Natural Resources and Economic Growth in Cote D’ivoire

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Abstract
This paper investigated the relationship between long run economic growth in Cote d’Ivoire and natural resource abundance based on time series econometric techniques other the period of 1960-2012. To assess the nexus between natural resources and economic growth, this study employed the ARDL model, also known as bounds testing approach. The results show that the natural resources negatively and significantly effect on the economic growth. This finding confirms the natural resources curse literature which emphasis that natural resources abundance have the tendency to slow down the economic growth. Hence there is a need to give more attention by implementing a series of policies to receive benefits from the resources abundance.

Key Words: Economic growth, Natural resources abundance, ARDL model

JEL Classifications: Q11, Q13

1. Introduction
The most obvious factors that explain good deal of international trade are ‘natural resources’- land of different quality (including climatic conditions), mineral deposits, etc. However, today’s one of the surprising features of modern economic growth is that economies with poor natural resources outperform economies with abundant natural resources. For example, the United States and Japan experienced rapid industrialization in the 19th century. Most of the Western European countries have few natural resources but developed on the basis of manufacturing and services (Kronenberg, 2004). Contrarily, some countries, which are abundant in natural resources, don’t benefit at all from resource extraction and processing. Their economies still keep low level even negative growth, like many Gulf States and African countries, despite their extensive reserves of natural wealth.

The relationship between natural resource and economic growth is still hotly debated because of different findings due to the different opinions and approaches. From recent years’ papers, more and more researchers prefer to accept the validity of the point “natural resources curse”, since it has been verified many times through historical events that resource poor economies can usually outperform resource abundant economies. Moreover, it becomes increasingly important for many countries to examine their natural resources which may cause their economic depression, and check the transmission channel which have negative impact on economic growth. This is crucial and fundamental for formulating and implementing effective policies to manage resource and promote growth.

The choice of Cote d’Ivoire for this study is justified for four reasons. The first is that Cote d’Ivoire is recorded as one of the natural resource abundant country in the world. Cote d’Ivoire is heavely dependent on agriculture and related activities, which engage roughly 68% of the population. Cote d’Ivoire is the world’s largest producer of cocoa bean and also a significant producer of coffee beans and palm oil. Cocoa, oil, and coffee are the top exports revenue earners, but the country is also producing gold. In spite of these potentialities, Cote d’Ivoire remained a poor country with one digit annual GDP growth estimated at 9.5% in

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2012 (World Development Indicators online 2013 ). The second reason is that more than three decade ago it was discovered crude oil in commercial quantities (African Economic Outlook, 2013). Theoretically, this discovery was expected to boost the economic growth of Cote d’Ivoire by extracting and refining the oil products. But this hope was transformed into a mirage. Thirdly, since 2002, the country has been ridden by violent conflict and political unrest. The conflict has been attributed to questions of identity and to the resources governance. Finally, most of the research done in this area did not made more attention in the scope of specific country-case study by seeking the evidence in favor or against the curse of natural resources hypothesis.

Against this background, our attempt is to investigate the relationship between long run natural resources and economic growth in Cote d’Ivoire based on econometric techniques.

The rest of the paper is organized as follows: Section 2 has a brief review of the economy in order to see the trends of natural resources and economic growth in Cote d’Ivoire. Section 3 is devoted to the survey on the literature review. The model specifications and econometric methodology used are indicated in section 4 while the empirical results of the study are presented in section 5 and section 6 concludes.

Brief Overview and Path of Cote d’Ivoire Economy

Cote d’Ivoire has remained a rural society: 82 percent of the population was rural in 1960, 63 percent remained rural in 1980, and more than 50 percent in 2009 and recently in 2012 the rural population was around 48 percent (WDI online, 2013). The forest area represents 32 percent of the land area which can be divided in two distinct parts: the tropical rain forests of the south and the savannahs of the north.

The Cote d’Ivoire economy is made up of relatively diverse agriculture; the primary sector continues to dominate and accounted for 26.6 percent of GDP in 2009 (CIA World Factbook, 2013). Most income in this sector is generated by cash crops such as cocoa, coffee, rubber and palm oil while the coffee and cocoa remain the twin drivers of Cote d’Ivoire’s economy. Figure 1 shows the trend of total natural resources rents as percentage of GDP. It can be seen that the natural resources rents which was accounting for about more than 1 percent of the GDP in the eve of the independence reached a peak of 4 percent in 1983 and thereafter dropped until 1993. Since 1994 the country has recovery and rose to constitute 11 percent of the GDP in 2008 and thereafter remained under 10 percent throughout our sample period.

