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THE NEW OIL SECTOR AND THE DUTCH DISEASE: THE CASE OF GHANA

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Abstract

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This paper investigates the impact of the new oil sector on the economic performance of major traditional sectors of the Ghanaian economy. The discovery of resource booming sectors in most countries often comes with several opportunities as well as challenges. Ghana discovered oil in 2007 and started subsequent commercial production and export in 2010. The results from the study show that, there is no clear case of declining performance of sectors in terms of output, growth and export earnings as a result of the oil production. The study could also not establish a sustained appreciation in the real effective exchange rate since commercial oil production commenced which is an indicator of the presence of the Dutch Disease phenomenon. The real effective exchange rate was also found to be highly influenced by oil production, oil prices, total exports and remittances. The study applied an autoregressive distributed lag model due to differences in the level of integration of variables. The data was obtained from the Bank of Ghana, the Ministry of Finance in Ghana and the Energy Information Administration.

Keywords: oil sector, dutch disease, real effective exchange rate, resource curse, agriculture, manufacturing, spending effect

INTRODUCTION

The Dutch Disease basically refers to a decrease in the price competitiveness of a country's export as a result of currency appreciation stemming from a new booming resource sector. The phenomenon originated from the Netherland which experienced natural gas discoveries in the 1960s. The newfound sector caused the Dutch currency to rise. This rendered exports of other tradable commodities less competitive in the world market. Great Britain experienced similar conditions in the 1970s when the price of crude oil increased significantly. The effect of this development was that, Britain became a net exporter of oil thus leading to an appreciation in the value of the British Pound.

Questions still remain whether the Dutch Disease is just a concept or a development that should be given due consideration by countries. To neoclassical economists, the phenomenon is nothing more than a simple adjustment mechanism of the productive factors, as the boom of natural resources changes the endowments and consequently the natural comparative advantage of a country.

There is nothing harmful about the decline in manufacturing if neoclassical, competitive conditions prevail in the economy (Sachs, 1997). Comparative advantage can be dynamic (Krugman, 1987). In such a case, the impact of the Dutch Disease will be slow growth as it renders a country's exports uncompetitive. Gylfason (2001) and Larsen (2004) proposed several alternatives on overcoming the phenomenon. Authors like Stiglitz (2004) and Palley (2003) discuss in their studies, ways of avoiding the Dutch disease phenomenon. The presence of the Dutch Disease is indicated by two effects: resource movement from non-oil sectors to the new oil sector and the spending effect which entails a sustained appreciation of the real effective exchange rate. The real effective exchange rate is the nominal effective exchange rate (a measure of the value of the Ghana cedi as against a weighted average of several foreign currencies) divided by a price deflator or index of costs.

The objective of the study is in threefold: to investigate whether there is a sustained appreciation in the real effective exchange rate in Ghana since oil production began, to assess the performance of traditional sectors and non-oil tradable exports after the commencement of oil production and the last but not the least is to find out how the real effective exchange rate is affected by a set of chosen variables using an Autoregressive Distributed Lag Model (ARDL).

METHODOLOGY AND DATA

The study employed both qualitative and quantitative techniques to achieve the set objectives. With respect to the real effective exchange rate movement, the study used data from 1991 to 2013 to inspect whether there was a sustained increase over the years.

With regards to the impact of the oil resource on traditional sectors of the Ghanaian economy, the study made use of data from the Ghana Statistical Service to assess the annual growth rate of the agricultural sector, the industrial sector and the services sector. The study also examined the performance of non-oil tradable export earnings.

An autoregressive distributed lag model was then used to estimate the relationship between the real effective exchange rate and selected variables. This approach was chosen due to the fact that, the variables had a mixture of I(0) and I(1) properties and had one cointegrating relationship. I(0) means that a variable was stationary in its level form. I(1) on the other hand means that the variable was stationary after first order difference. This ARDL method also made it possible to assign different variables with different lag lengths. The generation of the models and all diagnostic tests were done in GRETL software.

