive and increasing trend for Ghana and a positive and stable trend for Cote d'Ivoire.

Finally, the LSDV model established a negative but insignificant relationship between OPNES and RGDP growth in Nigeria and Cote d'Ivoire, and a positive and significant relationship between OPNES and RGDP growth in Ghana which is consistent with the results of the ARDL cointegration tests and the other statistical estimations used, indicating that Ghana is better-off followed by Cote d'Ivoire, while Nigeria seems to be worse-off in terms of the effects of trade openness on economic growth for the period from 1970 - 2016.

5.2 Conclusion

The empirical analysis revealed certain characteristics of West African countries openness to international trade from which the following main conclusions of the study are based. Firstly, that this study finds equilibrium long-run relationship between trade openness and economic growth in Nigeria, Ghana and Cote d'Ivoire, and that this relationship is negative but not statistically significant for Nigeria and Cote d'Ivoire, but positive and statistically significant for Ghana for the period from 1970 – 2016. Consistent with literature reviewed in Osabuohein (2007), this indicates that openness to trade tend to benefit Ghana more than Nigeria and Cote d'Ivoire. These findings suggest that the openness of the three (3) West African countries to international trade could be associated with growth, which is in line with other empirical works (Mbabazi, Milner & Morissey, 2004; Mputu, 2016; Keho, 2017). Secondly, that the evidence from the investigation also supported the existence of a unidirectional causality running from trade openness to economic growth in Ghana, but surprisingly, no causal relationship is established between trade openness and economic growth in Nigeria and Cote d'Ivoire. This simply means that, though a relationship exist between trade openness and economic growth in the three (3) countries, trade openness or economic growth is a cause or consequence of each other in Nigeria and Cote d'Ivoire. It has also been found that the declining RGDP in Nigeria and Cote d'Ivoire, while RGDP growth in Ghana is increasing, can be explained by the effect of trade openness.

Thirdly, that a tentative explanation of the finding of a negative relationship between trade openness and economic growth is the fact that it corroborates the postulations of Singer (1950), Prebisch, (1950) and Echekoba, Okonkwo & Adigwe (2015) who questioned the correlation between economic growth and openness to trade, and have even gone ahead to argue that trade openness has been detrimental to the long-run growth of developing countries, especially in Africa. Hence, the best policy regarding the unpredictability of the innovations of trade openness on RGDP growth is to raise both the volume and quality of exports, and to step up appropriate fiscal policies to reduce unfavourable terms of trade which is detrimental to economic growth.

Fourthly, that the short-term coefficients on ECT(-1) indicated that when deviation from long-term equilibrium does occur, it can take as long as over 7 years (7.498 years) (Nigeria) to return back to equilibrium, or as low as approximately 2 years (2.189 years)

(Ghana), and as little as 1 year (1.291) (Cote d'Ivoire). Generally speaking, changes in RGDP are driven partly by movements back to long-term equilibrium and partly by short-term trade openness shocks.

Fifthly, that the relationship between trade openness is nonlinear, indicating the fragility of the links between trade openness and economic growth in the three West African countries, which is in line with the findings in Ulasan (2015) in the study of Organisation for Economic Cooperation and Development (OECD) and non-OECD countries. The effects of trade openness may differ according to the level of trade openness. Thus, the results actually provide considerable evidence for the hypotheses that trade openness can promote growth in some countries, which collaborate the postulations of Ricardo (1817) and Heckscher (1949) who argued that international trade is a catalyst to economic growth. It is crucial to note that this study have no intention of establishing a simple and straight forward association of trade openness to the growth of real GDP amongst these West African countries. Rather, the main goal is to establish that trade openness can benefit a country depending on whether it is a big or small country, an d whether a country has a comparative advantage in those sectors that are receiving trade policy liberalization. We can conclude on the basis of these findings that the trade openness measure of total trade ratio to GDP, is reliable and valid as it corroborate the hypothesis by Kovarova (2017) and the World Bank (2017) which indicated that Ghana and Cote d'Ivoire rank higher than Nigeria on the trade openness index, as this is confirmed by the time series data and heterogeneous panel analysis of the three countries. The results convincingly show that more open economies like Ghana and Cote d'Ivoire can generate high GDP growth in spite of the fact that trade openness by itself, tends to generate volatility, which is often considered to be harmful to growth. The results also indicated that, though Nigeria - a comparatively larger country and less open to trade - highly depends on economic conditions in other countries which expose its economic situation to external shocks, leading to GDP growth volatility in the country.

Sixthly, the level of gross physical capital formation and the inflow of foreign direct investment have been partly responsible for economic growth in Nigeria. The positive relationship between FDI and RGDP growth in Nigeria is consistent with findings in Keho (2015, 2017), Anyanwu & Yameogo (2015) which found that net inflow of FDI into the West African countries is beneficial to growth. The finding is also in line with the now generally accepted view among endogenous growth theorists such as Krugman (1979), Feder (1983), Romer (1989), that increased openness with respect to both trade and capital flows, will be beneficial to economic growth. However, its applicability to sensitive economic development sectors such as agriculture and mining is limited.

The main conclusion is that this empirical investigation has found sufficient evidence that trade openness on its own cannot explain growth, it's a combination of other country-specific factors like the level of physical investment both by private and public sector in economic and social infrastructure and institutions, quality and quantity of human capital available and developed in terms of education and technological skills acquired, quality and quantity of net inflow of FDI into the domestic economy and the stability of the exchange rate of the domestic currency and it's efficient management, that complements the contribution of trade to growth. Accordingly, the three (3) West African countries must productively control trade openness through macroeconomic policies devoted to foster increased local production of manufactured and agricultural goods so as to reduce importation, in boosting economic growth.

5.3 Recommendations

In view of the findings therefore, the following are recommended:

Cote d'Ivoire:

i. Cote d'Ivoire should productively control trade openness through increased investment in infrastructure targeted at stimulating local production of manufactured and agricultural goods so as to reduce importation.

ii. Cote d'Ivoire should review her trade policies targeted at the quality of foreign direct investments (FDI) into the country. Most of FDIs repatriate huge profits to home country which leads balance of payments problems and resulting to negative effect on the domestic economy.

iii. Cote d'Ivoire should strengthen her real exchange rate policy as real devaluations of the currency seem beneficial in positively impacting on real GDP growth.

iv. Trade policy should promote human capital development in Cote d'Ivoire to improve labour productivity via education and skills acquisition and absorption of technology from advanced countries.

Ghana:

i. Ghana should review her trade policies targeted at the quality of foreign direct investments into the country. FDIs with high percentage of expatraite work force and high profit repatriation, negatively affect economic growth of the host country, as indicated by the findings of this study. Ghana should also raise physical investment both by private and public sector in economic and social infrastructure and institutions, which are major attractions for inflow of international capital.

ii. Ghana should raise investment in infrastructure targeted at stimulating local production of manufactured and agricultural goods which will have positive impact on her economic growth.

iii. Ghana is expected to pursue strong financial development with focus on her real exchange rate policy such that real devaluations of the currency could have positive on real GDP growth.

iv. Since trade openness was found to be a contributor to the growth of the economy of Ghana, policy-makers should pursue policies that will promote trade openness such as establishment of bilateral and multi-lateral trade agreements on mutually favourable terms, and provide and continue to incentivize export-oriented production like export processing zones and granting tax holidays for exporters.

Nigeria:

i. Nigeria exports mainly primary products, which prices are unstable and determined on the international market. For out-ward oriented strategy to have a positive impact on economic growth, the country should modify the composition of trade by switching from exports of primary products to semi-manufactured/manufactured to high value-added goods.

ii. Trade policy in Nigeria should promote increased investments in capital intensive sectors, mainly, critical infrastructure to support real production, which will reduce importation of goods and services which have negative effect on the trade openness index and with it, economic growth.

iii. Trade policy should promote investment in human capital development that can absorb technologies coming from developed countries.

5.4 Contributions of the Study to Knowledge

This study implements a procedure recently introduced by Dumitrescu & Hurlin (2012) for testing Granger causality in panel datasets. The model takes into account two dimensions of heterogeneity: the heterogeneity of the regression model used to test the Granger causality and the heterogeneity of the causality relationships. This approach, to the best of the researcher's knowledge, has not been applied in the study of the relationship between trade openness and economic growth in Nigeria, Ghana and Cote d'Ivoire. With the development of large panel databases, theories surrounding comparative analysis and panel causality are evolving and researchers may sometimes find it difficult to run most recent tests developed in the literature. This contribution constitutes an effort to help practitioners understand and apply the test.

The implications from this study could have important insights to policy makers in creating competitive environment for international trade interventions.

5.5 General Limitations of the Study

The data for this analysis have a number of perceived limitations, and they should be highlighted. First, owing to the shortage of reliable quarterly data for most of the variables under consideration for the entire period, the periodicity of all the data used in this investigation is annual. A priori, there were two options for selecting the period: one is straightforward and consisted in using the whole sample period available (1970 - 2016), and the other is to focus on a specific period which had a substantial and distinctive economic and, possibly, political regime. The study opted for the whole sample considering different dates of relative trade reforms and political stability in each of the selected countries using CUSUM and CUSUMSQ tests which ensured validity of the results.

Second, because of the inherent difficulties in measuring the stock of physical capital (INV), the lack of official and credible series of aggregated and disaggregated terms for the period studied, will restrict the inclusion of certain variables and limit the testing of certain models and hypotheses. Thus, one strategy would have been to construct a capital stock series; however, for that task the study needs two basic sets of information that, to the researcher's knowledge, do not exist: the initial base year for the capital stock and the rate of depreciation. Therefore, the only plausible strategy at this stage to overcome these obstacles is to use data related to investment, specifically gross domestic investment (GDI)/gross fixed capital formation (GFCF) at current prices in millions of US dollars, taken mainly from data published by the World Bank. It is important to note that this strategy has been widely used by researchers engaged in testing the new growth hypothesis for both cross-section and country-specific case studies of developing countries and even for industrialized nations. The pre-tests conducted ensured generalization and authenticity of results.

5.6 Suggestions for further Research

In view of the limitations of this study, it is anticipated that future studies should find statistical determinants of trade openness for West African regional block and bilateral trade among the countries of the sub-region. Moreover, future research work should make a further consideration of the elements of communication, transportation and logistics performance indexes considering the role they play in reducing costs of trading and enhancing global integration. So far the World Bank provides data for transportation, communication and logistic performance for more than 160 countries from 2007 to 2015; with time the database will have long period coverage, it is necessary that studies include these key elements as variables to examine their effects on trade openness.

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Appendices

Appendix 1: Raw Data
Appendix 1A: Cote d’Ivoire

Year	RGDP(US$billion)	OPNES	INV(US$billion)	HK	FDI(US$billion)	EXR
1970	9,890,416,000	64.88	327,420,400	535,249	47,457,381	276.40
1971	10,825,720,000	60.64	345,370,100	562,180	64,525,744	275.36
1972	11,284,360,000	62.52	386,068,800	647,739	52,550,109	252.03
1973	11,954,560,000	68.99	581,454,800	732,488	40,510,362	222.89
1974	12,471,880,000	84.07	675,932,000	744,024	26,258,715	240.70
1975	13,501,170,000	73.31	873,955,800	822,772	69,057,900	214.31
1976	15,245,040,000	77.99	1,071,770,000	936,679	44,779,150	238.95
1977	16,360,130,000	78.96	1,712,392,000	1,008,312	14,653,230	245.68
1978	18,144,930,000	73.96	2,351,368,000	1,132,576	83,312,700	225.66
1979	18,579,390,000	72.27	2,556,863,000	1,287,733	74,745,570	212.72
1980	16,543,520,000	76.18	2,700,213,000	1,496,178	94,661,310	211.28
1981	17,122,620,000	77.46	2,187,453,000	1,677,361	32,752,930	271.73
1982	17,157,010,000	75.75	1,754,683,000	1,733,825	47,473,230	328.61
1983	16,487,850,000	72.68	1,259,100,000	1,789,389	21,741,290	381.07
1984	16,042,470,000	77.10	797,104,100	1,839,437	29,158,870	436.96
1985	16,764,570,000	79.17	903,702,300	1,936,153	70,746,700	449.26
1986	17,310,990,000	69.68	1,104,804,000	1,984,928	87,510,150	346.31
1987	17,250,580,000	63.05	1,242,521,000	2,030,921	51,704,190	300.54
1988	17,446,630,000	58.38	1,297,315,000	2,161,470	18,494,820	297.85
1989	17,960,960,000	61.09	868,795,500	2,297,996	48,114,920	319.01
1990	17,764,120,000	58.80	722,113,200	2,441,282	16,305,880	272.26
1991	17,771,390,000	57.00	772,047,700	2,590,300	230,834,500	282.11
1992	17,727,930,000	60.03	772,218,900	2,747,122	87,900,030	264.69
1993	17,693,800,000	55.35	1,081,719,000	2,909,815	77,989,260	283.16
1994	17,837,340,000	69.84	1,140,264,000	3,077,266	211,482,200	555.20
1995	19,108,380,000	76.20	1,715,852,000	3,248,419	269,180,600	499.15
1996	20,585,330,000	73.52	1,470,313,000	3,423,416	415,303,600	511.55
1997	21,355,950,000	78.21	1,690,854,000	3,600,460	380,014,100	583.67
1998	22,408,950,000	76.37	1,705,055,000	3,780,523	323,675,900	589.95
1999	22,771,420,000	76.54	1,647,071,000	3,959,326	234,701,600	615.70
2000	22,300,410,000	74.64	1,123,633,000	4,218,362	272,680,100	711.98
2001	22,327,480,000	73.55	1,177,019,000	4,476,447	212,629,100	733.04
2002	21,955,140,000	79.86	1,156,261,000	4,734,113	165,347,500	696.99
2003	21,656,650,000	75.27	1,389,714,000	4,994,419	282,979,900	581.20
2004	21,923,410,000	84.61	1,672,204,000	5,262,539	348,920,800	528.28
2005	22,300,770,000	93.92	2,381,437,000	5,543,063	348,920,800	527.47
2006	22,638,810,000	95.07	1,885,364,000	5,837,965	350,652,900	522.89
2007	23,038,390,000	89.44	2,577,585,000	6,147,581	443,215,500	479.27
2008	23,624,220,000	87.27	2,923,746,000	6,473,333	466,489,600	447.81
2009	24,392,360,000	90.78	2,111,378,000	6,816,245	396,030,800	472.19

2010	24,884,500,000	93.96	3,343,739,000	7,177,187	358,118,900	495.28
2011	23,792,760,000	91.15	1,193,881,000	7,557,833	301,577,300	471.87
2012	26,340,130,000	92.81	4,088,169,000	7,959,151	330,274,400	510.53
2013	28,681,620,000	80.13	6,476,878,000	8,380,147	407,476,300	494.04
2014	31,203,900,000	62.37	7,001,369,000	8,818,770	438,772,600	494.41
2015	33,963,220,000	63.54	6,663,430,000	9,273,429	494,210,000	591.45
2016	36,794,320,000	52.59	7,525,484,000	10,395,400	481,027,700	593.01

Appendix 1B: Ghana

Year	RGDP(US$billion)	OPNES	INV(US$billion)	HK	FDI(US$billion)	EXR
1970	9,402,654,000	44.05	265,722,499	3,171,527	71,000,430	1.00
1971	9,893,108,000	36.20	300,688,307	3,803,672	67,047,145	1.00
1972	9,647,002,000	35.91	183,090,430	3,350,930	44,197,171	1.00
1973	9,925,277,000	37.85	188,732,400	3,767,160	29,439,847	1.00
1974	10,605,410,000	40.13	344,720,494	3,628,495	29,439,847	1.00
1975	9,286,984,000	37.80	326,595,700	3,588,464	70,869,950	1.00
1976	8,959,136,000	31.75	272,033,900	3,659,569	18,260,970	1.00
1977	9,162,876,000	22.05	299,714,300	3,759,050	19,217,480	1.00
1978	9,939,515,000	18.05	185,340,300	3,828,059	9,696,237	1.00
1979	9,689,543,000	22.39	270,512,800	3,945,992	2,800,000	1.00
1980	9,735,248,000	17.62	271,058,100	4,228,995	15,600,000	1.00
1981	9,394,216,000	10.08	199,418,600	4,534,815	16,263,750	1.00
1982	8,743,793,000	6.32	142,530,400	4,449,345	16,300,000	1.00
1983	8,344,749,000	11.54	152,601,400	4,661,701	2,400,000	1.00
1984	9,066,367,000	18.81	302,364,600	4,800,121	2,000,000	1.00
1985	9,527,992,000	24.24	429,244,400	4,763,500	5,600,000	0.01
1986	10,023,370,000	36.71	532,414,500	4,928,527	4,300,000	0.01
1987	10,503,980,000	45.85	525,768,700	5,039,351	4,700,000	0.02
1988	11,095,160,000	42.25	584,210,500	5,455,788	5,000,000	0.02
1989	11,659,450,000	41.09	690,930,800	5,021,709	15,000,000	0.03
1990	12,047,570,000	42.73	847,229,000	5,151,009	14,800,000	0.03
1991	12,683,900,000	42.49	1,043,799,000	5,403,696	20,000,000	0.04
1992	13,175,960,000	45.99	816,874,100	5,551,522	22,500,000	0.04
1993	13,814,990,000	56.67	1,419,106,000	5,703,639	125,000,000	0.06

1994	14,270,890,000	62.02	1,229,080,000	5,855,999	233,000,000	0.10
1995	14,857,770,000	57.42	1,366,138,000	6,006,952	106,500,000	0.12
1996	15,541,590,000	72.20	1,407,709,000	6,140,418	120,000,000	0.16
1997	16,193,770,000	85.40	1,642,578,000	6,272,258	81,800,000	0.20
1998	16,954,940,000	80.60	1,673,010,000	6,406,561	167,400,000	0.23
1999	17,700,960,000	81.71	1,579,955,000	6,542,922	243,700,000	0.27
2000	18,355,890,000	116.05	1,150,985,000	6,753,562	165,900,000	0.54
2001	19,090,130,000	110.05	1,441,559,000	6,597,517	89,320,000	0.72
2002	19,949,190,000	97.49	1,157,725,000	7,041,325	58,930,000	0.79
2003	20,986,540,000	97.29	1,750,640,000	7,495,789	136,751,000	0.87
2004	22,161,790,000	99.67	2,520,311,000	8,224,625	139,270,000	0.90
2005	23,469,340,000	98.17	3,112,404,000	8,845,149	144,970,000	0.91
2006	24,971,350,000	65.92	4,415,679,000	9,407,048	636,010,000	0.92
2007	26,056,810,000	65.35	4,978,443,000	10,519,277	1,383,178,000	0.94
2008	28,440,960,000	69.51	6,119,681,000	10,798,919	2,714,916,000	1.06
2009	29,819,140,000	71.59	5,122,232,000	11,908,888	2,372,540,000	1.41
2010	32,174,770,000	75.38	7,934,237,000	13,101,717	2,527,350,000	1.43
2011	36,694,040,000	86.30	10,131,760,000	14,339,523	3,247,588,000	1.51
2012	40,103,840,000	93.17	12,970,680,000	15,017,807	3,294,520,000	1.80
2013	43,036,440,000	81.65	12,952,830,000	16,092,290	3,227,000,000	1.95
2014	44,751,820,000	88.45	10,132,900,000	15,622,107	3,363,389,000	2.90
2015	46,504,250,000	99.25	8,941,182,000	16,938,609	3,192,321,000	3.67
2016	48,167,550,000	88.60	9,384,817,000	17,519,200	3,485,333,000	3.91

Appendix 1C: Nigeria

Year	RGDP(US$billion)	OPNES	INV(US$billion)	HK	FDI(US$billion)	EXR
1970	90,476,440,000	19.62	82,677,151,500	2,468,780	20,500,000	0.71
1971	103,358,000,000	24.46	76,208,691,000	2,727,252	28,600,000	0.71
1972	106,835,000,000	22.76	13,379,117,800	3,109,118	30,500,000	0.66
1973	112,597,000,000	31.27	26,383,393,800	3,552,526	37,300,000	0.66
1974	125,163,000,000	39.75	46,463,216,800	3,792,924	25,700,000	0.63
1975	118,620,000,000	41.17	52,817,299,000	4,252,367	70,869,950	0.62
1976	129,346,000,000	42.14	49,011,643,520	4,774,560	18,260,970	0.63
1977	137,138,000,000	47.39	42,151,006,200	5,115,123	19,217,480	0.64
1978	129,233,000,000	43.31	40,293,400,000	6,222,561	9,696,237	0.64
1979	137,969,000,000	43.88	58,602,288,400	7,788,790	2,800,000	0.66
1980	143,770,000,000	48.57	44,299,235,100	9,990,658	15,600,000	0.55
1981	124,896,000,000	48.29	58,697,580,000	12,832,034	16,263,750	0.62
1982	123,581,000,000	37.75	45,521,220,000	16,191,836	16,300,000	0.67
1983	117,339,000,000	27.04	29,852,230,000	19,865,570	2,400,000	0.72
1984	114,967,000,000	23.61	19,106,380,000	23,496,450	2,000,000	0.77
1985	124,536,000,000	25.9	18,036,360,000	25,291,084	5,600,000	0.89
1986	113,634,000,000	23.72	15,657,770,000	23,256,814	4,300,000	1.75
1987	101,416,000,000	41.65	11,966,730,000	23,875,542	4,700,000	4.02
1988	109,065,000,000	35.31	12,500,150,000	23,354,262	5,000,000	4.54
1989	116,119,000,000	60.39	12,750,120,000	22,375,488	15,000,000	7.36
1990	130,943,000,000	53.03	17,678,030,000	23,436,415	14,800,000	8.04
1991	130,134,000,000	64.87	17,610,710,000	24,080,082	20,000,000	9.91
1992	130,698,000,000	61.03	17,083,320,000	27,079,876	22,500,000	17.3
1993	133,430,000,000	58.11	19,815,760,000	30,417,463	125,000,000	22.07
1994	134,644,000,000	42.31	17,802,710,000	33,102,792	233,000,000	22.01
1995	134,230,000,000	59.77	13,139,250,000	37,782,423	106,500,000	21.9
1996	140,933,000,000	57.69	15,516,810,000	38,690,075		21.88

					120,000,000	
1997	144,882,000,000	76.86	16,888,390,000	39,097,218	81,800,000	21.89
1998	148,817,000,000	66.17	16,034,250,000	37,068,877	167,400,000	21.89
1999	149,523,000,000	55.85	15,565,120,000	38,232,403	243,700,000	92.34
2000	157,474,000,000	71.38	18,216,170,000	40,094,750	165,900,000	101.7
2001	164,421,000,000	81.81	14,261,890,000	42,130,610	89,320,000	111.23
2002	170,643,000,000	63.38	17,162,800,000	44,145,545	58,930,000	120.58
2003	188,312,000,000	75.22	25,768,070,000	47,272,550	136,751,000	129.22
2004	251,841,000,000	48.45	19,582,550,000	47,116,973	139,270,000	132.89
2005	260,516,000,000	50.75	17,534,380,000	48,212,007	144,970,000	131.27
2006	281,906,000,000	64.61	27,947,620,000	48,774,022	636,010,000	128.65
2007	301,156,000,000	64.46	39,609,860,000	46,267,772	1,383,178,000	125.81
2008	320,039,000,000	64.97	39,322,420,000	52,771,937	2,714,916,000	118.55
2009	342,232,000,000	61.8	52,994,310,000	60,062,456	2,365,640,000	148.9
2010	369,062,000,000	42.65	61,099,010,000	69,457,295	2,527,350,000	150.3
2011	387,100,000,000	52.79	56,060,380,000	73,620,449	3,222,243,000	153.86
2012	403,665,000,000	44.38	57,490,890,000	78,295,136	3,293,430,000	157.5
2013	425,440,000,000	31.05	62,012,450,000	95,708,920	3,226,330,000	157.31
2014	452,285,000,000	30.88	70,338,540,000	97,441,488	3,356,989,000	158.55
2015	464,282,000,000	21.12	69,410,290,000	95,555,229	2,970,894,000	192.44
2016	456,775,000,000	16.81	51,148,139,200	95,332,689	3,470,668,000	253.49

Appendix 2: Logged Data

Appendix A2: Cote d'Ivoire

Year	RGDP	0PNES	INV	HK	FDI	EXR
1970	23.01	4.17	19.61	13.19	17.68	5.62
1971	23.11	4.10	19.66	13.24	17.98	5.62
1972	23.15	4.14	19.77	13.38	17.78	5.53
1973	23.20	4.23	20.18	13.50	17.52	5.41
1974	23.25	4.43	20.33	13.52	17.08	5.48
1975	23.33	4.29	20.59	13.62	18.05	5.37
1976	23.45	4.36	20.79	13.75	17.62	5.48
1977	23.52	4.37	21.26	13.82	16.50	5.50
1978	23.62	4.30	21.58	13.94	18.24	5.42
1979	23.65	4.28	21.66	14.07	18.13	5.36
1980	23.53	4.33	21.72	14.22	18.37	5.35
1981	23.56	4.35	21.51	14.33	17.30	5.60
1982	23.57	4.33	21.29	14.37	17.68	5.79
1983	23.53	4.29	20.95	14.40	16.89	5.94
1984	23.50	4.35	20.50	14.42	17.19	6.08
1985	23.54	4.37	20.62	14.48	18.07	6.11
1986	23.57	4.24	20.82	14.50	18.29	5.85
1987	23.57	4.14	20.94	14.52	17.76	5.71
1988	23.58	4.07	20.98	14.59	16.73	5.70
1989	23.61	4.11	20.58	14.65	17.69	5.77
1990	23.60	4.07	20.40	14.71	16.61	5.61
1991	23.60	4.04	20.46	14.77	19.26	5.64
1992	23.60	4.09	20.46	14.83	18.29	5.58
1993	23.60	4.01	20.80	14.88	18.17	5.65
1994	23.60	4.25	20.85	14.94	19.17	6.32
1995	23.67	4.33	21.26	14.99	19.41	6.21
1996	23.75	4.30	21.11	15.05	19.84	6.24
1997	23.78	4.36	21.25	15.10	19.76	6.37
1998	23.83	4.34	21.26	15.15	19.60	6.38
1999	23.85	4.34	21.22	15.19	19.27	6.42
2000	23.83	4.31	20.84	15.25	19.42	6.57
2001	23.83	4.30	20.89	15.31	19.18	6.60
2002	23.81	4.38	20.87	15.37	18.92	6.55
2003	23.80	4.32	21.05	15.42	19.46	6.37
2004	23.81	4.44	21.24	15.48	19.67	6.27
2005	23.83	4.54	21.59	15.53	19.67	6.27
2006	23.84	4.55	21.36	15.58	19.68	6.26
2007	23.86	4.49	21.67	15.63	19.91	6.17
2008	23.89	4.47	21.80	15.68	19.96	6.10
2009	23.92	4.51	21.47	15.73	19.80	6.16
2010	23.94	4.54	21.93	15.79	19.70	6.21

2011	23.89	4.51	20.90	15.84	19.52	6.16
2012	23.99	4.53	22.13	15.89	19.62	6.24
2013	24.08	4.38	22.59	15.94	19.83	6.20
2014	24.16	4.13	22.67	15.99	19.90	6.20
2015	24.25	4.15	22.62	16.04	20.02	6.38
2016	24.33	3.96	22.74	16.16	19.99	6.39

