Economic Growth, Institutions, and the Natural Resource Curse in Sierra Leone: an Empirical Investigation

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Abstract

This paper empirically investigates the existence of the resource curse in Sierra Leone through looking at the relationship between economic growth and resource dependence. The study adopted a Barrow-type growth model to analyze the effect of natural resource dependence on economic growth. A time series approximation technique was employed using relevant data from Sierra Leone from 1975-2014. The results from the time series regressions found a positive relationship between the rate of economic growth and natural resource dependence. This means that, the findings of this paper rejected the resource curse hypothesis in the Sierra Leone context relative to the data and method (time series analysis) employed. The findings suggests that a 1% increase in total natural resources rents (% of GDP), as a proxy of resource dependence, improves the economic growth of the country by approximately 9% in the long run. To this end, the government should endeavor to improve the means and methods of collecting natural resources rents to boost the economy of the country, hence economic development and the standard of living of the people in the country.

Keywords: Economic Growth, Institutions, Natural Resources, Resource Curse

1.1 Introduction

For the past several years, the relationship between economic growth and natural resources abundance has been a subject of debate and a renewed interest in this subject emerged in the 1990s. There seem to be no consensus on this point at this time on whether economic growth is being boosted by natural resources. The United States, New Zealand, Norway, Australia, Canada, Iceland, etc. are clear examples of countries where preliminary economic development have been induced by natural resource abundance (Mehlum et al., 2006). Starting with the work of Sachs and Warner (1995), however, they suggest that natural resources have a negative effect (often called the "resource curse") on economic growth (Mikesell, 1997). Sachs and Warner (1997a,b,c, 1999b, 2001), and Soros (2007), also confirmed this conclusion by a large number of cross-section studies they carried out considering different country samples and extended periods, and thus became a stylized fact (e.g., Auty, 1990; Gelb, 1988; Gylfason et al., 1999; Auty and Mikesell, 1998; Sachs and Warner, 1999a).

It was late in the 20th century that these studies, among others, emerged as evidence piled up on the lack of growth experience of resource-rich countries after Second World War [1]. To investigate what the researchers called a 'conceptual puzzle' and 'oddity', the negative relationship between natural resource abundance and subsequent economic growth already recommenced by the case studies of Gelb (1988), Auty (1990, 1991, 1993, 1994a, b), among others, together with initial cross-section empirical analyses by Wheeler (1984) and Auty and Evans (1994), was the purpose of Sachs and Warner's (1995) initial work. According to Keay (2007), the oil crunch in the 1970s and 1980s overturned the benign view of growth based on resources- that predominated in the early 1900s, namely due to the enthusiasm with Canada's favorable growth trajectory. The evidence of a curse of natural resources is puzzling since standard economic theory suggests that, like physical and human capital, natural resources should induce economic growth.

In the theoretical literature, there are four reasons that cause natural resources abundance/dependence to be associated with lower economic growth. First, natural resources tend to generate high rents that could encourage corruption. This outcome will be referred to more broadly as the institutional effect of natural resources (Sala-i-Martin and Subramanian 2003). Second, endowments of natural resources can lead countries to volatility, mainly to commodity prices, which could have a hostile effect on growth. Third, natural resources endowments make countries susceptible to the Dutch Disease. Lastly, it has been shown that abundance of natural resource damages long run growth via its negative impact on education. According to DeLong and Williamson

(1994), the observation that resource-poor countries sometimes outperform resource-rich countries is nothing new in economic history. Experience seems to indicate that it is not so much the existence of natural resources per se that hurts growth but rather the failure of public authorities to meet the policy challenge posed by natural resource abundance and to correct institutional and market failures that cause the damage. Owing to this fact, recent research has added an interesting dimension to the literature. According to this research, the negative association between resource abundance and economic growth can be explained by the quality of institutions in a country. That is, developing nations with great abundance of natural resources are not doomed to failure or poor economic performance if they have strong institutions (the institutions effect). According to (Mehlum et al., 2006; Bulte and Damania, 2008), countries or regions with institutions to guard against civil war are, thus, unlikely to be impacted by the curse of natural resources. We will therefore complement the literature by examining empirically whether the resource curse exists in Sierra Leone at a country level using time series data.

Sierra Leone is one of the countries richly endowed with abundant natural resources in the world. Such resources include diamonds, gold, rutile, bauxite, platinum, iron ore, fish, etc. The country was in 2010, the world's 10^{th} largest producer of diamonds (2010 Minerals Yearbook Sierra Leone) while earlier on, in 2007, the country was the 7^{th} largest producer of diamonds in the world. Although best-known for diamonds, Sierra Leone is also the world's third largest producer of rutile. Furthermore, according to Africa Minerals Limited (AML), the country, the Tonkolili project to be specific, was confirmed to have one of the largest iron ore deposits in the world. In addition to this, Sierra Leone's coastal waters are known to have the largest numbers of fish as well as the largest species of fish in West Africa.

Moreover, in 2010 oil was discovered in the country by Anadarko Petroleum Corp. These prospects could enable Sierra Leone to become a junior oil producing country in the coming years. Despite all the availability of these resources, Sierra Leone is still one of the countries in the world that is below the United Nations HDI, its per capita income is below $1000 per year. The important question now is, 'is there a resource curse in Sierra Leone?' This paper will therefore empirically investigate the existence of the resource curse in Sierra Leone through looking at the relationship between economic growth and resource dependence. Also, this paper will further investigate the relationship between institutions and economic growth to ascertain the importance of institutions in economic growth. However, the findings of this work would therefore complement those by other researchers and government in the formulation of policy with regards natural resources and economic growth.

1.2 Statement of the Problem

Many developing countries are gifted with rich natural resources such as oil, gas and minerals. Mining of these non-renewable resources gives a unique opportunity for economic growth to rapidly improve and reduce poverty, but few developing countries have really managed to convert the endowment of natural resources into sustained and inclusive growth, my country, Sierra Leone, not being an exception. Sierra Leone is one of the naturally endowed countries in the world. It is one of the world leaders in fish, timber, and minerals exports. In spite of this, the country has remained poor with a per capita income of around US$600 and an annual GDP per capita growth averaging about 5% per annum (World Bank). Since the war, Sierra Leone has been improving, and the GDP has risen from US$ 1.43 billion in 2003 to almost US$ 3.8 billion in 2012. Nevertheless, according to Natural Resource Watch, Sierra Leone is still one of the world's poorest countries and was ranked 177 out of 187 on UNDP's 2013 Human Development Index. Life expectancy is only 48 years, and over 50% of the population lives in extreme poverty.

This stands in glaring contrast to the country's vast natural resources. According to official numbers, from 2009 to 2012, Sierra Leone exported over US$ 1.2 billion in natural resources, comprising around 70% of the country's total exports (Bank of Sierra Leone). In this same period, the four main minerals exported were diamonds, iron ore, bauxite and rutile, complemented by the export of smaller quantities of gold and zircom.

Moreover, potential oil and gas fields are currently being explored, which could make the extractive sector even more important to Sierra Leone's economy and boost opportunities to finance social development. This suggests that there is hope for Sierra Leone becoming a commercial crude oil producer. The announcement of the discovery put smiles on the faces of many Sierra Leoneans, at least for the reason that the discovery and extraction of the oil will accelerate the long awaited elevation of Sierra Leone from low-income country to middle-income country status in the immediate run and possibly high income status in the long run. Owing to all these facts above, one would like to ask these questions: (i) did resource dependence have a negative impact on economic growth in the country? (ii) Is quality of institutions matter for economic growth? The main problem of this study will be the effort or attempt to try to proffer answers to these questions. But if the resource curse hypothesis really holds in the Sierra Leone scenario, then these hopes must have been farfetched. However, for policy purposes, then, this will help in the design of more appropriate strategies to avoid the resource curse and to stimulate economic growth, hence economic development, and poverty reduction.

1.3 Objectives of the study

The main objective of this research is to investigate the existence of a resource curse in Sierra Leone using data for the period 1975 – 2014. Specifically, the study aims at:

- Investigating empirically the relationship between economic growth and natural resources. If there is a negative relationship between natural resources and economic growth implies the existence of the 'resource curse' otherwise, no 'resource curse'.
- Examining empirically the interaction between economic growth and the quality of institutions. A positive relationship between economic growth and institutions is suggestive evidence that the quality of institutions matter for economic growth in Sierra Leone.

2. An Overview of the Contributions of Natural Resources to Economic Growth in Sierra Leone

Since the early 1930s, the mining sector has contributed immensely to the country's economy. Diamonds, rutile, bauxite, and iron ore are presently mined by major mining companies after a disruption of about 10 years, from 1995 to 2005, owing to the civil war. The country's proven diamond fields spread over an estimated area of nearly 20,000 square kilometers, which is more than 25% of the country. All greenstone belts in Sierra Leone (with the possible exception of the Marampa Group) are known to have gold. Iron ore, platinum, chromite, lignite, clays, and base metals (copper, nickel, molybdenum, lead, and zinc) are the other set of minerals identified in the country.

