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Comparison of resource related sectors with non-resource sectors from the point of view of economic growth and Dutch Disease potential, studied on the case of four resource dependent countries

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Abstract:

The Dutch Disease phenomenon makes scholars conclude on the base of the historical empiric evidence, that natural resources can be actually a thread to the long term stability and prosperity of countries. This view of natural resources as a curse rather than a blessing was shown on many cases of national economies. No studies had however compared different commodities in order to draw a conclusion on the severity of their impact on GDP growth with other sectors and also on the lagged impact in a mid-term time span. The study compares on the base of historic longitudinal panel data analysis, selected types of resources with a Dutch Disease impact potential on GDP creation, such as crude oil and gold and compares these with agricultural and industrial output and high-tech exports in chosen countries.

Keywords: The Dutch Disease, oil production, gold, panel data

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JEL Classification: Q20

1. Introduction

Economic growth is to a major extent induced by learning by doing, in agriculture as well as manufacturing (Torvik, 2001) and not by resource based windfall. The Dutch disease or the "Natural Resources Cause" (Allcot et al., 2014) is the designation of a process related to a boom in the sector or natural resources, which causes reduction of non-resource sectors and deindustrialization. Paraphrased, it is a market failure causing negative externalities impacting on sectors of services and tradable goods and services, in preventing these from organic development (Bresser-Perreira, 2013). The phenomenon is based upon the concept of Ricardian rent, defined by dynamics of international markets and creating a cost differential between the cost of less efficient producers present in the market and the cost of countries producing the natural resource the commodity on account of its natural reserves. While according to Ricardian rent concept the owners of the most productive lands are the principal beneficiaries, some scholar see the curse of this rent-seeking following oil exports as well as exports of other mineral resources. In the short run local consumers can purchase tradable goods cheaper than in a situation without Ricardian rent, however in the long run sophistication of production will be impeded, as labor is transferred to resource extraction sectors with higher value created per capital.

If the view of Corden and Neary (1982) on the division of economy into sectors of natural resources, non-resource tradables including manufacturing and agriculture as well as non-tradable sectors including construction and non-tradable services is accepted, then it is realistic to expect the existence of a spending effect (increased spending due to resource related income leading to increase imports) and the resource movement effect (rise of labour costs due to rising marginal product of labour), both being the cause for Dutch disease phenomenon, resulting from the impact of non-natural

resources relative to the impact of non-tradable assets.

In 2006 the Center for Global Development identified the Dutch disease as a term used by economists to describe a reduction in a country's export performance as a result of an appreciation of the exchange rate after a natural resource. The natural resources can be as much a curse as a blessing, and the Dutch disease is as a case of "resource curse" or "paradox of plenty", existing even if the commodities that give rise to it have high technological content, as is currently the case of oil production. (Bressser-Pereira, L. C , 2008)

In other words, the Dutch disease can be labelled as re-allocation of capital from tradable to non-tradable sectors, leaving the markets more open to economic shocks. Evidence shows that fluctuations of commodity prices have strong impact on domestic spending, lead to output variabilities of commodity exporters and especially those that are less developed from the point of view of financial development, with less pro-cyclical fiscal policies and inflexible exchange rates. (IMF, 2015). Natural resources derived wealth exacerbates weaknesses of institutions (Brahmbhatt, 2010), but can also actually deteriorate governance (Collier et al., 2007). The term, was coined in 1977 by the Economist (2014) in reaction to Dutch economy which was characterized by reduction in manufacturing due to discovery of large gas reserves in the Northern Sea leading to increased demand for the currency thus leading to appreciation of the Dutch Guilder, causing inflation which in turn reduced profitability and competitiveness of the national output, lower interest rates and crippled the economic potential of the country.

The argument on the comparative advantages of the resource rich economies is however controversial, since the commodity prices tend to fluctuate and in times of low prices economies without developed back-up sectors incur into troubles. According to Stiglitz (2004), three major impacts of Dutch Disease can be identified: the focus on non-productive activities mal-allocating development effort, often leading to wars and corruption with secondary effects, dependence of by default volatile commodity and crowding out of other economic sectors.