Figure 1: Trend of total naturel resurces rents (%GDP)

1970-2012

Source: World Development Indicators and author calculations

Since its independence, Cote d’Ivoire has contrasting stages of its economic growth (Figure 2). Until 1978, the growth of per capita GDP of Cote d’Ivoire grows more than 4% on the average excepted for 1962 and 1965 periods due especially by the volatility of its mains exports products at international market. While, from 1979 to 1993 the economic growth continues to decline at the average rate of -3.7 percent annually (World Bank, 1998a and IMF, 1998). From 1994 to 1998, the growth resumed at around 4 percent and
decrease thereafter until 1999. During this period, the recovery to the growth was due especially by the policies put in place to capitalize rebalancing public accounts and the recovery of exports, consumption, private investment of the portfolio, also due in large part by the devaluation of the CFA franc in 1994, and secondly by the appreciation of the cocoa and coffee prices at the international market. However, this recovery has been weak because it was based on cyclical factors. From 1999 to 2011, the country was ridden by violent social and political crisis which lead to the decrease of the growth rate and thereafter the country has growing recovery until now.

2. Literature Review

Most of the studies undertaken on the subject have concluded that resources abundant countries underperformed compared to resource deficient countries. However, many empirical studies have shown that the influence per se from natural resources to economic growth really exists, despite the relationship has unstable characters, which is usually caused by different indices for evaluation or low statistical accuracy. The mechanisms that natural resources have impact on economic growth are shown in figure 3 below.

![Figure 3: Effects of Natural Resources on Economic Growth](image)
As described in figure 3, natural resources have direct and indirect effects on economic growth. The natural resources generally refer to natural resources abundance in most literatures, which often stands for the amount of resources in a certain place at a given time. Various measurements for resources abundance and methodologies are adopted, hence results are different. Secondly, as to the transmission mechanisms, which are often considered to be different factors of production, they don’t affect economic growth endogenously but have impact on factors that exogenously shock economic system. Thirdly, for economic measure there is a common acceptance to use GDP/ GNP growth rate or growth rate per capita as appropriate measurement indices.

Surveying the previous researches, there are a representative papers on this issue. Sachs and Warner (1995) examine a sample of 97 developing countries from 1970 to 1989 and find a significant negative relationship between natural resources exports to GDP and the GDP growth.

Gylfason (2000) reviews the reasons behind the negative relationship between natural resources and economic growth. He concludes that the heavy dependence on natural resources and agriculture may result in corruption and policy failure and may, moreover, discourage education, external trade and genuine saving. In another study, Gylfason (2001) provides empirical evidence for the negative relationship between natural resources and growth through the human capital channel. Using public expenditure on education as an indicator, he finds first a statistically significant relationship between natural resources abundance and low levels of education. He then finds a positive correlation between school enrolment and economic growth and concludes that about half of the natural resources curse works via the education channel.

Gylfason and Zoega (2002) conclude that natural capital may on average crowd out physical as well as human capital, thereby inhibiting economic growth. They provide empirical evidence using a sample of 85 countries over the period 1965-1998 and suggested that heavy dependence on natural resources can hurt saving and investment.

Hausmann and Rigobon’s (2002) empirical study based on Sachs and Warner’s analytical framework shows that highly resource-dependent countries usually have low economic performance. The countries like Saudi Arabia, Nigeria, Zaire and Venezuela which highly depend on oil and other resources have been in difficult economic situation since 1980.

Kronenberg (2004) analyzes the natural resources curse in the selected transition economies among the former “Eastern Bloc”, and finds a negative relationship between natural resources abundance and economic growth. A large part of the variation in growth rate can be attributed to the curse of natural resources. After controlling for many other factors, this relationship still holds. He believes that the prime reason for the curse in these transition economies is corruption, by studying the relationship separately among resources abundance, common accepted transmission channels and economic growth. The “Dutch disease” effect and a neglect of education can also partly account for the curse. If a country is endowed with right set of institutions and also adopts the right policies at the time of resources discovery, it more likely to achieve rapid growth and perform in better way compared with other countries with equal endowments but without such resources (Oyefusi, 2007).