As a result of the mining sector (particularly the iron ore sector), the growth of real gross domestic product (RGDP) increased from 6% in 2011 to 16.7% in 2012. Before this period, real GDP growth was 3.2% in 2009 and increased to 5% in 2010. Sierra Leone's dependence on the mining sector is replicated by its huge impact to GDP (20 percent) and recorded exports (90 percent) during the 1990s. After the war in 2002, the contribution of the mining sector to the country's GDP is presently about 30%. Prior to the start of the war in 1991, mining was by far the most significant foreign exchange earner for the country. Foreign exchange income is still overwhelmingly dependent upon a single product, diamonds, which accounted for 34% of (regular) export earnings in 2009. An additional 24% of export earnings were credited to rutile and bauxite, which had only been resuscitated from their wartime collapse in 2006. Fiscal revenues' reached a maximum of around 8 percent of GDP in 1990 but degenerated to less than 2 percent after the closure of two important mines in 1994 owing to the civil conflict in the country. Mining's significance to fiscal revenue increased substantially with the reopening of the two closed mines as well as the opening of the kimberlite diamond mine in 2003. And significantly exceed the production and export figures before the civil conflict.

As at present, the most important commodity to the economy of Sierra Leone is diamonds. In 2010, the country was the 10th largest producer of diamonds in the world, with a yearly production of approximately 440.000 carats. The country, in 2010, also exported in excess of 550.000 carats valued at around 130 MUSD[4]**.** Earlier on, in 2007, the country was the 7th largest producer of diamonds in the world (see table 3-2 below).

Table 2-1: Major African Diamond Producers in 2007

Country	US$ (million)	% of World Production
1. Botswana	2,960.14	24.50
2. South Africa	1,417.33	11.70
3. Angola	1,271.96	10.50
4. Namibia	748.05	6.20
5. Democratic republic of Congo	609.83	5.00
6. Lesotho	164.07	1.40
7. Sierra Leone	141.57	1.20
8. Central African Republic	59.86	0.50
9. Guinea	50.20	0.41
10. Tanzania	28.50	0.24
11. Ghana	27.86	0.23
12. Zimbabwe	23.38	0.20
13. Liberia	2.70	0.02
14. Togo	1.24	0,01
Total	**7,506.65**	**62.08**

Source: Partnership Africa Canada, Diamonds and Human Security Annual Review 2008, Ottawa, Canada

Regardless of the fact that the country has been among the top 10 diamond producing countries in the world, it has constantly been ranked at the bottom side of the UN Human Development Index throughout the previous few decades. However, there has been an improvement in the HDI in recent years.
Also, table 3-3 below shows the exports of diamonds from 1998 – 2006.

Table 2-2: Diamond exports from Sierra Leone: 1998 – 2006 (GGDO)

Year	Carats	Value (US$)	Duty: 3% (US$)
1998	15,818.04	1,780,287.41	53,480.22
1999	9,320.32	1,244,825.34	37,344.76
2000	77,372.39	10,066,920.81	302,007.62
2001	222,519.83	26,022,492.27	780,674.77
2002	341,859.23	41,732,130.29	1,251,964.71
2003	506,723.37	75,969,753.32	2,193,335.84
2004 (+)	499,242.43 (A)	89,618,053.54	2,688,541.60
2004 (+)	58,030.54 (K)	11,172,434.79	335,173.04
2005	552,044 (A)	119,429,528	3,582,885.84
2005	116,665 (K)	22,510,716	675,321.48
2006 (*)	209,762 (A)	45,535,966	1,366,078.98
2006 (*)	30,631 (K)	6,984,425	209,532.75

(+) = Figures from January to September 2004
(*) = Figures from January to June 2006
(A) = Alluvial, (K) = Kimberlite

Source: Strasser King (2004:9) and GGDO Diamond Export figures, 2001-2006

From table 3-3 above, one can see that the value of diamonds exported dropped from around USD 1.7m in 1998 to USD 1.2m in 1999 during the heights of the civil war. From the year 2000 to 2005, the export value of diamonds increased gradually from around USD 10m to USD 119.4m in 2005. This increment in the value of exports could be attributed to the end of the civil war in the country. However, in 2005 for example, irrespective of the high value of Diamonds exported (US$119,429,528), the country was just able to receive US$3,582,885.84 as duty (see table 2-2).

Additionally, the implementation of the Kimberly Process Certification Scheme (KPCS)[5], a regulatory mechanism, has aided the improvement and management of the diamond industry in Sierra Leone significantly. Before the year 2000, the joint effect of the war and the absence of good management of the minerals sector lead to the government losing substantial revenue from its minerals resources.

By 2000, however, the civil war had subsided, and with the implementation of the KPCS, the total value of exports of diamonds increased. And from table 2-3 below, one can see that the total value of diamond exports continued to rise. By 2012, the export value had risen to US$ 163.2m.

Table 2-3: Sierra Leone Diamond Export, 2012

No	Country of destination	No. of KPC	Total(ct)	Export value(US$ m)	% share of Market
1	Switzerland	15	295,369	82.683	50.66
2	EC	141	227,062	74.248	45.50
3	UAE	30	9,550	2.896	1.77
4	USA	28	1,449	1.211	0.74
5	Israel	20	2,983	1.207	0.74
6	India	3	3,649	0.305	0.19
7	S. Africa	8	152	0.235	0.14
8	China	4	400	0.206	0.13
9	Armenia	1	147	0.077	0.05
10	Canada	2	90	0.052	0.03
11	Bangladesh	1	279	0.046	0.03
12	Indonesia	1	11	0.022	0.01
13	Croatia	1	24	0.009	0.01
	Cancelled	2	-	-	-
	Totals	**257**	**541,166**	**163.20**	**100**

Source: Mining Journal special publication – Sierra Leone

Even though Sierra Leone is well known all over the world for diamonds, it also possesses one of the largest natural rutile reserves in the world. With a production of approximately 70,000 tons in 2010, the country is the world's third largest producer of rutile in the world. In 2012, Sierra rutile produced 94,493t of rutile, attaining a 39% growth in production, relative to the 67,916t in 2011. This brings in a profit of US$ 83.5 million for 2012 (Sierra Leone Mining Journal). However, most of this profit is been expatriated to the mining company's country and only a mega sum is been received by Sierra Leone since the taxes levied as rents are very low.

The trade in gold likewise saw a stable annual increase from 2008 to 2012, with export volume increasing from 105.64 kg in 2008 to 166.74 kg in 2009, and a record 270.27 kg in 2010. This development, however, suffered some reversal when a 5% export duty was levied in 2011. However, it is promising that the revenue generated from gold could now be appropriately accounted for, which was not the case before 2008. The table below shows annual gold export from 2008 to 2012.

Table 2-4: Yearly gold exports (2008 – 2012)

Year	kg	koz	Value (US$ m)	Value (le millions)	Monthly Average (US $)	Average p/oz
2008	105.64	3.40	2.418	7,143.43	201,539.6	712.01
2009	166.74	5.36	4.280	14,500.80	356,646.0	798.24
2010	270.27	8.69	8.729	34,445.34	727,379.9	1,004.41
2011	167.15	5.37	6.395	27,512.07	532,890.2	1,189.79
2012	141.02	4.53	5.740	24,694.75	478,346.8	1,265.87
Total	**850.82**	**27.36**	**27.561**	**108,296.38**	**459,360.5**	**994.07**

Source: Mining Journal special publication – Sierra Leone

The mining of iron ore commenced in 2011. In 2010, African Minerals Ltd. (AML) held a 100% ownership in the Tonkolili project, located in the Sula Mountains Greenstone Belt. 298.8 million Dollars was AML sales revenue in 2013 and as a result of these sales revenue AML was the major contributor to the GDP of the country. AML being the biggest private company in the country, its activities then improved the volume of trade of the country significantly. This helped the country collected the much needed foreign exchange. AML was also the biggest private company employer in the country. Tonkolili Project employed 11,500 people at peak. (Corporate Presentation, 2013).

But owing to the fact that there was a meltdown in the economic growth of the world, especially China, which was buying the bulk of the ore produced, and coupled with the Ebola epidemic that hits West Africa the company has now been taken over by Shandong Iron Still Group (SISG).

Furthermore, in 2010, Sierra Leone was not a producer of hydrocarbons. The company Anadarko Petroleum Corp., nevertheless, announced a deep water discovery in the Mercury-1 well. These prospects may possibly enable Sierra Leone to become a junior oil producing country in the coming years.

During the 1990s, mining and quarrying provided a livelihood for more than 250,000 people, and directly or indirectly employed about 14 percent of the total labor force. Mining is presently the second most important sector in Sierra Leone, after agriculture, for employment and income generation, with an approximation of 300,000 people been directly employed in the sector. The World Bank, in 2005 estimated the employment figure to be between 200,000 and 400,000 people that are dependent on artisanal mining for the better part of their livelihood, meaning 4-8 % of the population. Today, the sustainable development of the valuable mineral resources of the country – which includes not only diamonds but also gold, rutile, bauxite, and iron ore – is a significant issue for government and has been at the center of the National Recovery Strategy (NRS) launched in October 2002, and the Poverty Reduction Strategy Paper (PRSP) of March 2005.

Similarly, fish is another very important resource that contributes and has the potential to contribute immensely to the economy of the country, in order to help alleviate or reduce poverty. Sierra Leone has a long coastline and a continental shelf of about 30,000 sq km that contains commercially viable stocks of many varieties of fish as well as shrimp, octopus, squid, lobster and crab. Once a key source of Sierra Leone's exports, the fisheries sector already accounts for approximately 10% of the GDP of the country and employs approximately 500,000 people. Given its incomparable potential, the fishing industry has been targeted as an important growth sector in the Agenda for Change of the President. The coastal waters in Sierra Leone are known to have the largest numbers of fish in addition to the largest species of fish in West Africa. The government is resolute to intensify its revenue collection from fishing. Moreover, 80% of the rural population of the country depends on fish as their primary source of protein.