Kareem (2010) studied Dutch disease in a study examining oil-exporting countries using Heckscher-Ohlin factor endowment model in the period of 1977 – 2004 and found out that oil booms lead to reduced manufacturing output, that windfall shocks had negative impact on markets rather in countries with open capital markets to FDI, that the price of labor to capital as well as capital intensity appreciated thanks to a windfall and that high capital and high diversification intensity economic sectors are less impacted by windfall shocks. Collier and Goderis (2007) used a panel co-integration method for 130 countries in a period between 1963-2003, reached the conclusion that commodity price booms had a positive short-term impacts related to growth, this impact would however be negative in the long term and would be restricted to countries with low quality governance and essential natural resources such minerals and oil. Reinhart and Rogoff suggested in 2010 that Dutch disease induced external debt rising over 60% leads to a decline of 2% of GDP growth. The study of 97 developing markets, with high natural resource exports to GDP showed low GDP growth between 1970s and 1980s (Economist, 2014). Smith (2014) replicated calculations done by Black et al. (2005) in examining the impacts of oil price booms and subsequent busts for 19 oil-dependent markets did not contradict the negative view of the Dutch Disease model, however showed a strong negative relationship to price levels in case of countries with high non-hydrocarbon natural resources as well as agricultural products, suggesting move towards industrialization, caused by oil related windfall. His study suggests that there is ambiguity related to effects of oil boom and its impact on other sectors, as they do not imply mechanisms related to Dutch Disease including the spending effects or the resource movement, and thus raised doubts on the simplified explanations of the oil windfall related impact. Allcot et al. in 2014, examined the Dutch Disease in selected U.S. counties, using panel dataset of gas and oil production since the 1960s until the present time and came to the conclusion that manufacturing benefits from resources related windfall, due to pro-cyclical inputs, however limit their findings on local production as well as local manufacturing not taking into account related issues on scale of national states. Bjørnland et al. (2014), used a Bayesian Dynamic Factor model and quantified the impact of a fall of oil prices by 25% to by 2-2.5 percent of Norwegian economy. However, pure resource-based dependency may not be a simple explanation. Stiglitz puts

forward in his article for Guardian (2004) an exemplary case of such Dutch Disease doubt the comparison between Indonesia and Nigeria, both dependent on oil and having a similar level of per capita income in 164, yet today per capita income of Indonesia is four times Nigeria's, which has actually, as measured in constant dollars since 1995, fallen. A pattern alike could be observed in Sierra Leone as well as in Botswana, both dependent on diamond export. However, Botswana averaged 8.6% GDP growth over the past three decades, while Sierra Leone entered in a protracted civil conflict.

Gold mining, is a great sector in at least 34 African countries, a large number of resource-rich African countries did not get a good benefit from their resource endowments. The reason behind this situation is the fact that countries received small shares of the revenues from Gold mining sector and sometimes because of foreign direct investment have negative effect in this sector (Gajigo et al., 2012).

Economies that are dependent on natural resources when the source of the exploited natural resource depletes or the value declines internationally, the country is left without a booming sector and with its remaining economy weakened and prone to "Dutch Disease." This phenomenon is named for the experience of the Dutch economy in the 1960's. After natural gas was discovered in the North Sea, increased production of gas "crowded out" other activities. Essentially countries experiencing "Dutch Disease" like Africa countries find that resources shift into the booming natural resource sector resulting in decreased production in other sectors particularly manufacturing and agriculture. In addition, an appreciation of the real exchange rate often exacerbates the phenomenon by making domestic products more expensive on international markets. This depresses domestic export industries.

In the 2009 with the report of the World Economic Forum (WEF), which showed Ghana as relatively weak in related areas of technology, innovation, education, health, market competition and labor market efficiency. These findings suggest that skills and productivity is the most importance competitiveness challenge facing Ghanaian enterprises.

Akanni (2007) studied Oil Wealth and Economic Growth in Oil Exporting African Countries found that oil revenues in oil exporting African countries have failed to promote growth, increase welfare or solve migration problems. To find more evidence about Dutch disease in oil-rich countries by the study of Treviño (2011) on the 14 member countries of CFA franc zone, who divided them into two groups of oil exporter and non- exporter by studying some indicators like economic growth, GDP and real exchange rate, the results clearly refer to existence Dutch disease into oil exporter group during the oil-price boom.