The variables were first tested for non-stationarity properties using the Augmented Dickey Fuller method. Series with unit roots were stationarized by applying at least one round of non-seasonal differencing with the purpose to eliminate the unit root. The number of cointegrating relationships was also tested using the Johansen cointegration test. The optimum lag length was decided using information criterion; Akaike information criterion, Bayesian information criterion and Hannan–Quinn information criterion.

Rudd (1996) used a similar approach and time series data in his work "An empirical analysis of the Dutch Disease: developed and developing countries". The results from his study showed that, the Dutch Disease contributed to the contraction of traditional export industries however, there were other non-Dutch Disease factors. Similar studies were carried out by Treviño (2011) when investigating the presence of the Dutch Disease in CEMAC (Central African Economic and Monetary Community). Ueno (2010) also applied this technique in studying the impact of the Dutch Disease on the export performance of the Brazilian Industry. Ariunaa and Kim (2011) also attempted to diagnose the Dutch Disease in Mongolia using this same approach.

The variables of the model include: the real effective exchange rate (REER), the quantity of oil produced (Q), natural resource rent (R) measured in United States dollars, oil price per barrel (P), total exports (X), the total wage bill (TWB) and remittances (REM). The choice of variables was based on the focus of the study which is to investigate the impact of the new oil resource on the Ghanaian economy via the real effective exchange rate.

The price of oil was measured as the annual average international price of a barrel of crude oil in US$. Total exports were measured as the annual amount of earnings of tradable export commodities in Ghana in US$. The total wage bill was measured as the annual government expenditure on wages and salaries of public sector workers in Ghana cedis and remittances were measured as the annual transfers of migrant workers abroad in US$. Total resource rent was measured as a ratio of total natural resource rent to GDP.

The study omitted growth in real GDP due to its high correlation with other variables in the model for example total exports. The data for the study ranged from 1991 to 2013 and was obtained from the Bank of Ghana, the United States Energy Information Administration (EIA) and the Ghana Statistical Service. The basic ARDL model is given in equation (1).

$$REER_t = \beta_0 + \beta_1 REER_{t-1} + \ldots + \beta_a REER_{t-a} + \gamma_0 P_t + \ldots + \gamma_b P_{t-i} + \delta_0 TWB_t + \ldots + \delta_c TWB_{t-k} + \tau_0 X_t + \ldots + \tau_d X_{t-l} + \varphi_0 REM_t + \ldots + \varphi_e REM_{t-m} + \rho_0 Q_t + \ldots + \rho_g Q_{t-h} + \vartheta_0 R_t + \ldots + \vartheta_r R_{t-u} + \varepsilon_{t,} \quad (1)$$

where the random disturbance term ε_t is serially independent. The ARDL model for the variables were estimated as in Equation (2).

$$REER_t = \beta_0 + \sum_{i=1}^{n} \beta_i \Delta REER_{t-1} + \sum_{j=1}^{q} \gamma_j \Delta P_{t-j} + \sum_{l=1}^{x} \delta_l \Delta TWB_{t-l} + \sum_{s=1}^{y} \tau_s \Delta X_{t-s} + \sum_{f=1}^{w} \varphi_f \Delta REM_{t-f} + \sum_{h=1}^{g} \rho_h \Delta Q_{t-h} + \sum_{r=1}^{U} \vartheta_r \Delta R_{t-r} + \theta_0 REER_{t-1} + \theta_1 P_{t-1} + \theta_2 TWB_{t-1} + \theta_3 X_{t-1} + \theta_4 REM_{t-1} + \theta_5 Q_{t-1} + \theta_6 R_{t-1} + \mu_t , \quad (2)$$

β_0 is a constant term. γ_j, δ_l, τ_s, φ_f ρ_h, and ϑ_r are short-run coefficients. θ_0, θ_1, θ_2, θ_3, θ_4, θ_5 and θ_6 are long-run coefficients. Δ represents first order difference. From estimating the model in Equation (2), an F test on the null hypothesis that

H_0: $\theta_0 = \theta_1 = \theta_2 = \theta_3 = \theta_4 = \theta_5 = \theta_6 = 0$ is performed to determine if the variables that have long-run coefficients are statistically significant. The distribution of the test statistic is totally non-standard. Exact critical values for the F-test aren't available for the mix of I(0) and I(1) variables. However, Pesaran *et al.* (2001) supply bounds on the critical values for the asymptotic distribution of the F-statistic. If the computed F-statistic falls below the lower bound then the variables are I(0) and the conclusion is that there is no cointegration. If the F-statistic exceeds the upper bound, the variables are I(1) and cointegrated. Then a normal error correction model (ECM) could be used to estimate the given relationships among them. Finally, if the F-statistic falls between the bounds, the test is inconclusive.