Appendix B2: Ghana

Year	RGDP	OPNES	INV	HK	FDI	EXR
1970	22.96	3.79	19.40	14.97	18.08	0.00
1971	23.02	3.59	19.52	15.15	18.02	0.00
1972	22.99	3.58	19.03	15.02	17.60	0.00
1973	23.02	3.63	19.06	15.14	17.20	0.00
1974	23.08	3.69	19.66	15.10	17.20	0.00
1975	22.95	3.63	19.60	15.09	18.08	0.00
1976	22.92	3.46	19.42	15.11	16.72	0.00
1977	22.94	3.09	19.52	15.14	16.77	0.00
1978	23.02	2.89	19.04	15.16	16.09	0.00
1979	22.99	3.11	19.42	15.19	14.85	0.00
1980	23.00	2.87	19.42	15.26	16.56	0.00
1981	22.96	2.31	19.11	15.33	16.60	0.00
1982	22.89	1.84	18.78	15.31	16.61	0.00
1983	22.84	2.45	18.84	15.35	14.69	0.00
1984	22.93	2.93	19.53	15.38	14.51	0.00
1985	22.98	3.19	19.88	15.38	15.54	-4.61
1986	23.03	3.60	20.09	15.41	15.27	-4.61
1987	23.08	3.83	20.08	15.43	15.36	-3.91
1988	23.13	3.74	20.19	15.51	15.42	-3.91
1989	23.18	3.72	20.35	15.43	16.52	-3.51
1990	23.21	3.75	20.56	15.45	16.51	-3.51
1991	23.26	3.75	20.77	15.50	16.81	-3.22
1992	23.30	3.83	20.52	15.53	16.93	-3.22
1993	23.35	4.04	21.07	15.56	18.64	-2.81
1994	23.38	4.13	20.93	15.58	19.27	-2.30
1995	23.42	4.05	21.04	15.61	18.48	-2.12
1996	23.47	4.28	21.07	15.63	18.60	-1.83
1997	23.51	4.45	21.22	15.65	18.22	-1.61
1998	23.55	4.39	21.24	15.67	18.94	-1.47
1999	23.60	4.40	21.18	15.69	19.31	-1.31
2000	23.63	4.75	20.86	15.73	18.93	-0.62
2001	23.67	4.70	21.09	15.70	18.31	-0.33
2002	23.72	4.58	20.87	15.77	17.89	-0.24
2003	23.77	4.58	21.28	15.83	18.73	-0.14
2004	23.82	4.60	21.65	15.92	18.75	-0.11
2005	23.88	4.59	21.86	16.00	18.79	-0.09
2006	23.94	4.19	22.21	16.06	20.27	-0.08
2007	23.98	4.18	22.33	16.17	21.05	-0.06
2008	24.07	4.24	22.53	16.19	21.72	0.06
2009	24.12	4.27	22.36	16.29	21.59	0.34
2010	24.19	4.32	22.79	16.39	21.65	0.36
2011	24.33	4.46	23.04	16.48	21.90	0.41
2012	24.41	4.53	23.29	16.52	21.92	0.59

2013	24.49	4.40	23.28	16.59	21.89	0.67
2014	24.52	4.48	23.04	16.56	21.94	1.06
2015	24.56	4.60	22.91	16.65	21.88	1.30
2016	24.60	4.48	22.96	16.68	21.97	1.36

Appendix C2: Nigeria

Year	RGDP	OPNES	INV	HK	FDI	EXR
1970	25.2284	2.9765	25.1382	14.7192	16.8359	-0.3425
1971	25.3615	3.1970	25.0567	14.8188	17.1689	-0.3425
1972	25.3946	3.1250	23.3170	14.9498	17.2332	-0.4155
1973	25.4471	3.4427	23.9960	15.0832	17.4345	-0.4155
1974	25.5529	3.6826	24.5619	15.1486	17.0620	-0.4620
1975	25.4992	3.7177	24.6901	15.2630	18.0764	-0.4780
1976	25.5858	3.7410	24.6153	15.3788	16.7203	-0.4620
1977	25.6443	3.8584	24.4645	15.4477	16.7713	-0.4463
1978	25.5849	3.7684	24.4195	15.6437	16.0872	-0.4463
1979	25.6503	3.7815	24.7940	15.8682	14.8451	-0.4155
1980	25.6915	3.8830	24.5142	16.1172	16.5628	-0.5978
1981	25.5507	3.8772	24.7957	16.3675	16.6044	-0.4780
1982	25.5402	3.6310	24.5414	16.6000	16.6067	-0.4005
1983	25.4883	3.2973	24.1195	16.8045	14.6910	-0.3285
1984	25.4679	3.1617	23.6733	16.9724	14.5087	-0.2614
1985	25.5479	3.2542	23.6157	17.0460	15.5383	-0.1165
1986	25.4562	3.1663	23.4742	16.9621	15.2741	0.5596
1987	25.3425	3.7293	23.2054	16.9884	15.3631	1.3913
1988	25.4152	3.5642	23.2490	16.9663	15.4249	1.5129
1989	25.4779	4.1008	23.2688	16.9235	16.5236	1.9961
1990	25.5980	3.9709	23.5956	16.9698	16.5101	2.0844
1991	25.5918	4.1724	23.5918	16.9969	16.8112	2.2935
1992	25.5962	4.1114	23.5614	17.1143	16.9290	2.8507
1993	25.6168	4.0623	23.7097	17.2305	18.6438	3.0942
1994	25.6259	3.7450	23.6026	17.3151	19.2665	3.0915
1995	25.6228	4.0905	23.2989	17.4474	18.4837	3.0865
1996	25.6716	4.0551	23.4652	17.4711	18.6030	3.0856
1997	25.6992	4.3420	23.5499	17.4816	18.2198	3.0860
1998	25.7260	4.1922	23.4980	17.4283	18.9359	3.0860
1999	25.7307	4.0227	23.4683	17.4592	19.3114	4.5255
2000	25.7825	4.2680	23.6256	17.5068	18.9269	4.6220
2001	25.8257	4.4044	23.3809	17.5563	18.3077	4.7116
2002	25.8628	4.1491	23.5660	17.6030	17.8919	4.7923
2003	25.9614	4.3204	23.9724	17.6714	18.7337	4.8615
2004	26.2521	3.8805	23.6979	17.6681	18.7519	4.8895
2005	26.2859	3.9269	23.5874	17.6911	18.7920	4.8773
2006	26.3648	4.1684	24.0536	17.7027	20.2707	4.8571
2007	26.4309	4.1660	24.4023	17.6500	21.0476	4.8348
2008	26.4917	4.1739	24.3951	17.7815	21.7220	4.7753
2009	26.5588	4.1239	24.6935	17.9109	21.5843	5.0033
2010	26.6342	3.7530	24.8358	18.0562	21.6504	5.0126
2011	26.6819	3.9663	24.7497	18.1144	21.8933	5.0360
2012	26.7239	3.7928	24.7749	18.1760	21.9152	5.0594

2013	26.7764	3.4356	24.8506	18.3768	21.8946	5.0582
2014	26.8376	3.4301	24.9766	18.3948	21.9343	5.0661
2015	26.8638	3.0502	24.9633	18.3752	21.8121	5.2598
2016	26.8475	2.8220	24.6580	18.3729	21.9676	5.5353

Appendix D2: Pooled Data with Dummies

Year	COUNTRY	ID	RGDP	OPNES	INV	HK	FDI	EXR	D2	D3
1970	Nigeria	1	25.22836	2.976549	25.13821	14.71923	16.83594	-0.34249	0	0
1971	Nigeria	1	25.36146	3.197039	25.05674	14.81881	17.16892	-0.34249	0	0
1972	Nigeria	1	25.39455	3.125005	23.31696	14.94985	17.23324	-0.41552	0	0
1973	Nigeria	1	25.44708	3.442659	23.996	15.08317	17.4345	-0.41552	0	0
1974	Nigeria	1	25.55288	3.68261	24.56193	15.14865	17.062	-0.46204	0	0
1975	Nigeria	1	25.49919	3.71771	24.6901	15.26299	18.07636	-0.47804	0	0
1976	Nigeria	1	25.58576	3.740997	24.61532	15.37881	16.72028	-0.46204	0	0
1977	Nigeria	1	25.64425	3.858411	24.46452	15.44771	16.77133	-0.44629	0	0
1978	Nigeria	1	25.58488	3.768384	24.41945	15.64369	16.08725	-0.44629	0	0
1979	Nigeria	1	25.65029	3.781459	24.79404	15.8682	14.84513	-0.41552	0	0
1980	Nigeria	1	25.69148	3.883006	24.51423	16.11716	16.56278	-0.59784	0	0
1981	Nigeria	1	25.55075	3.877224	24.79566	16.36746	16.60445	-0.47804	0	0
1982	Nigeria	1	25.54016	3.630985	24.54144	16.60002	16.60668	-0.40048	0	0
1983	Nigeria	1	25.48833	3.297317	24.11953	16.8045	14.69098	-0.3285	0	0
1984	Nigeria	1	25.46791	3.16167	23.67329	16.97236	14.50866	-0.26136	0	0
1985	Nigeria	1	25.54786	3.254243	23.61566	17.04596	15.53828	-0.11653	0	0
1986	Nigeria	1	25.45625	3.166319	23.47423	16.96211	15.27413	0.559616	0	0
1987	Nigeria	1	25.3425	3.729301	23.2054	16.98837	15.36307	1.391282	0	0
1988	Nigeria	1	25.41521	3.564166	23.24901	16.96629	15.42495	1.512927	0	0
1989	Nigeria	1	25.47788	4.100824	23.26881	16.92348	16.52356	1.99606	0	0
1990	Nigeria	1	25.59803	3.970858	23.59559	16.9698	16.51014	2.084429	0	0
1991	Nigeria	1	25.59183	4.172385	23.59177	16.9969	16.81124	2.293544	0	0
1992	Nigeria	1	25.59616	4.111366	23.56137	17.1143	16.92903	2.850707	0	0
1993	Nigeria	1	25.61684	4.062338	23.70974	17.23053	18.64382	3.094219	0	0
1994	Nigeria	1	25.6259	3.745023	23.60262	17.31513	19.26655	3.091497	0	0
1995	Nigeria	1	25.62282	4.090504	23.29887	17.44735	18.48366	3.086487	0	0
1996	Nigeria	1	25.67155	4.055084	23.46519	17.47109	18.603	3.085573	0	0
1997	Nigeria	1	25.69919	4.341986	23.54989	17.48156	18.21979	3.08603	0	0
1998	Nigeria	1	25.72598	4.192227	23.49799	17.42829	18.9359	3.08603	0	0
1999	Nigeria	1	25.73072	4.02267	23.4683	17.45919	19.31145	4.525477	0	0
2000	Nigeria	1	25.78253	4.268018	23.62558	17.50676	18.9269	4.622027	0	0
2001	Nigeria	1	25.8257	4.404399	23.38086	17.55629	18.30774	4.7116	0	0
2002	Nigeria	1	25.86284	4.149148	23.56601	17.603	17.89186	4.792313	0	0
2003	Nigeria	1	25.96137	4.320417	23.9724	17.67144	18.73367	4.861516	0	0
2004	Nigeria	1	26.25206	3.880532	23.6979	17.66814	18.75193	4.889522	0	0
2005	Nigeria	1	26.28593	3.926912	23.58743	17.69112	18.79204	4.877256	0	0
2006	Nigeria	1	26.36484	4.168369	24.0536	17.70271	20.27072	4.857096	0	0
2007	Nigeria	1	26.43089	4.166045	24.40234	17.64996	21.04765	4.834773	0	0
2008	Nigeria	1	26.49171	4.173926	24.39506	17.78149	21.72203	4.775335	0	0
2009	Nigeria	1	26.55875	4.123903	24.69345	17.9109	21.58431	5.003275	0	0
2010	Nigeria	1	26.63423	3.753027	24.83576	18.05622	21.65044	5.012633	0	0
2011	Nigeria	1	26.68195	3.966322	24.7497	18.11443	21.89334	5.036043	0	0
2012	Nigeria	1	26.72385	3.792789	24.77489	18.176	21.9152	5.059425	0	0

2013	Nigeria	1	26.77639	3.435599	24.8506	18.37682	21.89461	5.058218	0	0
2014	Nigeria	1	26.83758	3.430109	24.97659	18.39476	21.93431	5.06607	0	0
2015	Nigeria	1	26.86376	3.05022	24.9633	18.37521	21.81213	5.259784	0	0
2016	Nigeria	1	26.84746	2.821974	24.65799	18.37288	21.96761	5.535324	0	0
1970	Ghana	2	22.96426	3.785235	19.39796	14.96972	18.0782	1.00	1	0
1971	Ghana	2	23.0151	3.589093	19.52158	15.15148	18.02091	1.00	1	0
1972	Ghana	2	22.98991	3.581148	19.02549	15.02475	17.60417	1.00	1	0
1973	Ghana	2	23.01835	3.633534	19.05584	15.14183	17.19786	1.00	1	0
1974	Ghana	2	23.08463	3.692093	19.65824	15.10433	17.19786	1.00	1	0
1975	Ghana	2	22.95188	3.632322	19.60423	15.09323	18.07636	1.00	1	0
1976	Ghana	2	22.91594	3.45789	19.42144	15.11286	16.72028	1.00	1	0
1977	Ghana	2	22.93843	3.093133	19.51834	15.13968	16.77133	1.00	1	0
1978	Ghana	2	23.01978	2.892889	19.0377	15.15787	16.08725	1.00	1	0
1979	Ghana	2	22.99431	3.108788	19.41583	15.18821	14.84513	1.00	1	0
1980	Ghana	2	22.99902	2.869098	19.41784	15.25747	16.56278	1.00	1	0
1981	Ghana	2	22.96336	2.310458	19.11092	15.32729	16.60445	1.00	1	0
1982	Ghana	2	22.89161	1.843774	18.77507	15.30827	16.60668	1.00	1	0
1983	Ghana	2	22.8449	2.446244	18.84334	15.35489	14.69098	1.00	1	0
1984	Ghana	2	22.92784	2.934634	19.52714	15.38415	14.50866	1.00	1	0
1985	Ghana	2	22.9775	3.188162	19.87754	15.37649	15.53828	-4.60517	1	0
1986	Ghana	2	23.02819	3.603095	20.09293	15.41055	15.27413	-4.60517	1	0
1987	Ghana	2	23.07502	3.825334	20.08037	15.43279	15.36307	-3.91202	1	0
1988	Ghana	2	23.12977	3.743498	20.18577	15.51219	15.42495	-3.91202	1	0
1989	Ghana	2	23.17938	3.715665	20.35355	15.42928	16.52356	-3.50656	1	0
1990	Ghana	2	23.21213	3.754859	20.55748	15.4547	16.51014	-3.50656	1	0
1991	Ghana	2	23.2636	3.74923	20.76613	15.50259	16.81124	-3.21888	1	0
1992	Ghana	2	23.30166	3.828502	20.521	15.52958	16.92903	-3.21888	1	0
1993	Ghana	2	23.34902	4.037229	21.07329	15.55661	18.64382	-2.81341	1	0
1994	Ghana	2	23.38149	4.127476	20.92953	15.58298	19.26655	-2.30259	1	0
1995	Ghana	2	23.42179	4.050447	21.03525	15.60843	18.48366	-2.12026	1	0
1996	Ghana	2	23.46679	4.279509	21.06523	15.6304	18.603	-1.83258	1	0
1997	Ghana	2	23.50789	4.447368	21.21953	15.65165	18.21979	-1.60944	1	0
1998	Ghana	2	23.55383	4.389493	21.23789	15.67283	18.9359	-1.46968	1	0
1999	Ghana	2	23.59688	4.403116	21.18066	15.69389	19.31145	-1.30933	1	0
2000	Ghana	2	23.63322	4.754008	20.86388	15.72558	18.9269	-0.61619	1	0
2001	Ghana	2	23.67244	4.700897	21.08899	15.7022	18.30774	-0.3285	1	0
2002	Ghana	2	23.71645	4.579742	20.86972	15.76731	17.89186	-0.23572	1	0
2003	Ghana	2	23.76715	4.577667	21.28325	15.82985	18.73367	-0.13926	1	0
2004	Ghana	2	23.82164	4.601868	21.64765	15.92264	18.75193	-0.10536	1	0
2005	Ghana	2	23.87896	4.586716	21.85866	15.99538	18.79204	-0.09431	1	0
2006	Ghana	2	23.941	4.188484	22.20843	16.05697	20.27072	-0.08338	1	0
2007	Ghana	2	23.98354	4.179824	22.32838	16.16872	21.04765	-0.06188	1	0
2008	Ghana	2	24.0711	4.241531	22.53478	16.19496	21.72203	0.058269	1	0
2009	Ghana	2	24.11842	4.271022	22.35686	16.2928	21.58723	0.34359	1	0
2010	Ghana	2	24.19445	4.322513	22.79445	16.38825	21.65044	0.357674	1	0
2011	Ghana	2	24.32588	4.457777	23.03894	16.47853	21.90118	0.41211	1	0

2012	Ghana	2	24.41474	4.534405	23.28596	16.52475	21.91553	0.587787	1	0
2013	Ghana	2	24.48531	4.40247	23.28458	16.59385	21.89482	0.667829	1	0
2014	Ghana	2	24.5244	4.482453	23.03905	16.5642	21.93621	1.064711	1	0
2015	Ghana	2	24.56281	4.597625	22.91393	16.64511	21.88401	1.300192	1	0
2016	Ghana	2	24.59795	4.48416	22.96236	16.67881	21.97183	1.363537	1	0
1970	Cote d'IVoire	3	23.01483	4.172493	19.60676	13.19049	17.67534	5.621849	0	1
1971	Cote d'IVoire	3	23.10519	4.104911	19.66013	13.23958	17.98257	5.618079	0	1
1972	Cote d'IVoire	3	23.14668	4.135467	19.77153	13.38124	17.77728	5.529548	0	1
1973	Cote d' IVoire	3	23.20438	4.233902	20.18104	13.5042	17.51707	5.406678	0	1
1974	Cote d' IVoire	3	23.24674	4.431686	20.3316	13.51983	17.08351	5.483551	0	1
1975	Cote d' IVoire	3	23.32604	4.294743	20.58854	13.62043	18.05046	5.367424	0	1
1976	Cote d' IVoire	3	23.44752	4.356571	20.79258	13.7501	17.61725	5.476254	0	1
1977	Cote d' IVoire	3	23.51811	4.368898	21.26116	13.82379	16.50017	5.50403	0	1
1978	Cote d IVoire	3	23.62166	4.30348	21.57826	13.94001	18.23811	5.419029	0	1
1979	Cote d' IVoire	3	23.64532	4.280353	21.66205	14.06839	18.1296	5.359977	0	1
1980	Cote d' IVoire	3	23.52926	4.333103	21.7166	14.21842	18.36582	5.353184	0	1
1981	Cote d' IVoire	3	23.56367	4.349751	21.506	14.33273	17.3045	5.604809	0	1
1982	Cote d' IVoire	3	23.56567	4.327439	21.28555	14.36584	17.67568	5.794872	0	1
1983	Cote d' IVoire	3	23.52589	4.286069	20.95366	14.39738	16.89472	5.942983	0	1
1984	Cote d' IVoire	3	23.49851	4.345145	20.4965	14.42497	17.18827	6.079842	0	1
1985	Cote d' IVoire	3	23.54253	4.371629	20.62201	14.47621	18.07462	6.107602	0	1
1986	Cote d' IVoire	3	23.57461	4.243875	20.82293	14.50109	18.28727	5.847334	0	1
1987	Cote d' IVoire	3	23.57111	4.143932	20.94041	14.524	17.76105	5.705581	0	1
1988	Cote d' IVoire	3	23.58241	4.066944	20.98356	14.5863	16.733	5.69659	0	1
1989	Cote d' IVoire	3	23.61147	4.112324	20.58262	14.64755	17.6891	5.765222	0	1
1990	Cote d' IVoire	3	23.60045	4.074167	20.39769	14.70803	16.60704	5.606757	0	1
1991	Cote d' IVoire	3	23.60086	4.043013	20.46456	14.76728	19.25721	5.642297	0	1
1992	Cote d'IVoire	3	23.59841	4.094762	20.46478	14.82606	18.29171	5.578559	0	1
1993	Cote d' Voire	3	23.59648	4.01365	20.80182	14.8836	18.17208	5.646012	0	1
1994	Cote d' IVoire	3	23.60456	4.246159	20.85453	14.93955	19.16965	6.319328	0	1
1995	Cote d' IVoire	3	23.67339	4.333392	21.26318	14.99368	19.41089	6.212907	0	1
1996	Cote d' IVoire	3	23.74784	4.297548	21.10874	15.04615	19.84452	6.237445	0	1
1997	Cote d' IVoire	3	23.7846	4.359373	21.2485	15.09657	19.75572	6.369336	0	1
1998	Cote d' IVoire	3	23.83273	4.335546	21.25686	15.14537	19.59525	6.380038	0	1
1999	Cote d' IVoire	3	23.84877	4.337813	21.22226	15.19158	19.27383	6.42276	0	1
2000	Cote d' IVoire	3	23.82787	4.312647	20.83983	15.25496	19.42381	6.56805	0	1
2001	Cote d' IVoire	3	23.82908	4.29797	20.88625	15.31434	19.17506	6.5972	0	1
2002	Cote d' IVoire	3	23.81227	4.380321	20.86846	15.3703	18.92356	6.546771	0	1
2003	Cote d' IVoire	3	23.79858	4.321048	21.05236	15.42383	19.46089	6.365095	0	1
2004	Cote d' IVoire	3	23.81082	4.438013	21.23741	15.47612	19.67036	6.269626	0	1
2005	Cote d' IVoire	3	23.82789	4.542471	21.59097	15.52806	19.67036	6.268092	0	1
2006	Cote d' IVoire	3	23.84293	4.554611	21.35739	15.57989	19.67531	6.259371	0	1
2007	Cote d' IVoire	3	23.86043	4.493542	21.67012	15.63157	19.90957	6.172264	0	1
2008	Cote d' IVoire	3	23.88554	4.469062	21.79613	15.6832	19.96075	6.104369	0	1
2009	Cote d' IVoire	3	23.91754	4.508431	21.47061	15.73482	19.797	6.157381	0	1
2010	Cote d' IVoire	3	23.93751	4.542863	21.93036	15.78642	19.69638	6.205123	0	1

2011	Cote d’ IVoire	3	23.89265	4.51256	20.90048	15.8381	19.52454	6.156704	0	1
2012	Cote d‘ IVoire	3	23.99436	4.530534	22.13136	15.88983	19.61543	6.235449	0	1
2013	Cote d’ IVoire	3	24.07952	4.383611	22.5915	15.94138	19.82549	6.202616	0	1
2014	Cote d’ IVoire	3	24.16381	4.133084	22.66937	15.99239	19.89949	6.203365	0	1
2015	Cote d’ IVoire	3	24.24854	4.15167	22.6199	16.04266	20.01847	6.382577	0	1
2016	Cote d’ IVoire	3	24.32861	3.962526	22.74156	16.15687	19.99144	6.385211	0	1

Appendix 3: Descriptive Statistics

Cote d'Ivoire

	RGDP	OPNES	INV	HK	FDI	EXR
Mean	1.99E+10	74.27553	1.97E+09	3685135.	1.99E+08	416.0951
Median	1.81E+10	75.27000	1.39E+09	2909815.	1.65E+08	447.8100
Maximum	3.68E+10	95.07000	7.53E+09	10395400	4.94E+08	733.0400
Minimum	9.89E+09	52.59000	3.27E+08	535249.0	14653230	211.2800
Std. Dev.	5.58E+09	11.18576	1.72E+09	2666249.	1.60E+08	152.6530
Skewness	0.816702	0.057792	2.040827	0.795530	0.370226	0.245990
Kurtosis	4.105976	2.282383	6.481187	2.604705	1.604856	1.873203
Jarque-Bera	7.620254	1.034653	56.35801	5.263467	4.885447	2.960444
Probability	0.022145	0.596112	0.000000	0.071954	0.086924	0.227587
Sum	9.35E+11	3490.950	9.24E+10	1.73E+08	9.37E+09	19556.47
Sum Sq. Dev.	1.43E+21	5755.577	1.36E+20	3.27E+14	1.18E+18	1071935.
Observations	47	47	47	47	47	47

Ghana

	RGDP	OPNES	INV	HK	FDI	EXR
Mean	1.84E+10	57.69809	2.63E+09	7226491.	6.76E+08	0.905745
Median	1.38E+10	56.67000	1.15E+09	5703639.	71000430	1.000000
Maximum	4.82E+10	116.0500	1.30E+10	17519200	3.49E+09	3.910000
Minimum	8.34E+09	6.320000	1.43E+08	3171527.	2000000.	0.010000
Std. Dev.	1.15E+10	30.14140	3.61E+09	4059522.	1.20E+09	0.858122
Skewness	1.306244	0.110250	1.659526	1.275700	1.542215	1.740873
Kurtosis	3.574818	1.852568	4.509837	3.403419	3.566288	6.752640
Jarque-Bera	14.01288	2.673554	26.03745	13.06677	19.25902	51.31784
Probability	0.000906	0.262691	0.000002	0.001454	0.000066	0.000000
Sum	8.67E+11	2711.810	1.24E+11	3.40E+08	3.18E+10	42.57000
Sum Sq. Dev.	6.04E+21	41791.18	5.99E+20	7.58E+14	6.60E+19	33.87315
Observations	47	47	47	47	47	47

Nigeria

	RGDP	OPNES	INV	HK	FDI	EXR
Mean	1.95E+11	47.02511	3.45E+10	35225132	6.68E+08	58.72191
Median	1.37E+11	47.39000	2.64E+10	30417463	70869950	21.88000
Maximum	4.64E+11	81.81000	8.27E+10	97441488	3.47E+09	253.4900
Minimum	9.05E+10	16.81000	1.20E+10	2468780.	2000000.	0.550000
Std. Dev.	1.13E+11	16.87853	2.06E+10	27031366	1.19E+09	70.64952
Skewness	1.277560	0.014963	0.612371	0.845698	1.540202	0.820484
Kurtosis	3.139190	2.095273	2.080736	3.013777	3.564621	2.385460
Jarque-Bera	12.82319	1.604709	4.592370	5.602816	19.20671	6.012936
Probability	0.001642	0.448272	0.100642	0.060725	0.000068	0.049466
Sum	9.16E+12	2210.180	1.62E+12	1.66E+09	3.14E+10	2759.930
Sum Sq. Dev.	5.90E+23	13104.70	1.95E+22	3.36E+16	6.48E+19	229602.3
Observations	47	47	47	47	47	47

Appendix 4: Unit Root Tests

A4: Cote d'Ivoire

Null Hypothesis: RGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.693609	0.8382
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/16/18 Time: 14:46
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	-0.018385	0.026507	-0.693609	0.4916
C	0.463735	0.627249	0.739315	0.4636

R-squared	0.010816	Mean dependent var	0.028696
Adjusted R-squared	-0.011666	S.D. dependent var	0.046553
S.E. of regression	0.046823	Akaike info criterion	-3.242362
Sum squared resid	0.096467	Schwarz criterion	-3.162856
Log likelihood	76.57433	Hannan-Quinn criter.	-3.212579
F-statistic	0.481093	Durbin-Watson stat	1.125193
Prob(F-statistic)	0.491573		

Null Hypothesis: D(RGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.343136	0.0012
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares
Date: 05/16/18 Time: 14:47
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.596312	0.137300	-4.343136	0.0001
C	0.015987	0.007351	2.174781	0.0352

R-squared	0.304914	Mean dependent var	-0.000444
Adjusted R-squared	0.288749	S.D. dependent var	0.050134
S.E. of regression	0.042281	Akaike info criterion	-3.445532
Sum squared resid	0.076870	Schwarz criterion	-3.365235
Log likelihood	79.52446	Hannan-Quinn criter.	-3.415598
F-statistic	18.86283	Durbin-Watson stat	1.974916
Prob(F-statistic)	0.000084		

Null Hypothesis: OPNES has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.544273	0.5025
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES)
Method: Least Squares
Date: 05/16/18 Time: 14:48
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES(-1)	-0.140223	0.090802	-1.544273	0.1297
C	0.598788	0.390926	1.531717	0.1328

R-squared	0.051413	Mean dependent var	-0.004565
Adjusted R-squared	0.029854	S.D. dependent var	0.090792
S.E. of regression	0.089426	Akaike info criterion	-1.948301
Sum squared resid	0.351870	Schwarz criterion	-1.868795
Log likelihood	46.81092	Hannan-Quinn criter.	-1.918518
F-statistic	2.384779	Durbin-Watson stat	1.696654
Prob(F-statistic)	0.129685		

Null Hypothesis: D(OPNES) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.081941	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES,2)
Method: Least Squares
Date: 05/16/18 Time: 14:49
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OPNES(-1))	-0.968618	0.159261	-6.081941	0.0000
C	-0.003097	0.013758	-0.225123	0.8230

R-squared	0.462433	Mean dependent var	-0.002667
Adjusted R-squared	0.449931	S.D. dependent var	0.124433
S.E. of regression	0.092288	Akaike info criterion	-1.884380
Sum squared resid	0.366234	Schwarz criterion	-1.804084
Log likelihood	44.39855	Hannan-Quinn criter.	-1.854446
F-statistic	36.99001	Durbin-Watson stat	1.886490
Prob(F-statistic)	0.000000		