In a more recent study some researchers found contradicting results in the context of the relationship between natural resources abundance and economic growth. Mohamed Jalloh (2013) investigated the nexus between natural resources endowment and economic growth using a sample of West African countries. The results from the panel regressions indicate that natural resource endowments have very minimal impact in terms of promoting economic growth in West Africa, more so in resources rich countries. Brunnschweiler and Bulte (2008) evaluated the empirical basis for the natural resources curse for a cross country sample of 60 countries for the period 1970-2000. They concluded that despite the popularity of the resources curse thesis, the apparent paradox of abundant may be a red herring. They show that resources abundant, conditions and institutions determine resources dependence. Ding and Field (2005) also found that natural resources do not affect growth. They differentiate between natural resources endowments and natural resources dependence.
3. Econometric Model: The UECM Model Specification

In their seminal work, Pesaran et al (2001) pointed out that as long as there exist both I(1) and (0) variables, a conventional cointegration test on the long-run equilibrium will produce biased results in the long-run interactions between the variables. In order to eliminate such bias due to the coexistence between I(1) and (0) variables, we implement the autoregressive distributed lag (ARDL) model, also known as bounds testing approach suggested by Pesaran et al. (2001). For a more description of the methodology see Pesaran et al (2001).

To model the relationship between the economic growth (GDP) and the explanatory variables we construct an unrestricted Vector Autoregression of order \( p \), VAR \((p)\), for the following economic growth and natural resources function:

\[
y_t = \delta + \sum_{i=1}^{p} \beta_i y_{t-i} + \varepsilon_t \quad (4)
\]

Where \( y_t \) is the vector of \( w_t \) and \( z_t \), \( z_t \) is assumed to be the dependent variable as the real GDP and \( w_t \) is the vector matrix which represents a set of explanatory variables. \( \beta t \) is a matrix of VAR parameters to be estimated and \( \varepsilon_t \) is a white noise error. According to Pesaran et al. (2001), the dependent variable must be I(1), while the exogenous variables can be either I(1) or I(0). Manipulation of equation (4), allows this VAR to be written as a vector error correction model (VECM) is estimated as:

\[
\Delta y_t = \delta + ct + \theta y_{t-1} + \sum_{i=1}^{p-1} \gamma_i \Delta z_{t-i} + \sum_{i=1}^{p-1} \omega_i \Delta w_{t-i} + \varepsilon_t \quad (3)
\]

Where \( \Delta \) is the first-difference operator. The long-run multiplier matrix \( \theta \) is given as:

\[
\theta = \begin{bmatrix}
\theta_{zz} & \theta_{zw} \\
\theta_{wz} & \theta_{ww}
\end{bmatrix} \quad (4)
\]

The diagonal elements of this matrix are left unrestricted. This allows for the possibility that each of the series can be I(0) or I(1). For example, if \( \theta zz = 0 \) it implies that economic growth \( z \) is I(1). In contrast, \( \theta zz < 0 \) implies that it is I(0). This VECM procedure allows for the testing of at most one cointegrating vector between the dependent variable \( z_t \) and a set of regressors. The Error Correction Model (ECM) is estimated as:

\[
\Delta z_t = c_0 + \Pi_{zz} z_{t-1} + \Pi_{zw} w_{t-1} + \sum_{i=2}^{p-1} \phi_i \Delta x_{t-i} + w_{t-1} + \varepsilon_t \quad (5)
\]

Given equation (5), the first differences reflect the rate of change of each variable, thus, this representation can be used to examine both the short-and long-run relationship between economic growth and its explanatory variables. Secondly, equation (5) also indicates the economic growth is influenced and explained by its past values, implying that it involves other shocks.