3. Literature Review

3.1 Theoretical Literature Review

One of the main drivers of economic growth in the endogenous growth theory is the abundance of natural resources. The literature on the "natural resource curse" is just an extension of this theory. The association between resource dependence/abundance and economic growth was empirically analyzed by Sachs and Warner (1995), using World Bank data (for a number of indicators), which lead to more subsequent research in this area. These papers (Papyrakis and Gerlagh, 2004; Leite and Weidmann, 1999), for example, also confirmed the existence of a resource curse. Although puzzling, there are two common explanations in the theoretical literature about the existence of the resource curse. These are economic and political and institutional. The "Dutch disease" is the stand out economic explanation of the resource curse. This explanation points to the fact that, increases in prices or the discovery of new resources stocks lead an expansion of the sector of natural resources.

This in turn leads to the manufacturing sector diminished importance or a decreased GDP share. Positive externalities (in the form of learning by doing) are mainly present in the manufacturing sector (Matsuyama, 1992 and Sachs & Warner, 1995). This implies that the larger the natural-resource sector gets, the less the positive externalities from the manufacturing sector become owing to its decline, leading to a negative impact on overall economic growth. Neary and van Wijnbergen (1986), in their related Dutch Disease theses confirmed that natural resource booms delay the industrial sector, presumed as the main driving force of the economy, through either real exchange rate appreciation or the absorption of production factors. Therefore, the expansion of the natural-resource sector is not sufficient to counterbalance the negative effect of deindustrialization on economic growth. In addition, Gylfason (2001a), for example, points out that there is a change in composition of exports in favour of raw materials, or even a drop in total exports, thus reducing economic growth. However, according to (Leite and Weidmann, 2002; Sala-i-Martin and Subramanian, 2003), the empirical evidence does not lend credence for the Dutch Disease as an explanation of the resource curse. Auty's (2001a) case study does not also support this thesis by showing the complexity and diversity of cases among natural resource abundant countries, including several exceptions to the curse such as Norway, which has seized its oil abundance to become a rich country.

The political and institutional explanation is the other popular justification about the existence of the resource curse. The functioning of a political system could be affected by natural resources as this literature suggests, through several channels. Rent-seeking is one of the channels. Lane and Tornell (1999) and Torvik (2002), for example, explored this rent-seeking phenomenon in depth and developed theoretical models of rent seeking. A high level of resource abundance that creates incentives for rent-seeking behavior is their main argument. Torvik (2002), for example, suggests that greater amount of natural resources increases the number of entrepreneurs engaged in rent seeking and reduces the number of entrepreneurs running productive firms. With a demand externality, it is shown that the resulting drop in income is higher than the increase in income from the natural resource.

Therefore, more natural resources lead to lower welfare. Bulte et al., (2005) consider this thesis to have a very little explanatory power because natural resources abundance/dependence only penalizes economic growth in some countries. This further ignites researchers such as Acemoglu, 1995; Baland and François, 2000; to develop models where results depend on initial conditions. According to Lederman and Maloney (2008), they point out that foreign aid and monopoly also encourages high rents. This is not just for natural resources. Furthermore, nations that obtain significant revenue from natural resources may tax their populations less heavily and that the population may in turn be less likely to demand greater accountability and representation (Ross, 2001). In addition, natural resources can affect a country's social structure by creating wealthy elites who are less likely to support economic and political reforms.

Such rentier effects may undermine economic development in a country. Therefore, there are three consequences relating to when revenues from resources are extracted easily. First, for any given revenue target, the need for taxation decreases. Therefore, Inglehart, 1997; Lipset, 1959; Moore, 1966; Putnam, 1993 and more argue that citizens have less incentive to develop mechanisms of accountability and to develop deep civil society and social associations that are arguably preconditions of democracy. Second, the appeasement of the population through a diversity of instruments, such as, infrastructure projects, giving benefits to the population, buying off critics, etc., becomes possible as a result of the large revenues from resources. Lastly, the government is also permitted to pursue direct repression and violence against dissenters owing to the revenues from the resources. In this regard, the influence of good laws and institutions on the society that prevents rent-seeking behavior cannot be overemphasized.

In addition to what has been discussed above, there are a huge number of papers on the relationship between economic growth and institutions in a country. According to North (1990), by creating an environment that encourages voluntary transactions, risk-taking, and engaging in productive activities in general, institutions spur economic growth. Sobel (2008), stresses that economic institutions are important for economic growth since they determine how economic inputs—human, physical, and natural-resource capital— are transformed into economic outputs such as economic growth. Sobel (2008) suggests that by overlooking the role of economic institutions, one assumes that economic activity occurs in a vacuum. Acemoglu and Robinson (2008), in one of their works reason that institutions are the fundamental cause of economic growth and, therefore, of the differences in different levels of economic development across countries. In addition to what has been said, institutional qualities across countries may help explain differences in human capital, physical capital and technology across countries—all of which bring about economic growth. North (1991) said that institutions in general can be either informal, such as customs and traditions, or formal, such as laws and regulations, all of which produce the "rules of the game." It is these rules of the game that provide the incentives in a nation and determine how different economic actors interact and, thus, how economic inputs are used (Sobel, 2008; North, 1991).

3.2 Empirical Literature Review

Sachs and Warner (1995), in their initial paper developed a model of the Dutch disease to illustrate why a resource curse may exist in resource-rich nations. This seminal paper which is hugely influential ignites the debate on the effect of natural resources on economic growth. From 1970 to 1989, using data for a large number of nations (varying from 40 to 95 depending on the specific regression), Sachs and Warner examined the impact of natural resources on economic growth. They used primary product exports as a percentage of GDP or GNP as a proxy for resource abundance which they term SXP. Their findings suggest that, after controlling for a number of factors, natural resources have a negative impact on economic growth. According to them, the likely effects of the Dutch disease on the manufacturing sector, as explained above, is the cause of the negative impact.

By using different measures of natural resources, Boschini et al. (2007), carried a study that tests for the impact of natural resources on economic growth. These include the value of primary exports; value of exports of ores and metals plus fuels; value of mineral production (not including fuels); and value of production of gold, silver, and diamonds; all as a percentage of GNP or GDP for 80 nations from 1975 to 1998. They found out that gold, silver, and diamonds have the strongest negative impact on economic growth.

SXP as an appropriate measure of resource abundance has been questioned by a number of papers. Ding and Field (2005), for example, in their paper recognized a difference between resource abundance and resource dependence and argue that primary exports as a proportion of GDP (SXP) measures resource dependence rather than resource abundance. Therefore, rather than using SXP as a proxy for resource abundance, the authors construct two new measures. The World Bank's estimates of agricultural land, pasture land, forests, protected areas, metals, coal, oil, and natural gas are the measures they used for natural resource capital. Resource dependence is then measured as a ratio of natural-resource capital to total capital while resource abundance is measured as natural-resource capital per population. The authors conclude that resource abundance has a positive relationship with economic growth while resource dependence has a negative impact on economic growth after controlling for income, investment rate, openness, and rule of law.

Other studies by Sala-i-Martin and Subramanian (2003); Isham et al. (2005), which explore the impact of more direct measures of mining production, reserves or the stock of natural resources dismiss the negative impact of geographically concentrated resources found with export shares as confirmed by Lederman and Maloney (2008). For example, no correlation of fuel and mineral reserves on growth during 1970-1989 was found by Stijns (2005), while Davis (1995) points out that countries with a high share of minerals in exports and GDP performed relatively well in the same period. In fact, the mining share in GDP is one of the set of variables that impact positively on growth across the several million regressions in Sala-i- Martin et al (2004).

A few set of papers suggest the weaker growth in the resource sector caused there source curse. For example, an empirical study shows that the relatively slower growth in mineral and energy economies may simply reflect a resource drag whereby optimally managed per capita resource production does not grow substantially over time and hence introduces a drag on the measured growth of per capita economic output, which would have implications for trade and industrial policies implemented on the presumption that there are growth-reducing market failures associated with mineral and energy production (Davis 2011).

While the above argument is possibly true, it does not explain why several countries that are developed and have enormous natural resources, such as Norway, are also not dragged by the slower resource growth. Which means other factors must also be at play.

According to Birdsall and Hamoudi (2002), they argue that the findings of Dollar and Kraay (2001) that openness promotes growth is due, at least in some instance, to commodity dependent countries. Many countries of commodity exports were forced to diminish imports hence trade deficit, owing to the collapse of commodity prices in the 1980s, thus measures of openness were reduced. The openness growth-effect declines by at least half, when the authors control for commodity dependent countries. The authors conclude that the curse of natural resources (the resource curse) has very little or nothing to do with trade policy. Jalloh (2013) used a Barrow-type growth model to analyze the impact of natural resource wealth on economic growth. He employed a dynamic panel estimation technique using relevant data from West African Countries. His panel regressions findings indicate that natural resource endowments have very minimal impact in terms of promoting economic growth in West Africa, more so in resource rich countries. He suggests that part of the factors explaining his findings amongst others; include high corruption in the public sector as well as the frequency of civil conflicts in resource rich economies of West Africa.

Cotet and Tsui (2010) and Michaels (2011) carried out rare panel studies and dismiss the resource curse. The resource proxies they used are rather very special, which impede the comparison with previous studies. A unique panel dataset describing worldwide oil discoveries and extractions was used by Cotet and Tsui (2010), while Michaels (2011) focuses on geological variation in oil abundance in the Southern USA counties. Both studies show the positive correlation between oil abundance and population growth, which increases GDP growth in absolute terms but not in per capita terms. Also, a number of studies have been carried out on the 'resource Curse' in some developing countries in Sub Sahara Africa (SSA) such as Opeyemi (2012); Adu (2012) and Hammond (2011).