Null Hypothesis: INV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.534390	0.5075
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 05/16/18 Time: 14:50
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.108741	0.070869	-1.534390	0.1321
C	2.361137	1.495262	1.579079	0.1215

R-squared	0.050790	Mean dependent var	0.068043
Adjusted R-squared	0.029217	S.D. dependent var	0.335775
S.E. of regression	0.330834	Akaike info criterion	0.668102
Sum squared resid	4.815838	Schwarz criterion	0.747608
Log likelihood	-13.36635	Hannan-Quinn criter.	0.697886
F-statistic	2.354351	Durbin-Watson stat	2.197297
Prob(F-statistic)	0.132094		

Null Hypothesis: D(INV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.731196	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV,2)
Method: Least Squares
Date: 05/16/18 Time: 14:50
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-1.163431	0.150485	-7.731196	0.0000
C	0.079376	0.051509	1.541028	0.1306

R-squared	0.581596	Mean dependent var	0.001556
Adjusted R-squared	0.571865	S.D. dependent var	0.517893
S.E. of regression	0.338868	Akaike info criterion	0.717014
Sum squared resid	4.937753	Schwarz criterion	0.797310
Log likelihood	-14.13281	Hannan-Quinn criter.	0.746947
F-statistic	59.77140	Durbin-Watson stat	1.945559
Prob(F-statistic)	0.000000		

Null Hypothesis: HK has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.015606	0.2793
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK)
Method: Least Squares
Date: 05/16/18 Time: 14:51
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HK(-1)	-0.012577	0.006240	-2.015606	0.0503
D(HK(-1))	0.323074	0.152710	2.115604	0.0404
C	0.230959	0.097438	2.370316	0.0224

R-squared	0.272291	Mean dependent var	0.064889
Adjusted R-squared	0.237639	S.D. dependent var	0.033003
S.E. of regression	0.028816	Akaike info criterion	-4.191436
Sum squared resid	0.034875	Schwarz criterion	-4.070992
Log likelihood	97.30732	Hannan-Quinn criter.	-4.146536
F-statistic	7.857707	Durbin-Watson stat	1.542857
Prob(F-statistic)	0.001262		

Null Hypothesis: D(HK) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.814504	0.0054
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK,2)
Method: Least Squares
Date: 05/16/18 Time: 14:52
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HK(-1))	-0.536296	0.140594	-3.814504	0.0004
C	0.035521	0.009953	3.569039	0.0009

R-squared	0.252829	Mean dependent var	0.001556
Adjusted R-squared	0.235453	S.D. dependent var	0.034109
S.E. of regression	0.029824	Akaike info criterion	-4.143548
Sum squared resid	0.038248	Schwarz criterion	-4.063252
Log likelihood	95.22982	Hannan-Quinn criter.	-4.113614
F-statistic	14.55044	Durbin-Watson stat	1.635196
Prob(F-statistic)	0.000431		

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.188621	0.6713
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 05/16/18 Time: 14:52
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.111427	0.093745	-1.188621	0.2413
D(FDI(-1))	-0.391228	0.144025	-2.716380	0.0095
C	2.141286	1.746815	1.225823	0.2271

R-squared	0.228797	Mean dependent var	0.044667
Adjusted R-squared	0.192073	S.D. dependent var	0.706903
S.E. of regression	0.635398	Akaike info criterion	1.995211
Sum squared resid	16.95670	Schwarz criterion	2.115655
Log likelihood	-41.89224	Hannan-Quinn criter.	2.040111
F-statistic	6.230168	Durbin-Watson stat	2.097010
Prob(F-statistic)	0.004271		

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.66204	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 05/16/18 Time: 14:53
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.449809	0.135979	-10.66204	0.0000
C	0.068057	0.095435	0.713118	0.4796

R-squared	0.725554	Mean dependent var	-0.007333
Adjusted R-squared	0.719171	S.D. dependent var	1.204758
S.E. of regression	0.638441	Akaike info criterion	1.983852
Sum squared resid	17.52710	Schwarz criterion	2.064148
Log likelihood	-42.63666	Hannan-Quinn criter.	2.013785
F-statistic	113.6791	Durbin-Watson stat	2.149993
Prob(F-statistic)	0.000000		

Null Hypothesis: EXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.172960	0.6782
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 05/16/18 Time: 14:53
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.065415	0.055769	-1.172960	0.2471
C	0.406131	0.332643	1.220920	0.2286

R-squared	0.030321	Mean dependent var	0.016739
Adjusted R-squared	0.008283	S.D. dependent var	0.143683
S.E. of regression	0.143086	Akaike info criterion	-1.008233
Sum squared resid	0.900842	Schwarz criterion	-0.928727
Log likelihood	25.18935	Hannan-Quinn criter.	-0.978449
F-statistic	1.375835	Durbin-Watson stat	1.742531
Prob(F-statistic)	0.247123		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.943180	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 05/16/18 Time: 14:54
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.901831	0.151742	-5.943180	0.0000
C	0.015453	0.021952	0.703943	0.4853

R-squared	0.450980	Mean dependent var	0.000222
Adjusted R-squared	0.438212	S.D. dependent var	0.195128
S.E. of regression	0.146253	Akaike info criterion	-0.963526
Sum squared resid	0.919772	Schwarz criterion	-0.883230
Log likelihood	23.67934	Hannan-Quinn criter.	-0.933593
F-statistic	35.32138	Durbin-Watson stat	1.980259
Prob(F-statistic)	0.000000		

B4: Ghana

Null Hypothesis: RGDP has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		2.208345	0.9999
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/16/18 Time: 12:21
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.031370	0.014205	2.208345	0.0327
D(RGDP(-1))	0.173508	0.158561	1.094266	0.2801
C	-0.707267	0.330582	-2.139458	0.0383

R-squared	0.216303	Mean dependent var	0.035111
Adjusted R-squared	0.178984	S.D. dependent var	0.046251
S.E. of regression	0.041908	Akaike info criterion	-3.442322
Sum squared resid	0.073765	Schwarz criterion	-3.321878
Log likelihood	80.45225	Hannan-Quinn criter.	-3.397422
F-statistic	5.796067	Durbin-Watson stat	1.858431
Prob(F-statistic)	0.005986		

Null Hypothesis: D(RGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-4.551305	0.0006
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares
Date: 05/16/18 Time: 12:21
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.647114	0.142182	-4.551305	0.0000
C	0.022564	0.008253	2.734191	0.0090

R-squared	0.325113	Mean dependent var	-0.000444
Adjusted R-squared	0.309418	S.D. dependent var	0.052655
S.E. of regression	0.043757	Akaike info criterion	-3.376914
Sum squared resid	0.082330	Schwarz criterion	-3.296618
Log likelihood	77.98056	Hannan-Quinn criter.	-3.346980
F-statistic	20.71437	Durbin-Watson stat	1.942601
Prob(F-statistic)	0.000043		

Null Hypothesis: OPNES has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.541158	0.5039
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES)
Method: Least Squares
Date: 05/16/18 Time: 12:23
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES(-1)	-0.073033	0.047389	-1.541158	0.1308
D(OPNES(-1))	0.383580	0.143330	2.676203	0.0106
C	0.294766	0.185136	1.592162	0.1188

R-squared	0.163156	Mean dependent var	0.019778
Adjusted R-squared	0.123306	S.D. dependent var	0.227291
S.E. of regression	0.212817	Akaike info criterion	-0.192426
Sum squared resid	1.902229	Schwarz criterion	-0.071982
Log likelihood	7.329582	Hannan-Quinn criter.	-0.147525
F-statistic	4.094276	Durbin-Watson stat	1.778836
Prob(F-statistic)	0.023743		

Null Hypothesis: D(OPNES) has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.070461	0.0001
Test critical values:	1% level	-3.588509	
	5% level	-2.929734	
	10% level	-2.603064	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES,2)
Method: Least Squares
Date: 05/16/18 Time: 12:24
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OPNES(-1))	-0.860602	0.169729	-5.070461	0.0000
D(OPNES(-1),2)	0.313524	0.148130	2.116548	0.0404
C	0.014975	0.031858	0.470042	0.6408

R-squared	0.392943	Mean dependent var	-0.002500
Adjusted R-squared	0.363330	S.D. dependent var	0.263325
S.E. of regression	0.210111	Akaike info criterion	-0.216613
Sum squared resid	1.810017	Schwarz criterion	-0.094963
Log likelihood	7.765481	Hannan-Quinn criter.	-0.171499
F-statistic	13.26947	Durbin-Watson stat	1.852145
Prob(F-statistic)	0.000036		

Null Hypothesis: INV has a unit root
Exogenous: None
Lag Length: 2 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.617770	0.9724
Test critical values:	1% level	-2.618579	
	5% level	-1.948495	
	10% level	-1.612135	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 05/17/18 Time: 16:44
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	0.005519	0.003412	1.617770	0.1134
D(INV(-1))	-0.491168	0.151957	-3.232275	0.0024
D(INV(-2))	-0.248807	0.151825	-1.638768	0.1089

R-squared	0.203197	Mean dependent var	0.067955
Adjusted R-squared	0.164329	S.D. dependent var	0.504761
S.E. of regression	0.461428	Akaike info criterion	1.356765
Sum squared resid	8.729548	Schwarz criterion	1.478414
Log likelihood	-26.84882	Hannan-Quinn criter.	1.401878
Durbin-Watson stat	2.072063		

Null Hypothesis: D(INV) has a unit root
Exogenous: None
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.543822	0.0000
Test critical values:	1% level	-2.618579	
	5% level	-1.948495	
	10% level	-1.612135	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV,2)
Method: Least Squares
Date: 05/17/18 Time: 16:39
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-1.634754	0.249816	-6.543822	0.0000
D(INV(-1),2)	0.196472	0.151168	1.299693	0.2008

R-squared	0.695409	Mean dependent var	0.000455
Adjusted R-squared	0.688157	S.D. dependent var	0.842054
S.E. of regression	0.470228	Akaike info criterion	1.373189
Sum squared resid	9.286787	Schwarz criterion	1.454289
Log likelihood	-28.21016	Hannan-Quinn criter.	1.403265
Durbin-Watson stat	2.027279		

Null Hypothesis: HK has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		1.315105	0.9984
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK)
Method: Least Squares
Date: 05/16/18 Time: 12:25
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HK(-1)	0.021785	0.016565	1.315105	0.1953
C	-0.303604	0.259240	-1.171129	0.2479

R-squared	0.037820	Mean dependent var	0.037174
Adjusted R-squared	0.015953	S.D. dependent var	0.052690
S.E. of regression	0.052268	Akaike info criterion	-3.022343
Sum squared resid	0.120208	Schwarz criterion	-2.942836
Log likelihood	71.51388	Hannan-Quinn criter.	-2.992559
F-statistic	1.729502	Durbin-Watson stat	2.621950
Prob(F-statistic)	0.195287		

Null Hypothesis: D(HK) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-10.04270	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK,2)
Method: Least Squares
Date: 05/16/18 Time: 12:26
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HK(-1))	-1.313261	0.130768	-10.04270	0.0000
C	0.045695	0.008443	5.412013	0.0000

R-squared	0.701090	Mean dependent var	-0.003333
Adjusted R-squared	0.694138	S.D. dependent var	0.083557
S.E. of regression	0.046211	Akaike info criterion	-3.267765
Sum squared resid	0.091825	Schwarz criterion	-3.187468
Log likelihood	75.52470	Hannan-Quinn criter.	-3.237831
F-statistic	100.8559	Durbin-Watson stat	1.281827
Prob(F-statistic)	0.000000		

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.433149	0.8946
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 05/16/18 Time: 12:26
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.021260	0.049082	-0.433149	0.6670
C	0.471220	0.899046	0.524133	0.6028

R-squared	0.004246	Mean dependent var	0.084565
Adjusted R-squared	-0.018385	S.D. dependent var	0.718955
S.E. of regression	0.725534	Akaike info criterion	2.238687
Sum squared resid	23.16158	Schwarz criterion	2.318193
Log likelihood	-49.48980	Hannan-Quinn criter.	2.268471
F-statistic	0.187618	Durbin-Watson stat	1.999836
Prob(F-statistic)	0.667022		

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.676365	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 05/16/18 Time: 12:27
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.017513	0.152405	-6.676365	0.0000
C	0.089257	0.110326	0.809029	0.4230

R-squared	0.508986	Mean dependent var	0.003333
Adjusted R-squared	0.497567	S.D. dependent var	1.036975
S.E. of regression	0.735034	Akaike info criterion	2.265627
Sum squared resid	23.23184	Schwarz criterion	2.345923
Log likelihood	-48.97662	Hannan-Quinn criter.	2.295561
F-statistic	44.57385	Durbin-Watson stat	1.999548
Prob(F-statistic)	0.000000		

Null Hypothesis: EXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.255709	0.6421
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 05/16/18 Time: 12:28
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.084345	0.067169	-1.255709	0.2158
C	-0.045300	0.121529	-0.372751	0.7111

R-squared	0.034597	Mean dependent var	0.029565
Adjusted R-squared	0.012656	S.D. dependent var	0.722837
S.E. of regression	0.718248	Akaike info criterion	2.218502
Sum squared resid	22.69875	Schwarz criterion	2.298008
Log likelihood	-49.02554	Hannan-Quinn criter.	2.248285
F-statistic	1.576806	Durbin-Watson stat	1.824743
Prob(F-statistic)	0.215849		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.288066	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 05/16/18 Time: 12:29
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.958079	0.152365	-6.288066	0.0000
C	0.029011	0.110221	0.263210	0.7936

R-squared	0.479039	Mean dependent var	0.001333
Adjusted R-squared	0.466924	S.D. dependent var	1.011876
S.E. of regression	0.738792	Akaike info criterion	2.275826
Sum squared resid	23.46998	Schwarz criterion	2.356122
Log likelihood	-49.20608	Hannan-Quinn criter.	2.305759
F-statistic	39.53977	Durbin-Watson stat	1.992640
Prob(F-statistic)	0.000000		

C4: Nigeria

Null Hypothesis: RGDP has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		0.824075	0.9934
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.
Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP)
Method: Least Squares
Date: 05/16/18 Time: 07:13
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.018089	0.021951	0.824075	0.4143
C	-0.432265	0.567350	-0.761902	0.4502

R-squared	0.015199	Mean dependent var	0.035198
Adjusted R-squared	-0.007182	S.D. dependent var	0.069158
S.E. of regression	0.069406	Akaike info criterion	-2.455176
Sum squared resid	0.211958	Schwarz criterion	-2.375669
Log likelihood	58.46904	Hannan-Quinn criter.	-2.425392
F-statistic	0.679099	Durbin-Watson stat	1.710854
Prob(F-statistic)	0.414342		

Null Hypothesis: D(RGDP) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.751398	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RGDP,2)
Method: Least Squares
Date: 05/16/18 Time: 07:16
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	-0.852584	0.148239	-5.751398	0.0000
C	0.027665	0.011524	2.400621	0.0208

R-squared	0.434795	Mean dependent var	-0.003320
Adjusted R-squared	0.421651	S.D. dependent var	0.089860
S.E. of regression	0.068338	Akaike info criterion	-2.485277
Sum squared resid	0.200813	Schwarz criterion	-2.404981
Log likelihood	57.91874	Hannan-Quinn criter.	-2.455344
F-statistic	33.07858	Durbin-Watson stat	1.985464
Prob(F-statistic)	0.000001		

Null Hypothesis: OPNES has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-1.876940	0.3400
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES)
Method: Least Squares
Date: 05/16/18 Time: 07:17
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES(-1)	-0.167013	0.088981	-1.876940	0.0672
C	0.631035	0.339661	1.857837	0.0699

R-squared	0.074131	Mean dependent var	-0.003359
Adjusted R-squared	0.053088	S.D. dependent var	0.234292
S.E. of regression	0.227988	Akaike info criterion	-0.076540
Sum squared resid	2.287061	Schwarz criterion	0.002966
Log likelihood	3.760426	Hannan-Quinn criter.	-0.046757
F-statistic	3.522904	Durbin-Watson stat	2.113848
Prob(F-statistic)	0.067167		

Null Hypothesis: D(OPNES) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.881562	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(OPNES,2)
Method: Least Squares
Date: 05/16/18 Time: 07:17
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OPNES(-1))	-1.181973	0.149967	-7.881562	0.0000
C	-0.008035	0.034767	-0.231116	0.8183

R-squared	0.590940	Mean dependent var	-0.009971
Adjusted R-squared	0.581427	S.D. dependent var	0.360481
S.E. of regression	0.233221	Akaike info criterion	-0.030231
Sum squared resid	2.338864	Schwarz criterion	0.050065
Log likelihood	2.680204	Hannan-Quinn criter.	-0.000298
F-statistic	62.11902	Durbin-Watson stat	1.872497
Prob(F-statistic)	0.000000		

Null Hypothesis: INV has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.369591	0.1557
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 05/16/18 Time: 07:18
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.199438	0.084166	-2.369591	0.0223
C	4.790712	2.026791	2.363693	0.0226

R-squared	0.113171	Mean dependent var	-0.010439
Adjusted R-squared	0.093016	S.D. dependent var	0.362352
S.E. of regression	0.345089	Akaike info criterion	0.752474
Sum squared resid	5.239792	Schwarz criterion	0.831980
Log likelihood	-15.30690	Hannan-Quinn criter.	0.782258
F-statistic	5.614961	Durbin-Watson stat	1.979032
Prob(F-statistic)	0.022259		

Null Hypothesis: D(INV) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.046121	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV,2)
Method: Least Squares
Date: 05/16/18 Time: 07:19
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-1.078898	0.153119	-7.046121	0.0000
C	-0.009167	0.055068	-0.166462	0.8686

R-squared	0.535877	Mean dependent var	-0.004973
Adjusted R-squared	0.525083	S.D. dependent var	0.536003
S.E. of regression	0.369383	Akaike info criterion	0.889458
Sum squared resid	5.867068	Schwarz criterion	0.969755
Log likelihood	-18.01282	Hannan-Quinn criter.	0.919392
F-statistic	49.64782	Durbin-Watson stat	1.546399
Prob(F-statistic)	0.000000		

Null Hypothesis: HK has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.155839	0.2248
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK)
Method: Least Squares
Date: 05/16/18 Time: 07:20
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
HK(-1)	-0.022135	0.010268	-2.155839	0.0369
D(HK(-1))	0.552475	0.121654	4.541365	0.0000
C	0.410147	0.178415	2.298845	0.0266

R-squared	0.466692	Mean dependent var	0.078980
Adjusted R-squared	0.441297	S.D. dependent var	0.085232
S.E. of regression	0.063708	Akaike info criterion	-2.604683
Sum squared resid	0.170464	Schwarz criterion	-2.484239
Log likelihood	61.60536	Hannan-Quinn criter.	-2.559782
F-statistic	18.37688	Durbin-Watson stat	2.075958
Prob(F-statistic)	0.000002		

Null Hypothesis: D(HK) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.987992	0.0437
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(HK,2)
Method: Least Squares
Date: 05/19/18 Time: 20:27
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(HK(-1))	-0.353786	0.118403	-2.987992	0.0046
C	0.026479	0.013798	1.919081	0.0616

R-squared	0.171932	Mean dependent var	-0.002264
Adjusted R-squared	0.152675	S.D. dependent var	0.072083
S.E. of regression	0.066353	Akaike info criterion	-2.544233
Sum squared resid	0.189316	Schwarz criterion	-2.463936
Log likelihood	59.24523	Hannan-Quinn criter.	-2.514299
F-statistic	8.928097	Durbin-Watson stat	2.092715
Prob(F-statistic)	0.004626		

Null Hypothesis: FDI has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.501832	0.8814
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI)
Method: Least Squares
Date: 05/16/18 Time: 07:22
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
FDI(-1)	-0.024470	0.048761	-0.501832	0.6183
C	0.555303	0.890685	0.623457	0.5362

R-squared	0.005691	Mean dependent var	0.111559
Adjusted R-squared	-0.016907	S.D. dependent var	0.718820
S.E. of regression	0.724871	Akaike info criterion	2.236859
Sum squared resid	23.11928	Schwarz criterion	2.316365
Log likelihood	-49.44776	Hannan-Quinn criter.	2.266642
F-statistic	0.251835	Durbin-Watson stat	2.079428
Prob(F-statistic)	0.618288		

Null Hypothesis: D(FDI) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-6.974681	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(FDI,2)
Method: Least Squares
Date: 05/16/18 Time: 07:22
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(FDI(-1))	-1.060572	0.152060	-6.974681	0.0000
C	0.113336	0.110585	1.024874	0.3112

R-squared	0.530804	Mean dependent var	-0.003944
Adjusted R-squared	0.519893	S.D. dependent var	1.058168
S.E. of regression	0.733202	Akaike info criterion	2.260636
Sum squared resid	23.11617	Schwarz criterion	2.340932
Log likelihood	-48.86431	Hannan-Quinn criter.	2.290570
F-statistic	48.64617	Durbin-Watson stat	2.009852
Prob(F-statistic)	0.000000		

Null Hypothesis: EXR has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-0.142156	0.9383
Test critical values:	1% level	-3.581152	
	5% level	-2.926622	
	10% level	-2.601424	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR)
Method: Least Squares
Date: 05/16/18 Time: 07:24
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
EXR(-1)	-0.002549	0.017928	-0.142156	0.8876
C	0.133760	0.058779	2.275644	0.0278

R-squared	0.000459	Mean dependent var	0.127778
Adjusted R-squared	-0.022258	S.D. dependent var	0.275327
S.E. of regression	0.278374	Akaike info criterion	0.322801
Sum squared resid	3.409648	Schwarz criterion	0.402308
Log likelihood	-5.424432	Hannan-Quinn criter.	0.352585
F-statistic	0.020208	Durbin-Watson stat	1.613747
Prob(F-statistic)	0.887606		

Null Hypothesis: D(EXR) has a unit root
Exogenous: Constant
Lag Length: 0 (Automatic - based on SIC, maxlag=9)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-5.421016	0.0000
Test critical values:	1% level	-3.584743	
	5% level	-2.928142	
	10% level	-2.602225	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(EXR,2)
Method: Least Squares
Date: 05/16/18 Time: 07:24
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR(-1))	-0.812776	0.149931	-5.421016	0.0000
C	0.107309	0.045181	2.375113	0.0221

R-squared	0.405974	Mean dependent var	0.006122
Adjusted R-squared	0.392160	S.D. dependent var	0.354018
S.E. of regression	0.276007	Akaike info criterion	0.306645
Sum squared resid	3.275733	Schwarz criterion	0.386941
Log likelihood	-4.899518	Hannan-Quinn criter.	0.336579
F-statistic	29.38741	Durbin-Watson stat	2.018505
Prob(F-statistic)	0.000003		

Appendix 5: ARDL Bound Test

A5: Cote d'Ivoire

Dependent Variable: RGDP
Method: ARDL
Date: 05/31/18 Time: 15:23
Sample (adjusted): 1974 2016
Included observations: 43 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic): OPNES INV HK FDI EXR
Fixed regressors: C
Number of models evalulated: 12500
Selected Model: ARDL(4, 1, 0, 0, 2, 0)
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	0.718149	0.162253	4.426105	0.0001
RGDP(-2)	-0.241483	0.165101	-1.462638	0.1540
RGDP(-3)	0.344200	0.145508	2.365498	0.0247
RGDP(-4)	-0.595720	0.129282	-4.607899	0.0001
OPNES	-0.212546	0.078376	-2.711872	0.0110
OPNES(-1)	0.180552	0.087142	2.071921	0.0470
INV	0.078097	0.011997	6.509559	0.0000
HK	0.189643	0.046665	4.063898	0.0003
FDI	-0.004777	0.008905	-0.536473	0.5956
FDI(-1)	-0.007144	0.007277	-0.981777	0.3341
FDI(-2)	-0.021269	0.005077	-4.189682	0.0002
EXR	0.107536	0.033236	3.235511	0.0030
C	13.97163	2.898976	4.819506	0.0000

R-squared	0.990753	Mean dependent var	23.72837
Adjusted R-squared	0.987055	S.D. dependent var	0.227397
S.E. of regression	0.025873	Akaike info criterion	-4.226621
Sum squared resid	0.020082	Schwarz criterion	-3.694165
Log likelihood	103.8723	Hannan-Quinn criter.	-4.030267
F-statistic	267.8694	Durbin-Watson stat	2.159631
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(RGDP)
Selected Model: ARDL(4, 1, 0, 0, 2, 0)
Case 2: Restricted Constant and No Trend
Date: 05/31/18 Time: 15:25
Sample: 1970 2016
Included observations: 43

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	13.97163	1.851807	7.544867	0.0000
RGDP(-1)*	-0.774855	0.098924	-7.832818	0.0000
OPNES(-1)	-0.031994	0.036285	-0.881727	0.3849
INV**	0.078097	0.012340	6.328891	0.0000
HK**	0.189643	0.033039	5.740015	0.0000
FDI(-1)	-0.033191	0.012773	-2.598524	0.0144
EXR**	0.107536	0.023031	4.669220	0.0001
D(RGDP(-1))	0.493003	0.113113	4.358497	0.0001
D(RGDP(-2))	0.251520	0.121962	2.062286	0.0479
D(RGDP(-3))	0.595720	0.119658	4.978508	0.0000
D(OPNES)	-0.212546	0.058257	-3.648443	0.0010
D(FDI)	-0.004777	0.007619	-0.626998	0.5354
D(FDI(-1))	0.021269	0.007946	2.676591	0.0119

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES	-0.041290	0.037191	-1.110229	0.2757
INV	0.100789	0.014161	7.117511	0.0000
HK	0.244746	0.016499	14.83436	0.0000
FDI	-0.042835	0.013170	-3.252516	0.0028
EXR	0.138782	0.020169	6.880921	0.0000
C	18.03130	0.164673	109.4975	0.0000

EC = RGDP - (-0.0413*OPNES + 0.1008*INV + 0.2447*HK -0.0428*FDI + 0.1388*EXR + 18.0313)

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	11.16951	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=45	
Actual Sample Size	43			
		10%	2.276	3.297
		5%	2.694	3.829
		1%	3.674	5.019

	Finite Sample: n=40	
10%	2.306	3.353
5%	2.734	3.92
1%	3.657	5.256

ARDL Error Correction Regression
Dependent Variable: D(RGDP)
Selected Model: ARDL(4, 1, 0, 0, 2, 0)
Case 2: Restricted Constant and No Trend
Date: 05/31/18 Time: 15:26
Sample: 1970 2016
Included observations: 43

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(RGDP(-1))	0.493003	0.087365	5.643030	0.0000
D(RGDP(-2))	0.251520	0.097860	2.570194	0.0154
D(RGDP(-3))	0.595720	0.089743	6.638056	0.0000
D(OPNES)	-0.212546	0.045672	-4.653739	0.0001
D(FDI)	-0.004777	0.005940	-0.804280	0.4276
D(FDI(-1))	0.021269	0.005886	3.613767	0.0011
CointEq(-1)*	-0.774855	0.079995	-9.686275	0.0000

R-squared	0.780779	Mean dependent var	0.026279
Adjusted R-squared	0.744242	S.D. dependent var	0.046702
S.E. of regression	0.023618	Akaike info criterion	-4.505690
Sum squared resid	0.020082	Schwarz criterion	-4.218983
Log likelihood	103.8723	Hannan-Quinn criter.	-4.399962
Durbin-Watson stat	2.159631		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	11.16951	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	2.599707	Prob. F(2,28)	0.0921
Obs*R-squared	6.734301	Prob. Chi-Square(2)	0.0345

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 05/31/18 Time: 15:27
Sample: 1974 2016
Included observations: 43
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.006268	0.157103	0.039900	0.9685
RGDP(-2)	0.197541	0.220466	0.896015	0.3779
RGDP(-3)	-0.224050	0.191253	-1.171485	0.2513
RGDP(-4)	0.067575	0.117711	0.574079	0.5705
OPNES	0.025028	0.058786	0.425740	0.6736
OPNES(-1)	-0.000997	0.059027	-0.016883	0.9866
INV	-0.005773	0.012062	-0.478606	0.6359
HK	-0.005406	0.031654	-0.170790	0.8656
FDI	0.004132	0.007876	0.524691	0.6039
FDI(-1)	-0.005736	0.007751	-0.740138	0.4654
FDI(-2)	-0.001501	0.007615	-0.197052	0.8452
EXR	-0.007406	0.022149	-0.334354	0.7406
C	-0.921246	1.858236	-0.495763	0.6239
RESID(-1)	-0.111465	0.229472	-0.485746	0.6309
RESID(-2)	-0.531331	0.243875	-2.178702	0.0379