In addition, following Pesaran et al.(2001), if we impose the restrictions that \( \theta_{zz} = \theta_{zw} = 0 \), \( \delta \neq 0 \) and \( c = 0 \) (i.e. no trend), then the estimated economic growth and natural resource function can be stated using the unrestricted error model (UECM) as:

\[
\Delta \ln GDP_t = \beta_0 + \beta_1 \ln GDP_{t-1} + \beta_2 \ln HC_{t-1} + \beta_3 \ln GOV_{t-1} + \beta_4 \ln OP_{t-1} + \beta_5 \ln NR_{t-1} + \beta_6 \ln INV_{t-1} + \\
+ \sum_{i=0}^{p} \beta_i \ln \Delta GDP_{t-i} + \sum_{i=0}^{p} \beta_i \ln \Delta HC_{t-i} + \sum_{i=0}^{p} \beta_i \ln \Delta GOV_{t-i} + \sum_{i=0}^{p} \beta_i \ln \Delta OP_{t-i} + \sum_{i=0}^{p} \beta_i \ln \Delta NR_{t-i} + \varepsilon_t \quad (6)
\]
Where GDP our dependent variable is the annual real GDP per capita; HC is the human capital, GOV is the government final consumption expenditure, OP is the degree of openness of the economy, NR is related to the natural resources abundance; The bounds test for examining evidence for a long run relationship can be conducted using the $F$ test. The $F$-test tests the joint significance of the coefficients on the one period lagged level of the variables in equation (5) that is, $H_0 = \beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = 0$. The approximate critical values for the $F$-test are obtained from Pesaran et al (2001). The asymptotic distribution of critical values is obtained for the cases in which all regressors are purely I(1) as well when the regressors are purely I(0) mutually cointegrated.

Control Variables

Following the literature we surveyed and due to the lack of data we include a set of variables in our regressions. HC is the index of human capital per person, based on years of schooling (Barro/Lee, 2012) and returns to education (Psacharopoulos, 1994); GOV is the general government final consumption expenditures on goods and services relative to GDP; INV is the investment share in output proxied by the GFCF relative to GDP; OP is the openness of the nation which is the ration of total trade to GDP ($\frac{(IM + EX)}{GDP}$).

Measuring Natural Resources Abundance

In the earlier researches, the most used measure of resources abundance is the share of primary commodity exports in GDP. However, for Cote d’Ivoire this data is only available for a small sample period. Thus we compiled a set of five indicators to proxy the natural resources. The list of indicators is: coal rents, forest rents, natural gas rents, Oil rents and mineral rents. All of these for indicators are relative to GDP. However, we should recognize that none of this set of indicators alone cannot adequately proxy the resources abundance in the case of Cote d’Ivoire.

Our data for this paper is taken from the World Bank’s World Development Indicators online database (WDI) and the Penn World Table 8.0.

4. Empirical Results

This section of the paper presents and discusses our empirical findings relating to natural resource abundance and economic growth in Cote d’Ivoire. First we discuss the results of the non-stationarity tests and their implications. After determining the order on integration the long run relationship is determined by employing the ARDL model, also known as bounds testing approach suggested by Pesaran et al. (2001).

Unit Roots results

<table>
<thead>
<tr>
<th>Variables</th>
<th>At level I(0)</th>
<th>1st difference I(1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln(GDP)</td>
<td>0.03</td>
<td>-5.92*</td>
</tr>
<tr>
<td>Ln(GOV)</td>
<td>-1.33</td>
<td>6.54*</td>
</tr>
<tr>
<td>Ln(HC)</td>
<td>-1.18</td>
<td>-5.12*</td>
</tr>
<tr>
<td>Ln(OP)</td>
<td>-1.44</td>
<td>-8.83*</td>
</tr>
<tr>
<td>Ln(INV)</td>
<td>-1.16</td>
<td>-5.91*</td>
</tr>
<tr>
<td>Ln(NR)</td>
<td>-0.94</td>
<td>-7.22*</td>
</tr>
</tbody>
</table>

Notes: 1) * indicates stationarity at 1% level, ** indicates stationarity at 5% level and *** indicates stationarity a 10%
2) Asymptotic critical values
1% -3.56
5% -2.92
10% - 2.60
We tested the presence of unit root (non-stationarity) in our data based on the Augmented Dickey-Fuller (ADF) unit root test. The results are presented in table 1A. Table 1A presents the results of the unit root test on the log level and at first difference. The results show that all variables are integrated of order 1 I(1). This means that all the variables have unit root. The implication of this is that shocks to any of the non-stationary variables will have permanent effect. There is thus an absence of mean reverting process in all the variables we tested.