The form of the error correction model is given in Equation (3).

$$\Delta REER_t = \beta_0 + \sum_{j=1} \beta_j \Delta REER_{t-j} + \sum_{j=1} \gamma_j \Delta P_{t-j} + \sum_{j=1} \delta_j \Delta TWB_{t-j} + \\ + \sum_{j=1} \tau_j \Delta X_{t-j} + \sum_{j=1} \varphi_j \Delta REM_{t-j} + \sum_{j=1} \rho_j \Delta Q_{t-j} + \sum_{j=1} \vartheta_j \Delta R_{t-j} + \\ + \omega Z_{t-1} + \mu_t \ , \qquad (3)$$

Z_{t-1} is the error correction term. It is the OLS (Ordinary Least Squares) residual from estimating the model with the level variables and ω is the speed of adjustment parameter. Equation (2) shows that in the long-run,

$$\Delta REER_t = 0, \Delta P_t = \Delta TWB_t = \Delta X_t = \Delta REM_t = \\ = \Delta Q_t = \Delta R_t = 0.$$

Therefore the long-run elasticity of the real effective exchange rate with respect to the individual variables is given by:

$$-\left(\frac{\theta_0}{\theta_1}\right), -\left(\frac{\theta_0}{\theta_2}\right), -\left(\frac{\theta_0}{\theta_3}\right), -\left(\frac{\theta_0}{\theta_4}\right), -\left(\frac{\theta_0}{\theta_5}\right)$$

and $-\left(\frac{\theta_0}{\theta_6}\right)$ respectively.

RESULTS

Real Effective Exchange Rate

As stated earlier in the text, one of the most common manifestations of the spending effect is a sustained appreciation of the real effective exchange rate. This results from an increase in the prices of domestic goods and services accounted for by an increase in aggregate demand. Fig. 1 shows the movement in the real effective exchange rate before and after oil production and export. Generally, it has been depreciating and it continued to depreciate after oil production.

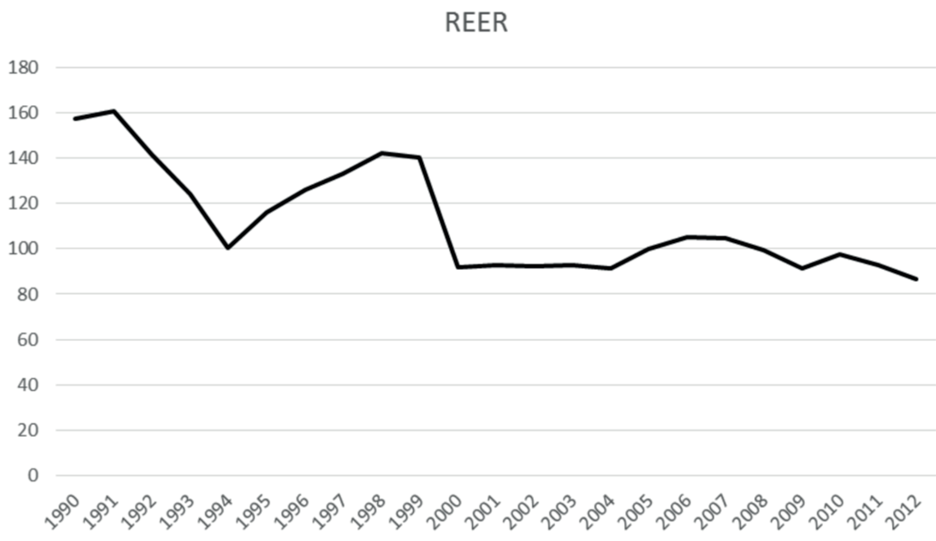
The Resource Movement Effect

A shift of resources away from traditional (tradable) activities into the oil sector would imply a change in the contribution of each sector to non-oil GDP over time and also a change in growth performance. See Fig. 2 for growth rates of sectors.