R-squared	0.156612	Mean dependent var	-2.85E-15
Adjusted R-squared	-0.265083	S.D. dependent var	0.021866
S.E. of regression	0.024594	Akaike info criterion	-4.303925
Sum squared resid	0.016937	Schwarz criterion	-3.689553
Log likelihood	107.5344	Hannan-Quinn criter.	-4.077364
F-statistic	0.371387	Durbin-Watson stat	2.112248
Prob(F-statistic)	0.972709		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	1.581199	Prob. F(12,30)	0.1507
Obs*R-squared	16.65970	Prob. Chi-Square(12)	0.1629
Scaled explained SS	10.70347	Prob. Chi-Square(12)	0.5545

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 05/31/18 Time: 15:28
Sample: 1974 2016
Included observations: 43
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.051688	0.067836	-0.761944	0.4520
RGDP(-1)	-0.000107	0.002451	-0.043563	0.9655
RGDP(-2)	0.003560	0.004034	0.882444	0.3846
RGDP(-3)	-0.003655	0.005259	-0.695065	0.4924
RGDP(-4)	0.002715	0.004579	0.593087	0.5576
OPNES	0.004125	0.001797	2.295748	0.0289
OPNES(-1)	-0.003896	0.002007	-1.940885	0.0617
INV	0.000418	0.000244	1.713889	0.0969
HK	-0.000910	0.001163	-0.782641	0.4400
FDI	0.000147	0.000254	0.576558	0.5685
FDI(-1)	-0.000112	0.000156	-0.717560	0.4786
FDI(-2)	0.000167	0.000258	0.644627	0.5241
EXR	-0.001217	0.000848	-1.434900	0.1617

R-squared	0.387435	Mean dependent var	0.000467
Adjusted R-squared	0.142409	S.D. dependent var	0.000768
S.E. of regression	0.000711	Akaike info criterion	-11.41514
Sum squared resid	1.52E-05	Schwarz criterion	-10.88269
Log likelihood	258.4255	Hannan-Quinn criter.	-11.21879
F-statistic	1.581199	Durbin-Watson stat	2.589028
Prob(F-statistic)	0.150671		

Ramsey RESET Test
Equation: UNTITLED
Specification: RGDP RGDP(-1) RGDP(-2) RGDP(-3) RGDP(-4) OPNES OPNES(-1) INV HK FDI FDI(-1) FDI(-2) EXR C
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	0.365705	29	0.7172
F-statistic	0.133740	(1, 29)	0.7172

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	9.22E-05	1	9.22E-05
Restricted SSR	0.020082	30	0.000669
Unrestricted SSR	0.019989	29	0.000689

Unrestricted Test Equation:
Dependent Variable: RGDP
Method: ARDL
Date: 05/31/18 Time: 15:28
Sample: 1974 2016
Included observations: 43
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Akaike info criterion (AIC)
Dynamic regressors (4 lags, automatic):
Fixed regressors: C
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	-0.241617	2.013121	-0.120021	0.9053
RGDP(-2)	0.088584	0.702007	0.126187	0.9005
RGDP(-3)	-0.123834	0.964603	-0.128378	0.8987
RGDP(-4)	0.215353	1.722449	0.125027	0.9014
OPNES	0.076771	0.623304	0.123168	0.9028
OPNES(-1)	-0.062345	0.529490	-0.117745	0.9071
INV	-0.028151	0.228993	-0.122933	0.9030
HK	-0.067236	0.555978	-0.120934	0.9046
FDI	0.002281	0.019693	0.115844	0.9086
FDI(-1)	0.002712	0.022339	0.121387	0.9042
FDI(-2)	0.007260	0.062410	0.116327	0.9082
EXR	-0.037791	0.317302	-0.119101	0.9060
C	10.93223	7.713670	1.417254	0.1671
FITTED^2	0.028072	0.059189	0.474281	0.6389

R-squared	0.990796	Mean dependent var	23.72837
Adjusted R-squared	0.986670	S.D. dependent var	0.227397
S.E. of regression	0.026254	Akaike info criterion	-4.184710
Sum squared resid	0.019989	Schwarz criterion	-3.611296
Log likelihood	103.9713	Hannan-Quinn criter.	-3.973253
F-statistic	240.1346	Durbin-Watson stat	2.155161
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

B5: GHANA

Dependent Variable: RGDP
Method: ARDL
Date: 07/19/18 Time: 22:40
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (4 lags, automatic): OPNES INV HK FDI EXR
Fixed regressors: C
Number of models evalulated: 12500
Selected Model: ARDL(1, 1, 3, 2, 0, 2)
Note: final equation sample is larger than selection sample
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	0.543177	0.085735	6.335574	0.0000
OPNES	0.014738	0.016908	0.871678	0.3905
OPNES(-1)	0.051011	0.019784	2.578438	0.0153
INV	0.039475	0.025858	1.526621	0.1377
INV(-1)	-0.006466	0.049274	-0.131222	0.8965
INV(-2)	-0.002510	0.019295	-0.130106	0.8974
INV(-3)	0.072685	0.026115	2.783258	0.0094
HK	0.300828	0.147591	2.038260	0.0507
HK(-1)	0.099914	0.139627	0.715579	0.4800
HK(-2)	-0.185254	0.154676	-1.197689	0.2407
FDI	-0.009358	0.008805	-1.062786	0.2966
EXR	-0.004013	0.007822	-0.513101	0.6118
EXR(-1)	0.000605	0.002743	0.220477	0.8270
EXR(-2)	0.018237	0.006093	2.993098	0.0056
C	5.158983	1.183663	4.358490	0.0002

R-squared	0.998045	Mean dependent var	23.51568
Adjusted R-squared	0.997102	S.D. dependent var	0.540307
S.E. of regression	0.029088	Akaike info criterion	-3.972084
Sum squared resid	0.024537	Schwarz criterion	-3.363838
Log likelihood	102.3859	Hannan-Quinn criter.	-3.746517
F-statistic	1057.685	Durbin-Watson stat	1.856679
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(RGDP)
Selected Model: ARDL(1, 1, 3, 2, 0, 2)
Case 2: Restricted Constant and No Trend
Date: 07/19/18 Time: 22:41
Sample: 1970 2016
Included observations: 44

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	5.158983	1.416765	3.641382	0.0010
RGDP(-1)*	-0.456823	0.123160	-3.709189	0.0009
OPNES(-1)	0.065749	0.022976	2.861616	0.0077
INV(-1)	0.103184	0.038533	2.677799	0.0121
HK(-1)	0.215488	0.111711	1.928981	0.0636
FDI**	-0.009358	0.008096	-1.155825	0.2572
EXR(-1)	0.014828	0.007540	1.966517	0.0589
D(OPNES)	0.014738	0.026864	0.548614	0.5875
D(INV)	0.039475	0.025503	1.547875	0.1325
D(INV(-1))	-0.070175	0.026810	-2.617455	0.0139
D(INV(-2))	-0.072685	0.023624	-3.076759	0.0045
D(HK)	0.300828	0.127737	2.355054	0.0255
D(HK(-1))	0.185254	0.137188	1.350363	0.1873
D(EXR)	-0.004013	0.008807	-0.455686	0.6520
D(EXR(-1))	-0.018237	0.008079	-2.257404	0.0317

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES	0.143927	0.031415	4.581450	0.0001
INV	0.225874	0.074883	3.016337	0.0053
HK	0.471711	0.120390	3.918184	0.0005
FDI	-0.020484	0.018620	-1.100115	0.2803
EXR	0.032459	0.010476	3.098407	0.0043
C	11.29319	0.873262	12.93219	0.0000

EC = RGDP - (0.1439*OPNES + 0.2259*INV + 0.4717*HK -0.0205*FDI + 0.0325*EXR + 11.2932)

F-Bounds Test			Null Hypothesis: No levels relationship	
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	5.699050	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=45	
Actual Sample Size	44			
		10%	2.276	3.297

5%	2.694	3.829
1%	3.674	5.019
	Finite Sample: n=40	
10%	2.306	3.353
5%	2.734	3.92
1%	3.657	5.256

ARDL Error Correction Regression
Dependent Variable: D(RGDP)
Selected Model: ARDL(1, 1, 3, 2, 0, 2)
Case 2: Restricted Constant and No Trend
Date: 07/19/18 Time: 22:43
Sample: 1970 2016
Included observations: 44

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(OPNES)	0.014738	0.020925	0.704317	0.4869
D(INV)	0.039475	0.018281	2.159327	0.0392
D(INV(-1))	-0.070175	0.021538	-3.258220	0.0029
D(INV(-2))	-0.072685	0.019503	-3.726797	0.0008
D(HK)	0.300828	0.080452	3.739235	0.0008
D(HK(-1))	0.185254	0.088612	2.090616	0.0454
D(EXR)	-0.004013	0.006138	-0.653796	0.5184
D(EXR(-1))	-0.018237	0.007051	-2.586231	0.0150
CointEq(-1)*	-0.456823	0.065836	-6.938815	0.0000

R-squared	0.726729	Mean dependent var	0.036591
Adjusted R-squared	0.664268	S.D. dependent var	0.045696
S.E. of regression	0.026477	Akaike info criterion	-4.244811
Sum squared resid	0.024537	Schwarz criterion	-3.879864
Log likelihood	102.3859	Hannan-Quinn criter.	-4.109471
Durbin-Watson stat	1.856679		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test — Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	5.699050	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	0.475942	Prob. F(2,27)	0.6264
Obs*R-squared	1.498392	Prob. Chi-Square(2)	0.4727

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 07/19/18 Time: 22:45
Sample: 1973 2016
Included observations: 44
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.091539	0.216449	0.422913	0.6757
OPNES	-0.003113	0.027667	-0.112518	0.9112
OPNES(-1)	-0.010081	0.038476	-0.262017	0.7953
INV	0.003086	0.028017	0.110133	0.9131
INV(-1)	5.90E-05	0.030198	0.001953	0.9985
INV(-2)	-0.009965	0.027551	-0.361691	0.7204
INV(-3)	-0.003903	0.024472	-0.159472	0.8745
HK	-0.030158	0.136973	-0.220174	0.8274
HK(-1)	-0.028697	0.158003	-0.181625	0.8572
HK(-2)	0.003656	0.143233	0.025522	0.9798
FDI	0.000712	0.008337	0.085357	0.9326
EXR	0.000474	0.010176	0.046572	0.9632
EXR(-1)	-0.003386	0.010236	-0.330797	0.7434
EXR(-2)	-0.001251	0.008609	-0.145364	0.8855
C	-1.027230	2.357559	-0.435718	0.6665
RESID(-1)	-0.109306	0.326565	-0.334713	0.7404
RESID(-2)	-0.227865	0.233722	-0.974941	0.3382

R-squared	0.034054	Mean dependent var	6.06E-15
Adjusted R-squared	-0.538358	S.D. dependent var	0.023888
S.E. of regression	0.029628	Akaike info criterion	-3.915823
Sum squared resid	0.023701	Schwarz criterion	-3.226477
Log likelihood	103.1481	Hannan-Quinn criter.	-3.660180
F-statistic	0.059493	Durbin-Watson stat	1.852876
Prob(F-statistic)	1.000000		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.933834	Prob. F(14,29)	0.5368
Obs*R-squared	13.67225	Prob. Chi-Square(14)	0.4744
Scaled explained SS	9.760238	Prob. Chi-Square(14)	0.7795

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/19/18 Time: 22:46
Sample: 1973 2016
Included observations: 44
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.032761	0.051253	0.639211	0.5277
RGDP(-1)	-0.000411	0.003827	-0.107383	0.9152
OPNES	0.000504	0.000792	0.636512	0.5294
OPNES(-1)	-0.000679	0.000596	-1.139015	0.2640
INV	-0.000538	0.001180	-0.455785	0.6519
INV(-1)	0.000619	0.001756	0.352581	0.7270
INV(-2)	-0.000221	0.000727	-0.303633	0.7636
INV(-3)	0.000619	0.000863	0.716656	0.4793
HK	-2.86E-06	0.002810	-0.001018	0.9992
HK(-1)	-0.003439	0.004791	-0.717816	0.4786
HK(-2)	0.001263	0.004364	0.289301	0.7744
FDI	0.000146	0.000309	0.471512	0.6408
EXR	7.02E-05	0.000136	0.514060	0.6111
EXR(-1)	1.49E-05	0.000126	0.118332	0.9066
EXR(-2)	0.000139	0.000216	0.645576	0.5236

R-squared	0.310733	Mean dependent var	0.000558
Adjusted R-squared	-0.022017	S.D. dependent var	0.001023
S.E. of regression	0.001034	Akaike info criterion	-10.64611
Sum squared resid	3.10E-05	Schwarz criterion	-10.03786
Log likelihood	249.2143	Hannan-Quinn criter.	-10.42054
F-statistic	0.933834	Durbin-Watson stat	1.914457
Prob(F-statistic)	0.536824		

Ramsey RESET Test
Equation: UNTITLED
Specification: RGDP RGDP(-1) OPNES OPNES(-1) INV INV(-1) INV(-2) INV(-3) HK HK(-1) HK(-2) FDI EXR EXR(-1) EXR(-2) C
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	1.623340	28	0.1157
F-statistic	2.635233	(1, 28)	0.1157

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	0.002111	1	0.002111
Restricted SSR	0.024537	29	0.000846
Unrestricted SSR	0.022426	28	0.000801

Unrestricted Test Equation:
Dependent Variable: RGDP
Method: ARDL
Date: 07/19/18 Time: 22:46
Sample: 1973 2016
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (4 lags, automatic):
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	-0.792197	0.835787	-0.947845	0.3513
OPNES	-0.007694	0.023517	-0.327174	0.7460
OPNES(-1)	-0.068016	0.062212	-1.093299	0.2836
INV	-0.055093	0.064136	-0.858998	0.3976
INV(-1)	0.013294	0.042729	0.311117	0.7580
INV(-2)	0.005753	0.022169	0.259524	0.7971
INV(-3)	-0.099423	0.107971	-0.920830	0.3650
HK	-0.351856	0.380437	-0.924874	0.3629
HK(-1)	-0.138929	0.224112	-0.619909	0.5403
HK(-2)	0.168295	0.292604	0.575165	0.5698
FDI	0.013832	0.018672	0.740770	0.4650
EXR	0.004913	0.009368	0.524449	0.6041
EXR(-1)	7.38E-05	0.002933	0.025152	0.9801
EXR(-2)	-0.027081	0.026399	-1.025821	0.3138
C	21.92202	10.38870	2.110179	0.0439
FITTED^2	0.050778	0.030763	1.650638	0.1100

R-squared	0.998214	Mean dependent var	23.51568
Adjusted R-squared	0.997256	S.D. dependent var	0.540307
S.E. of regression	0.028301	Akaike info criterion	-4.016576
Sum squared resid	0.022426	Schwarz criterion	-3.367780
Log likelihood	104.3647	Hannan-Quinn criter.	-3.775971
F-statistic	1043.012	Durbin-Watson stat	1.940449
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

C5: Nigeria

Dependent Variable: RGDP
Method: ARDL
Date: 07/19/18   Time: 22:25
Sample (adjusted): 1971 2016
Included observations: 46 after adjustments
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (4 lags, automatic): OPNES INV HK FDI EXR
Fixed regressors: C
Number of models evalulated: 12500
Selected Model: ARDL(1, 0, 0, 0, 0, 1)
Note: final equation sample is larger than selection sample
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	0.866631	0.051206	16.92448	0.0000
OPNES	-0.045591	0.024252	-1.879920	0.0678
INV	0.053325	0.014040	3.798031	0.0005
HK	-0.039950	0.020953	-1.906610	0.0642
FDI	-0.010986	0.011020	-0.996936	0.3251
EXR	-0.048866	0.034168	-1.430165	0.1608
EXR(-1)	0.106389	0.038110	2.791647	0.0082
C	3.123080	1.091449	2.861408	0.0068

R-squared	0.988475	Mean dependent var	25.87739
Adjusted R-squared	0.986351	S.D. dependent var	0.484756
S.E. of regression	0.056633	Akaike info criterion	-2.747692
Sum squared resid	0.121876	Schwarz criterion	-2.429668
Log likelihood	71.19692	Hannan-Quinn criter.	-2.628558
F-statistic	465.5795	Durbin-Watson stat	2.170786
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

ARDL Long Run Form and Bounds Test
Dependent Variable: D(RGDP)
Selected Model: ARDL(1, 0, 0, 0, 0, 1)
Case 2: Restricted Constant and No Trend
Date: 07/19/18 Time: 22:22
Sample: 1970 2016
Included observations: 46

Conditional Error Correction Regression

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	3.123080	1.204514	2.592813	0.0134
RGDP(-1)*	-0.133369	0.069832	-1.909847	0.0637
OPNES**	-0.045591	0.028989	-1.572686	0.1241
INV**	0.053325	0.029884	1.784399	0.0823
HK**	-0.039950	0.023513	-1.699028	0.0975
FDI**	-0.010986	0.011334	-0.969305	0.3385
EXR(-1)	0.057523	0.014645	3.927723	0.0003
D(EXR)	-0.048866	0.034705	-1.408030	0.1673

* p-value incompatible with t-Bounds distribution.
** Variable interpreted as Z = Z(-1) + D(Z).

Levels Equation
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
OPNES	-0.341842	0.165597	-2.064300	0.0459
INV	0.399834	0.160905	2.484904	0.0175
HK	-0.299543	0.241388	-1.240915	0.2222
FDI	-0.082376	0.098650	-0.835033	0.4089
EXR	0.431304	0.196676	2.192961	0.0345
C	23.41685	3.522370	6.648039	0.0000

EC = RGDP - (-0.3418*OPNES + 0.3998*INV -0.2995*HK -0.0824*FDI + 0.4313*EXR + 23.4168)

F-Bounds Test		Null Hypothesis: No levels relationship		
Test Statistic	Value	Signif.	I(0)	I(1)
			Asymptotic: n=1000	
F-statistic	6.635122	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15
			Finite Sample: n=50	
Actual Sample Size	46			
		10%	2.259	3.264

5%	2.67	3.781
1%	3.593	4.981
	Finite Sample: n=45	
10%	2.276	3.297
5%	2.694	3.829
1%	3.674	5.019

ARDL Error Correction Regression
Dependent Variable: D(RGDP)
Selected Model: ARDL(1, 0, 0, 0, 0, 1)
Case 2: Restricted Constant and No Trend
Date: 07/19/18   Time: 22:27
Sample: 1970 2016
Included observations: 46

ECM Regression
Case 2: Restricted Constant and No Trend

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(EXR)	-0.048866	0.026066	-1.874689	0.0685
CointEq(-1)*	-0.133369	0.018186	-7.333445	0.0000

R-squared	0.433740	Mean dependent var	0.035198
Adjusted R-squared	0.420871	S.D. dependent var	0.069158
S.E. of regression	0.052630	Akaike info criterion	-3.008562
Sum squared resid	0.121876	Schwarz criterion	-2.929056
Log likelihood	71.19692	Hannan-Quinn criter.	-2.978778
Durbin-Watson stat	2.170786		

* p-value incompatible with t-Bounds distribution.

F-Bounds Test   Null Hypothesis: No levels relationship

Test Statistic	Value	Signif.	I(0)	I(1)
F-statistic	6.635122	10%	2.08	3
K	5	5%	2.39	3.38
		2.5%	2.7	3.73
		1%	3.06	4.15

Breusch-Godfrey Serial Correlation LM Test:

F-statistic	1.800403	Prob. F(2,36)	0.1798
Obs*R-squared	4.182669	Prob. Chi-Square(2)	0.1235

Test Equation:
Dependent Variable: RESID
Method: ARDL
Date: 07/19/18 Time: 22:29
Sample: 1971 2016
Included observations: 46
Presample missing value lagged residuals set to zero.

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RGDP(-1)	0.065021	0.078290	0.830510	0.4117
OPNES	0.015372	0.029556	0.520101	0.6062
INV	-0.011709	0.030491	-0.383997	0.7032
HK	-0.013796	0.024374	-0.566027	0.5749
FDI	-0.003327	0.011258	-0.295509	0.7693
EXR	0.018764	0.035413	0.529866	0.5995
EXR(-1)	-0.021437	0.035301	-0.607263	0.5475
C	-1.156728	1.346647	-0.858969	0.3960
RESID(-1)	-0.205982	0.181786	-1.133102	0.2647
RESID(-2)	-0.318161	0.180021	-1.767360	0.0856

R-squared	0.090928	Mean dependent var	-3.31E-15
Adjusted R-squared	-0.136341	S.D. dependent var	0.052042
S.E. of regression	0.055476	Akaike info criterion	-2.756066
Sum squared resid	0.110794	Schwarz criterion	-2.358536
Log likelihood	73.38953	Hannan-Quinn criter.	-2.607149
F-statistic	0.400089	Durbin-Watson stat	1.991841
Prob(F-statistic)	0.926777		

Heteroskedasticity Test: Breusch-Pagan-Godfrey

F-statistic	0.326594	Prob. F(7,38)	0.9371
Obs*R-squared	2.610411	Prob. Chi-Square(7)	0.9186
Scaled explained SS	3.291861	Prob. Chi-Square(7)	0.8568

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 07/19/18 Time: 22:31
Sample: 1971 2016
Included observations: 46
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.049179	0.101619	0.483952	0.6312
RGDP(-1)	-0.001632	0.003687	-0.442775	0.6604
OPNES	-0.001483	0.003139	-0.472310	0.6394
INV	0.001055	0.001476	0.714735	0.4791
HK	-0.000340	0.001768	-0.192164	0.8486
FDI	-0.001178	0.001095	-1.075610	0.2889
EXR	-0.000425	0.001665	-0.255132	0.8000
EXR(-1)	0.001799	0.002775	0.648173	0.5208

R-squared	0.056748	Mean dependent var	0.002649
Adjusted R-squared	-0.117009	S.D. dependent var	0.005150
S.E. of regression	0.005443	Akaike info criterion	-7.432306
Sum squared resid	0.001126	Schwarz criterion	-7.114282
Log likelihood	178.9430	Hannan-Quinn criter.	-7.313173
F-statistic	0.326594	Durbin-Watson stat	2.386449
Prob(F-statistic)	0.937079		

Ramsey RESET Test
Equation: UNTITLED
Specification: RGDP RGDP(-1) OPNES INV HK FDI EXR EXR(-1) C
Omitted Variables: Squares of fitted values

	Value	Df	Probability
t-statistic	0.601274	37	0.5513
F-statistic	0.361531	(1, 37)	0.5513

F-test summary:

	Sum of Sq.	Df	Mean Squares
Test SSR	0.001179	1	0.001179
Restricted SSR	0.121876	38	0.003207
Unrestricted SSR	0.120696	37	0.003262

Unrestricted Test Equation:
Dependent Variable: RGDP
Method: ARDL
Date: 07/19/18 Time: 22:34
Sample: 1971 2016
Included observations: 46
Maximum dependent lags: 4 (Automatic selection)
Model selection method: Schwarz criterion (SIC)
Dynamic regressors (4 lags, automatic):
Fixed regressors: C
HAC standard errors & covariance (Bartlett kernel, Newey-West fixed
bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.*
RGDP(-1)	-1.665044	5.414767	-0.307501	0.7602
OPNES	0.105591	0.334343	0.315816	0.7539
INV	-0.102215	0.338150	-0.302276	0.7641
HK	0.074854	0.247196	0.302814	0.7637
FDI	0.019274	0.066545	0.289637	0.7737
EXR	0.089765	0.298503	0.300717	0.7653
EXR(-1)	-0.198401	0.657948	-0.301545	0.7647
C	32.05746	61.75205	0.519132	0.6068
FITTED^2	0.056019	0.120118	0.466366	0.6437

R-squared	0.988586	Mean dependent var	25.87739
Adjusted R-squared	0.986118	S.D. dependent var	0.484756
S.E. of regression	0.057114	Akaike info criterion	-2.713938
Sum squared resid	0.120696	Schwarz criterion	-2.356160
Log likelihood	71.42057	Hannan-Quinn criter.	-2.579912
F-statistic	400.5825	Durbin-Watson stat	2.172494
Prob(F-statistic)	0.000000		

*Note: p-values and any subsequent tests do not account for model selection.