For example, Opeyemi (2012) carried out a study which investigates the existence of the resource curse in Nigeria and examines various challenges that caused it. Some of the issues are economical while others are political such as: high level of corruption, poor level of science and technology, policy implementation and infrastructural development, volatilities of price in the oil market, Dutch disease through overreliance on oil revenue, insufficient investment in education, weak institutionalized states, and lack of transparency among others. The result of the regressions showed that corruption/weak institution, poor level of technology and Dutch Disease have direct and significant impact on the resource curse in Nigeria while volatility of crude oil price does not have a significant impact on resource curse in Nigeria.

For Adu (2012), the paper investigated the relationship between long run economic growth in Ghana and natural resource abundance. Using nine different indicators that could proxy for resource abundance in nine alternative specifications, their results rejected the resource curse hypothesis.

A substantial body of empirical research has shown that the key to increasing economic growth and prosperity is economic freedom. In top academic journals of the world, Fact-based studies have shown that economic freedom in a country promotes growth, prosperity, and other positive outcomes. De Haan and Sturm (2000), for example, show empirically that positive (negative) change in economic freedom leads to positive (negative) change in economic growth rates using the EFW index published annually in Economic Freedom of the World. The critical importance of institutional quality has been identified over the last decade, in the literature on economic growth. For example, large effects of institutional quality on income per capita were found by Acemoglu et al. (2001). In another paper, the impact of economic freedom on economic growth was examined by Gwartney et al. (2006), but with a specific focus on investment and productivity. They conclude that economic freedom promotes investment and growth for a country.

Changes in economic freedom have a huge influence on the steady-state level of income even after the level of technology, the level of education of the workforce, and the level of investment are taken into account. Dawson (1998) showed that economic freedom directly increases economic growth by increasing the efficiency at which inputs are transformed into outputs; it has an indirect effect by encouraging and attracting investment. Similar conclusions were found by Gwartney, Holcombe, and Lawson (2006).

The crucial role of institutions for natural resources abundance countries has been made aware by recent research on the resource curse. For example, countries with abundant natural resources need not be affected by a resource curse if they have strong institutions (Mehlum et al. 2006). Using Sachs and Warner's measure of natural-resource abundance (SXP), they show that the resource-curse effect depends on the quality of the institutions: for countries with weak institutions, natural resources are a curse but, for countries with strong institutions, resources are actually a "blessing," and their economic growth is greater than that of resource poor Nations.

In another approach, Papyrakis and Gerlagh (2007) show the existence of a resource curse within United States regions. They conclude that resource abundance (as measured by the primary sector share in Gross State Product) fosters corruption (correlated to poor institutions), reduces investment, schooling, and R&D.

This research will add to the literature stated above by using a more comprehensive measure of institutions. Sachs and Warner (1995) and Brunnschweiler (2006) used the rule-of law index while Kolstad (2007), employed the democracy index, as an institutions proxy. Our proxy for institutions, the EFW index from the Fraser Institute's Economic Freedom of the World by Gwartney and Lawson compiled annually, is a more comprehensive estimate of economic institutions center on several components (42 variables). These proxyfor institutions (EFW index) will allow us to analyze precisely the institutions impact on economic growth.

Several papers that have attempted empirically to study the resource curse hypothesis has one common characteristic, which is, the use of panel and cross country data for large number of countries rich in different sources types, whose growth impact might not be the same. In order to understand the relationship between endowment of resource and economic growth, studies that are related to single – country case are needed. Unfortunately, no time series econometric technique research has been carried out in Sierra Leone. This paper aims to narrow or fill the gap in the literature by employing time series data (country – case study) to examine the existence of the resource curse in Sierra Leone. The main contribution of this paper is to apply time series econometric method and a different proxy for natural resource dependence (total natural resources rents as % of GDP) to analyze the contribution of natural resources to the growth and development process of Sierra Leone.

Also, the bulk of papers examining the economic growth-resource curse nexus used a kind of the neoclassical growth model (Solow, 1956), which has been enhanced to incorporate variables of human capital (from Mankiw et al., 1992) and transmission mechanisms such as institutions, democracy or Dutch disease. Studies are yet to include all these explanatory variables in a single model for time series empirical investigation to measure their different effects for a single-country case like Sierra Leone. This paper also aims to narrow this gap. Time series country - case studies like this will allow us to relate our findings to the facts and experience of our country and other government policy makers in other regions that are similar to this country to apply the findings of this paper to promote economic growth.

4. Data and Methods

4.1 Source of Data

In this section, Data set collected from World Bank's data set from the World Development Indicators, International Financial Statistics, EFW and United Nations Educational Scientific and Cultural Organization (UNESCO) Institute of Statistics database were used. The following variables real GDP, resource dependence, economic freedom, openness to trade, tertiary education enrollment, inflation rate and a war dummy are employed in the study for the period 1975 to 2014. The degree to which the institutions and polices of various countries are helpful to economic freedom is measured in an index published as economic freedom of the world. Voluntary Exchange, personal choice, freedom to compete and security of privately owned property are the foundations of economic freedom. To quantify the amount of economic freedom in five broad areas (size of government; legal structure and security of property rights; access to sound money; freedom to trade internationally; regulation of credit), and the construction of a summary index involve the use of 42 variables. It ranks countries from 10 (high economic freedom) to 0 (no economic freedom at all). The RD (resource dependence) and TEE (tertiary education enrollment) data are obtained from the World Bank Publications. The human capital stock (TEE) is also considered as part of the country's natural resources, hence assess its impact on the growth of the economy by introducing it in the model as one of the control variables. The RGDP (real GDP), OPEN (openness to trade) and INF (inflation) data, are all obtained from IFS CD-ROM WDI.

4.2 Model Specification

This paper presents an empirical examination into the existence of the resource course in Sierra Leone by looking at the relationship between economic growth and resource dependence, applying an econometric approach. The methodology involves regressing real GDP on resource dependence, economic freedom, openness to trade, tertiary education enrolment, inflation and war, a dummy variable, employing the following procedure: Testing for stationary of the variables by applying the Augmented Dickey Fuller tests of unit roots; followed by Johansen co-integration to look for the presence of long-run relationships. Also, the Vector Error Correction Model (VECM) and the Granger Causality Tests were used to evaluate the error correction term and causal relationship respectively. Lastly, tests of stability and diagnostic also involved to determine the robustness of the adopted model. In relation to reviewed literatures, the following functional form was adopted as the model:

RGDP = F (RD, EFW, OPEN, TEE, INF, WAR) ……. (1)

Equation 2 below is the econometric form of the model:

$$RGDP_t = \alpha_0 + \alpha_1 RD_t + \alpha_2 EFW_t + \alpha_3 OPEN_t + \alpha_4 TEE_t + \alpha_5 INF_t + \alpha_6 WAR_t + \varepsilon_t \ldots (2)$$

To approximate the degree of responsiveness (elasticity) of RGDP with respect to RD, EFW, OPEN, TEE, INF and WAR. The Log-Log model (eq. 3) was applied.

$$LOGRGDP_t = \alpha_0 + \alpha_1 LOGRD_t + \alpha_2 LOGEFW_t + \alpha_3 LOGOPEN_t + \alpha_4 LOGTEE_t + \alpha_5 LOGINF_t + \alpha_6 WAR_t + \varepsilon_t \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Where,

RGDP = real gross domestic product
RD = resource dependence, a proxy for natural resources measured as total natural resources rents (% of GDP)
EFW = economic freedom of the world as a proxy for quality of institutions taken from The Economic Freedom of the World annual report by James Gwartney and Robert Lawson
OPEN = openness to trade measured as a ratio of the sum of exports and imports to GDP
TEE = a proxy for human capital measured as the number of tertiary education enrollment in the total Population

INF = inflation rate
DUM = a dummy variable taking the value of one between 1991 and 2000 and zero otherwise
α_0 = constant,
α_1- α_5 = parameters to be assessed and
ε_t = error term

The following are expected of the model: $\alpha_1, \alpha_2, \alpha_3, \alpha_4 > 0$ and α_5 and $\alpha_6 < 0$. E-views 7.2 software was used to estimate the model.

4.3 Estimation of Econometric Model

The use of Econometric method to point out the importance of examining the data producing method that are important to the variables before approximating the parameters and carry out several hypothesis testing, is a normal exercise for all effective studies. This process is intended to eliminate spurious regression outcomes difficulties.

4.3.1 Unit Root Test Estimation

Unit root testing was carried out in the study. The sequence of integration for each variable in the resource curse function was to be determined. That is why the test was employed. If a variable is non-stationary at level but become stationary at first differencing – integrated of order one; it is said to have a unit root. Augmented Dickey Fuller (ADF) test was employed to estimate equation (4):

$$\Delta Y_t = \alpha_0 + \alpha_1 Y_{t-1} + \sum_{i=1}^{n} \alpha \Delta Y_i + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (4)$$

Where,

Δ= Difference operator,
t = Time trend
Y_t = Variable under deliberation
n = Number of lags and
ε_t = Stochastic error term.

The null hypothesis is that, the series is non-stationary against alternative hypothesis that the series is stationary. We reject the null hypothesis of non-stationary and conclude that the series is stationary if the absolute value of the ADF test is greater than the critical value at the 5% level. On the other hand, if the absolute value of the ADF test is less than the critical value, we accept the null hypothesis meaning the series is non-stationary.

