Applied Studies in Agribusiness and Commerce – APSTRACT
University of Debrecen, Faculty of Economics and Business, Debrecen
DOI: 10.19041/APSTRACT/2019/3-4/4

SCIENTIFIC PAPER

A NOTE ON THE DUTCH DISEASE

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Abstract: *Many resource rich countries are poor, where many resource poor countries are rich. One of the possible explanations of this paradox called the 'resource curse' is the Dutch Disease. This paper aims to analyse this phenomenon with the help of a simple macro-economic trade model. It presents a number of Dutch Disease Cases of which the 'Norwegian Case' provides an example containing an effective policy against the negative impact of Dutch Disease on the national economy.*

Keywords: *Dutch Disease, Resource Curse, Real Exchange Rate, Norwegian Case*
(JEL Classification: O11, O24, Q33)

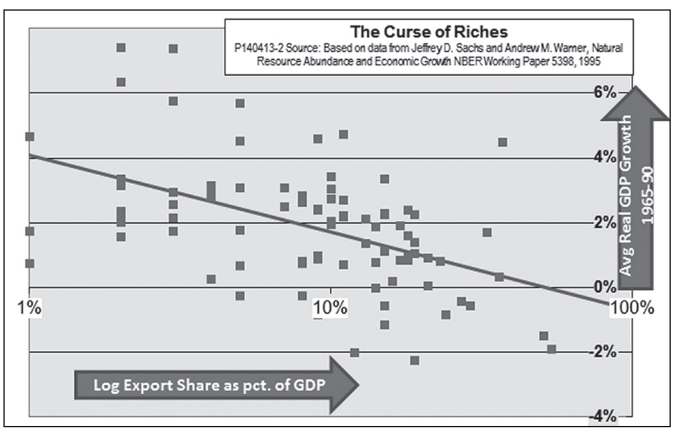
INTRODUCTION

Dutch Disease is one of the reasons for the Resource Curse. The resource curse implies that many export oriented resource rich countries are poor, where many resource poor countries are rich (Figure 1). This paradox is partly explained by the Dutch Disease. Another aspect of the resource curse is the social-economic impact of richness in point-source natural resources like oil and natural gas. Many point-source rich countries are characterized by a low Social Progress Index (Economonitor, 2014).

This note concentrates on the Dutch Disease as the driver of the resource curse. Generally it works as follows. The discovery of a country's reserve of a point-source resource generates a global demand for it, causing a rise of the real exchange rate of the country's currency. This makes imports relatively cheap in comparison with the home produced importables (goods that may be either imported or produced at home) which implies a deterioration of this sector's international competitiveness, causing it to shrink and even to disappear completely in an extreme case. This also explains the name "Dutch Disease", which was coined first by the Economist in 1977 referring to the discovery of a huge reserve of natural gas in the Netherlands at the end of the fifties, after which the manufacturing sector lost much of its competitiveness because of the appreciation of the Dutch Guilder (The Economist, 2014). An in depth analysis has been provided by Corden and Neary (1982). The aim of this note is to provide the essential insight in the phenomenon.

Another possible source of Dutch Disease is massive development aid, causing capital import on a large scale, which may increase the real exchange rate and thus provoking the downturn of industrial production that has to compete with imports.

Figure 1: Resource Curse.



Source: Economonitor: Ed Dolan's Econ Blog, April 21st, 2014.

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The aim of this paper is to develop a macroeconomic model that explains Dutch Disease and can easily be used in university education to demonstrate its impact.

Cases of Dutch Disease

Dutch disease is not a scarce phenomenon. Table 1 shows a number of examples of Dutch disease covered by literature on the issue.

In theory, the cure for Dutch disease is quite simple: export of royalties by investing them abroad. This causes a fall in the real exchange rate and in that way the negative effects for the home production of importables is avoided. In practice, this can be realized by a 'wealth fund' in which the royalties accumulate. The wealth fund should be invested abroad in order to generate the lowering effect on the real exchange rate. This is called the Norwegian Case after the country that implemented it successfully.

Table 1: Examples of Dutch disease

- Australian gold rush in the 19th century, first documented by Cairns in 1859
- Australian mineral commodities in the 2000s and 2010s
- Signs of emerging Dutch disease in Chile in the late 2000s, due to the boom in mineral commodity prices
- Azerbaijani oil in the 2000s
- Canada's rising dollar hampered its manufacturing sector from the early 2000s until the oil price crash in late 2014/early 2015 due to foreign demand for natural resources, with the Athabasca oil sands becoming increasingly dominant.
- Indonesia's greatly increased export revenues after the oil booms in 1974 and 1979
- Nigeria and other post-colonial African states in the 1990s
- The Philippines' strong foreign exchange market inflows in the 2000s leading to appreciation of currency and loss of competitiveness
- Russian oil and natural gas in the 2000s
- Gold and other wealth imported to Spain and Portugal during the 16th century from the Americas
- The effect of North Sea Oil on manufacturing sectors in Norway and the UK in 1970-1990.
- Post-disaster booms accompanied by inflation following the provision of large amounts of relief and recovery assistance such as occurred in some places in Asia following the Asian tsunami in 2004
- Venezuelan oil during the 2000s. Using the official exchange rate, Caracas is the most expensive city in the world, though the black market exchange rate is said to be as much as hundred times as many bolivares to the dollar as the official one. Being a large exporter of oil revenues also keeps the currency's value above what it would otherwise be.