Appendix 6: Vector Autoregression Estimates

A6: Cote d'Ivoire

Vector Autoregression Estimates
Date: 05/22/18 Time: 21:24
Sample (adjusted): 1972 2016
Included observations: 42 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	RGDP	OPNES	INV	HK	FDI	EXR
RGDP(-1)	1.252186	-0.814545	3.530083	0.157874	2.076912	-1.264734
	(0.21351)	(0.37895)	(1.61131)	(0.11455)	(3.04647)	(0.60151)
	[5.86467]	[-2.14948]	[2.19081]	[1.37818]	[0.68174]	[-2.10259]
RGDP(-2)	-0.540266	0.541988	-1.944812	0.018289	-2.273618	1.059521
	(0.21476)	(0.38116)	(1.62072)	(0.11522)	(3.06426)	(0.60502)
	[-2.51567]	[1.42193]	[-1.19997]	[0.15873]	[-0.74198]	[1.75121]
OPNES(-1)	-0.004212	0.667110	0.722712	0.037280	0.169261	-0.816777
	(0.12555)	(0.22284)	(0.94751)	(0.06736)	(1.79144)	(0.35371)
	[-0.03355]	[2.99371]	[0.76275]	[0.55344]	[0.09448]	[-2.30916]
OPNES(-2)	-0.022497	0.262644	0.111524	-0.083167	-0.278790	0.577354
	(0.14153)	(0.25120)	(1.06812)	(0.07594)	(2.01946)	(0.39873)
	[-0.15895]	[1.04556]	[0.10441]	[-1.09524]	[-0.13805]	[1.44797]
INV(-1)	0.013109	-0.026332	0.260099	-0.002550	0.125271	0.060011
	(0.03119)	(0.05535)	(0.23536)	(0.01673)	(0.44499)	(0.08786)
	[0.42033]	[-0.47572]	[1.10512]	[-0.15238]	[0.28152]	[0.68303]
INV(-2)	0.021723	-0.007960	0.102498	-0.001899	-0.302595	-0.004737
	(0.03044)	(0.05403)	(0.22975)	(0.01633)	(0.43438)	(0.08577)
	[0.71355]	[-0.14731]	[0.44613]	[-0.11624]	[-0.69661]	[-0.05523]
HK(-1)	0.299614	0.879912	1.505752	1.054330	4.000741	-0.410470
	(0.40528)	(0.71930)	(3.05849)	(0.21744)	(5.78261)	(1.14175)
	[0.73928]	[1.22329]	[0.49232]	[4.84892]	[0.69186]	[-0.35951]
HK(-2)	-0.217067	-0.828979	-1.499045	-0.126530	-3.147023	0.448293
	(0.37823)	(0.67130)	(2.85441)	(0.20293)	(5.39676)	(1.06556)
	[-0.57390]	[-1.23488]	[-0.52517]	[-0.62352]	[-0.58313]	[0.42071]
FDI(-1)	-0.006037	0.023152	0.052023	0.012272	0.182374	-0.011342
	(0.01354)	(0.02403)	(0.10216)	(0.00726)	(0.19314)	(0.03814)
	[-0.44601]	[0.96364]	[0.50925]	[1.68976]	[0.94424]	[-0.29743]
FDI(-2)	-0.000932	0.012029	0.027320	0.004791	0.162237	0.095276
	(0.01271)	(0.02255)	(0.09590)	(0.00682)	(0.18131)	(0.03580)
	[-0.07337]	[0.53337]	[0.28489]	[0.70276]	[0.89479]	[2.66138]
EXR(-1)	0.029204	0.136884	-0.308949	-0.055428	0.193803	1.201427
	(0.06903)	(0.12252)	(0.52095)	(0.03704)	(0.98494)	(0.19447)
	[0.42306]	[1.11726]	[-0.59305]	[-1.49662]	[0.19677]	[6.17789]
EXR(-2)	-0.006981	-0.133320	-0.289313	0.031246	0.304717	-0.427425
	(0.07300)	(0.12956)	(0.55090)	(0.03916)	(1.04157)	(0.20565)
	[-0.09563]	[-1.02901]	[-0.52517]	[0.79780]	[0.29255]	[-2.07838]

C	4.969028	6.002076	-25.75541	-2.923923	5.214605	4.009974
	(3.36718)	(5.97618)	(25.4110)	(1.80654)	(48.0439)	(9.48604)
	[1.47572]	[1.00433]	[-1.01355]	[-1.61853]	[0.10854]	[0.42272]
R-squared	0.974220	0.813122	0.815868	0.999173	0.751623	0.915249
Adj. R-squared	0.963553	0.735793	0.739676	0.998831	0.648847	0.880179
Sum sq. resids	0.059819	0.188432	3.406827	0.017219	12.17824	0.474764
S.E. equation	0.045417	0.080608	0.342749	0.024367	0.648027	0.127950
F-statistic	91.32614	10.51510	10.70798	2919.580	7.313186	26.09815
Log likelihood	78.04068	53.94501	-6.845765	104.1926	-33.59702	34.53934
Akaike AIC	-3.097175	-1.949762	0.945036	-4.342504	2.218906	-1.025683
Schwarz SC	-2.559325	-1.411912	1.482887	-3.804654	2.756756	-0.487833
Mean dependent	23.72952	4.298571	21.23310	14.98643	18.75643	6.015238
S.D. dependent	0.237897	0.156822	0.671767	0.712590	1.093566	0.369636

Determinant resid covariance (dof adj.)	1.53E-12
Determinant resid covariance	1.66E-13
Log likelihood	260.4156
Akaike information criterion	-8.686457
Schwarz criterion	-5.459356
Number of coefficients	78

B6: Ghana

Vector Autoregression Estimates
Date: 05/19/18 Time: 21:09
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	RGDP	OPNES	INV	HK	FDI	EXR
RGDP(-1)	0.838366	-0.003462	0.790662	-0.233951	1.338937	-0.464759
	(0.18582)	(0.57288)	(0.45555)	(0.15912)	(2.14397)	(0.70685)
	[4.51163]	[-0.00604]	[1.73563]	[-1.47032]	[0.62451]	[-0.65750]
RGDP(-2)	0.150897	0.349224	1.647621	0.282779	0.275437	0.436471
	(0.18326)	(0.56498)	(0.44927)	(0.15692)	(2.11440)	(0.69711)
	[0.82340]	[0.61812]	[3.66737]	[1.80205]	[0.13027]	[0.62612]
OPNES(-1)	0.016870	0.384268	0.241529	0.018023	-0.095914	-0.209712
	(0.05291)	(0.16312)	(0.12971)	(0.04531)	(0.61048)	(0.20127)
	[0.31883]	[2.35571]	[1.86202]	[0.39780]	[-0.15711]	[-1.04194]
OPNES(-2)	-0.071155	0.410463	0.179452	0.121718	-0.224133	0.352986
	(0.04976)	(0.15342)	(0.12200)	(0.04261)	(0.57416)	(0.18930)
	[-1.42985]	[2.67546]	[1.47096]	[2.85647]	[-0.39037]	[1.86472]
INV(-1)	0.023025	-0.194096	-0.038753	0.011861	0.020309	-0.075470
	(0.03750)	(0.11561)	(0.09193)	(0.03211)	(0.43265)	(0.14264)
	[0.61403]	[-1.67895]	[-0.42155]	[0.36940]	[0.04694]	[-0.52909]
INV(-2)	-0.031098	-0.244685	-0.345852	0.061700	-0.405078	0.029801
	(0.03443)	(0.10613)	(0.08439)	(0.02948)	(0.39718)	(0.13095)
	[-0.90334]	[-2.30553]	[-4.09810]	[2.09316]	[-1.01988]	[0.22757]
HK(-1)	0.200949	-0.335314	1.258818	1.145179	0.071714	-1.920966
	(0.15785)	(0.48663)	(0.38696)	(0.13516)	(1.82117)	(0.60043)
	[1.27307]	[-0.68906]	[3.25309]	[8.47285]	[0.03938]	[-3.19932]
HK(-2)	-0.271913	0.098127	-1.700765	-0.190634	-0.553359	2.159456
	(0.15941)	(0.49146)	(0.39081)	(0.13650)	(1.83927)	(0.60640)
	[-1.70570]	[0.19966]	[-4.35195]	[-1.39657]	[-0.30086]	[3.56113]
FDI(-1)	-0.018093	-0.021289	0.031387	-0.004153	0.625515	0.081667
	(0.01514)	(0.04667)	(0.03711)	(0.01296)	(0.17465)	(0.05758)
	[-1.19526]	[-0.45620]	[0.84581]	[-0.32044]	[3.58160]	[1.41832]
FDI(-2)	-4.42E-05	0.030030	0.001864	-0.006814	-0.062306	-0.046734
	(0.01495)	(0.04610)	(0.03666)	(0.01280)	(0.17252)	(0.05688)
	[-0.00296]	[0.65143]	[0.05086]	[-0.53219]	[-0.36115]	[-0.82162]
EXR(-1)	0.034065	-0.009313	-0.062991	0.017181	0.096156	0.802226
	(0.04012)	(0.12368)	(0.09835)	(0.03435)	(0.46287)	(0.15261)
	[0.84910]	[-0.07530]	[-0.64047]	[0.50015]	[0.20774]	[5.25683]
EXR(-2)	0.030562	0.015778	-0.170172	-0.019168	0.251450	0.029426
	(0.04251)	(0.13105)	(0.10421)	(0.03640)	(0.49045)	(0.16170)
	[0.71896]	[0.12040]	[-1.63297]	[-0.52662]	[0.51269]	[0.18198]
C	2.078500	6.270505	-23.99186	-2.518185	-15.88974	-2.676832
	(1.43198)	(4.41467)	(3.51051)	(1.22616)	(16.5217)	(5.44711)
	[1.45149]	[1.42038]	[-6.83429]	[-2.05371]	[-0.96175]	[-0.49142]

R-squared	0.988448	0.825340	0.952329	0.997866	0.931780	0.992659
Adj. R-squared	0.984115	0.759843	0.934452	0.997066	0.906198	0.989906
Sum sq. resids	0.119018	1.131188	0.715284	0.087264	15.84336	1.722148
S.E. equation	0.060986	0.188015	0.149508	0.052221	0.703637	0.231985
F-statistic	228.1659	12.60111	53.27206	1247.073	36.42274	360.5827
Log likelihood	69.68852	19.02414	29.33687	76.67114	-40.36421	9.567300
Akaike AIC	-2.519490	-0.267740	-0.726083	-2.829828	2.371743	0.152564
Schwarz SC	-1.997565	0.254185	-0.204159	-2.307904	2.893667	0.674489
Mean dependent	25.88885	3.808407	24.04090	17.06785	18.26974	2.539380
S.D. dependent	0.483887	0.383658	0.583962	0.964086	2.297431	2.309016

Determinant resid covariance (dof adj.)	1.68E-10
Determinant resid covariance	2.17E-11
Log likelihood	169.3023
Akaike information criterion	-4.057881
Schwarz criterion	-0.926333
Number of coefficients	78

C6: **Nigeria**

Vector Autoregression Estimates
Date: 05/19/18   Time: 20:54
Sample (adjusted): 1972 2016
Included observations: 45 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	RGDP	OPNES	INV	HK	FDI	EXR
RGDP(-1)	0.838366	-0.003462	0.790662	-0.233951	1.338937	-0.464759
	(0.18582)	(0.57288)	(0.45555)	(0.15912)	(2.14397)	(0.70685)
	[4.51163]	[-0.00604]	[1.73563]	[-1.47032]	[0.62451]	[-0.65750]
RGDP(-2)	F 0.150897	0.349224	1.647621	0.282779	0.275437	0.436471
	(0.18326)	(0.56498)	(0.44927)	(0.15692)	(2.11440)	(0.69711)
	[0.82340]	[0.61812]	[3.66737]	[1.80205]	[0.13027]	[0.62612]
OPNES(-1)	0.016870	0.384268	0.241529	0.018023	-0.095914	-0.209712
	(0.05291)	(0.16312)	(0.12971)	(0.04531)	(0.61048)	(0.20127)
	[0.31883]	[2.35571]	[1.86202]	[0.39780]	[-0.15711]	[-1.04194]
OPNES(-2)	-0.071155	0.410463	0.179452	0.121718	-0.224133	0.352986
	(0.04976)	(0.15342)	(0.12200)	(0.04261)	(0.57416)	(0.18930)
	[-1.42985]	[2.67546]	[1.47096]	[2.85647]	[-0.39037]	[1.86472]
INV(-1)	0.023025	-0.194096	-0.038753	0.011861	0.020309	-0.075470
	(0.03750)	(0.11561)	(0.09193)	(0.03211)	(0.43265)	(0.14264)
	[0.61403]	[-1.67895]	[-0.42155]	[0.36940]	[0.04694]	[-0.52909]
INV(-2)	-0.031098	-0.244685	-0.345852	0.061700	-0.405078	0.029801
	(0.03443)	(0.10613)	(0.08439)	(0.02948)	(0.39718)	(0.13095)
	[-0.90334]	[-2.30553]	[-4.09810]	[2.09316]	[-1.01988]	[0.22757]
HK(-1)	0.200949	-0.335314	1.258818	1.145179	0.071714	-1.920966
	(0.15785)	(0.48663)	(0.38696)	(0.13516)	(1.82117)	(0.60043)
	[1.27307]	[-0.68906]	[3.25309]	[8.47285]	[0.03938]	[-3.19932]
HK(-2)	-0.271913	0.098127	-1.700765	-0.190634	-0.553359	2.159456
	(0.15941)	(0.49146)	(0.39081)	(0.13650)	(1.83927)	(0.60640)
	[-1.70570]	[0.19966]	[-4.35195]	[-1.39657]	[-0.30086]	[3.56113]
FDI(-1)	-0.018093	-0.021289	0.031387	-0.004153	0.625515	0.081667
	(0.01514)	(0.04667)	(0.03711)	(0.01296)	(0.17465)	(0.05758)
	[-1.19526]	[-0.45620]	[0.84581]	[-0.32044]	[3.58160]	[1.41832]
FDI(-2)	-4.42E-05	0.030030	0.001864	-0.006814	-0.062306	-0.046734
	(0.01495)	(0.04610)	(0.03666)	(0.01280)	(0.17252)	(0.05688)
	[-0.00296]	[0.65143]	[0.05086]	[-0.53219]	[-0.36115]	[-0.82162]
EXR(-1)	0.034065	-0.009313	-0.062991	0.017181	0.096156	0.802226
	(0.04012)	(0.12368)	(0.09835)	(0.03435)	(0.46287)	(0.15261)
	[0.84910]	[-0.07530]	[-0.64047]	[0.50015]	[0.20774]	[5.25683]
EXR(-2)	0.030562	0.015778	-0.170172	-0.019168	0.251450	0.029426
	(0.04251)	(0.13105)	(0.10421)	(0.03640)	(0.49045)	(0.16170)
	[0.71896]	[0.12040]	[-1.63297]	[-0.52662]	[0.51269]	[0.18198]
C	2.078500	6.270505	-23.99186	-2.518185	-15.88974	-2.676832
	(1.43198)	(4.41467)	(3.51051)	(1.22616)	(16.5217)	(5.44711)
	[1.45149]	[1.42038]	[-6.83429]	[-2.05371]	[-0.96175]	[-0.49142]

R-squared	0.988448	0.825340	0.952329	0.997866	0.931780	0.992659
Adj. R-squared	0.984115	0.759843	0.934452	0.997066	0.906198	0.989906
Sum sq. resids	0.119018	1.131188	0.715284	0.087264	15.84336	1.722148
S.E. equation	0.060986	0.188015	0.149508	0.052221	0.703637	0.231985
F-statistic	228.1659	12.60111	53.27206	1247.073	36.42274	360.5827
Log likelihood	69.68852	19.02414	29.33687	76.67114	-40.36421	9.567300
Akaike AIC	-2.519490	-0.267740	-0.726083	-2.829828	2.371743	0.152564
Schwarz SC	-1.997565	0.254185	-0.204159	-2.307904	2.893667	0.674489
Mean dependent	25.88885	3.808407	24.04090	17.06785	18.26974	2.539380
S.D. dependent	0.483887	0.383658	0.583962	0.964086	2.297431	2.309016

Determinant resid covariance (dof adj.)	1.68E-10
Determinant resid covariance	2.17E-11
Log likelihood	169.3023
Akaike information criterion	-4.057881
Schwarz criterion	-0.926333
Number of coefficients	78

Appendix 7: VAR Lag Order Selection Criteria

Cote d'Ivoire

VAR Lag Order Selection Criteria
Endogenous variables: RGDP OPNES INV HK FDI EXR
Exogenous variables: C
Date: 08/24/18 Time: 20:00
Sample: 1970 2016
Included observations: 44

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-16.47570	NA	1.12e-07	1.021623	1.264921	1.111850
1	240.5806	432.3220	4.92e-12*	-9.026392	-7.323302*	-8.394804*
2	269.5644	40.84083	7.43e-12	-8.707474	-5.544592	-7.534525
3	316.2744	53.07954*	5.89e-12	-9.194292*	-4.571619	-7.479982

* 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

Ghana

VAR Lag Order Selection Criteria
Endogenous variables: RGDP OPNES INV HK FDI EXR
Exogenous variables: C
Date: 08/24/18 Time: 19:57
Sample: 1970 2016
Included observations: 44

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-116.2836	NA	1.05e-05	5.558345	5.801643	5.648572
1	128.3042	411.3522	8.10e-10	-3.922920	-2.219829*	-3.291332*
2	160.8873	45.91255	1.04e-09	-3.767606	-0.604724	-2.594657
3	212.1713	58.27723*	6.69e-10*	-4.462332*	0.160341	-2.748022

* 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

Nigeria

VAR Lag Order Selection Criteria
Endogenous variables: RGDP OPNES INV HK FDI EXR
Exogenous variables: C
Date: 08/24/18 Time: 19:36
Sample: 1970 2016
Included observations: 44

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-179.8791	NA	0.000188	8.449052	8.692350	8.539278
1	123.2116	509.7436	1.02e-09	-3.691438	-1.988348*	-3.059850*
2	170.9548	67.27444*	6.57e-10*	-4.225218*	-1.062336	-3.052269
3	198.7403	31.57444	1.23e-09	-3.851831	0.770842	-2.137521

* 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 8: VAR Granger Causality/Block Exogeneity Test

A8: Cote d'Ivoire

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/16/18 Time: 15:20
Sample: 1970 2016
Included observations: 45

Dependent variable: RGDP

Excluded	Chi-sq	df	Prob.
OPNES	0.054225	2	0.9733
INV	0.586954	2	0.7457
HK	2.346207	2	0.3094
FDI	0.021072	2	0.9895
EXR	0.053390	2	0.9737
All	3.536792	10	0.9658

Dependent variable: OPNES

Excluded	Chi-sq	df	Prob.
RGDP	5.368760	2	0.0683
INV	0.145165	2	0.9300
HK	5.023393	2	0.0811
FDI	1.214875	2	0.5447
EXR	1.275511	2	0.5285
All	20.30829	10	0.0265

Dependent variable: INV

Excluded	Chi-sq	df	Prob.
RGDP	5.572767	2	0.0616
OPNES	3.792686	2	0.1501
HK	0.314513	2	0.8545
FDI	0.553821	2	0.7581
EXR	3.748012	2	0.1535
All	12.25369	10	0.2684

Dependent variable: HK

Excluded	Chi-sq	df	Prob.
RGDP	5.340383	2	0.0692
OPNES	0.219879	2	0.8959
INV	0.530837	2	0.7669
FDI	4.887643	2	0.0868
EXR	2.783230	2	0.2487
All	14.52086	10	0.1505

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
RGDP	0.826205	2	0.6616
OPNES	0.426971	2	0.8078
INV	0.532168	2	0.7664
HK	1.113423	2	0.5731
EXR	0.110848	2	0.9461
All	9.697385	10	0.4674

Dependent variable: EXR

Excluded	Chi-sq	df	Prob.
RGDP	4.837381	2	0.0890
OPNES	9.717991	2	0.0078
INV	0.578882	2	0.7487
HK	0.383985	2	0.8253
FDI	7.260816	2	0.0265
All	23.95910	10	0.0077

B8: Ghana

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/16/18 Time: 14:25
Sample: 1970 2016
Included observations: 45

Dependent variable: RGDP

Excluded	Chi-sq	df	Prob.
OPNES	7.843898	2	0.0198
INV	0.605196	2	0.7389
HK	7.258769	2	0.0265
FDI	2.095574	2	0.3507
EXR	1.670443	2	0.4338
All	25.81415	10	0.0040

Dependent variable: OPNES

Excluded	Chi-sq	df	Prob.
RGDP	1.854799	2	0.3956
INV	4.657163	2	0.0974
HK	1.852652	2	0.3960
FDI	7.638387	2	0.0219
EXR	7.345518	2	0.0254
All	17.70298	10	0.0602

Dependent variable: INV

Excluded	Chi-sq	df	Prob.
RGDP	0.386589	2	0.8242
OPNES	5.870964	2	0.0531
HK	2.719655	2	0.2567
FDI	0.241635	2	0.8862
EXR	0.262031	2	0.8772
All	18.53745	10	0.0465

Dependent variable: HK

Excluded	Chi-sq	Df	Prob.
RGDP	0.858841	2	0.6509
OPNES	0.141158	2	0.9319
INV	1.278155	2	0.5278
FDI	2.736455	2	0.2546
EXR	1.148389	2	0.5632
All	4.723122	10	0.9089

Dependent variable: FDI

Excluded	Chi-sq	Df	Prob.
RGDP	1.117251	2	0.5720
OPNES	0.555494	2	0.7575
INV	7.500903	2	0.0235
HK	3.446109	2	0.1785
EXR	0.438846	2	0.8030
All	29.92425	10	0.0009

Dependent variable: EXR

Excluded	Chi-sq	Df	Prob.
RGDP	19.72604	2	0.0001
OPNES	9.424954	2	0.0090
INV	1.369637	2	0.5042
HK	10.57855	2	0.0050
FDI	4.678073	2	0.0964
All	58.65995	10	0.0000

C8: Nigeria

VAR Granger Causality/Block Exogeneity Wald Tests
Date: 05/16/18 Time: 14:31
Sample: 1970 2016
Included observations: 45

Dependent variable: RGDP

Excluded	Chi-sq	df	Prob.
OPNES	2.826024	2	0.2434
INV	0.958293	2	0.6193
HK	7.953232	2	0.0187
FDI	2.231898	2	0.3276
EXR	10.17147	2	0.0062
All	21.22645	10	0.0196

Dependent variable: OPNES

Excluded	Chi-sq	df	Prob.
RGDP	2.012789	2	0.3655
INV	11.42508	2	0.0033
HK	7.494659	2	0.0236
FDI	0.444761	2	0.8006
EXR	0.006747	2	0.9966
All	31.55495	10	0.0005

Dependent variable: INV

Excluded	Chi-sq	df	Prob.
RGDP	148.4183	2	0.0000
OPNES	17.12241	2	0.0002
HK	51.74285	2	0.0000
FDI	1.139001	2	0.5658
EXR	21.25171	2	0.0000
All	202.0644	10	0.0000

Dependent variable: HK

Excluded	Chi-sq	df	Prob.
RGDP	3.390501	2	0.1836
OPNES	17.95957	2	0.0001
INV	5.354169	2	0.0688
FDI	0.840778	2	0.6568
EXR	0.251613	2	0.8818
All	30.41013	10	0.0007

Dependent variable: FDI

Excluded	Chi-sq	df	Prob.
RGDP	2.928859	2	0.2312
OPNES	0.452229	2	0.7976
INV	1.099006	2	0.5772
HK	2.062410	2	0.3566
EXR	2.066016	2	0.3559
All	14.45299	10	0.1533

Dependent variable: EXR

Excluded	Chi-sq	df	Prob.
RGDP	0.268731	2	0.8743
OPNES	3.215031	2	0.2004
INV	0.219599	2	0.8960
HK	15.33202	2	0.0005
FDI	1.892367	2	0.3882
All	28.09810	10	0.0017

Appendix 9: VEC Estimates

A9: Cote d'Ivoire

Vector Error Correction Estimates
Date: 06/06/18 Time: 21:26
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
RGDP(-1)	1.000000
OPNES(-1)	-0.332130 (0.08793) [-3.77735]
INV(-1)	0.077202 (0.03159) [2.44392]
HK(-1)	-0.380230 (0.03677) [-10.3400]
FDI(-1)	0.130243 (0.02358) [5.52292]
EXR(-1)	-0.345099 (0.05217) [-6.61514]
C	-18.60740

Error Correction:	D(RGDP)	D(OPNES)	D(INV)	D(HK)	D(FDI)	D(EXR)
CointEq1	-0.008706 (0.09384) [-0.09278]	-0.164147 (0.18586) [-0.88317]	-1.116822 (0.71892) [-1.55348]	0.187820 (0.04516) [4.15902]	-0.011568 (1.40617) [-0.00823]	0.698402 (0.25423) [2.74714]
D(RGDP(-1))	0.370257 (0.20992) [1.76381]	-0.451709 (0.41579) [-1.08639]	2.639323 (1.60827) [1.64109]	-0.091770 (0.10103) [-0.90838]	0.285814 (3.14571) [0.09086]	-1.164063 (0.56873) [-2.04678]
D(RGDP(-2))	-0.033333 (0.22465) [-0.14838]	0.141518 (0.44497) [0.31804]	1.007138 (1.72117) [0.58515]	0.137801 (0.10812) [1.27454]	1.095799 (3.36653) [0.32550]	-0.777045 (0.60865) [-1.27667]
D(OPNES(-1))	0.089876 (0.13350) [0.67322]	-0.180970 (0.26443) [-0.68438]	0.070789 (1.02281) [0.06921]	0.209810 (0.06425) [3.26558]	0.263284 (2.00057) [0.13160]	-0.322523 (0.36169) [-0.89171]
D(OPNES(-2))	0.009489 (0.11677) [0.08126]	0.205904 (0.23130) [0.89022]	-0.166550 (0.89465) [-0.18616]	0.060089 (0.05620) [1.06923]	2.178256 (1.74990) [1.24479]	0.603040 (0.31637) [1.90610]
D(INV(-1))	0.014729 (0.02810) [0.52417]	-0.009342 (0.05566) [-0.16785]	-0.271504 (0.21529) [-1.26111]	-0.013207 (0.01352) [-0.97656]	0.095191 (0.42110) [0.22605]	-0.007969 (0.07613) [-0.10468]

D(INV(-2))	0.040422	-0.017533	0.100305	-0.010709	-0.123170	0.005012
	(0.02760)	(0.05466)	(0.21143)	(0.01328)	(0.41355)	(0.07477)
	[1.46474]	[-0.32077]	[0.47441]	[-0.80629]	[-0.29784]	[0.06703]
D(HK(-1))	0.134384	1.464152	1.887539	0.171630	-2.609855	-0.352508
	(0.29544)	(0.58518)	(2.26349)	(0.14218)	(4.42729)	(0.80043)
	[0.45486]	[2.50205]	[0.83391]	[1.20710]	[-0.58949]	[-0.44040]
D(HK(-2))	-0.341221	-0.081151	1.727162	-0.469682	-2.158249	-1.008697
	(0.34943)	(0.69212)	(2.67714)	(0.16817)	(5.23638)	(0.94671)
	[-0.97650]	[-0.11725]	[0.64515]	[-2.79292]	[-0.41216]	[-1.06548]
D(FDI(-1))	-0.010670	0.011942	0.158862	-0.016081	-0.549341	-0.126389
	(0.01477)	(0.02925)	(0.11312)	(0.00711)	(0.22126)	(0.04000)
	[-0.72264]	[0.40833]	[1.40433]	[-2.26300]	[-2.48275]	[-3.15946]
D(FDI(-2))	-0.018303	-0.007177	0.129220	-0.015577	-0.143084	-0.048952
	(0.01331)	(0.02636)	(0.10197)	(0.00641)	(0.19945)	(0.03606)
	[-1.37521]	[-0.27225]	[1.26724]	[-2.43189]	[-0.71740]	[-1.35753]
D(EXR(-1))	-0.000908	0.070653	-0.217777	-0.039740	0.368393	0.343559
	(0.06842)	(0.13553)	(0.52422)	(0.03293)	(1.02535)	(0.18538)
	[-0.01327]	[0.52132]	[-0.41543]	[-1.20681]	[0.35928]	[1.85328]
D(EXR(-2))	0.041431	-0.156402	-0.517170	0.006454	0.246542	-0.067129
	(0.06318)	(0.12514)	(0.48406)	(0.03041)	(0.94681)	(0.17118)
	[0.65573]	[-1.24977]	[-1.06840]	[0.21224]	[0.26039]	[-0.39216]
C	0.028251	-0.081205	-0.249481	0.084507	0.344525	0.161019
	(0.03195)	(0.06328)	(0.24478)	(0.01538)	(0.47877)	(0.08656)
	[0.88424]	[-1.28323]	[-1.01922]	[5.49607]	[0.71960]	[1.86022]
R-squared	0.304233	0.310194	0.257895	0.647712	0.343321	0.486759
Adj. R-squared	0.002734	0.011278	-0.063683	0.495054	0.058760	0.264355
Sum sq. resids	0.064118	0.251547	3.763528	0.014851	14.39841	0.470637
S.E. equation	0.046231	0.091569	0.354191	0.022249	0.692782	0.125251
F-statistic	1.009069	1.037729	0.801967	4.242893	1.206492	2.188624
Log likelihood	81.25351	51.18162	-8.338973	113.4327	-37.85772	37.39958
Akaike AIC	-3.056978	-1.690074	1.015408	-4.519668	2.357169	-1.063617
Schwarz SC	-2.489281	-1.122377	1.583105	-3.951971	2.924866	-0.495920
Mean dependent	0.026818	-0.004091	0.067500	0.063182	0.050227	0.019545
S.D. dependent	0.046294	0.092090	0.343424	0.031310	0.714079	0.146032

Determinant resid covariance (dof adj.)	1.39E-12
Determinant resid covariance	1.39E-13
Log likelihood	276.6613
Akaike information criterion	-8.484604
Schwarz criterion	-4.835125
Number of coefficients	90

B9: Ghana

Vector Error Correction Estimates
Date: 05/16/18 Time: 14:19
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
RGDP(-1)	1.000000
OPNES(-1)	-0.229364 (0.03100) [-7.39815]
INV(-1)	0.175514 (0.07328) [2.39522]
HK(-1)	-1.108989 (0.14272) [-7.77055]
FDI(-1)	-0.107311 (0.02021) [-5.31066]
EXR(-1)	0.073514 (0.01505) [4.88549]
C	-6.848402

Error Correction:	D(RGDP)	D(OPNES)	D(INV)	D(HK)	D(FDI)	D(EXR)
CointEq1	-0.257134 (0.06726) [-3.82281]	-0.928462 (0.35543) [-2.61223]	-0.294702 (0.44153) [-0.66746]	0.038950 (0.08423) [0.46243]	1.179347 (1.31858) [0.89441]	-2.533096 (1.09641) [-2.31036]
D(RGDP(-1))	0.070071 (0.16496) [0.42479]	1.514116 (0.87165) [1.73707]	1.050607 (1.08280) [0.97027]	-0.071249 (0.20656) [-0.34492]	0.671666 (3.23366) [0.20771]	-0.390233 (2.68882) [-0.14513]
D(RGDP(-2))	0.025783 (0.14630) [0.17624]	-0.541002 (0.77307) [-0.69981]	-0.753932 (0.96033) [-0.78507]	0.191060 (0.18320) [1.04289]	2.660431 (2.86794) [0.92765]	5.861938 (2.38472) [2.45813]
D(OPNES(-1))	0.002188 (0.03653) [0.05990]	0.160171 (0.19304) [0.82975]	0.525076 (0.23980) [2.18967]	0.012961 (0.04575) [0.28333]	0.441884 (0.71613) [0.61704]	-1.182400 (0.59547) [-1.98566]
D(OPNES(-2))	-0.063679 (0.03649) [-1.74499]	-0.670469 (0.19283) [-3.47695]	-0.481814 (0.23954) [-2.01138]	-0.013380 (0.04570) [-0.29278]	0.730433 (0.71537) [1.02105]	-1.332843 (0.59484) [-2.24068]
D(INV(-1))	0.035938 (0.02972) [1.20933]	0.062643 (0.15703) [0.39893]	-0.073963 (0.19507) [-0.37917]	-5.33E-05 (0.03721) [-0.00143]	0.743481 (0.58255) [1.27626]	-0.061800 (0.48439) [-0.12758]
D(INV(-2))	0.017422	-0.043835	0.177394	0.009257	-0.196818	-0.371263