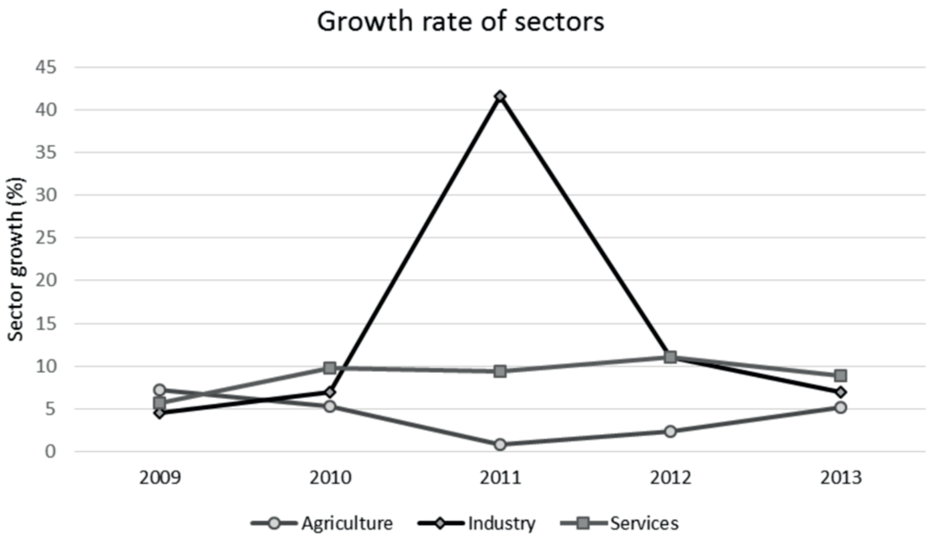
Fig. 3 shows the performance of export earnings of non-tradable commodities; Primary commodities (PRC), Agricultural raw materials (AR), Manufactured goods (MG). Agricultural raw materials and other primary commodities (C) experienced slight declines after 2012.

Analytical Framework

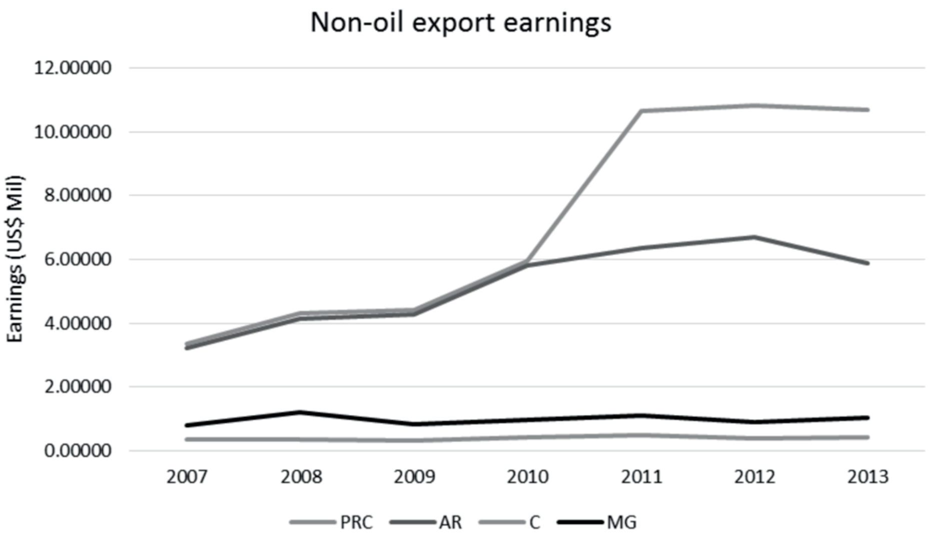
The ordinary least squares method was used to generate a regression model of the variables in their level form. The residual term was then saved and