Source: Wikipedia: "Dutch Disease". For references, see site.

A Dutch Disease Model

Percentage growth in production y equals the growth rate of non-tradables ynt, the production of home consumed exportables xh plus the growth rate of the production of home produced importables mh plus growth rate of exports x multiplied by its initial shares in total production α, β, γ and $(1 - \alpha - \beta - \gamma)$[1]

$$y = \alpha y_{nt} + \beta\, x_h + \gamma m_h + (1 - \alpha - \beta - \gamma)\, x.$$

The production of non-tradables y_{nt} and exportables x_h, goods that can be exported or consumed at home, consumed at home are assumed to be non-price elastic; they are assumed to only react to a relative change in the income y, so:

$$y_{nt} = \delta y,$$
$$x_h = \varepsilon y,$$

with δ and ε for the income elasticities of y_{nt} and x_h with respect to y respectively. Home produced importables mh are influenced by the change in the real exchange rate c, which is the relative change of the real value of the home currency expressed in the foreign currency.

$$mh = -\mu c,$$

with $-\mu$ for the elasticity of m_h with respect to c. this implies that if the real exchange rate increases, the home production of importables decreases as a consequence of imports being cheaper than the home produced substitutes. The sudden increase of exports is represented by $\underline{x}$, so:

$$x = \underline{x}.$$

The real exchange rate c reacts to the sudden change in export as follows:

$$c = \lambda\,(x - k),\ \lambda > 0;$$ (see appendix),

with λ for the elasticity of c with respect to the growth rate of exports x and the percentage change of capital export k. Finally, initial and continuing equilibrium on the trade balance is assumed, which means that the growth rate of exports x plus the relative change of the real exchange rate of the home currency expressed in the foreign currency equals the percentage growth of imports m plus capital export k as a percentage of imports.[2]

$$x + c = m + k.$$

[1] In this paper with 'growth rate' the year to year percentage growth is meant.

[2] Here I am assuming that in the initial situation (before the export boom) there was equilibrium on the capital account. A deficit on the capital account is shown here a percentage of total import value expressed in the foreign currency.

Capital export k is assumed to be an exogenous variable. The idea behind this is that the government may develop a policy to export more capital or there may be exogenous capital import because of development aid.

$$k = \underline{k}.$$

From the above it follows:

$$y = \frac{1-\alpha-\beta-\gamma\left(1+\mu\lambda\right)}{1-\alpha\delta-\beta\varepsilon}\underline{x} + \frac{\gamma\mu\lambda}{1-\alpha\delta-\beta\varepsilon}\underline{k}, \text{ with } \alpha\delta+\beta\varepsilon<1.$$

Finally, some idea could be formed of the wider problem of the resource curse by taking into account the income distribution. Booming exports of the point resource cause a rise in the income of a small group of mine owners and other stakeholders, where the decrease of the production of importable causes a decrease in the income of a relatively large group of people. A rough indication for the changing income distribution i may be:

$$i = x - m_h$$

The higher i the more unequal the income distribution is.

Some preliminary conclusions:

1. If $\underline{x} > 0$, $\underline{k} = 0$, $\alpha + \beta + \gamma(1+\mu\lambda) < 1$, the positive exports shock x has a positive impact on production y.
2. If $\underline{x} > 0$, $\underline{k} = 0$, $\alpha + \beta + \gamma(1+\mu\lambda) > 1$, the positive exports shock x has a negative impact on production y.
3. If $\underline{x} > 0$, $\underline{k} = 0$, $\alpha + \beta + \gamma(1+\mu\lambda) = 1$, the positive exports shock x has no impact on production y.
4. If $\underline{x} > 0$, $\underline{k} = 0$, $\alpha + \beta + \gamma(1+\mu\lambda) < 1$, the positive impact of the exports shock x on production y is strengthened by capital export k.
5. If $\underline{x} = 0$, $\underline{k} < 0$, the import of capital $\underline{k}$ has a negative impact on production y.