	(0.02984)	(0.15767)	(0.19587)	(0.03737)	(0.58494)	(0.48638)
	[0.58388]	[-0.27801]	[0.90569]	[0.24775]	[-0.33648]	[-0.76332]
D(HK(-1))	0.267923	-1.448553	1.230024	-0.007363	4.359618	-1.388170
	(0.14380)	(0.75985)	(0.94391)	(0.18007)	(2.81889)	(2.34393)
	[1.86320]	[-1.90638]	[1.30312]	[-0.04089]	[1.54657]	[-0.59224]
D(HK(-2))	0.064945	-0.453262	-0.263746	0.257644	1.637871	-2.545474
	(0.14015)	(0.74055)	(0.91994)	(0.17550)	(2.74731)	(2.28441)
	[0.46341]	[-0.61206]	[-0.28670]	[1.46809]	[0.59617]	[-1.11428]
D(FDI(-1))	-0.029992	-0.056629	-0.084127	0.003038	-0.079690	-0.104029
	(0.01210)	(0.06393)	(0.07941)	(0.01515)	(0.23715)	(0.19720)
	[-2.47915]	[-0.88585]	[-1.05938]	[0.20055]	[-0.33603]	[-0.52754]
D(FDI(-2))	-0.026333	-0.089175	-0.050642	-0.002613	0.090839	0.055114
	(0.01148)	(0.06068)	(0.07538)	(0.01438)	(0.22511)	(0.18718)
	[-2.29311]	[-1.46957]	[-0.67182]	[-0.18171]	[0.40352]	[0.29444]
D(EXR(-1))	-0.002126	-0.114211	-0.055983	0.003855	0.085045	-0.077337
	(0.00822)	(0.04342)	(0.05393)	(0.01029)	(0.16106)	(0.13393)
	[-0.25878]	[-2.63064]	[-1.03803]	[0.37464]	[0.52802]	[-0.57746]
D(EXR(-2))	0.002549	-0.031789	0.060667	1.93E-05	0.075619	-0.166235
	(0.00803)	(0.04241)	(0.05268)	(0.01005)	(0.15733)	(0.13082)
	[0.31761]	[-0.74958]	[1.15155]	[0.00192]	[0.48064]	[-1.27070]
C	0.023425	0.074972	0.045417	0.023387	-0.294234	0.070142
	(0.00935)	(0.04943)	(0.06140)	(0.01171)	(0.18337)	(0.15247)
	[2.50423]	[1.51679]	[0.73968]	[1.99656]	[-1.60461]	[0.46003]
R-squared	0.572075	0.527835	0.444007	0.213152	0.357338	0.565772
Adj. R-squared	0.386641	0.323230	0.203077	-0.127815	0.078851	0.377606
Sum sq. resids	0.038423	1.072849	1.655569	0.060251	14.76534	10.20886
S.E. equation	0.035788	0.189107	0.234916	0.044815	0.701554	0.583348
F-statistic	3.085061	2.579779	1.842886	0.625139	1.283141	3.006778
Log likelihood	92.51918	19.27189	9.727693	82.62204	-38.41134	-30.29276
Akaike AIC	-3.569054	-0.239631	0.194196	-3.119184	2.382334	2.013307
Schwarz SC	-3.001357	0.328065	0.761892	-2.551487	2.950030	2.581004
Mean dependent	0.036591	0.020455	0.089318	0.037727	0.099318	0.030909
S.D. dependent	0.045696	0.229873	0.263151	0.042199	0.730964	0.739427

Determinant resid covariance (dof adj.)	2.42E-10
Determinant resid covariance	2.43E-11
Log likelihood	163.0803
Akaike information criterion	-3.321830
Schwarz criterion	0.327649
Number of coefficients	90

C9: Nigeria

Vector Error Correction Estimates
Date: 05/16/18 Time: 08:03
Sample (adjusted): 1973 2016
Included observations: 44 after adjustments
Standard errors in ( ) & t-statistics in [ ]

Cointegrating Eq:	CointEq1
RGDP(-1)	1.000000
OPNES(-1)	0.004375 (0.05112) [0.08559]
INV(-1)	-0.641920 (0.04091) [-15.6920]
HK(-1)	-0.215310 (0.03181) [-6.76810]
FDI(-1)	0.011029 (0.01553) [0.71017]
EXR(-1)	-0.062250 (0.02458) [-2.53259]
C	-6.838905

Error Correction:	D(RGDP)	D(OPNES)	D(INV)	D(HK)	D(FDI)	D(EXR)
CointEq1	-0.121906 (0.16998) [-0.71720]	1.333386 (0.57048) [2.33731]	1.658518 (0.33175) [4.99927]	-0.180817 (0.16853) [-1.07288]	4.026684 (2.05385) [1.96055]	-0.348668 (0.70415) [-0.49516]
D(RGDP(-1))	0.252438 (0.24989) [1.01019]	-1.262429 (0.83869) [-1.50523]	-0.939126 (0.48773) [-1.92551]	-0.000190 (0.24777) [-0.00077]	-2.538356 (3.01949) [-0.84066]	-0.924501 (1.03522) [-0.89305]
D(RGDP(-2))	-0.089063 (0.21490) [-0.41445]	-0.032273 (0.72124) [-0.04475]	0.271119 (0.41943) [0.64640]	0.470143 (0.21307) [2.20649]	-1.724985 (2.59663) [-0.66432]	-0.559843 (0.89024) [-0.62887]
D(OPNES(-1))	0.012668 (0.05133) [0.24680]	-0.277425 (0.17227) [-1.61044]	0.186898 (0.10018) [1.86565]	0.037864 (0.05089) [0.74402]	-0.365350 (0.62020) [-0.58909]	-0.234307 (0.21263) [-1.10194]
D(OPNES(-2))	-0.095897 (0.05048) [-1.89954]	0.278653 (0.16944) [1.64456]	0.266333 (0.09853) [2.70295]	0.128632 (0.05006) [2.56975]	-0.081669 (0.61002) [-0.13388]	0.103176 (0.20914) [0.49333]
D(INV(-1))	-0.011232 (0.05733) [-0.19591]	0.295610 (0.19242) [1.53630]	0.308043 (0.11190) [2.75292]	-0.044301 (0.05684) [-0.77933]	1.417645 (0.69274) [2.04642]	-0.175222 (0.23750) [-0.73776]
D(INV(-2))	-0.057920	0.078016	0.061494	0.008492	0.755668	-0.102600

	(0.04695)	(0.15757)	(0.09163)	(0.04655)	(0.56730)	(0.19450)
	[-1.23367]	[0.49511]	[0.67108]	[0.18243]	[1.33203]	[-0.52751]
D(HK(-1))	0.089734	0.460193	2.041522	0.543668	1.291882	-2.227057
	(0.18209)	(0.61112)	(0.35539)	(0.18054)	(2.20018)	(0.75432)
	[0.49281]	[0.75303]	[5.74449]	[3.01132]	[0.58717]	[-2.95240]
D(HK(-2))	-0.722006	1.199318	-0.066821	0.110059	2.306935	0.003024
	(0.22476)	(0.75437)	(0.43869)	(0.22286)	(2.71589)	(0.93113)
	[-3.21228]	[1.58984]	[-0.15232]	[0.49385]	[0.84942]	[0.00325]
D(FDI(-1))	-0.001368	-0.066337	0.002693	-0.004850	-0.246299	0.075498
	(0.01494)	(0.05013)	(0.02915)	(0.01481)	(0.18047)	(0.06187)
	[-0.09160]	[-1.32338]	[0.09239]	[-0.32753]	[-1.36477]	[1.22020]
D(FDI(-2))	-0.002112	0.003984	-0.052979	0.002370	-0.181089	-0.032343
	(0.01466)	(0.04920)	(0.02861)	(0.01453)	(0.17712)	(0.06073)
	[-0.14411]	[0.08098]	[-1.85178]	[0.16310]	[-1.02240]	[-0.53260]
D(EXR(-1))	-0.071263	0.190497	0.141886	0.026915	0.357332	-0.085818
	(0.04844)	(0.16258)	(0.09455)	(0.04803)	(0.58532)	(0.20068)
	[-1.47114]	[1.17172]	[1.50072]	[0.56037]	[0.61049]	[-0.42765]
D(EXR(-2))	-0.037417	0.263515	-0.125467	-0.012747	0.173804	-0.057756
	(0.04146)	(0.13914)	(0.08092)	(0.04111)	(0.50095)	(0.17175)
	[-0.90252]	[1.89383]	[-1.55057]	[-0.31009]	[0.34695]	[-0.33628]
C	0.095576	-0.152978	-0.104833	0.004587	-0.054257	0.378253
	(0.03159)	(0.10602)	(0.06166)	(0.03132)	(0.38171)	(0.13087)
	[3.02548]	[-1.44285]	[-1.70026]	[0.14645]	[-0.14214]	[2.89033]
R-squared	0.395779	0.420987	0.833470	0.614887	0.218824	0.364514
Adj. R-squared	0.133950	0.170081	0.761307	0.448005	-0.119685	0.089137
Sum sq. resids	0.124126	1.398204	0.472845	0.122030	18.12300	2.130225
S.E. equation	0.064324	0.215886	0.125545	0.063778	0.777239	0.266472
F-statistic	1.511591	1.677869	11.54983	3.684562	0.646435	1.323692
Log likelihood	66.72095	13.44473	37.29660	67.09566	-42.91912	4.181867
Akaike AIC	-2.396407	0.025239	-1.058936	-2.413439	2.587233	0.446279
Schwarz SC	-1.828710	0.592936	-0.491240	-1.845742	3.154929	1.013975
Mean dependent	0.033020	-0.006886	0.030477	0.077798	0.107600	0.135245
S.D. dependent	0.069119	0.236977	0.256968	0.085843	0.734525	0.279207

Determinant resid covariance (dof adj.)	3.82E-10
Determinant resid covariance	3.84E-11
Log likelihood	153.0265
Akaike information criterion	-2.864843
Schwarz criterion	0.784636
Number of coefficients	90

Appendix 10: Impulse Response Function

A10: Cote d'Ivoire

Response of RGDP: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.046492	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.062865	0.002254	0.002191	0.003138	-0.000139	0.001487
3	0.060971	0.003072	0.008141	0.006697	0.000408	0.001596
4	0.051161	0.004511	0.011305	0.010791	0.003045	-0.001130
5	0.040360	0.006462	0.011386	0.015058	0.005667	-0.005431
6	0.030806	0.008683	0.009004	0.018632	0.007084	-0.009279
7	0.022557	0.010570	0.005569	0.020836	0.007232	-0.011393
8	0.015340	0.011742	0.002206	0.021426	0.006689	-0.011586
9	0.009240	0.012093	-0.000495	0.020632	0.006032	-0.010349
10	0.004561	0.011725	-0.002375	0.018904	0.005556	-0.008348

Response of OPNES: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.013763	0.079455	0.000000	0.000000	0.000000	0.000000
2	-0.040795	0.061657	-0.003986	0.037497	0.013070	0.012735
3	-0.057365	0.057375	-0.006588	0.026638	0.027604	0.006961
4	-0.054616	0.051321	-0.012843	0.026084	0.032940	0.003485
5	-0.048325	0.045472	-0.017625	0.020873	0.029557	0.004516
6	-0.043734	0.038099	-0.019437	0.014864	0.024770	0.009002
7	-0.040549	0.030084	-0.018114	0.007796	0.020516	0.013710
8	-0.036854	0.022323	-0.015381	0.001623	0.017610	0.016903
9	-0.031638	0.015442	-0.012232	-0.003124	0.015385	0.018150
10	-0.025147	0.009702	-0.009253	-0.006283	0.013331	0.017850

Response of INV: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.203663	-0.003834	0.255488	0.000000	0.000000	0.000000
2	0.218967	0.049542	0.077403	0.048926	0.024573	-0.034642
3	0.206780	0.057779	0.060565	0.084376	0.041764	-0.064617
4	0.162707	0.078436	0.038328	0.095783	0.032017	-0.074597
5	0.098146	0.087060	0.018916	0.105260	0.027161	-0.068483
6	0.033051	0.089737	0.004065	0.100698	0.025917	-0.058326
7	-0.018018	0.087804	-0.009581	0.091535	0.027824	-0.046631
8	-0.051316	0.082498	-0.020813	0.078475	0.029034	-0.033978
9	-0.068976	0.074408	-0.028832	0.063578	0.028969	-0.020443
10	-0.074804	0.064197	-0.032791	0.047950	0.027784	-0.007005

Response of HK: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.006219	-0.000260	0.000928	0.026647	0.000000	0.000000
2	0.013692	0.000545	-0.000177	0.028398	0.008250	-0.004198
3	0.027462	0.000712	-0.000931	0.029533	0.010724	-0.007541
4	0.039289	0.001244	-0.001384	0.029926	0.009976	-0.008546
5	0.046352	0.001342	-0.000407	0.029965	0.008587	-0.008149
6	0.049354	0.001364	0.001285	0.029912	0.007893	-0.007831
7	0.050085	0.001594	0.002843	0.030223	0.007947	-0.008248

8	0.049795	0.002166	0.003784	0.030924	0.008296	-0.009289
9	0.048974	0.003011	0.004054	0.031822	0.008581	-0.010517
10	0.047706	0.003980	0.003838	0.032658	0.008684	-0.011555

Response of FDI:

Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.119911	0.139390	0.060526	0.248423	0.554505	0.000000
2	0.150391	0.106442	0.031052	0.050838	0.125521	0.000290
3	0.054793	0.073090	-0.056771	0.113399	0.142439	0.034745
4	-0.004742	0.039456	-0.014176	0.043967	0.074560	0.034818
5	-0.032458	0.021043	-0.021552	0.039925	0.065785	0.033959
6	-0.029589	0.005567	-0.015548	0.024896	0.048723	0.026984
7	-0.011150	-0.004293	-0.015575	0.019630	0.038174	0.021658
8	0.012096	-0.011871	-0.011825	0.014825	0.027090	0.017941
9	0.033409	-0.017119	-0.006866	0.012638	0.018858	0.015057
10	0.050714	-0.020370	-0.000817	0.012357	0.013067	0.011517

Response of EXR:

Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.004682	0.072428	-0.017674	-0.020640	0.014793	0.097632
2	-0.029809	0.015682	-0.005299	-0.028816	0.012978	0.116519
3	-0.024725	-0.000817	0.009766	-0.035401	0.049206	0.083665
4	0.013021	-0.006423	0.015306	-0.024149	0.050314	0.049097
5	0.043291	-0.006407	0.011256	-0.009540	0.040406	0.026717
6	0.056545	-0.006557	0.009925	6.92E-05	0.027341	0.014357
7	0.056363	-0.006568	0.010061	0.006211	0.017675	0.007047
8	0.050060	-0.006149	0.010456	0.010468	0.011840	0.001436
9	0.042760	-0.004998	0.009869	0.013894	0.008621	-0.003428
10	0.036575	-0.003320	0.008282	0.016650	0.006612	-0.007272

Cholesky Ordering: RGDP OPNES INV HK FDI EXR

B10: Ghana

Response of RGDP: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.035788	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.043629	0.019116	0.003032	0.017102	-0.002182	-0.008874
3	0.043726	0.025701	0.001463	0.019736	-0.001893	-0.014790
4	0.042720	0.030979	0.003488	0.025628	0.008519	-0.017981
5	0.040975	0.039507	0.007165	0.027051	0.016676	-0.019337
6	0.045558	0.049405	0.009284	0.028762	0.021658	-0.022798
7	0.048425	0.055499	0.010347	0.030247	0.023393	-0.026854
8	0.048923	0.058671	0.010493	0.033063	0.024285	-0.028903
9	0.047584	0.061605	0.011023	0.034539	0.027024	-0.029584
10	0.047822	0.064506	0.012036	0.034773	0.029689	-0.030599

Response of OPNES: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.021895	0.187836	0.000000	0.000000	0.000000	0.000000
2	0.003683	0.301195	0.006841	-0.053022	0.021425	-0.076994
3	0.005763	0.294101	-0.001876	-0.056106	0.012168	-0.127627
4	-0.053917	0.296314	-0.005689	-0.027581	0.030683	-0.106101
5	-0.082583	0.339210	0.007686	-0.041789	0.073263	-0.097557
6	-0.052993	0.362009	0.015879	-0.066409	0.090624	-0.121506
7	-0.038325	0.362522	0.014154	-0.056528	0.077271	-0.132023
8	-0.053070	0.368320	0.009947	-0.042672	0.071093	-0.126457
9	-0.060997	0.373464	0.010902	-0.048205	0.081846	-0.127118
10	-0.056160	0.372734	0.013720	-0.053160	0.088662	-0.131267

Response of INV: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.009273	0.038495	0.231555	0.000000	0.000000	0.000000
2	0.069475	0.181982	0.209481	0.049046	-0.035653	-0.032765
3	0.042808	0.166012	0.233481	0.026933	-0.032738	-0.055285
4	0.033751	0.135363	0.220469	0.058686	-0.041200	-0.062493
5	-0.006860	0.125226	0.226043	0.054121	0.000859	-0.034568
6	0.008066	0.153721	0.243022	0.050498	0.016630	-0.034896
7	0.035539	0.167158	0.240136	0.041940	0.012920	-0.051841
8	0.039837	0.161376	0.238467	0.055359	-0.001646	-0.056271
9	0.025929	0.161913	0.234351	0.063264	-0.001007	-0.051398
10	0.021546	0.163985	0.237817	0.057990	0.010634	-0.050458

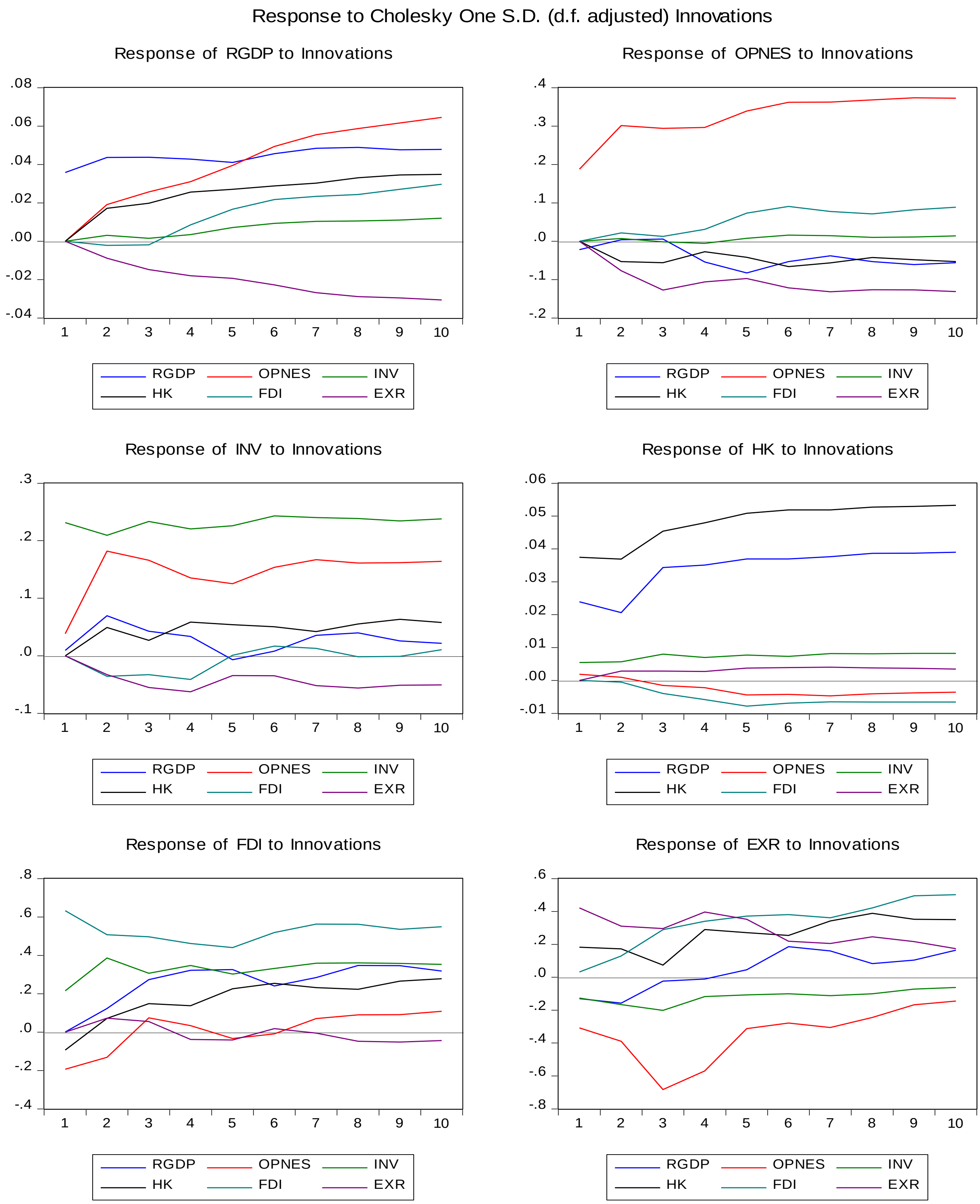
Response of HK: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.023919	0.001872	0.005448	0.037457	0.000000	0.000000
2	0.020655	0.000946	0.005647	0.036897	-0.000509	0.002835
3	0.034372	-0.001554	0.008023	0.045426	-0.003973	0.002832
4	0.035074	-0.002225	0.006982	0.047930	-0.005825	0.002743
5	0.036933	-0.004424	0.007711	0.050826	-0.007808	0.003734
6	0.036940	-0.004242	0.007313	0.051860	-0.006924	0.003914
7	0.037658	-0.004706	0.008158	0.051856	-0.006498	0.004002
8	0.038634	-0.004062	0.008110	0.052713	-0.006573	0.003790
9	0.038740	-0.003773	0.008247	0.052918	-0.006574	0.003692

10	0.038985	-0.003548	0.008247	0.053276	-0.006548	0.003466

Response of FDI: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.000691	-0.193423	0.214959	-0.093455	0.632316	0.000000
2	0.122534	-0.131968	0.385589	0.071484	0.507332	0.072470
3	0.273004	0.074089	0.305848	0.148458	0.496639	0.054804
4	0.322111	0.033229	0.346617	0.137712	0.461411	-0.038004
5	0.326175	-0.033371	0.302840	0.225561	0.440104	-0.041305
6	0.240388	-0.009614	0.331776	0.253423	0.518684	0.018160
7	0.283769	0.070730	0.359195	0.231917	0.562357	-0.004897
8	0.347390	0.089363	0.360594	0.222602	0.561814	-0.048398
9	0.346064	0.090436	0.357528	0.265213	0.535618	-0.051667
10	0.317587	0.108129	0.353262	0.277748	0.549317	-0.043911

Response of EXR: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.129933	-0.308203	-0.126640	0.182568	0.031611	0.421967
2	-0.157731	-0.389228	-0.166709	0.171997	0.129382	0.310755
3	-0.023032	-0.682342	-0.201600	0.073696	0.289055	0.296368
4	-0.011218	-0.569125	-0.117440	0.290099	0.339760	0.396482
5	0.045620	-0.312783	-0.107811	0.270670	0.371629	0.352576
6	0.186465	-0.277965	-0.100038	0.254155	0.380284	0.218665
7	0.160505	-0.306003	-0.111854	0.342792	0.361916	0.205045
8	0.082869	-0.244536	-0.100013	0.389056	0.421503	0.246368
9	0.104866	-0.167492	-0.072451	0.352732	0.494916	0.216159
10	0.164684	-0.144922	-0.062160	0.350415	0.501781	0.173210

Cholesky Ordering: RGDP OPNES INV HK FDI EXR



Response to Cholesky One S.D. (d.f. adjusted) Innovations
Response of RGDP to Innovations
Response of OPNES to Innovations
Response of INV to Innovations
Response of HK to Innovations
Response of FDI to Innovations
Response of EXR to Innovations
RGDP
OPNES
INV
HK
FDI
EXR

C10: Nigeria

Response of RGDP: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.064324	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.081037	0.002419	0.011062	0.009099	-0.004571	-0.015260
3	0.078586	-0.010859	0.005799	-0.012949	-0.011650	-0.021498
4	0.090968	-0.004887	0.008321	-0.030345	-0.009266	-0.026817
5	0.087684	-0.019050	0.005845	-0.034717	-0.009673	-0.030311
6	0.085509	-0.022715	0.002573	-0.045395	-0.009597	-0.032119
7	0.087751	-0.028569	0.002441	-0.053680	-0.008390	-0.035905
8	0.086355	-0.032784	0.002592	-0.056056	-0.007512	-0.036990
9	0.084724	-0.036902	0.002079	-0.059348	-0.007660	-0.038510
10	0.085475	-0.037326	0.002448	-0.060885	-0.007362	-0.039663

Response of OPNES: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.018355	0.215104	0.000000	0.000000	0.000000	0.000000
2	-0.039559	0.157314	-0.066092	0.007622	-0.035803	0.025762
3	-0.017612	0.212446	-0.087735	-0.009653	-0.001983	0.054367
4	-0.027783	0.144369	-0.098225	-0.061352	0.010052	0.045491
5	-0.039935	0.147257	-0.093365	-0.099841	0.019622	0.049876
6	-0.059907	0.106492	-0.097690	-0.123859	0.017021	0.038597
7	-0.064465	0.110637	-0.100439	-0.132504	0.019180	0.036800
8	-0.066793	0.093055	-0.101787	-0.134962	0.018510	0.030985
9	-0.066479	0.095868	-0.099952	-0.132940	0.021459	0.031969
10	-0.067290	0.089787	-0.098519	-0.131875	0.020737	0.029742

Response of INV: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.032222	-0.006589	0.121160	0.000000	0.000000	0.000000
2	0.045936	0.037775	0.045488	0.104838	0.017746	0.009261
3	0.126963	0.068325	-0.000161	0.068444	-0.049226	-0.043184
4	0.195127	0.061305	0.001259	0.035520	-0.028111	-0.047438
5	0.184027	0.004067	0.001604	-0.018996	-0.004189	-0.049327
6	0.171964	-0.018247	0.000418	-0.086717	-0.005021	-0.064259
7	0.166375	-0.043231	-0.004142	-0.118486	-0.010021	-0.081175
8	0.159479	-0.062978	-0.011989	-0.132600	-0.008991	-0.088375
9	0.159794	-0.078603	-0.014178	-0.147716	-0.005218	-0.094869
10	0.160481	-0.087628	-0.011357	-0.154379	-0.002175	-0.099042