Regression Results and Discussions

After determining the order of integration the long-run is determined by employing the cointegration procedures. The first step is to run a VAR and determine the number of lags. For our study the numbers of lags is 3 determined by the AIC criterion. The second step is to run the full model (6) and obtained the F-statistic. Decision of cointegration has obtained through following way, if the F-statistic fall outside the upper and lower bounds, a conclusive inference can be made without considering the order of integration of the underlying regressors. For instance, if the F-statistic is higher (lower) than the upper (lower) critical bound, then the null hypothesis of no cointegration is rejected (accepted). In cases where the F-statistic falls inside the upper and lower bounds, a conclusive inference cannot be made.

Pesaran et al. (2001) discuss five cases with different restrictions on the trends and intercepts for F-test. The present analysis considers only the case V with unrestricted intercept and unrestricted trend. The computed F-statistic \( F_{\text{GDP}}(GDP, GOV, HC, INV, NR, OP) = 35.16 \) is higher than the upper bound critical value of 4.90 at the 1 per cent level.

Long run coefficients of the variables under investigation are shown in the table 2.

**Table 2: Long Run Coefficient**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Coefficients</th>
<th>T-Ratio [ Prob]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln HC</td>
<td>-9.89</td>
<td>-2.90[0.05]</td>
</tr>
<tr>
<td>Ln NR</td>
<td>-0.26</td>
<td>-2.82[0.02]</td>
</tr>
<tr>
<td>Ln GOV</td>
<td>-1.46</td>
<td>-4.88[0.00]</td>
</tr>
<tr>
<td>Ln INV</td>
<td>-0.19</td>
<td>-3.19[0.19]</td>
</tr>
<tr>
<td>Ln OP</td>
<td>0.14</td>
<td>0.23[0.82]</td>
</tr>
<tr>
<td>Constant</td>
<td>11.93</td>
<td>4.50[0.00]</td>
</tr>
<tr>
<td>@trend</td>
<td>0.15</td>
<td>2.76[0.02]</td>
</tr>
<tr>
<td>R-Squared</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Diagnostic tests

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>Value [ Prob]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serial Correlation</td>
<td>4.24[0.08]</td>
</tr>
<tr>
<td>Functional Form</td>
<td>0.55[0.49]</td>
</tr>
<tr>
<td>Normality</td>
<td>0.15[0.92]</td>
</tr>
<tr>
<td>heteroscedasticity</td>
<td>0.44[0.94]</td>
</tr>
</tbody>
</table>

The results show that the natural resources negatively and significantly effect on the economic growth. The long run elasticity is -0.26. The other control variables that was included in the model also negatively and significant except OP variable effect on the growth. Diagnostic tests for serial correlation LM test, normality and heteroscedasticity are considered, and results are shown below in table 2. The results reveal that there is no evidence of confirmation of autocorrelation and normality test providing evidence that the error terms is normally distributed.

On the basis of regression results we conclude that natural resource negatively effect on economic growth in the long run and phenomenon of the Dutch diseases hold in the case of Cote d’Ivoire. The R-Squared indicate a good fit since the model explains more than 90% of the variations in order to avoid
unnecessary over-parameterization. We have applied CUSMUS and CUSMUS of Square (Brown, Durbin and Evans, 1975) Tests and Recursive coefficients to check the stability of the economic growth and natural resources function. The model appears stable and correctly specified given that neither the CUSMUS nor the CUSMUS of Squares test statistics exceed the bounds of the 5 per cent level of significances (see Figures 1 and 2).

5. Conclusion

This study examined the validity of the “natural resources curse” in the case of Cote d’Ivoire over the period from 1960-2012. To assess the nexus between natural resources and economic growth, this study employed the ARDL model, also known as bounds testing approach. The results reveal that natural resources and the other control variables have a negative impact in term of promoting economic growth. This finding confirms the resource curse literature which emphasis that natural resources abundance have the tendency to slow down the economic growth. As can be seen from the results, all variables negatively impact the growth; this can be explained mainly by the corruption which is a qualitative variable, the inappropriate administrative intervention in access to natural resources.

In order to receive the main benefit of natural resources endowment, Cote d’Ivoire must implement a series of policies going to education orientation, technically skill labor, also pay attention to exploitation and utilization, and conservation and proliferation. Resources exploitation and management and protection must go together to boost economic growth.

References


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Appendix

Figure 1

![CUSUM and 5% Significance](image1)

Figure 2

![CUSUM of Squares and 5% Significance](image2)