4.3.2 Estimation of Co-Integration Test

Examination of co-integration will be suitable to approximate the long-run resource curse function, since the variables are presumed to be stationary- integrated of the same order. The theory states that if the linear combination of non-stationary time series is co-integrated, then they are stationary. To test for the existence of long-run equilibrium relationship between the variables of equal order of integration via the design of co-integration equation(s), the test of co-integration must be employed. The Johansen and Juselius (1988, 1990) test method of maximum likelihood will be used. The test needs the error term in the long-run relationship to be stationary. Entirely, assumed that Y_t is a vector of n number of stochastic variables, it follows that there occur a K-lag vector Auto-regression with Gaussian errors of the resulting arrangement where the methodology of Johansen and Juselius (1988, 1990) implement its preliminary idea in the Vector Auto regression (VAR) of order K identified by:

$$Y_t = \delta + \beta_1 Y_{t-1} + \cdots + \alpha_k Y_{t-k} + W_t \dots\dots\dots\dots\dots\dots\dots 5$$

Where,

Y_t = (nx1) column vector of k-variables that are integrated of order one and
w_t = vector of white noise residuals.
Equation (5) above can also be stated as equation (6) representing the Vector Error Correction Model (VECM).

$$\Delta Y_t = \delta + \Pi Y_{t-1} + \sum_{i=1}^{k-1} \Gamma_i \Delta Y_{t-1} + \varepsilon_t \qquad (6)$$

$$\Pi = \sum_{i=1}^{k} \Gamma_i - 1 \; and \; \Gamma_i = -\sum_{j=i+1}^{k} . \alpha_j$$

Where,
Δ = difference operator,
Y_t = k-variables nx1 column vector,
$\boldsymbol{\delta}$ = constant,
ε_t = error term,
$\boldsymbol{\Gamma}_i$ = long-run coefficient matrix and
$\boldsymbol{\Pi}$ = short-run coefficient matrix.
$\boldsymbol{\Gamma}_i$ and $\boldsymbol{\Pi}$ show the effect in the long-run and short-run respectively. Therefore, to estimate the number of co-integration vectors is the important aim here. The use of two statistical tests, which are the trace test ($\boldsymbol{\lambda}_{trace}$) and the maximum Eigen value test ($\boldsymbol{\lambda}_{max}$) were recommended by Johansen and Juselius (1988, 1990).
Equations (7) and (8) are used to estimate the two tests.

$$\lambda_{trace}(r) = -T \sum_{j=i+1}^{n} ln(1 - \widehat{\lambda_i}) \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 7$$

$$\lambda_{max}(r, r+1) = -Tln\left(1 - \widehat{\lambda_{r+1}}\right) \dots\dots\dots\dots\dots\dots\dots\dots\dots 8$$

Where,
$\boldsymbol{\lambda}_{trace}$ tests the null hypothesis r = 0 against the alternative of r > 0
T = number of usable observations
$\boldsymbol{\lambda}_i$ = estimated characteristics root or Eigen values
$\boldsymbol{\lambda}_{max}$ test the null hypothesis r = 0 against the alternative of r =1.

If there is a long run relationship among the variables, then the null hypothesis of no co-integrating vector is rejected in favour of the alternative.

4.3.3 Estimation of Vector error Correction Model

The Vector Error Correction Model (VECM) is a restrictive vector auto regressive (VAR) model that can be used to approximate time series data that are non-stationary and which are known to be co-integrated. It is planned in such a manner that it limits the long-run relationship of the explanatory variables to meet their co-integration relationship and at the same time permit for short-run correction. Equation (9) can also help to describe the situation.

$$\Delta X_t = \gamma_0 + \gamma_1 + \Delta Y_t + \lambda V_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots 9$$

Putting equation (3) into equation (9) to include the error correction term, to reveal the short-run dynamics gives:

$$\begin{aligned} \Delta LogRGDP_t = {} & \alpha_0 + \sum_{i-1}^{q} \alpha_1 \Delta LogRGDP_{t-j} + \sum_{i-1}^{q} \alpha_2 \Delta LogRD_{t-j} + \sum_{i-1}^{q} \alpha_3 \Delta LogEFW_{t-j} \\ & + \sum_{i-1}^{q} \alpha_4 \Delta LogOPEN_{t-j} + \sum_{i-1}^{q} \alpha_5 \Delta LogTEE_{t-j} + \sum_{i-1}^{q} \alpha_6 \Delta LogINF_{t-j} + \sum_{i-1}^{q} \alpha_7 \Delta WAR_{t-j} \\ & + \lambda ECM_{t-1} + \varepsilon_t \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots 10 \end{aligned}$$

Where,
Δ = first difference operator,
q = lag length,
$\boldsymbol{\lambda}$ = adjustment speed and
ECM_{t-1} = lagged error term.
All other variables remained as defined previously.

4.3.4 Test of Granger Causality

In order to detect causal relationship between the variables under examination and to also establish whether the present lagged values of one variable affects another, the test of Granger causality was conducted.

Assumed two variables X and Y, X is affected by Y if X can be forecast well from prior values of X and Y than from prior values of X alone (Granger, 1969). Equations (11) and (12) can be used to describe this causal relationship.

$$X_t = b_0 + \sum_{i=1}^{p} b_i Y_{t-i} + \sum_{j=1}^{q} d_i X_{t-j} + e_t \quad \text{11}$$

$$Y_t = c_0 + \sum_{i=1}^{p} c_i X_{t-i} + \sum_{j=1}^{q} r_i Y_{t-j} + w_t \quad \text{12}$$

Equations (11) and (12) are centered on the supposition that $\boldsymbol{e}_t$ and w_t are uncorrelated white noise error terms.

4.3.5 Stability and Diagnostic Tests

Normal practice demands for stability and diagnostic tests, to determine the strength of the model employed. To examine the stability of the coefficient estimated as the sample size increases is the objective of this test. Our primary motive is to investigate whether the approximations will be different in large samples or remain stable over time. The procedure of cumulative sum (CUSUM) test proposed by Brown et al (1975) will be used to observe the stability of the assessed model. The coefficient estimates are believed to be stable if the plot of CUSUM is within 5% significance level (illustrated by two lines). Auto regressive conditional heteroscedasticity (ARCH), normality of residual, serial correlation, and heteroscedasticity test statistics are employed for the diagnostic test.

5. Analysis and discussion of empirical results

In this section of this chapter, we analyze the empirical results. We employed the Augmented Dickey Fuller (ADF) test to test for the time series properties of the variables under examination. This is done by differencing each variable till stationary is achieved. Also, the Johansen's co-integration test was used for the maximum lag selection criteria. In addition to this, the Vector Error Correction model (VECM) estimation was carried out. Finally, the analysis of the granger causality test and the stability and diagnostic test results are carried out to determine the strength of the econometric model.

5.1 Results of Unit Root Test

Table 5-1: Results of the Augmented Dickey Fuller (ADF) Unit Root Test

		Augmented Dickey-Fuller (ADF) Unit Root Test				
Variable		**One-lag model**		**Two-Lag Model**		**Conclusion**
		Constant	**Constant and Trend**	**Constant**	**Constant and Trend**	
LNRGDP	level	-3.098940	-3.959692	-3.098940	-3.959692	
	Δ level	-8.250955**	-8.128524**	-8.250955**	-8.128524**	I(1)
LNRD	level	-1.640405	-2.142251	-1.640405	-2.142251	
	Δ level	-5.848821**	-5.800177**	-5.848821**	-5.800177**	I(1)
LNEFW	level	-1.011121	-1.231342	-1.011121	-1.231342	
	Δ level	-5.526276**	-5.888514**	-5.526276**	-5.888514**	I(1)
LNOPEN	level	-1.910617	-2.027655	-1.910617	-2.027655	
	Δ level	-6.657576**	-7.033931**	-6.657576**	-7.033931**	I(1)
LNTEE	level	-1.239191	-2.508026	-1.239191	-2.508026	
	Δ level	-5.699916**	-5.624079**	-5.699916**	-5.624079**	I(1)
LNINF	level	-2.394843	-2.632792	-2.394843	-2.632792	
	Δ level	-6.784694**	-6.684086**	-6.784694**	-6.684086**	I(1)

Δ = first difference, ** means 5%, and I (1) = integrated of order one

Not all the variables are stationary in level but stationary at first difference as shown by the ADF unit root test results in table 5-1. The variables are, therefore, integrated of order one, denoted as I (1).

5.2 Results of Optimal Lag Selection

In order to test for the long-run relationship between the variables by using the Johansen's test of co-integration and also to conduct the Vector Error Correction Model (VECM) estimation, the optimal lag selection criteria was first employed to determine the lag length to be used in carrying out the estimation. According to the optimal lag selection criteria, Lag three maximum was selected by the system as shown in table 5-2

Table 5-2: VAR Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-101.9356	NA	5.26e-08	5.942464	6.290771	6.065259
1	57.60536	241.4674	3.26e-10	0.778089	3.912848	1.883238
2	158.4699	109.0428	7.43e-11	-1.214590	4.706621	0.872914
3	302.3238	93.31063*	5.61e-12*	-5.531017*	3.176647*	-2.461157*
* 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						

***Source*: E-views 7.2 output**

5.3 Co-integration Test Results

In order to establish the existence of long- run relationship between the variables, the Johansen's co-integration test was carried out. Both the trace statistics (λ_{trace}) and the maximum Eigen statistics (λ_{max}) were employed and the results are shown in tables 5-3 and 5-4.