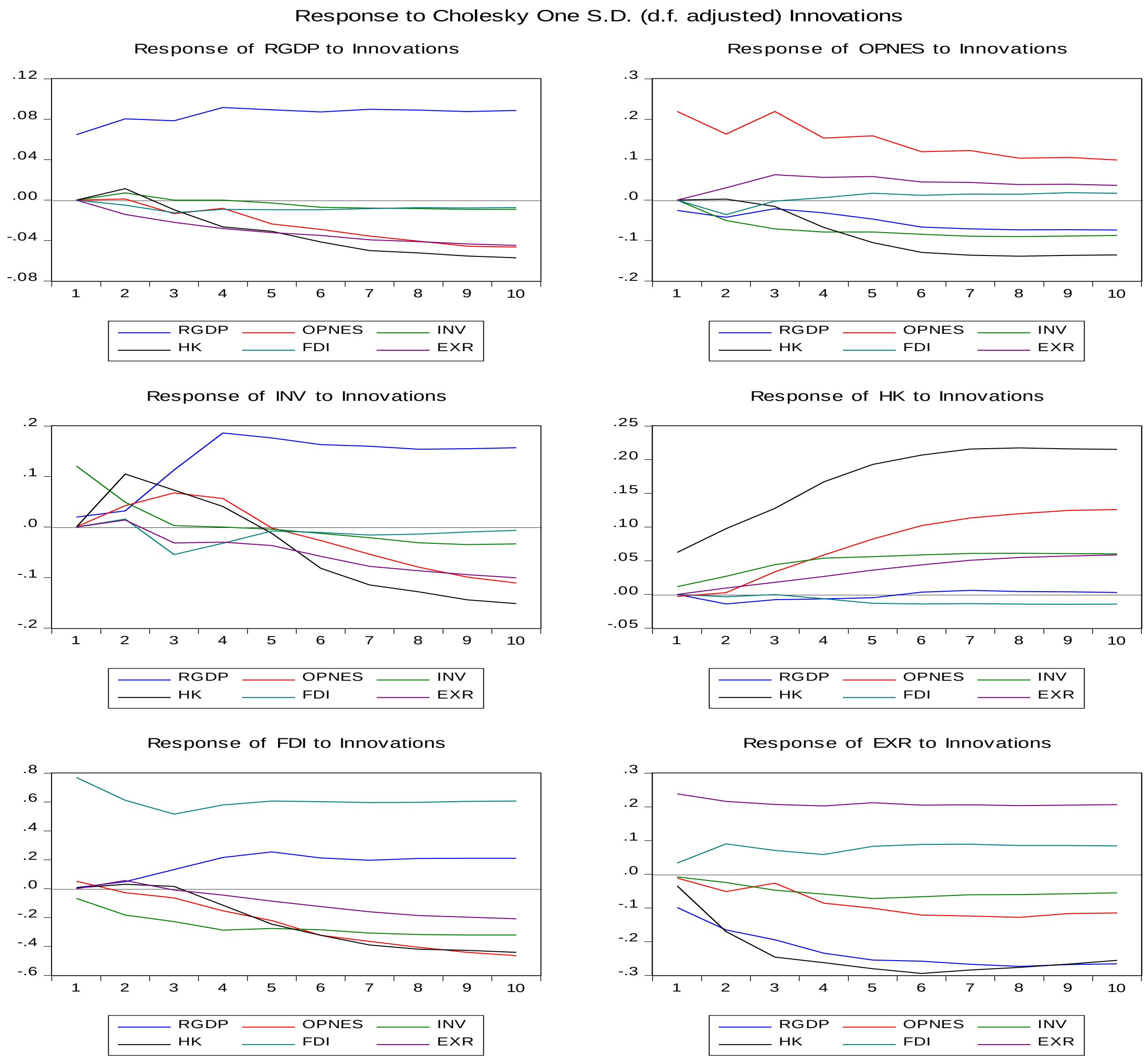
Response of HK: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.000748	-0.001668	0.010686	0.062850	0.000000	0.000000
2	-0.015321	0.004290	0.025012	0.098351	-0.003818	0.009148
3	-0.009139	0.033649	0.040332	0.129362	-0.001972	0.017741
4	-0.007564	0.056806	0.047273	0.169983	-0.008836	0.025288
5	-0.005022	0.079239	0.046748	0.196832	-0.015289	0.033543
6	0.003659	0.097233	0.047436	0.211117	-0.016121	0.039429
7	0.006930	0.106811	0.048421	0.220330	-0.015926	0.044930
8	0.006207	0.111657	0.047831	0.222218	-0.016431	0.048539
9	0.006399	0.115172	0.047057	0.220972	-0.016562	0.050096

10	0.005746	0.115679	0.046138	0.220097	-0.016515	0.051015

Response of FDI: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	0.029383	0.035982	-0.050180	0.003611	0.774216	0.000000
2	0.076675	-0.040007	-0.179547	0.026539	0.622050	0.025565
3	0.163269	-0.063339	-0.219096	0.003522	0.532935	-0.038249
4	0.234781	-0.142412	-0.264678	-0.130569	0.600607	-0.083912
5	0.269425	-0.205538	-0.239462	-0.265353	0.621422	-0.117623
6	0.226884	-0.299796	-0.235956	-0.340113	0.620706	-0.142118
7	0.207671	-0.333998	-0.251252	-0.404380	0.617343	-0.169181
8	0.216695	-0.363767	-0.256283	-0.433943	0.615854	-0.193308
9	0.214698	-0.389522	-0.256702	-0.439886	0.621073	-0.200549
10	0.212703	-0.406815	-0.255047	-0.452126	0.624314	-0.207590

Response of EXR: Period	RGDP	OPNES	INV	HK	FDI	EXR
1	-0.102812	-0.008513	-0.024598	-0.028568	0.038797	0.239663
2	-0.168505	-0.052847	-0.043725	-0.161730	0.091784	0.224297
3	-0.198971	-0.035627	-0.066548	-0.230427	0.071409	0.212591
4	-0.235981	-0.096327	-0.083172	-0.247987	0.063966	0.212075
5	-0.252215	-0.109238	-0.092434	-0.267499	0.090006	0.219686
6	-0.257395	-0.132228	-0.086774	-0.281928	0.094438	0.211855
7	-0.266562	-0.134384	-0.080782	-0.273500	0.093754	0.212641
8	-0.271764	-0.138224	-0.080786	-0.266040	0.091036	0.210739
9	-0.266552	-0.127954	-0.078500	-0.256595	0.090609	0.211219
10	-0.264749	-0.126458	-0.076763	-0.246260	0.089457	0.212385

Cholesky Ordering: RGDP OPNES INV HK FDI EXR


Response to Cholesky One S.D. (d.f. adjusted) Innovations
Response of RGDP to Innovations
Response of OPNES to Innovations
Response of INV to Innovations
Response of HK to Innovations
Response of FDI to Innovations
Response of EXR to Innovations
RGDP
OPNES
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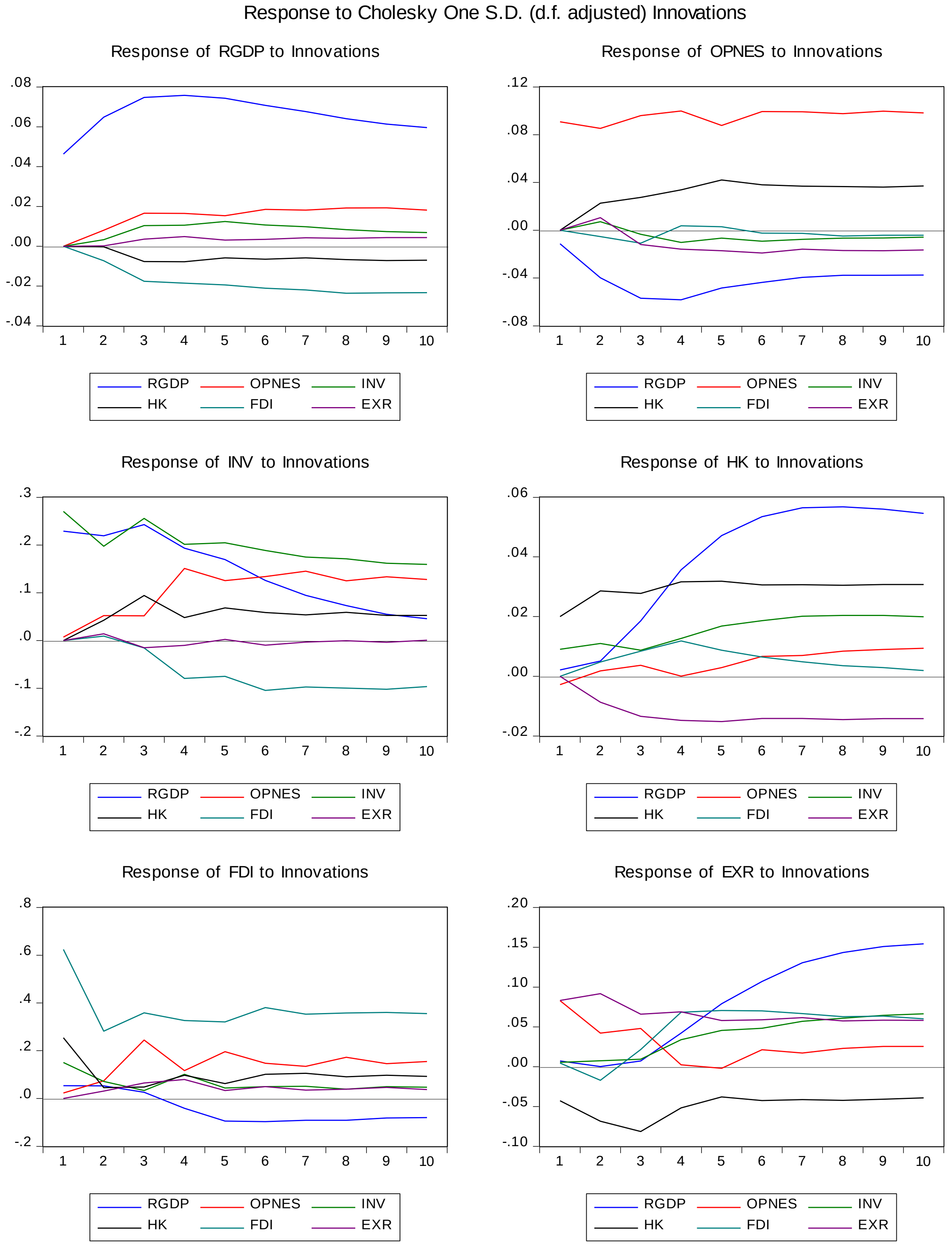
FDI
EXR


Response to Cholesky One S.D. (d.f. adjusted) Innovations
Response of RGDP to Innovations
Response of OPNES to Innovations
Response of INV to Innovations
Response of HK to Innovations
Response of FDI to Innovations
Response of EXR to Innovations
RGDP
OPNES
INV
HK
FDI
EXR

Appendix 11: Forecast Error Variance Decomposition

A11:
Cote d'Ivoire

Variance Decomposition of RGDP: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.046492	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.078329	99.64218	0.082818	0.078207	0.160459	0.000314	0.036021
3	0.099881	98.54424	0.145538	0.712465	0.548196	0.001861	0.047701
4	0.113441	96.73323	0.270968	1.545498	1.329914	0.073488	0.046904
5	0.122301	94.11577	0.512323	2.196392	2.660059	0.277922	0.237539
6	0.128633	90.81359	0.918779	2.475399	4.502690	0.554483	0.735061
7	0.133470	87.20692	1.480533	2.473347	6.619262	0.808614	1.411324
8	0.137223	83.75085	2.132797	2.365730	8.699951	1.002626	2.048046
9	0.140111	80.76853	2.790673	2.270448	10.51326	1.147069	2.510022
10	0.142313	78.39139	3.383773	2.228587	11.95499	1.264248	2.777011

Variance Decomposition of OPNES: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.080638	2.913107	97.08689	0.000000	0.000000	0.000000	0.000000
2	0.117146	13.50722	73.70488	0.115763	10.24555	1.244801	1.181788
3	0.147883	23.52325	61.30322	0.271119	9.673998	4.265268	0.963147
4	0.171547	27.61691	54.50641	0.761970	9.501079	6.856625	0.757007
5	0.188339	29.49551	51.04923	1.507852	9.110604	8.151267	0.685533
6	0.200323	30.83843	48.74142	2.274282	8.603804	8.734161	0.807903
7	0.208989	32.09854	46.85529	2.840794	8.044226	8.988509	1.172642
8	0.215332	33.16454	45.21013	3.186090	7.582955	9.135522	1.720763
9	0.219847	33.88721	43.86555	3.366132	7.294869	9.253874	2.332365
10	0.222891	34.24063	42.86488	3.447136	7.176409	9.360532	2.910408

Variance Decomposition of INV: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.326753	38.84939	0.013765	61.13685	0.000000	0.000000	0.000000
2	0.409093	53.43366	1.475325	42.58282	1.430313	0.360813	0.717066
3	0.479751	57.43080	2.523251	32.55707	4.133183	1.020205	2.335487
4	0.529169	56.65914	4.271030	27.28472	6.673590	1.204637	3.906883
5	0.560443	53.57883	6.220724	24.43846	9.477036	1.308810	4.976143
6	0.580923	50.19133	8.176042	22.75060	11.82532	1.417197	5.639514
7	0.597432	47.54674	9.890398	21.53635	13.52828	1.556863	5.941368
8	0.612334	45.96294	11.22998	20.61640	14.52026	1.706822	5.963603
9	0.625602	45.24965	12.17332	19.96360	14.94371	1.849612	5.820110
10	0.636624	45.07702	12.77230	19.54363	14.99803	1.976586	5.632433

Variance Decomposition of HK: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.027380	5.159420	0.009032	0.114901	94.71665	0.000000	0.000000
2	0.042774	12.36114	0.019919	0.048787	82.88645	3.720431	0.963283
3	0.060243	27.01161	0.024018	0.048485	65.81880	5.044490	2.052601

4	0.079022	40.41910	0.038734	0.058850	52.59528	4.525568	2.362469
5	0.097124	49.53341	0.044731	0.040715	44.33579	3.777552	2.267793
6	0.113537	55.14278	0.047167	0.042610	39.38462	3.247607	2.135224
7	0.128275	58.44489	0.052392	0.082515	36.40592	2.928071	2.086211
8	0.141649	60.28728	0.066341	0.139044	34.62212	2.744279	2.140930
9	0.153900	61.19717	0.094484	0.187192	33.60483	2.635659	2.280669
10	0.165128	61.50462	0.140156	0.216624	33.10189	2.566002	2.470713

Variance Decompositi on of FDI: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.637700	3.535760	4.777841	0.900857	15.17575	75.60979	0.000000
2	0.678169	8.044158	6.688111	1.006198	13.98056	70.28096	1.83E-05
3	0.711221	7.907387	7.137020	1.551997	15.25350	67.91141	0.238676
4	0.718554	7.751167	7.293606	1.559405	15.31815	67.60905	0.468624
5	0.724814	7.818387	7.252449	1.621000	15.35810	67.26999	0.680079
6	0.728166	7.911692	7.191681	1.651705	15.33393	67.09984	0.811153
7	0.730016	7.894980	7.158744	1.688866	15.32863	67.03371	0.895067
8	0.731181	7.897205	7.162303	1.709644	15.32092	66.95750	0.952421
9	0.732683	8.072779	7.187564	1.711424	15.28793	66.74955	0.990750
10	0.735029	8.497359	7.218557	1.700640	15.21875	66.35571	1.008985

Variance Decompositi on of EXR: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.125527	0.139143	33.29174	1.982458	2.703650	1.388785	60.49423
2	0.177468	2.890876	17.43666	1.080966	3.989047	1.229593	73.37285
3	0.207067	3.549267	12.80960	1.016460	5.853069	6.550215	70.22138
4	0.221014	3.462536	11.32842	1.371815	6.331584	10.93213	66.57352
5	0.230925	6.686041	10.45385	1.494193	5.970424	13.07541	62.32008
6	0.240039	11.73702	9.749680	1.553830	5.525653	13.39869	58.03513
7	0.247670	16.20384	9.228454	1.624569	5.253268	13.09504	54.59483
8	0.253467	19.37182	8.870036	1.721277	5.186298	12.72113	52.12945
9	0.257829	21.47246	8.610064	1.810067	5.302742	12.40621	50.39846
10	0.261279	22.86861	8.400306	1.863046	5.569723	12.14473	49.15359

Cholesky Ordering: RGDP OPNES INV HK FDI EXR

B11: Ghana

Variance Decomposition of RGDP: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.035788	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.062728	80.92443	9.286804	0.233672	7.433011	0.120947	2.001132
3	0.084388	71.56295	14.40674	0.159179	9.576581	0.117167	4.177383
4	0.104742	63.08752	18.09931	0.214251	12.20280	0.737559	5.658550
5	0.125083	54.96862	22.66707	0.478327	13.23378	2.294586	6.357619
6	0.148541	48.38467	27.13555	0.729821	13.13333	3.752926	6.863704
7	0.172568	43.72346	30.44827	0.900272	12.80290	4.618138	7.506956
8	0.195561	40.30504	32.71018	0.988914	12.82783	5.138139	8.029888
9	0.217309	37.43587	34.52711	1.058192	12.91481	5.707660	8.356360
10	0.238418	35.12368	36.00424	1.133974	12.85637	6.292428	8.589308

Variance Decomposition of OPNES: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.189107	1.340517	98.65948	0.000000	0.000000	0.000000	0.000000
2	0.368427	0.363163	92.82572	0.034476	2.071156	0.338168	4.367320
3	0.491788	0.217553	87.86066	0.020805	2.463964	0.251008	9.186007
4	0.587840	0.993519	86.90267	0.023927	1.944677	0.448122	9.687083
5	0.695794	2.117841	85.79539	0.029280	1.748766	1.428538	8.880182
6	0.803509	2.023048	84.63265	0.061011	1.994419	2.343252	8.945621
7	0.897393	1.804281	84.17001	0.073791	1.995726	2.620033	9.336157
8	0.983238	1.794301	84.14668	0.071702	1.850809	2.705302	9.431203
9	1.065482	1.855725	83.94332	0.071530	1.780796	2.893847	9.454782
10	1.142560	1.855397	83.64203	0.076624	1.765113	3.118749	9.542091

Variance Decomposition of INV: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.234916	0.155824	2.685217	97.15896	0.000000	0.000000	0.000000
2	0.376514	3.465449	24.40660	68.77719	1.696845	0.896645	0.757278
3	0.480127	2.926076	26.96467	65.94318	1.358162	1.016328	1.791586
4	0.554651	2.562883	26.16150	65.21311	2.137221	1.313323	2.611964
5	0.615294	2.095019	25.40084	66.48824	2.510396	1.067396	2.438101
6	0.682192	1.718255	25.74086	66.77800	2.590115	0.927740	2.245026
7	0.746237	1.662788	26.52979	66.16283	2.480474	0.805303	2.358811
8	0.804735	1.674883	26.83429	65.67447	2.606180	0.692897	2.517282
9	0.857935	1.564951	27.17120	65.24365	2.836746	0.609767	2.573688
10	0.908838	1.450761	27.46840	64.98706	2.935012	0.557066	2.601705

Variance Decomposition of HK: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.044815	28.48719	0.174531	1.478095	69.86018	0.000000	0.000000
2	0.061947	26.02661	0.114640	1.604696	72.03789	0.006764	0.209405
3	0.084694	30.39422	0.095018	1.755870	67.30732	0.223716	0.223858
4	0.103902	31.59055	0.108988	1.618240	66.00087	0.462906	0.218448
5	0.122053	32.04996	0.210369	1.571874	65.17120	0.744673	0.251920

6	0.138151	32.16550	0.258501	1.507138	64.95951	0.832457	0.276886
7	0.152774	32.37883	0.306277	1.517581	64.64063	0.861656	0.295024
8	0.166586	32.61060	0.317062	1.513384	64.37871	0.880357	0.299893
9	0.179419	32.77456	0.317539	1.515927	64.19794	0.893168	0.300872
10	0.191533	32.90280	0.312964	1.515626	64.07122	0.900621	0.296771

Variance Decompositi on of FDI: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.701554	9.71E-05	7.601394	9.388371	1.774526	81.23561	0.000000
2	0.970069	1.595581	5.826342	20.70982	1.471132	69.83903	0.558097
3	1.177409	6.459421	4.350970	20.80582	2.588456	65.19983	0.595501
4	1.358162	10.47932	3.329782	22.14960	2.973443	60.54201	0.525841
5	1.513306	13.08645	2.730670	21.84559	4.616663	57.22258	0.498048
6	1.670819	12.80535	2.243393	21.86390	6.087795	56.57918	0.420383
7	1.837454	12.97313	2.003118	21.89956	6.626744	56.14915	0.348303
8	2.000615	13.95849	1.889233	21.72186	6.827958	55.25013	0.352330
9	2.148981	14.69091	1.814472	21.59397	7.440786	54.09671	0.363165
10	2.288294	14.88278	1.823549	21.42795	8.035624	53.47298	0.357114

Variance Decompositi on of EXR: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.583348	4.961194	27.91366	4.712845	9.794740	0.293646	52.32392
2	0.829070	6.075716	35.86019	6.376534	9.153024	2.580758	39.95377
3	1.170870	3.084917	51.94096	6.161622	4.985274	7.388488	26.43874
4	1.437203	2.053598	50.15518	4.757283	7.383133	10.49253	25.15827
5	1.585172	1.770928	45.12212	4.373158	8.984695	14.12133	25.62777
6	1.700540	2.741109	41.87925	4.145982	10.04066	17.27113	23.92187
7	1.820516	3.169017	39.36654	3.995028	12.30632	19.02180	22.14130
8	1.944395	2.959719	36.09185	3.766763	14.79181	21.37451	21.01535
9	2.059383	2.897722	32.83540	3.481635	16.11979	24.82970	19.83576
10	2.167400	3.193425	30.09120	3.225505	17.16700	27.77631	18.54657

Cholesky Ordering: RGDP OPNES INV HK FDI EXR

C11: Nigeria

Variance Decomposition of RGDP: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.064324	100.0000	0.000000	0.000000	0.000000	0.000000	0.000000
2	0.105685	95.83875	0.052409	1.095620	0.741192	0.187029	2.085002
3	0.135137	92.43312	0.677715	0.854222	1.371517	0.857557	3.805871
4	0.168393	88.71206	0.520684	0.794305	4.130621	0.855054	4.987277
5	0.196619	84.95701	1.320601	0.670993	6.147531	0.869189	6.034674
6	0.222885	80.83157	2.066323	0.535488	8.932031	0.861782	6.772808
7	0.249883	76.64095	2.951062	0.435570	11.72108	0.798359	7.452972
8	0.274858	73.21639	3.861824	0.368902	13.84712	0.734559	7.971205
9	0.298589	70.09241	4.799769	0.317444	15.68423	0.688246	8.417897
10	0.321239	67.63620	5.496858	0.280063	17.14263	0.647134	8.797118

Variance Decomposition of OPNES: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.215886	0.722892	99.27711	0.000000	0.000000	0.000000	0.000000
2	0.281587	2.398521	89.56557	5.508953	0.073271	1.616658	0.837031
3	0.368083	1.632653	85.72973	8.905432	0.111660	0.949034	2.671492
4	0.415550	1.727974	79.33271	12.57439	2.267385	0.803114	3.294425
5	0.466390	2.104964	72.94891	13.98990	6.382663	0.814576	3.758994
6	0.509031	3.152111	65.61572	15.42732	11.27868	0.795635	3.730521
7	0.552156	4.042036	59.78130	16.42049	15.34455	0.796873	3.614744
8	0.589809	4.824887	54.88131	17.36912	18.68388	0.796863	3.443930
9	0.625004	5.428152	51.22714	18.02552	21.16306	0.827522	3.328613
10	0.656987	5.961551	48.22874	18.56194	23.18187	0.848539	3.217362

Variance Decomposition of INV: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.125545	6.587309	0.275461	93.13723	0.000000	0.000000	0.000000
2	0.180996	9.610670	4.488418	51.12704	33.55070	0.961362	0.261816
3	0.250040	30.81896	9.818714	26.78983	25.07296	4.379566	3.119963
4	0.329631	52.77411	9.108421	15.41606	15.58790	3.247213	3.866293
5	0.381252	62.74957	6.820247	11.52582	11.90075	2.439480	4.564129
6	0.432356	64.61170	5.481355	8.962247	13.27645	1.910355	5.757887
7	0.487060	62.58151	5.107061	7.069358	16.37959	1.547668	7.314813
8	0.540597	59.50290	5.502780	5.787681	19.31249	1.283967	8.610178
9	0.595824	56.17607	6.270310	4.821105	22.04467	1.064645	9.623201
10	0.649781	53.33368	7.090871	4.084221	24.18028	0.896293	10.41466

Variance Decomposition of HK: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.063778	0.013770	0.068435	2.807273	97.11052	0.000000	0.000000
2	0.121316	1.598706	0.143964	5.026470	92.56318	0.099061	0.568619
3	0.186046	0.921057	3.332368	6.836741	87.70539	0.053353	1.151088
4	0.264091	0.539137	6.280676	6.597164	84.95644	0.138433	1.488150
5	0.343999	0.339065	9.007704	5.734963	82.81127	0.279132	1.827868
6	0.420045	0.234996	11.39981	5.121733	80.80191	0.334510	2.107046

7	0.490976	0.191926	13.07665	4.721407	79.28029	0.350054	2.379672
8	0.554849	0.162795	14.28888	4.440076	78.11784	0.361796	2.628615
9	0.612364	0.144569	15.26815	4.235698	77.15414	0.370170	2.827271
10	0.664719	0.130165	15.98629	4.076522	76.44270	0.375884	2.988442

Variance Decompositi on of FDI: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.777239	0.142919	0.214323	0.416822	0.002158	99.22378	0.000000
2	1.015933	0.653266	0.280521	3.367336	0.069506	95.56605	0.063321
3	1.181646	2.391997	0.494680	5.927010	0.052266	90.98246	0.151583
4	1.388007	4.594768	1.411236	7.931867	0.922787	84.66400	0.475339
5	1.602858	6.270977	2.702617	8.179915	3.432654	78.51887	0.894962
6	1.813100	6.466862	4.846239	8.086489	6.201592	73.08497	1.313847
7	2.019505	6.269968	6.641494	8.065847	9.008188	68.25370	1.760804
8	2.219981	6.141469	8.181154	8.007574	11.27559	64.17884	2.215373
9	2.410702	6.001330	9.548693	7.924553	12.89165	61.06299	2.570780
10	2.593175	5.859257	10.71327	7.815883	14.18108	58.56796	2.862555

Variance Decompositi on of EXR: Period	S.E.	RGDP	OPNES	INV	HK	FDI	EXR
1	0.266472	14.88627	0.102060	0.852132	1.149342	2.119752	80.89044
2	0.434737	20.61645	1.516065	1.331750	14.27154	5.253760	57.01044
3	0.581097	23.26312	1.224426	2.056886	23.71201	4.450642	45.29292
4	0.721195	25.80940	2.578910	2.665359	27.21797	3.676121	38.05224
5	0.855646	27.02429	3.462009	3.060553	29.10989	3.718105	33.62515
6	0.978101	27.60642	4.476996	3.129261	30.58549	3.777634	30.42420
7	1.086798	28.37630	5.155202	3.087110	31.10648	3.803962	28.47095
8	1.184944	29.13031	5.697303	3.061703	31.20769	3.790150	27.11284
9	1.271354	29.70080	5.962082	3.040905	31.18314	3.800390	26.31269
10	1.349842	30.19410	6.166570	3.020956	30.99055	3.810487	25.81733

Cholesky Ordering: RGDP OPNES INV HK FDI EXR

Appendix 12: Wald Test for LSDV

Wald Test:
Equation: Untitled

Test Statistic	Value	df	Probability
F-statistic	3.084029	(3, 125)	0.0298
Chi-square	9.252086	3	0.0261

Null Hypothesis: C(2)=C(7)=C(12)=0
Null Hypothesis Summary:

Normalized Restriction (= 0)	Value	Std. Err.
C(2)	-0.134567	0.052338
C(7)	0.191734	0.065789
C(12)	0.140881	0.077464

Restrictions are linear in coefficients.