Chukwuka et al. (2013) studied the effect of oil discovery in Nigeria on agriculture sector activity by using annual time series data from Central Bank of Nigeria, and the study was focusing in relationship between agricultural commodity export and oil export by using co-integration and vector error correction model (VECM), so these results showed that Dutch disease is exist in Nigeria because with 1% increase in oil export the agricultural commodity export will decrease by 16% with less competitive in international markets, these results in the same context with Olusi (2007) and Oyesanmi (2011) whose found that Dutch Disease exist in the Nigerian case.

Also Dutch disease has a negative impact on Nigeria's and Indonesia's agriculture sectors because of local currency appreciation which affected on labour, land markets and cropping pattern and at the end led to less competitive (Rudd, 1996), another evidence from Brazilian economy with overvaluation of the exchange rate over the last years because of impressive growth of oil which reflected on decreasing economy performance and its competitive ability, which lead us to say it is a case of resources curse (Ueno, 2010).

2. Data and Methodology

2.1. Data

The data was chosen from four countries with a high Dutch Disease potential, due to their dependence of natural resources for the period 2002-2011: Ghana, Russia, Saudi Arabia and Venezuela.

Ghana has a great gold sector but relatively weak in related areas of technology, innovation, education, health, market competition and labor market efficiency, in addition to receive small shares of the revenues from gold mining sector (Gajigo et al., 2012). Venezuela is one of the world largest exporters of crude oil. 80% of export earning come from oil, Accounts for 50% of the Gov. Revenue and one-third of the country's gross domestic product (GDP) (Weiner, 2000). Russia is one of the major global suppliers of oil, provides about 13% of the world market. 30% of GDP in Russia comes from exports, however raw materials account for 90% of the goods exports, two-thirds of these raw materials consist of just two products: oil and natural gas (Oomes and Kalcheva, 2007). Saudi Arabia is an interesting country in terms of Dutch Disease as it is the largest oil producing country in the world, with production arrived approximately 10.3 Million barrel in March 2015 with increasing about 450,000 barrel from February in the same year, so with this a heavy dependence on natural resource there is at least one condition of Dutch Disease requirement was achieved. As to independent variables annual gold production (*g*), annual crude oil production (*o*), GDP (*y*), inflation (*i*), population growth (*p*), high-technology exports (*t*), agricultural output (*a*), value-added industry (*id*)and trade in services (*td*)were selected (USGS, 2014; OECD, 2014; FAOSTAT, 2014; WB Data, 2015). Population growth and inflation were included in the equation in order to eliminate impact of unrelated influences on GDP growth.

Tab. 1 Descriptive statistics of the data sample

	Gold (kg)	Crude Oil (toe)	GDP(US $)	Inflation (annual %)	Pop. growth (annual %)	High-technology exports (000 of US $)	Agriculture (000 US $)	Industry, value added (US $)	Trade in services (US $)
Mean	65449.88	223697.8	3.36E+11	14.25	1.67	1272224	15457761	1.48E+11	1.73E+11
Standard Err.	10909.32	35835.37	4.98E+10	1.71	0.19	333524	2275252	1.88E+10	3.04E+10
Median	37569.5	181332.5	2.22E+11	11.28	2.14	121189	9993392	1.17E+11	1.01E+11
Std. Dev.	68996.57	226642.8	3.15E+11	10.84	1.18	2082860	14389963	1.19E+11	1.92E+11
Kurtosis	-0.95488	-2.05682	-0.74492	0.75	-0.89	-0.389206	-0.63538	-1.40357	-0.37672
Skewness	0.782122	0.04	0.767292	1.07	-0.82	1.233140	1.088396	0.198859	1.094252
Count	40	40	40	40	40	40	40	40	40