Series: LNRGDP LNRD LNEFW LNOPEN LNTEE LNINF WAR
Lags interval (in first differences): 1 to 3

Table 5-3: Unrestricted Co-integration Rank Test (Trace)

Hypothesized No. of CE(s)	Eigen value	Trace Statistic	0.05 Critical Value	Prob.**
None *	0.997076	529.3942	125.6154	0.0001
At most 1 *	0.963472	319.3377	95.75366	0.0000
At most 2 *	0.907996	200.1891	69.81889	0.0000
At most 3 *	0.861288	114.2960	47.85613	0.0000
At most 4 *	0.609210	43.18310	29.79707	0.0008
At most 5	0.225021	9.358008	15.49471	0.3333
At most 6	0.005013	0.180933	3.841466	0.6706
Trace test indicates 5 co integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: E-views 7.2 output; ** means 5%

Table 5-4: Unrestricted Co integration Rank Test (Maximum Eigen value)

Hypothesized No. of CE(s)	Eigen value	Max-Eigen Statistic	0.05 Critical Value	Prob.**
None *	0.997076	210.0565	46.23142	0.0000
At most 1 *	0.963472	119.1486	40.07757	0.0000
At most 2 *	0.907996	85.89312	33.87687	0.0000
At most 3 *	0.861288	71.11292	27.58434	0.0000
At most 4 *	0.609210	33.82509	21.13162	0.0005
At most 5	0.225021	9.177075	14.26460	0.2717
At most 6	0.005013	0.180933	3.841466	0.6706
Max-eigen value test indicates 5 co integrating eqn(s) at the 0.05 level				
* denotes rejection of the hypothesis at the 0.05 level				
**MacKinnon-Haug-Michelis (1999) p-values				

Source: E-views 7.2 output; ** means 5%

The result of the co-integration test for the trace statistics shows five co-integrating equations at the 5% level of significance and the maximum Eigen statistics also shows five co-integrating equations at the 5% level of significance. However, the Vector Error Correction Model (VECM) was then estimated since the variables under estimation are co-integrated, that is there exist long-run relationship among real GDP and resource dependence, quality of institutions, openness to trade, tertiary education enrollment, and inflation. Table 5-5 lists the long-run resource curse function results.

Table 5-5: Result of the long run budget deficit model

Dependent variable: LNRGDP				
Independent variables	coefficient	Standard error	t-statistics	conclusion
LNRD	9.238358	0.35972	25.6821	Significant
LNEFW	15.37538	1.05848	14.5259	Significant
LNOPEN	-7.692845	0.25244	-30.4740	Significant
LNTEE	4.204514	0.11401	36.8785	Significant
LNINF	-2.436746	0.11591	-21.0227	Significant
WAR	-0.575664	0.15942	-3.6110	Significant
Constant	268.2395	……	……	……

Source: **computed by authors from e-views 7.2 output**

Results from the long run resource dependence model revealed that resource dependence has a positive relationship with economic growth represented by real GDP in the case of Sierra Leone. The coefficient was found to be positive and significant at the 1 percent level of significance signifying that a 1 percent increase in natural resources rents leads to approximately 9 percent improvement in economic growth on average in the long run. The degree of responsiveness of economic growth with respect to resource dependence is 9.238. This result did not substantiate the resource curse phenomenon. A good number of researchers have also reached similar conclusions that, relative to the resource dependence proxy and econometric method employed (time series in this case), natural resource dependence does not slow economic growth rather it improves it (Van der Ploeg and Poelhekke, 2010; Sala-i-Martin *et al.*, 2004; Nunn, 2008; Manzano and Rigobon, 2006; Adu, 2012) as also indicated in the findings of this paper.

Also, the quality of institutions represented by economic freedom of the world (EFW) has a positive relationship with economic growth. The coefficient was also found to be positive and significant since the absolute value of the t-statistics is greater than two. This implies that a 1 percent improvement in the quality of institutions will further improve economic growth by approximately 15 percent on average in the long run. The elasticity of economic growth relative to the quality of institutions is 15.375. These findings lend credence to the idea that sound economic institutions matter for economic growth as found by the following researchers (Easton and Walker, 1997; De Haan and Sturm, 2000; Dawson, 1998; Doucouliagos and Ulubasoglu, 2006). They indicated that economic freedom directly improves economic growth by increasing the efficiency at which inputs are transformed into outputs; it has an indirect effect by encouraging and attracting investment. Related outcomes were also established by Gwartney, Holcombe, and Lawson (2006).

In relation to openness to trade and economic growth, the study finds a negative and significant relationship. In relative terms, this implies that a 1 percent increase in trade openness decreases economic growth by 7 percent on average in the long run. This finding lends support to the result of Huchet-Bourdon et al. (2013) which suggests that trade may have a negative impact on growth when countries, like Sierra Leone, have specialized in low quality products. They concluded that trade obviously improves growth once countries have specialized in high quality products and their export basket exhibits a minimum required level of quality. They established that the higher the quality of the export basket, the greater the impact of the export ratio on growth. Our findings also endorses Hausmann *et al.* (2007)'s result that a higher quality of exports increases growth. Our results also lend credence to Feenstra and Kee (2008) and Feenstra (2010) which imply that a higher variety of exports contributes to improve growth.

In terms of the relationship between the variable representing human capital (TEE) and economic growth in Sierra Leone, the results from the time series regression demonstrate a positive and significant impact on growth. In terms of relative effects, the results show that a 1% improvement in the quality of human capital will encourage a corresponding growth in real GDP by approximately 4% in the long run.

This result supports the findings of Jalloh (2013) that the quality of human capital plays a significant role in promoting economic growth in any country. As for inflation, it has an inverse relationship with economic growth. The sign of the coefficient is negative and significant suggesting that a 1 percent increase in inflation will decrease economic growth by approximately 2% on average in the long run. Given the welfare effect of economic growth, it suggests that a country with high inflation characteristically sees depreciation in its currency in relation to the currencies of its trading partners. And since Sierra Leone is a high net importing country, this will cause all prices of imported goods to increase there by further increasing the budget deficit of the country, and hence further cause setback to economic growth. This finding lends support to Kargbo et al. (2015) which states that inflation has a negative effect on economic growth in Sierra Leone.

The variable for the war dummy is established to have a negative effect on economic growth and therefore diminishes output growth.

5.4 Short run dynamics (VECM)

In order to determine the dynamics of the short run, the Vector Error Correction Model (VECM) was employed. Since the existence of long run relationship among the variables has been established, this encourages the approximation of the short run dynamic model. The vector error-correction model (VECM) is a restrictive vector autoregressive (VAR) model for the static forms of real GDP, resource dependence, quality of institutions, openness to trade, tertiary education enrollment, and inflation. The ordinary least square (OLS) method was used to estimate the VECM. To test the short-run and long-run behavior of the dependent variable (real GDP) relative to its explanatory variables the error correction mechanism was employed. Previously, it has already been established that the variables have long-run relationship. There may be disequilibrium, however, in the short run that is why the error correction model was therefore employed to remove divergence from the long-run equilibrium. The coefficient of the speed of adjustment is the most important when estimating for the short run. The Vector Error Correction Model (VECM) result is shown in table 5-6

Table 5-6: Result of the Vector Error Correction Model

Dependent Variable: Δ LNRGDP$_t$				
Variable	**Coefficient**	**Std. Error**	**t-Statistic**	**Prob.**
ECT_{t-1}	-0.025531	0.010223	-2.497423	0.0209**
Δ $LNRGDP_{t-1}$	0.610855	0.184734	3.306671	0.0034***
Δ $LNRGDP_{t-2}$	0.532989	0.183679	2.901745	0.0085***
Δ $LNRD_{t-1}$	-1.555722	1.237414	-1.257237	0.2225
Δ $LNRD_{t-2}$	-0.665989	1.499094	-0.444261	0.6614
Δ $LNEFW_{t-1}$	0.726060	2.649658	0.274020	0.7867
Δ $LNEFW_{t-2}$	6.865177	4.228980	1.623365	0.1194
Δ $LNOPEN_{t-1}$	2.111712	1.126937	1.873850	0.0749*
Δ $LNOPEN_{t-2}$	0.329625	1.114166	0.295849	0.7703
Δ $LNTEE_{t-1}$	4.231345	2.069698	2.044426	0.0537*
Δ $LNTEE_{t-2}$	2.784745	1.529014	1.821269	0.0828*
Δ $LNIF_{t-1}$	-0.513766	0.330899	-1.552637	0.1355
Δ $LNIF_{t-2}$	-0.511009	0.303131	-1.685767	0.1066
Δ $LNWAR_{t-1}$	-1.847980	1.195977	1.545163	0.1372
Δ $LNWAR_{t-2}$	-0.752900	0.948726	0.793591	0.4363
C	-0.017162	0.226440	-0.075792	0.9403
R-squared	0.861520	Mean dependent var	0.160487	
Adjusted R-squared	0.734034	S.D. dependent var	1.564733	
S.E. of regression	1.156173	Akaike info criterion	3.426578	
Sum squared resid	28.07148	Schwarz criterion	4.123191	
Log likelihood	-47.39169	Hannan-Quinn criter.	3.672167	
F-statistic	2.995881	Durbin-Watson stat	2.015716	
Prob(F-statistic)	0.010631			

Source: E-views 7.2 output; * Significant at 1%, ** Significant at 5%, * Significant at 10%,**

The long run causal relationship running from resource dependence, quality of institutions, openness to trade, tertiary education enrollment, and inflation to economic growth was confirmed by the existence of the expected negative sign of the coefficient of the error correction term. The adjustment speed of the error term is -0.025531. The magnitude of the coefficient suggests that 2.55 percent of the disequilibrium (deviation from the long run) in the previous year's shock corrects back to long run equilibrium in the current year. The result in table 5-6 above shows that, in the short run; resource dependence is found to negatively affect economic growth but insignificant in both periods (one lag and two lag periods). Similarly, inflation is found to negatively affect growth but not significant in both periods, lag one and lag two. The results further indicate that the quality of institutions and economic growth are positively related but also not significant in one and two lag periods.