Appendix 13: Panel Unit Root Test

Panel unit root test: Summary

Series: RGDP
Date: 05/23/18 Time: 11:47
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	3.68815	0.9999	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	4.71225	1.0000	3	135
ADF - Fisher Chi-square	0.16241	0.9999	3	135
PP - Fisher Chi-square	0.51460	0.9977	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(RGDP)
Date: 05/23/18 Time: 11:48
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-2.71337	0.0033	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-4.00238	0.0000	3	132
ADF - Fisher Chi-square	27.6701	0.0001	3	132
PP - Fisher Chi-square	49.2149	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: OPNES
Date: 05/23/18 Time: 11:50
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.35959	0.6404	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-0.06252	0.4751	3	135
ADF - Fisher Chi-square	4.32232	0.6331	3	135
PP - Fisher Chi-square	5.50308	0.4811	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(OPNES)
Date: 05/23/18 Time: 11:51
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-5.09566	0.0000	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.17859	0.0000	3	132
ADF - Fisher Chi-square	38.5477	0.0000	3	132
PP - Fisher Chi-square	72.9280	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: INV
Date: 05/23/18 Time: 11:52
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.53333	0.7031	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.54337	0.7066	3	135
ADF - Fisher Chi-square	4.61533	0.5940	3	135
PP - Fisher Chi-square	5.10430	0.5305	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(INV)
Date: 05/23/18 Time: 11:54
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-10.6801	0.0000	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-8.65487	0.0000	3	132
ADF - Fisher Chi-square	68.5759	0.0000	3	132
PP - Fisher Chi-square	93.7412	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: HK
Date: 05/23/18 Time: 11:45
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-1.74856	0.0402	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.23584	0.5932	3	135
ADF - Fisher Chi-square	4.79186	0.5708	3	135
PP - Fisher Chi-square	12.0522	0.0608	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(HK)
Date: 05/23/18 Time: 11:43
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-6.28572	0.0000	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.93475	0.0000	3	132
ADF - Fisher Chi-square	44.4355	0.0000	3	132
PP - Fisher Chi-square	98.3807	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: FDI
Date: 05/23/18 Time: 11:59
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.73200	0.7679	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	1.67927	0.9535	3	135
ADF - Fisher Chi-square	1.21159	0.9763	3	135
PP - Fisher Chi-square	2.40894	0.8785	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(FDI)
Date: 05/23/18 Time: 12:00
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-7.98370	0.0000	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-7.91068	0.0000	3	132
ADF - Fisher Chi-square	63.7840	0.0000	3	132
PP - Fisher Chi-square	91.5877	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: EXR
Date: 05/23/18 Time: 12:02
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	0.20661	0.5818	3	135
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	0.81313	0.7919	3	135
ADF - Fisher Chi-square	2.77346	0.8367	3	135
PP - Fisher Chi-square	2.58736	0.8586	3	138

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Panel unit root test: Summary
Series: D(EXR)
Date: 05/23/18 Time: 12:03
Sample: 1970 2016
Exogenous variables: Individual effects
User-specified lags: 1
Newey-West automatic bandwidth selection and Bartlett kernel
Balanced observations for each test

Method	Statistic	Prob.**	Cross-sections	Obs
Null: Unit root (assumes common unit root process)				
Levin, Lin & Chu t*	-4.78118	0.0000	3	132
Null: Unit root (assumes individual unit root process)				
Im, Pesaran and Shin W-stat	-5.67086	0.0000	3	132
ADF - Fisher Chi-square	42.1293	0.0000	3	132
PP - Fisher Chi-square	70.0859	0.0000	3	135

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Appendix 14: Panel Cointegration Test

A14: Pedroni Residual Cointegration Test

Pedroni Residual Cointegration Test
Series: RGDP OPNES INV HK FDI EXR
Date: 05/16/18 Time: 09:00
Sample: 1970 2016
Included observations: 141
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	0.783985	0.2165	1.630290	0.0515
Panel rho-Statistic	-0.560847	0.2875	-0.673579	0.2503
Panel PP-Statistic	-2.177412	0.0147	-2.249628	0.0122
Panel ADF-Statistic	0.435919	0.6686	-0.449168	0.3267

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	-0.127277	0.4494
Group PP-Statistic	-2.288546	0.0111
Group ADF-Statistic	-0.411682	0.3403

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
1	0.525	0.010998	0.012502	1.00	46
2	0.316	0.001986	0.001326	6.00	46
3	0.451	0.001665	0.001830	2.00	46

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
1	0.631	0.007857	2	--	44
2	0.153	0.001861	2	--	44
3	0.283	0.001615	2	--	44

Pedroni Residual Cointegration Test
Series: RGDP OPNES INV HK FDI EXR
Date: 05/16/18 Time: 09:02
Sample: 1970 2016
Included observations: 141
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: Deterministic intercept and trend
User-specified lag length: 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	5.531036	0.0000	3.019173	0.0013
Panel rho-Statistic	-0.288356	0.3865	-0.242859	0.4041
Panel PP-Statistic	-2.045776	0.0204	-2.023276	0.0215
Panel ADF-Statistic	-1.027742	0.1520	-1.087427	0.1384

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.332546	0.6303
Group PP-Statistic	-1.886246	0.0296
Group ADF-Statistic	-0.767124	0.2215

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
1	0.380	0.003251	0.003007	4.00	46
2	0.299	0.002005	0.001313	6.00	46
3	0.449	0.001664	0.001825	2.00	46

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
1	0.207	0.003104	2	--	44
2	0.136	0.001874	2	--	44
3	0.281	0.001616	2	--	44

Pedroni Residual Cointegration Test
Series: RGDP OPNES INV HK FDI EXR
Date: 05/16/18 Time: 09:03
Sample: 1970 2016
Included observations: 141
Cross-sections included: 3
Null Hypothesis: No cointegration
Trend assumption: No deterministic intercept or trend
User-specified lag length: 2
Newey-West automatic bandwidth selection and Bartlett kernel

Alternative hypothesis: common AR coefs. (within-dimension)

	Statistic	Prob.	Weighted Statistic	Prob.
Panel v-Statistic	-1.871257	0.9693	-1.998518	0.9772
Panel rho-Statistic	0.540368	0.7055	0.909267	0.8184
Panel PP-Statistic	-0.185496	0.4264	0.296008	0.6164
Panel ADF-Statistic	0.069732	0.5278	0.531358	0.7024

Alternative hypothesis: individual AR coefs. (between-dimension)

	Statistic	Prob.
Group rho-Statistic	0.283887	0.6118
Group PP-Statistic	-1.014044	0.1553
Group ADF-Statistic	-0.314470	0.3766

Cross section specific results

Phillips-Peron results (non-parametric)

Cross ID	AR(1)	Variance	HAC	Bandwidth	Obs
1	0.505	0.051381	0.056227	1.00	46
2	0.433	0.014213	0.013168	1.00	46
3	0.782	0.078527	0.081878	3.00	46

Augmented Dickey-Fuller results (parametric)

Cross ID	AR(1)	Variance	Lag	Max lag	Obs
1	0.491	0.024148	2	--	44
2	0.477	0.013466	2	--	44
3	0.749	0.077682	2	--	44

B14: Kao Residual Cointegration Test

Kao Residual Cointegration Test
Series: RGDP OPNES INV HK FDI EXR
Date: 05/26/18 Time: 20:10
Sample: 1970 2016
Included observations: 141
Null Hypothesis: No cointegration
Trend assumption: No deterministic trend
User-specified lag length: 1
Newey-West automatic bandwidth selection and Bartlett kernel

	t-Statistic	Prob.
ADF	-3.762777	0.0001
Residual variance	0.003125	
HAC variance	0.004193	

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(RESID)
Method: Least Squares
Date: 05/26/18 Time: 20:10
Sample (adjusted): 1972 2016
Included observations: 135 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
RESID(-1)	-0.330892	0.068235	-4.849332	0.0000
D(RESID(-1))	0.062250	0.085456	0.728443	0.4676

R-squared	0.155748	Mean dependent var	0.004782
Adjusted R-squared	0.149400	S.D. dependent var	0.092633
S.E. of regression	0.085433	Akaike info criterion	-2.067454
Sum squared resid	0.970751	Schwarz criterion	-2.024413
Log likelihood	141.5531	Hannan-Quinn criter.	-2.049963
Durbin-Watson stat	1.910100		

C14: Johansen Fisher Panel Cointegration Test

Johansen Fisher Panel Cointegration Test
Series: RGDP OPNES INV HK FDI EXR
Date: 05/19/18 Time: 22:30
Sample: 1970 2016
Included observations: 141
Trend assumption: Linear deterministic trend
Lags interval (in first differences): 1 1
Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Hypothesized No. of CE(s)	Fisher Stat.* (from trace test)	Prob.	Fisher Stat.* (from max-eigen test)	Prob.
None	75.96	0.0000	51.23	0.0000
At most 1	30.59	0.0000	13.18	0.0329
At most 2	21.99	0.0012	11.08	0.0491
At most 3	15.00	0.0203	12.40	0.0436
At most 4	7.042	0.3170	4.460	0.6147
At most 5	12.46	0.0524	12.46	0.0524

* Probabilities are computed using asymptotic Chi-square distribution.

Individual cross section results

Cross Section	Trace Test Statistics	Prob.**	Max-Eign Test Statistics	Prob.**
Hypothesis of no cointegration				
1	196.3400	0.0000	96.0708	0.0000
2	122.6554	0.0002	48.3890	0.0047
3	99.2764	0.0280	41.1987	0.0372
Hypothesis of at most 1 cointegration relationship				
1	100.2692	0.0000	34.6948	0.0399
2	74.2664	0.0211	27.5766	0.2337
3	58.0778	0.2991	24.7735	0.4005
Hypothesis of at most 2 cointegration relationship				
1	65.5744	0.0005	28.4187	0.0390
2	46.6898	0.0641	21.0139	0.2754
3	33.3043	0.5401	16.7572	0.6009
Hypothesis of at most 3 cointegration relationship				
1	37.1557	0.0059	25.7632	0.0104
2	25.6759	0.1387	14.3090	0.3402
3	16.5471	0.6733	11.7122	0.5763
Hypothesis of at most 4 cointegration relationship				
1	11.3925	0.1885	9.5571	0.2427
2	11.3668	0.1899	6.8165	0.5111
3	4.8349	0.8261	3.9274	0.8669
Hypothesis of at most 5 cointegration relationship				
1	1.8355	0.1755	1.8355	0.1755
2	4.5503	0.0329	4.5503	0.0329
3	0.9075	0.3408	0.9075	0.3408

**MacKinnon-Haug-Michelis (1999) p-values

Appendix 15: Panel Regression Results

Fixed Effects

Dependent Variable: RGDP
Method: Panel Least Squares
Date: 05/27/18 Time: 20:20
Sample: 1970 2016
Periods included: 47
Cross-sections included: 3
Total panel (balanced) observations: 141
White cross-section standard errors & covariance (d.f. corrected)
WARNING: estimated coefficient covariance matrix is of reduced rank

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	20.50003	1.098576	18.66056	0.0000
OPNES	0.031634	0.032679	0.968023	0.3357
INV	0.084016	0.026381	3.184736	0.0020
HK	-0.048999	0.053911	-0.908884	0.3659
FDI	0.141844	0.021078	6.729464	0.0000
EXR	0.013275	0.013206	1.005232	0.3176

Effects Specification

Cross-section fixed (dummy variables)
Period fixed (dummy variables)

R-squared	0.995452	Mean dependent var	24.34077
Adjusted R-squared	0.992682	S.D. dependent var	1.171854
S.E. of regression	0.100247	Akaike info criterion	-1.479252
Sum squared resid	0.874305	Schwarz criterion	-0.349939
Log likelihood	158.2872	Hannan-Quinn criter.	-1.020338
F-statistic	359.3158	Durbin-Watson stat	0.704609
Prob(F-statistic)	0.000000		

Pooled OLS

Dependent Variable: RGDP
Method: Panel EGLS (Cross-section weights)
Date: 05/27/18 Time: 20:05
Sample: 1970 2016
Periods included: 47
Cross-sections included: 3
Total panel (balanced) observations: 141
Linear estimation after one-step weighting matrix
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.18759	0.351549	28.97916	0.0000
OPNES	-0.161962	0.038652	-4.190270	0.0001
INV	0.483837	0.014628	33.07648	0.0000
HK	0.336078	0.032664	10.28892	0.0000
FDI	-0.073896	0.011242	-6.572915	0.0000
EXR	0.073618	0.004271	17.23504	0.0000

Weighted Statistics

R-squared	0.964003	Mean dependent var	25.86232
Adjusted R-squared	0.962670	S.D. dependent var	5.248333
S.E. of regression	0.241638	Sum squared resid	7.882511
F-statistic	723.0659	Durbin-Watson stat	0.465552
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.957951	Mean dependent var	24.34077
Sum squared resid	8.084015	Durbin-Watson stat	0.417814

Dependent Variable: RGDP
Method: Panel EGLS (Period random effects)
Date: 05/27/18 Time: 20:10
Sample: 1970 2016
Periods included: 47
Cross-sections included: 3
Total panel (balanced) observations: 141
Swamy and Arora estimator of component variances
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	10.25236	0.373232	27.46915	0.0000
OPNES	-0.207723	0.045995	-4.516246	0.0000
INV	0.490994	0.015597	31.47922	0.0000
HK	0.319841	0.031105	10.28270	0.0000
FDI	-0.061456	0.011107	-5.532987	0.0000
EXR	0.068976	0.004578	15.06779	0.0000

Effects Specification

	S.D.	Rho
Period random	0.000000	0.0000
Idiosyncratic random	0.189047	1.0000

Weighted Statistics

R-squared	0.958440	Mean dependent var	24.34077
Adjusted R-squared	0.956901	S.D. dependent var	1.171854
S.E. of regression	0.243282	Sum squared resid	7.990106
F-statistic	622.6606	Durbin-Watson stat	0.420721
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	0.958440	Mean dependent var	24.34077
Sum squared resid	7.990106	Durbin-Watson stat	0.420721

Correlated Random Effects - Hausman Test
Equation: Untitled
Test period random effects

Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Period random	120.178110	5	0.0000

** WARNING: estimated period random effects variance is zero.

Period random effects test comparisons:

Variable	Fixed	Random	Var(Diff.)	Prob.
OPNES	-0.167433	-0.207723	0.001337	0.2705
INV	0.464358	0.490994	0.000071	0.0015
HK	0.454761	0.319841	0.000580	0.0000
FDI	0.056409	-0.061456	0.000430	0.0000
EXR	0.071840	0.068976	0.000002	0.0637

Period random effects test equation:
Dependent Variable: RGDP
Method: Panel Least Squares
Date: 06/25/18 Time: 08:25
Sample: 1970 2016
Periods included: 47
Cross-sections included: 3
Total panel (balanced) observations: 141

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	6.370302	0.620095	10.27311	0.0000
OPNES	-0.167433	0.052401	-3.195204	0.0019
INV	0.464358	0.015323	30.30553	0.0000
HK	0.454761	0.031670	14.35927	0.0000
FDI	0.056409	0.023591	2.391184	0.0189
EXR	0.071840	0.005908	12.16043	0.0000

Effects Specification

Period fixed (dummy variables)

R-squared	0.983455	Mean dependent var	24.34077
Adjusted R-squared	0.973975	S.D. dependent var	1.171854
S.E. of regression	0.189047	Akaike info criterion	-0.216174
Sum squared resid	3.180761	Schwarz criterion	0.871312
Log likelihood	67.24024	Hannan-Quinn criter.	0.225743
F-statistic	103.7334	Durbin-Watson stat	0.583916
Prob(F-statistic)	0.000000		

Appendix 16: Panel least squares LSDV

Dependent Variable: RGDP
Method: Panel Least Squares
Date: 05/28/18 Time: 18:02
Sample: 1970 2016
Periods included: 47
Cross-sections included: 3
Total panel (balanced) observations: 141
White cross-section standard errors & covariance (d.f. corrected)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	15.00318	1.912188	7.846079	0.0000
OPNES	-0.114659	0.070785	-1.619820	0.1078
INV	0.279391	0.076521	3.651163	0.0004
HK	0.184851	0.068468	2.699827	0.0079
FDI	0.072118	0.032859	2.194762	0.0301
EXR	0.046987	0.047135	0.996856	0.3208
D2	-5.029961	2.019451	-2.490757	0.0141
D3	2.653167	1.881453	1.410169	0.1610
D2*OPNES	0.265518	0.074081	3.584181	0.0005
D2*INV	-0.262133	0.074978	-3.496144	0.0007
D2*HK	0.587191	0.102778	5.713223	0.0000
D2*FDI	-0.045498	0.032126	-1.416248	0.1592
D2*EXR	-0.018357	0.047129	-0.389503	0.6976
D3*OPNES	-0.052585	0.075698	-0.694668	0.4886
D3*INV	-0.120278	0.076796	-1.566213	0.1199
D3*HK	0.016773	0.065871	0.254638	0.7994
D3*FDI	-0.078606	0.037740	-2.082836	0.0393
D3*EXR	0.038491	0.062432	0.616526	0.5387

R-squared	0.994283	Mean dependent var	24.34077
Adjusted R-squared	0.993492	S.D. dependent var	1.171854
S.E. of regression	0.094533	Akaike info criterion	-1.761000
Sum squared resid	1.099179	Schwarz criterion	-1.384563
Log likelihood	142.1505	Hannan-Quinn criter.	-1.608029
F-statistic	1258.267	Durbin-Watson stat	0.882784
Prob(F-statistic)	0.000000		

Appendix 17: Panel diagnostic tests

Residual Cross-Section Dependence Test
Null hypothesis: No cross-section dependence (correlation) in residuals
Equation: Untitled
Periods included: 47
Cross-sections included: 3
Total panel observations: 141
Total panel observations: 141

Test	Statistic	d.f.	Prob.
Breusch-Pagan LM	6.841394	3	0.0771
Pesaran scaled LM	1.568243		0.1168
Pesaran CD	0.406812		0.6841

Appendix 18: Pairwise Dumistrusci-Hurlin Panel Causality Test

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 08/24/18 Time: 18:09
Sample: 1970 2016
Lags: 1

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
OPNES does not homogeneously cause RGDP	1.62145	0.64443	0.5193
RGDP does not homogeneously cause OPNES	2.42868	1.55281	0.1205
INV does not homogeneously cause RGDP	2.16567	1.25684	0.2088
RGDP does not homogeneously cause INV	3.06250	2.26605	0.0234
HK does not homogeneously cause RGDP	1.39757	0.39249	0.6947
RGDP does not homogeneously cause HK	6.48450	6.11682	1.E-09
FDI does not homogeneously cause RGDP	1.88603	0.94216	0.3461
RGDP does not homogeneously cause FDI	7.96282	7.78037	7.E-15
EXR does not homogeneously cause RGDP	4.06322	3.39215	0.0007
RGDP does not homogeneously cause EXR	2.33917	1.45207	0.1465
INV does not homogeneously cause OPNES	5.32188	4.80853	2.E-06
OPNES does not homogeneously cause INV	1.31379	0.29821	0.7655
HK does not homogeneously cause OPNES	1.38676	0.38032	0.7037
OPNES does not homogeneously cause HK	0.47248	-0.64852	0.5167
FDI does not homogeneously cause OPNES	0.95209	-0.10881	0.9134
OPNES does not homogeneously cause FDI	3.20766	2.42938	0.0151
EXR does not homogeneously cause OPNES	1.44960	0.45104	0.6520
OPNES does not homogeneously cause EXR	1.33071	0.31725	0.7511
HK does not homogeneously cause INV	2.14597	1.23467	0.2170
INV does not homogeneously cause HK	5.76718	5.30963	1.E-07
FDI does not homogeneously cause INV	2.93444	2.12193	0.0338
INV does not homogeneously cause FDI	6.98785	6.68325	2.E-11
EXR does not homogeneously cause INV	0.61572	-0.48732	0.6260
INV does not homogeneously cause EXR	3.26456	2.49342	0.0127
FDI does not homogeneously cause HK	1.68700	0.71819	0.4726
HK does not homogeneously cause FDI	7.15237	6.86838	6.E-12
EXR does not homogeneously cause HK	1.15115	0.11520	0.9083
HK does not homogeneously cause EXR	4.50031	3.88401	0.0001
EXR does not homogeneously cause FDI	5.17542	4.64371	3.E-06
FDI does not homogeneously cause EXR	3.14084	2.35420	0.0186

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 08/24/18 Time: 18:11
Sample: 1970 2016
Lags: 2

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
OPNES does not homogeneously cause RGDP	4.39312	1.78569	0.0741
RGDP does not homogeneously cause OPNES	5.50201	2.65118	0.0080
INV does not homogeneously cause RGDP	2.50195	0.30962	0.7569
RGDP does not homogeneously cause INV	5.49392	2.64487	0.0082
HK does not homogeneously cause RGDP	2.91062	0.62858	0.5296
RGDP does not homogeneously cause HK	4.25838	1.68052	0.0929
FDI does not homogeneously cause RGDP	1.67051	-0.33933	0.7344
RGDP does not homogeneously cause FDI	8.79458	5.22104	2.E-07
EXR does not homogeneously cause RGDP	4.01238	1.48852	0.1366
RGDP does not homogeneously cause EXR	6.01582	3.05220	0.0023
INV does not homogeneously cause OPNES	7.70856	4.37340	1.E-05
OPNES does not homogeneously cause INV	4.88502	2.16961	0.0300
HK does not homogeneously cause OPNES	6.02535	3.05964	0.0022
OPNES does not homogeneously cause HK	3.05459	0.74095	0.4587
FDI does not homogeneously cause OPNES	2.06277	-0.03317	0.9735
OPNES does not homogeneously cause FDI	2.99138	0.69162	0.4892
EXR does not homogeneously cause OPNES	1.51269	-0.46251	0.6437
OPNES does not homogeneously cause EXR	5.55073	2.68920	0.0072
HK does not homogeneously cause INV	3.18780	0.84492	0.3982
INV does not homogeneously cause HK	2.60262	0.38819	0.6979
FDI does not homogeneously cause INV	4.39028	1.78347	0.0745
INV does not homogeneously cause FDI	9.09654	5.45672	5.E-08
EXR does not homogeneously cause INV	1.04992	-0.82370	0.4101
INV does not homogeneously cause EXR	6.06241	3.08857	0.0020
FDI does not homogeneously cause HK	1.46210	-0.50199	0.6157
HK does not homogeneously cause FDI	7.12497	3.91791	9.E-05
EXR does not homogeneously cause HK	0.66687	-1.12267	0.2616
HK does not homogeneously cause EXR	10.6439	6.66442	3.E-11
EXR does not homogeneously cause FDI	4.68829	2.01607	0.0438
FDI does not homogeneously cause EXR	5.61849	2.74209	0.0061

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 06/04/18 Time: 18:43
Sample: 1970 2016
Lags: 3

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
OPNES does not homogeneously cause RGDP	4.84493	1.04314	0.2969
RGDP does not homogeneously cause OPNES	6.01778	1.77421	0.0760
INV does not homogeneously cause RGDP	4.27019	0.68489	0.4934
RGDP does not homogeneously cause INV	7.98324	2.99934	0.0027
HK does not homogeneously cause RGDP	6.67352	2.18295	0.0290
RGDP does not homogeneously cause HK	9.95115	4.22599	2.E-05
FDI does not homogeneously cause RGDP	2.73138	-0.27429	0.7839
RGDP does not homogeneously cause FDI	7.76981	2.86630	0.0042
EXR does not homogeneously cause RGDP	5.17505	1.24891	0.2117
RGDP does not homogeneously cause EXR	6.15586	1.86028	0.0628
INV does not homogeneously cause OPNES	5.88729	1.69287	0.0905
OPNES does not homogeneously cause INV	9.23850	3.78178	0.0002
HK does not homogeneously cause OPNES	6.30398	1.95261	0.0509
OPNES does not homogeneously cause HK	3.60584	0.27078	0.7866
FDI does not homogeneously cause OPNES	2.02663	-0.71358	0.4755
OPNES does not homogeneously cause FDI	4.25350	0.67449	0.5000
EXR does not homogeneously cause OPNES	4.68181	0.94146	0.3465
OPNES does not homogeneously cause EXR	16.8768	8.54297	0.0000
HK does not homogeneously cause INV	7.33264	2.59380	0.0095
INV does not homogeneously cause HK	5.22619	1.28079	0.2003
FDI does not homogeneously cause INV	5.25511	1.29882	0.1940
INV does not homogeneously cause FDI	8.51742	3.33231	0.0009
EXR does not homogeneously cause INV	3.02244	-0.09287	0.9260
INV does not homogeneously cause EXR	6.61362	2.14561	0.0319
FDI does not homogeneously cause HK	1.16847	-1.24850	0.2118
HK does not homogeneously cause FDI	7.30459	2.57631	0.0100
EXR does not homogeneously cause HK	1.49517	-1.04486	0.2961
HK does not homogeneously cause EXR	10.0098	4.26253	2.E-05
EXR does not homogeneously cause FDI	5.35908	1.36362	0.1727
FDI does not homogeneously cause EXR	9.63002	4.02582	6.E-05

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 06/04/18 Time: 18:47
Sample: 1970 2016
Lags: 4

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
OPNES does not homogeneously cause RGDP	7.30620	1.60797	0.1078
RGDP does not homogeneously cause OPNES	7.50790	1.71409	0.0865
INV does not homogeneously cause RGDP	7.32251	1.61655	0.1060
RGDP does not homogeneously cause INV	7.73875	1.83555	0.0664
HK does not homogeneously cause RGDP	12.1195	4.14043	3.E-05
RGDP does not homogeneously cause HK	11.1794	3.64578	0.0003
FDI does not homogeneously cause RGDP	3.20607	-0.54925	0.5828
RGDP does not homogeneously cause FDI	7.24254	1.57447	0.1154
EXR does not homogeneously cause RGDP	6.73114	1.30541	0.1918
RGDP does not homogeneously cause EXR	6.57142	1.22138	0.2219
INV does not homogeneously cause OPNES	7.59681	1.76087	0.0783
OPNES does not homogeneously cause INV	7.86285	1.90084	0.0573
HK does not homogeneously cause OPNES	6.37378	1.11739	0.2638
OPNES does not homogeneously cause HK	5.16361	0.48068	0.6307
FDI does not homogeneously cause OPNES	3.60769	-0.33794	0.7354
OPNES does not homogeneously cause FDI	5.20197	0.50086	0.6165
EXR does not homogeneously cause OPNES	3.37863	-0.45846	0.6466
OPNES does not homogeneously cause EXR	16.9726	6.69378	2.E-11
HK does not homogeneously cause INV	7.39943	1.65702	0.0975
INV does not homogeneously cause HK	6.06110	0.95288	0.3407
FDI does not homogeneously cause INV	5.14559	0.47120	0.6375
INV does not homogeneously cause FDI	10.0803	3.06753	0.0022
EXR does not homogeneously cause INV	2.95835	-0.67958	0.4968
INV does not homogeneously cause EXR	6.64596	1.26059	0.2075
FDI does not homogeneously cause HK	1.54190	-1.42482	0.1542
HK does not homogeneously cause FDI	8.50830	2.24043	0.0251
EXR does not homogeneously cause HK	2.37775	-0.98505	0.3246
HK does not homogeneously cause EXR	11.9649	4.05908	5.E-05
EXR does not homogeneously cause FDI	6.09479	0.97061	0.3317
FDI does not homogeneously cause EXR	15.1540	5.73696	1.E-08

Pairwise Dumitrescu Hurlin Panel Causality Tests
Date: 06/04/18 Time: 18:49
Sample: 1970 2016
Lags: 5

Null Hypothesis:	W-Stat.	Zbar-Stat.	Prob.
OPNES does not homogeneously cause RGDP	8.61228	1.49193	0.1357
RGDP does not homogeneously cause OPNES	10.0079	2.12915	0.0332
INV does not homogeneously cause RGDP	9.38061	1.84275	0.0654
RGDP does not homogeneously cause INV	7.02461	0.76700	0.4431
HK does not homogeneously cause RGDP	12.6355	3.32895	0.0009
RGDP does not homogeneously cause HK	22.0886	7.64527	2.E-14
FDI does not homogeneously cause RGDP	5.31823	-0.01214	0.9903
RGDP does not homogeneously cause FDI	8.62979	1.49992	0.1336
EXR does not homogeneously cause RGDP	10.4085	2.31210	0.0208
RGDP does not homogeneously cause EXR	7.44616	0.95948	0.3373
INV does not homogeneously cause OPNES	7.30609	0.89552	0.3705
OPNES does not homogeneously cause INV	7.82629	1.13304	0.2572
HK does not homogeneously cause OPNES	8.45958	1.42221	0.1550
OPNES does not homogeneously cause HK	4.11838	-0.56000	0.5755
FDI does not homogeneously cause OPNES	4.75657	-0.26860	0.7882
OPNES does not homogeneously cause FDI	6.80955	0.66880	0.5036
EXR does not homogeneously cause OPNES	5.14139	-0.09289	0.9260
OPNES does not homogeneously cause EXR	17.1041	5.36931	8.E-08
HK does not homogeneously cause INV	7.25617	0.87273	0.3828
INV does not homogeneously cause HK	7.52556	0.99573	0.3194
FDI does not homogeneously cause INV	8.81617	1.58503	0.1130
INV does not homogeneously cause FDI	10.9667	2.56698	0.0103
EXR does not homogeneously cause INV	3.50374	-0.84065	0.4005
INV does not homogeneously cause EXR	7.46818	0.96953	0.3323
FDI does not homogeneously cause HK	4.04951	-0.59145	0.5542
HK does not homogeneously cause FDI	8.74284	1.55155	0.1208
EXR does not homogeneously cause HK	6.04269	0.31865	0.7500
HK does not homogeneously cause EXR	11.6079	2.85976	0.0042
EXR does not homogeneously cause FDI	5.43565	0.04147	0.9669
FDI does not homogeneously cause EXR	14.7033	4.27311	2.E-05