1: *Trend in the real effective exchange rate*
Source: World Bank Country Indicators



2: *Growth rate of sectors in Ghana*
Source: Ghana Statistical Service



3: *Non-oil export earnings*
Source: United Nations Conference on Trade and Development (UNCTAD)

I: *OLS model with level variables*

Variable	Coefficient	Std. Error	t-ratio	P-value	Significance
Constant	143.482	7.052	20.346	< 0.001	***
Q_t	2.977	1.160	2.567	0.021	**
R_t	−36.290	10.572	−3.433	0.003	***
TWB_t	−28.835	7.804	−3.695	0.002	***
REM_t	−0.301	0.074	−4.057	0.001	***

$R^2 = 0.65$, $F (4, 16) = 14.40$ and P-value (F) < 0.01, n = 21. The asterisk * indicate the significance at 10% level, ** at 5% level and *** at 1% level.

used in the normal error correction model when the variables were established to have a long-run relationship.

Since the variables were integrated of different orders (see Tab. II for unit root test), the study applied the autoregressive distributed lag model in estimating the long-run and short-run relationships. The optimum number of lags was determined using the information criteria (AIC, BIC and HQC). The optimum lag length that minimized all three criteria was two. The variables were also tested for the number of cointegrating relationships using the Johansen test of cointegration with an unrestricted constant and no trend. The result showed that there was at most one cointegrating relationship.

Tab. III shows the results of the ARDL model. It regresses the first differenced real effective exchange rate on all the level explanatory variables and their first order differences with lags. Statistically insignificant variables were removed. The long-run relationships were represented by the variables: $REER_{t-1}$, Q_{t-1}, X_{t-1} and REM_{t-1}. Their coefficients were tested for cointegration or a long-run relationship using the Bounds testing method.

The lower and upper bounds for the F-test statistic at the 10%, 5%, and 1% significance levels were (2.12, 3.23), (2.45, 3.61), and (3.15, 4.43) respectively. The obtained F statistic from testing for the coefficients is 3.75 which is higher than the upper bounds at 5% thus indicating that the variables were cointegrated and had a long run relationship.

This thus meant that, a normal error correction model could be used to estimate short-run dynamics. Diagnostic checks (see Tab. IV) were run to ensure that the model meets the standard classical requirements. The estimated parameters were stable (see Tab. IV) for CUSUM test results.

Tab. IV shows the diagnostic test results for the ARDL model. All requirements were met.

A normal error correction model (see Tab. V) was then used to estimate the short run dynamics. The first order differenced real effective exchange rate was regressed on the first order differenced and lagged explanatory variables. The lagged residual term from the level model was statistically significant and negative validating the long-run relationship (see Tab. VII) among the variables.

The ECM model fulfils all the classical requirements. For the test results (see Tab. VI).

From the results of the error correction model, a dollar increase in the price of oil per barrel leads to a 0.22 percent depreciation in the real effective exchange rate in the short run. 76% of the deviation

II: *Unit root test*

	With constant	With constant	
	Level form	First order difference	
Variable	P-values	P-values	Decision
Real effective exchange rate	0.070	0.017	I(1)
Oil production	0.015		I(0)
Oil price	0.954	< 0.001	I(1)
Total exports	0.193	< 0.001	I(1)
Total wage bill	0.008		I(0)
Remittances	0.994	0.026	I(1)
Resource rent	0.170	0.002	I(1)

III: *ARDL model*

Variable	Coefficient	Std. Error	t-ratio	P-value	Significance
Constant	72.684	25.436	2.858	0.013	**
$REER_{t-1}$	–0.665	0.205	–3.244	0.006	***
X_{t-1}	101.724	38.452	2.646	0.019	**
Q_{t-1}	–3.908	2.122	–1.841	0.087	*
REM_{t-1}	–0.207	0.089	–2.319	0.036	**
ΔX_{t-1}	–53.844	27.769	–1.939	0.073	*

R^2 = 0.50, F (5, 14) = 2.85 and P-value (F) = 0.006, n = 20. The subscript t–q where q = 1, 2, 3 shows the various lagged terms of the variables and the symbol, Δ before the variables denotes first order difference. The asterisk * indicate the significance at 10% level, ** at 5% level and *** at 1% level. The dependent variable is $\Delta REER_t$.