The one lag period value of the degree of openness of the economy to international trade is found to have a positive elasticity with RGDP and significant at 10% and the two period lag value has a positive elasticity with RGDP but insignificant. The positive effect of the one lag period of openness to trade on economic growth in the short run as opposed to the long run may due to the fact that, in the short run the importation of capital and other goods may not have been in large scale. This implies that openness to the international market will allow the country to export its primary products which will boost economic growth. Since the quality of these exports is not high, this tends to affect the economy negatively (Huchet-Bourdon et al. (2013) as there will be a deficit terms of trade in the long run.

The lag-one and lag-two variables representing human capital (tertiary education enrollment), are found to have a positive elasticity on RGDP and both significant at 10% level. This result is in line with the findings of the long-run model. The war dummy is found to have negative effect on Real GDP but not significant at both lag periods in the short run. The R- squared value is 0.861520, suggesting that approximately 86% of the variation in the growth of the economy is explained by the independent variables, which is a sign of a very good fit. The F-statistic probability value (0.010631) indicates that the whole equation is statistically significant.

5.5 Granger Causality Test Results

To determine whether causal relationship exist between the variables under examination, the granger causality test was conducted. The results show that a bi-directional causal relationship exist between openness to trade and real gross domestic product as shown by the significant probability values which are less than or equal to 0.10.
Furthermore, the result confirms the presence of unidirectional causal relationship between real gross domestic product and resource dependence; real gross domestic product and war; quality of institutions and resource dependence; openness to trade and resource dependence; tertiary education enrollment and resource dependence; inflation and resource dependence; resource dependence and war; openness to trade and quality of institutions; quality of institutions and tertiary education enrollment; inflation and quality of institutions; quality of institutions and war; tertiary education enrollment and openness to trade; inflation and openness to trade; openness to trade and war; inflation and war.

However, there was no causal relationship between quality of institutions and real gross domestic product; human capital and real gross domestic product; inflation and real gross domestic product; inflation and human capital; war and human capital. The hypothesis of the study was not rejected owing to the entire results of the test.

Table 5-7: Pair wise Granger Causality Test Result

Null Hypothesis:	Obs	F-Statistic	Prob.
LNRD does not Granger Cause LNRGDP	38	0.62654	0.5407
LNRGDP does not Granger Cause LNRD		3.72505	0.0348
LNEFW does not Granger Cause LNRGDP	38	1.57565	0.2220
LNRGDP does not Granger Cause LNEFW		1.89172	0.1668
LNOPEN does not Granger Cause LNRGDP	38	2.63647	0.0866
LNRGDP does not Granger Cause LNOPEN		5.92090	0.0063
LNTEE does not Granger Cause LNRGDP	38	2.39254	0.1071
LNRGDP does not Granger Cause LNTEE		0.35331	0.7050
LNINF does not Granger Cause LNRGDP	38	1.31587	0.2819
LNRGDP does not Granger Cause LNINF		0.10350	0.9020
WAR does not Granger Cause LNRGDP	38	1.39667	0.2617
LNRGDP does not Granger Cause WAR		5.22971	0.0106
LNEFW does not Granger Cause LNRD	38	10.0628	0.0004
LNRD does not Granger Cause LNEFW		1.34628	0.2741
LNOPEN does not Granger Cause LNRD	38	3.32015	0.0486
LNRD does not Granger Cause LNOPEN		0.50137	0.6102
LNTEE does not Granger Cause LNRD	38	2.63761	0.0866
LNRD does not Granger Cause LNTEE		1.60174	0.2168
LNINF does not Granger Cause LNRD	38	5.52809	0.0085
LNRD does not Granger Cause LNINF		0.61206	0.5483
WAR does not Granger Cause LNRD	38	1.17699	0.3208
LNRD does not Granger Cause WAR		6.68826	0.0036
LNOPEN does not Granger Cause LNEFW	38	2.67519	0.0838
LNEFW does not Granger Cause LNOPEN		1.24398	0.3014
LNTEE does not Granger Cause LNEFW	38	2.38407	0.1079
LNEFW does not Granger Cause LNTEE		19.9449	2.E-06
LNINF does not Granger Cause LNEFW	38	5.83816	0.0067
LNEFW does not Granger Cause LNINF		0.15786	0.8546
WAR does not Granger Cause LNEFW	38	1.03800	0.3654
LNEFW does not Granger Cause WAR		3.61610	0.0380
LNTEE does not Granger Cause LNOPEN	38	2.51757	0.0960
LNOPEN does not Granger Cause LNTEE		0.38528	0.6833
LNINF does not Granger Cause LNOPEN	38	4.59028	0.0174
LNOPEN does not Granger Cause LNINF		0.31624	0.7311
WAR does not Granger Cause LNOPEN	38	0.19020	0.8277
LNOPEN does not Granger Cause WAR		4.28912	0.0221
LNINF does not Granger Cause LNTEE	38	0.01918	0.9810
LNTEE does not Granger Cause LNINF		1.14373	0.3309
WAR does not Granger Cause LNTEE	38	0.11665	0.8903
LNTEE does not Granger Cause WAR		0.08559	0.9182
WAR does not Granger Cause LNINF	38	1.65927	0.2058
LNINF does not Granger Cause WAR		6.86956	0.0032

Source: E-views 7.2 output

5.6 Diagnostics and stability test results

To determine the strength of the model employed, Diagnostics and stability tests were also performed. Table 5-8 showed the results of the tests that have been carried.

Table 5-8 Diagnostics Test Result

Test Type	Null Hypothesis	Statistic	Probability	Inference
Normality Test (Jarque-Bera Statistics)	Residuals are normally distributed	Jarque-Bera Statistics = 0.6838	Probability = 0.7406	Fail to reject Ho
Serial Correlation (Breush-Godfrey Serial Correlation LM Test)	No serially correlated errors	F-statistic = 0.053780	Prob. Chi-Square = 0.9011	Fail to reject Ho
Heteroskedasticity Test: Breusch-Pagan-Godfrey	Variance of the Model is Homoschidastic	F-statistics = 0.608375	Prob. Chi-Square = 0.7100	Fail to reject Ho
ARCH Test (Autoregressive Heteroskedasticity Test)	ARCH effect does not characterize model's errors	F-statistics = 0.493815	Prob. Chi-Square = 0.4431	Fail to reject Ho

Source: E-views 7.2 output

The good fit of the model was confirmed by the diagnostic test that was carried out. There is no Serial Correlation in the model, the Variance of the Model is Homoschidastic, the residuals of the model are normally distributed, and no ARCH effect as confirmed by the probability values greater than 5%.

In relation to stability test, the outcome of the CUSUM plot lies within the 5% critical band width that ascertains the stability of the coefficients and the correct specification of the model (see figure1).

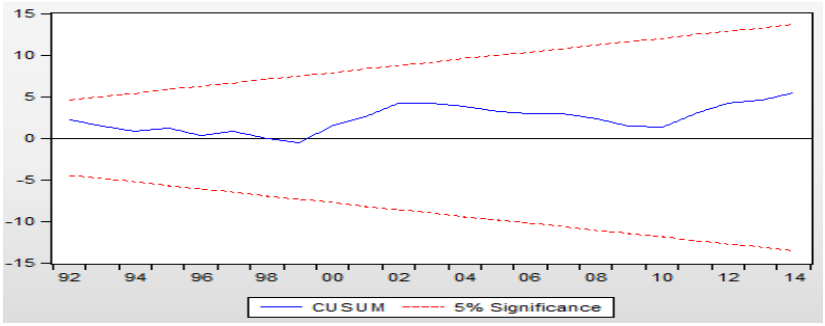

Figure 1: Plot of Cumulative Sum (CUSUM)

5.7 Variance Inflation Factors

Table 5-9: Variance Inflation Factors

Variable	Coefficient Variance	Uncentered VIF	Centered VIF
C(1)	0.000105	2.012701	2.012701
C(2)	0.034127	2.335084	2.323044
C(3)	0.033738	2.337186	2.328984
C(4)	1.531192	2.135802	2.120091
C(5)	2.247284	3.136118	3.111930
C(6)	7.020689	1.331068	1.329948
C(7)	17.88427	3.390143	3.387697
C(8)	1.269988	1.552048	1.550626
C(9)	1.241366	1.516638	1.515393
C(10)	4.283651	3.804404	3.667048
C(11)	2.337884	2.077899	2.007006
C(12)	0.109494	2.144983	2.144102
C(13)	0.091889	1.796200	1.795731
C(14)	1.430361	2.140079	2.140079
C(15)	0.900080	1.346683	1.346683
C(16)	0.051275	1.419262	NA

VIF is an indicator of multicollinearity. The larger the value of VIF_i, the more "troublesome" or collinear the variable Xi becomes. As a rule of thumb, if the VIF of a variable exceeds 10, that variable is said to be highly collinear. In view of the above, table 5-9 shows the results of the variance Inflation Factor. This implies that since the VIF for each of the variables does not exceed 10 means that there is no multicollinearity among the variables.