2.2. Estimation methods

The comparison of different sectors and their effect on Dutch Disease phenomenon (see Regression 1) uses balanced cross-sectional time-series data using multivariate ordinary least squares (OLS) method with one year and two year lags for all variables, observing behaviour of logarithmically transformed macroeconomic indicators[1] across the time span of 10 years. Fixed effects model of panel data OLS is chosen rather than random effect model, as variance between the coefficients caused by multiple time-invariant elements of the sample countries is not to be omitted and the causes of general changes are studied within chosen markets and panel data reflects dynamics as well as Granger causality rather than cross-sectional analysis (Diggle et al., 2002). The comparison of country-specific situations in relation to Dutch Disease impact caused by chosen variables (see Regression 2), is performed with individual logarithmically transformed time-series data using multivariate ordinary least squares (OLS) method with Robust Standard Errors, observing behaviour of macroeconomic indicator across the time span of 10 years and subsequent comparison of the achieved results.

Statistic fit and F-test was applied for both calculations in order to confirm the robustness.

Eq. 1 Relationship between the GDP growth and chosen variables in chosen countries

[1] Population growth, due to negative values was not log-transformed.

$$\ln y_1 = \alpha + \ln \beta_1 g_{it} + \ln \beta_2 o_{it} + \ln \beta_3 i_{it} + \beta_4 p_{it} + \ln \beta_5 t_{it} + \ln \beta_6 a_{it} + \ln \beta_7 id_{it} + \ln \beta_8 td_{it} + \varepsilon_{it}$$

Tab. 2 Coefficients of the regression applied

Variable	*Coefficient*
y	be a performance variable of GDP
α	be the intercept of the regression line and the Y axis
g_{it}	annual production of gold
o_{it}	annual production of oil
i_{it}	annual inflation
p_{it}	annual population growth
t_{it}	high-technology exports
a_{it}	annual agricultural output
id_{it}	industrial value added
td_{it}	trade in services
β_{1-8}	Coefficient
ε_{jt}	error term

Eq. 2 Relationship between the GDP growth and chosen variables in one particular country with one-year lag

$$\ln y_1 = \alpha + \ln \beta_1 g_{t-1} + \ln \beta_2 o_{t-1} + \ln \beta_3 i_{t-1} + \beta_4 p_{t-1} + \ln \beta_5 t_{t-1} + \ln \beta_6 a_{t-1} + \ln \beta_7 id_{t-1} + \ln \beta_8 td_{t-1} + \varepsilon_{it-1}$$

Eq. 3 Relationship between the GDP growth and chosen variables in one particular country with two years' lag

$$\ln y_1 = \alpha + \ln \beta_1 g_{t-2} + \ln \beta_2 o_{t-2} + \ln \beta_3 i_{t-2} + \beta_4 p_{t-2} + \ln \beta_5 t_{t-2} + \ln \beta_6 a_{t-2} + \ln \beta_7 id_{t-2} + \ln \beta_8 td_{t-2} + \varepsilon_{it-2}$$

2.3. Results and discussion

The panel data analysis applying Regression 1 formula, provided four statistically significant results on resources and sectors that have influenced in an important way the GDP growth in the data sample in the year of output as gold (p=0.0540), crude oil (p=0.0140), industry value added (p=0.0022), trade in services (p=0.0002) and agriculture (p=0.0001) had resulted as the statistically significant (see Tab. 3). As to lagged values that showed to be statistically significant, it was gold with two years lag (p=0.0540), crude oil with one-year lag (p=0.0001), industry value added with one and two years lag (p=0.0145, p=0.0007), trade in services with one-year lag (p=0.0001) and agriculture with 2 years lag (p=0.0001).

The standard deviation of the output variable (1.56) shows little variation, the coefficient of determination (R^2) represents the fit of a regression line of 99.9%. It is also a measure of the proportion of variability of the dependent variable and shows the strength of relationship between the dependent and independent variables. The multiple coefficient of determination (R^2) for the regression model is 0.99 indicates that 99% of the variations in the determinants of the dependent variable were explained by the variables included in the sample, while Durbin-Watson test value (2.15) indicates that there is little autocorrelation. LSDV R-squared related to fixed effects provides us with confirmation of non-stochastics, unbiased and liner consistent data, while Rho (-0.22) denotes a weak correlation between variables and F-tests for common intercept and named regressors (0.02;0.00) confirm normality of the sample (see Tab. 4).