Model Examples

In order to facilitate computations in Excel the model is rewritten as follows:

$$y-\alpha y_{nt}-\beta x_h-\gamma m_h- \; 1-\alpha-\beta-\gamma \;\; x=0,$$

$$\delta y-y_{nt}=0,$$

$$\varepsilon y-x_h=0,$$

$$m_h+\mu c=0,$$

$$x=\underline{x},$$

$$c-\lambda x+\lambda k=0,$$

$$k=\underline{k},$$

$$x-m+c-k=0,$$

$$i-x+m_h=0.$$

So:

$$\begin{bmatrix} 1 & -\alpha & -\beta & -\gamma & -(1-\alpha-\beta-\gamma) & 0 & 0 & 0 & 0 \\ \delta & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \varepsilon & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & \mu & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\lambda & 1 & \lambda & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & -1 & -1 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} y \\ y_{nt} \\ x_h \\ m_h \\ x \\ c \\ k \\ m \\ i \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ \underline{x} \\ 0 \\ \underline{k} \\ 0 \\ 0 \end{bmatrix}, \text{ and:}$$

$$\begin{bmatrix} y \\ y_{nt} \\ x_h \\ m_h \\ x \\ c \\ k \\ m \\ i \end{bmatrix} = \begin{bmatrix} 1 & -\alpha & -\beta & -\gamma & -(1-\alpha-\beta-\gamma) & 0 & 0 & 0 & 0 \\ \delta & -1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ \varepsilon & 0 & -1 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 & \mu & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & -\lambda & 1 & \lambda & 0 & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & 1 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 & 1 & -1 & -1 & 0 \\ 0 & 0 & 0 & 1 & -1 & 0 & 0 & 0 & 1 \end{bmatrix}^{-1} \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ \underline{x} \\ 0 \\ \underline{k} \\ 0 \\ 0 \end{bmatrix}.$$

Some examples are presented in Table 2.

Table 2: Examples

Ex.	$\underline{x}$	$\underline{k}$	α	β	γ	δ	ε	μ	λ	α+β+γ(1+ μλ)	γμλ	y
1.	20	0	0.3	0.2	0.3	0.50	0.5	0.40	0.5	< 1	>0	> 0
2.	20	0	0.3	0.2	0.4	0.50	0.5	0.80	1.0	> 1	>0	< 0
3.	20	0	0.3	0.2	0.4	0.75	1.0	0.67	1.0	≈1	>0	≈ 0
4.	20	20	0.3	0.2	0.3	0.50	0.5	0.40	0.5	< 1	>0	> 0
5.	0	-20	0.3	0.2	0.3	0.50	0.5	0.40	0.5	> 1	>0	< 0

The outcomes of the examples are presented in Table 3.

Table 3: Outcomes of Examples 1-5.

Example	y	y_{nt}	x_h	m_h	x	c	k	m	i
1.	3.73	1.87	1.87	-4.00	20.00	10.00	0.00	30.00	24.00
2.	-1.07	-0.53	-0.53	-16.00	20.00	20.00	0.00	40.00	36.00
3.	0.00	0.00	0.00	-13.33	20.00	20.00	0.00	40.00	33.33
4.	5.33	2.67	2.67	0.00	20.00	0.00	20.00	0.00	20.00
5.	-1.6	-0.8	-0.8	-4	0.00	10.00	-20.00	30.00	4.00

From the results in Table 3 it is quite clear that controlling the real exchange rate c by way of capital exports generates the highest increase in income y and has a moderate impact on the income distribution i (Example 4: The Norwegian Case). Example 5 shows the impact of large scale development aid. Because of the increase of the real exchange rate c by 10%, home consumption of importables mh decreases by 4%, where imports m increases by 30%, resulting in a decrease of national income y by 1.6%.

CONCLUSIONS

Dutch disease may have disruptive consequences for an economy. Because of the global increase of demand for localized resources the appreciation of the real exchange rate may cause the decline of other sectors and increase the disparity in the income distribution. It can be partly cured by investing royalties abroad through a wealth fund causing a decrease in the real exchange rate of the home currency, but this may be difficult because of political interests. This may also moderate the growing inequality of the income distribution as a result of the booming exports sector, in this way partly preventing the sorrow situation of a resource curse. Further large scale development support may cause Dutch disease because it may generate an increase of the real exchange rate as well.

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APPENDIX

Growth rates x of exports and m of imports are assumed to be related to the percentage change c of the real exchange rate as follows (with $-\varphi_1$ for the elasticity of x with respect to c, φ_2 for the elasticity of m with respect to c, $\underline{x}$ for the exogenous percentage increase of exports, and k for the exogenous capital export as a percentage of total imports):[3]

$$x = -\varphi_1 c + \underline{x}$$
$$m = \varphi_2 c$$
$$k = \underline{k}.$$

Because of the assumption of initial and continuous trade balance equilibrium:

$$x + c = m + k,\ \text{so: } \varphi_2 c + \underline{k} = (1-\varphi_1)c + \underline{x},\ \text{so: } c = \frac{1}{(\varphi_1 + \varphi_2 - 1)}(\underline{x} - \underline{k}),$$

and $c = \lambda(\underline{x} - \underline{k})$, with $\lambda = \frac{1}{(\varphi_1 + \varphi_2 - 1)}$.

In the case of Dutch Disease $\varphi_1 + \varphi_2 > 1$ *so:* $\lambda > 0$

[3] It is assumed that in the initial situation the capital balance is in equilibrium.