6. Conclusion and Policy Recommendation

This study tried to examine the nexus between natural resource dependence and economic growth for the Sierra Leone scenario. To address the question as to whether natural resources contributed positively to economic growth, the study followed the works of Mankiw et al (1992), Sala-i-Martin (1992; 1995), Sachs and Warner (1999), Hoeffler (2002) and Lederman and Maloney (2002) by applying a Barrow-style (1991) growth model to examine the effect of natural resource dependence on economic growth. A time series econometric approximation technique was employed following the procedures by Arrelano and Bond (1991), Arrelano and Bover (1995), and Blundell and Bond (1998). The study examines empirically the impact of resource dependence on real GDP. The study further employed control variables such as quality of institutions (using economic freedom of the world as a proxy), openness to trade, tertiary education enrollment (a proxy for human capital), and inflation as major factors influencing economic growth for the Sierra Leone economy for the period 1975 to 2014. A war dummy is also involved in the model to explain for its influence on economic growth.

Economic theory proposes that natural resources abundance enhances economic growth by availability of "natural capital". However, even though studies such as Sachs and Warner (1995, 1999, 2001) and Papyrakis and Gerlagh (2007) found an inverse relationship between the rate of economic growth and natural resource dependence at the international level, our paper shows contrary to these findings and support the economic theory. This means that, the findings of this paper rejected the resource curse hypothesis in the Sierra Leone context relative to the data and method (time series analysis) employed. This suggests that an increase in total natural resources rents (% of GDP), as a proxy of resource dependence, improves the economic growth of the country.

This lends credence to the research findings of the International Council on Mining and Metals' (ICMM) Resource Endowment Initiative that was launched in 2004 in partnership with the World Bank and the United Nations Conference on Trade and Development which conclude that contrary to the frequently-cited 'resource-curse' arguments, mining can make substantial contributions to economic growth and mitigate poverty in Sierra Leone and other mineral-rich countries. To this end, the government should endeavor to improve the means and methods of collecting natural resources rents to boost the economy of the country, hence economic development and the standard of living of the people in the country. However, government should not just concentrate on natural resources rents since theses rents depend on commodities and commodity prices are almost always not stable in the international market. To forestall and mitigate this challenge, the government should diversify its economy by improving other sectors such as the manufacturing industry. Furthermore, in the long run, innovation and technological advancement should be the buzz word of the government to complement the contributions of natural resources to the economy.

Also, the findings of this study recommend that the quality of institutions is crucial for economic growth for the country. The implication is that, an improvement in the quality of institutions (as represented by Economic freedom) of the country increases its economic growth. Economic freedom is partitioned into five main arears which are Size of government (Area 1); Legal structure and security of property rights (Area 2); Access to sound money (Area 3); Freedom to trade internationally (Area 4); and Regulation of credit, labor, and business (Area 5). Area 2 which is the Legal structure and security of property rights is particularly important. The rule of law—the enforcement of contracts, an impartial court system, and an independent judicial system—is vital for the safeguard of property and security of contracts, which are parts of the basic foundations of a market economy. With the absence of the rule of law, economic growth and prosperity are impossible. Certainly, the legal system is the most significant internal function of a government. Security of property rights, protected by the rule of law, is important to economic freedom. In view of the above, the government should concentrate on improving the three major areas that would improve significantly the level of economic freedom and the gain from exporting natural resources. However, the following areas should be the most important areas that government should concentrate on in order to significantly boost the economic growth of the country (1) The rule of law should be improved to safeguard property rights, boost investment, and mitigate corruption.

In the absence of appropriate mechanisms of settlement of disputes and security of property rights, many equally beneficial exchanges are discouraged, thus discouraging the market-exchange system. Although vital for success and prosperity, improving the legal system is not an easy task that can just be achieved overnight. (2) Trade barriers should be eliminated. The country could take advantage from opening its markets to international trade in order to gain entry to more and larger international markets. The gains of openness could be achieved by improving the manufacturing and service industry for export. (3) Business regulations should be attractive to boost investment and encourage business creation by removing needless regulatory barriers, mitigating corruption, and thus reducing the administrative costs on businesses.

Trade Openness is found to have a significant and negative relationship on RGDP. This suggests that, an increase in trade openness will slow or reduce economic growth. This finding supported Marilyne Huchet-Bourdon et. al (2012). They investigate empirically, upon considering export quality and export variety, the relationship between trade openness and growth. They pointed out an interesting non-linear pattern between trade openness and growth when export quality is taken into account: trade may have a negative impact on growth when countries have specialized in low quality products; trade clearly enhances growth once countries have specialized in high quality products and their export basket exhibits a minimum required level of quality. They conclude, therefore, that there is some pattern of complementarily between trade dependency and trade in quality so that the higher the quality of the export basket, the greater the impact of the export ratio on growth. They also found that the higher the variety of the export basket, the higher the impact of the trade ratio. This lay credence to the fact that Sierra Leone lacks high quality export since all of the country's exports are primary products that depend on unstable international market prices. Also coupled with the fact that the country imports virtually almost everything it needs. From an economic policy stand point; these findings are very interesting as they show that investment in productive capacity to move the country's exports up the quality chain could be decisive to enhance growth. Also, to enable access to the export market for new exporters, through export promotion agencies, for example, can have significant effects for economic growth and development in the country.

Human capital, as one of the most important input factors, has been considered to be a significant determinant of growth. Using tertiary education enrollment in the total Population as a proxy for human capital, economic growth, and human capital are found to be significantly and positively related. This implies that an improvement in human capital will improve the growth of the country's economy, hence possibly the economic development and standard of living of the general populace of the country. From policy perspective, the government should develop and implement strategies that will continue to increase tertiary education enrollment such as building more tertiary institutions, increasing the number of students accessing Sierra Leone Grants-in-aid (SLG), etc. Tertiary education is more relevant for technology innovation and diffusion (Aghion and Howitt, 1998).

Inflation and Economic growth are found to be significantly and negatively related. This implies that an increase in inflation will worsen the growth of the country's economy. Consequently, fiscal and monetary authorities should regulate the deficit and money supply of the country as they are possible causes of high inflation. The depreciation of the nominal exchange rate could also be a major source of inflation. This indicates that deteriorating exchange rate apparently reduces the purchasing power of income and gains of capital derived from any returns. In view of this, policy makers should not only depend on the depreciation policy to improve the balance of payment as a way of improving economic growth, but should also make sure that huge efforts are put in place to develop the infrastructural and manufacturing sectors which are favorable for investments and export in order to improve the quality and variety of exports. The growth of the economy and the war dummy are found to be negatively and significantly related in the model. During war, the country's currency will be depreciated and there will be loss of capital, foreign direct investment to be specific, to other competitive stable countries. In view of the above, government should improve on good governance, create an atmosphere of political stability and effective institutions to attract investment and improve economic growth.

We further look ahead for more research for the resource curse to further ascertain whether indeed the curse is or is not in existent. Since we have used total natural resources rents (% of GDP) as a proxy for resource dependence, it would be prudent for other researchers to employ other proxies such as natural resources export as a percentage of total exports to further ascertain the existence of the resource curse in the country. These types of studies could be useful for policy makers in their quest for the improvement of economic growth and poverty alleviation.

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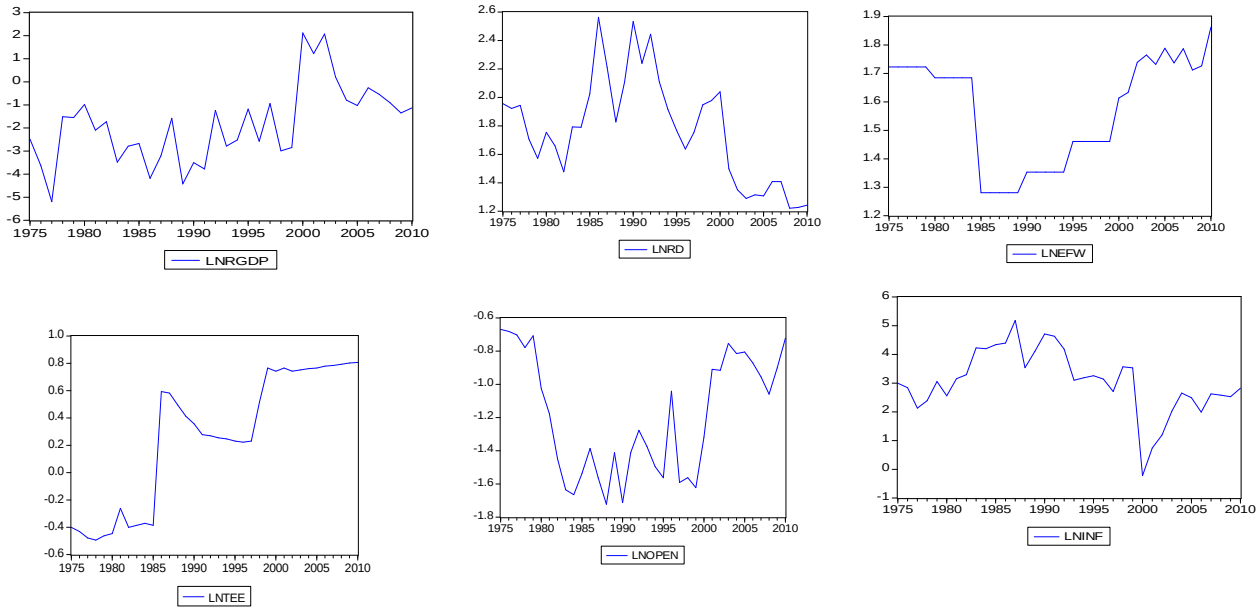
Appendix Figure 1 (Non-Stationary in Levels)



Appendix Figure 2 (Stationary at first difference)