Tab. 3 Statistically significant results of the panel data analysis

Sector	*Coefficient*	*Std. Error*	*t-ratio*	*p-value*
Gold	−0.1019	0.0468854	−2.17	0.0540
Gold_2	−0.0168685	0.00497769	−3.3888	0.0007
Crude Oil	−0.0220	0.0074	−2.95	0.0140
CrudeOil_1	−0.0554884	0.00551878	−10.0545	0.0001
Industry Value Added	0.5621	0.0241	23.32	0.0022
Industry Value Added	−0.344072	0.140747	−2.4446	0.0145
Industry Value Added	−0.036382	0.0107651	−3.3796	0.0007
Trade in services	0.4243	0.0444	9.545	0.0002
Trade in services_1	0.0715335	0.00231029	30.9630	0.0001
Agriculture	0.0334733	0.00467846	7.1548	0.0001
Agriculture_2	−0.0216432	0.000755049	−28.6647	0.0001

Tab. 4 Results of testing

Test	*Value*	*Test*	*Value*
Mean dependent var	25.86	S.D. dependent var	1.56
Sum squared resid	0.01	S.E. of regression	0.014
LSDV R-squared	0.99	Within R-squared	0.99
LSDV F(25, 10)	18064.63	P-value(F)	2.77E-20
Log-likelihood	126.42	Akaike criterion	−200.83
Schwarz criterion	−159.66	Hannan-Quinn	−186.46
Rho	−0.22	Durbin-Watson	2.16
F-test (common intercept)	0.02	F-test (named regressors)	0.00

The results show an important impact of natural resources in the chosen four countries on GDP growth, confirms the Dutch Disease potential. Gold extraction seems to have been more important

influence on GDP growth than crude oil production, which however has little generalization potential, due to limited sample of four countries. The impact is however rather immediate or hard to predict as nor in case of oil nor in case of gold can be seen a balanced impact during the three years measured. The impact on economic growth in the measured countries can be however traced back to industry value added, trade in services as well as to agriculture, with more important values than gold and oil. Unsurprisingly, high-tech exports showed no important values, when compared to resources or the sectors of trade, agriculture and industry.

On the base of the aforementioned findings, it can be therefore stated, that industry, trade as well as agriculture play rather a more important role on GDP growth in countries that can be defined as prime Dutch Disease candidates. One of the explanations can consist in the fact that the level of extraction of natural resources was constituted an important share of the GDP and therefore the growth was driven by other sectors.

3. Conclusion

The measurement of four countries that represent potentially important Dutch Disease target countries showed a striking importance of industry, services as well as trade sector on the GDP growth in the period of 11 years, which is comparable or more important than the contribution of extractive sector. The explanation of this finding can lie in the fact, that extraction of resources did contribute an important share to national GDP volume decades ago, yet rather contributed less to GDP growth than the sector mentioned. This would imply a possible illumination on the dangers of Dutch Disease as a phenomenon especially crucial during a period of growing output of the natural resources contribution to GDP, while after reaching a certain threshold, such as the extraction capacity limits, the complementary sectors of economy can become actually responsible for GDP growth in a more dramatic way than the extraction itself.

Development of social capital is a precursor to long-term economic growth, in the view of mainstream economics being a hydraulic system situated in time as well as in space. Abundant natural resources should be a blessing, not a curse and can become one, if the exploitation of natural resources happens with measured approach and in balance with development of other principal economic sectors. This in other words requires robust planning on macroeconomic level, with complex coordination between different frameworks of governance and includes imposition of limits in the extraction sectors, which is rather more difficult to put into practice than to consider from a theoretical point of view and which actually goes against the laissez faire neoliberal market view.

In other words, not the resources themselves, but incapacity to see a wider panorama of the market system as well as a view of long term economic perspectives, implies the Dutch Disease potential.

Rent-seeking behavior and short termism of state officials, and natural resources wealth grab, which is less complicated than a strenuous, gradual development of industries and commercial infrastructures, in combination with dependence and volatility of the prices of resources, can be indeed detrimental to creation of the pool of social capital and crowd out other, in the short term less lucrative activities, which can however at the end provide and incomparably more important contribution to balance the satisfaction of economic needs.

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