IV: *Diagnostic test results in ARDL model*

Requirement	Test	P-values
Model specification	Lagrange multiplier test	0.293
Model specification	RESET test	0.778
Heteroskedasticity	White test	0.239
Normality of residuals	Chi-square	0.080
Autocorrelation	Breusch-Godfrey test	0.161
Parameter stability	CUSUM test	0.592

V: *Error correction model*

Variable	Coefficient	Std. Error	t-ratio	P-value	Significance
Constant	−2.977	2.958	−1.007	0.329	
ΔP_{t-1}	−0.218	0.100	−2.162	0.046	**
Z_{t-1}	−0.764	0.276	−2.774	0.014	**

$R^2 = 0.38$, $F(2, 16) = 4.19$ and P-value (F) = 0.03, n = 20. The dependent variable is $\Delta REER_t$

VI: *Diagnostic test results for ECM*

Requirement	Test	P-values
Model specification	Lagrange multiplier test	0.069
Model specification	RESET test	0.541
Heteroscedasticity	White test	0.178
Normality of residuals	Chi-square	0.054
Autocorrelation	Breusch-Godfrey test	0.695
Parameter stability	CUSUM test	0.123

VII: *Long-run elasticities*

Variable	Long-run coefficients	Symbols	Long-run impact
$REER_{t-1}$	−0.665	θ_0	
X_{t-1}	101.724	θ_1	0.01
REM_{t-1}	−0.207	θ_4	−3.21
Q_{t-1}	−3.908	θ_5	−0.17

in the real effective exchange rate from its equilibrium is restored annually.

The study estimates the long-run relationships using the results from the ARDL model. These were in the form of elasticities; the elasticity of real effective exchange rate to total exports, the quantity of oil produced and remittances. The results (see Tab. VII) show that the real effective exchange rate is highly elastic to changes in remittances and inelastic to total exports and the quantity of oil produced in the long-run. A dollar increase in total exports leads to a 0.01% appreciation in the real effective exchange rate. It depreciates by 0.17% per every thousand barrels of crude oil produced and depreciates by 3.21% for every million dollar increase in remittances.

DISCUSSION AND CONCLUSION

Given the criteria stipulated for measuring the presence of the Dutch Disease, the analysis shows that the real effective exchange rate in Ghana depreciated generally. The decline was also noted from 2012 where it depreciated significantly against the United States dollar. There is therefore no appreciation in the Ghanaian cedi which could signal the presence of the Dutch disease. This is in line with the study results by Treviño (2011) who could not establish direct symptoms of the Dutch Disease. Ueno (2010) could also not prove the presence of the Dutch Disease in the Brazilian economy but however admitted that the economy lost competitiveness due to overvaluation of the currency.

In measuring the impact of the oil boom on the performance of other sectors, the study observed the growth rates of the traditional sectors. It was noted that, the growth performance of the agricultural sector slumped but it however recovered within a year.

This case is therefore not strong enough to support the argument of the Dutch Disease.

The study also considered the performance of traditional tradable exports. There was no decline in export earnings for most sectors except agricultural raw materials which experienced a slight decline after 2012.

With regards to the resource movement effect, the capital requirement of the oil sector is high and that has reduced the accessibility of the sector to indigenous entrepreneurs. Most of these entrepreneurs are limited to the roles of providing services to the huge multinational oil companies. The sector is therefore employment unfriendly. The study admits data inadequacy in demonstrating the trend in labour movement within the period of oil production. There was also no significant data to show the trend in capital movement within sectors in the economy.

The study sought to assess the presence of the Dutch Disease phenomenon in the Ghanaian economy with the discovery and commercial production of oil. It applied various analytical tools such as

graphical analysis and an autoregressive distributed lag model. The results show that, there is no clear case of declining performance of sectors in terms of output, growth and export earnings as a result of oil production. There is also no clear case of real exchange rate appreciation.

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