DEPARTMENT OF ECONOMICS AND FINANCE

COLLEGE OF BUSINESS AND LAW

UNIVERSITY OF CANTERBURY

CHRISTCHURCH, NEW ZEALAND

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Ramez Badeeb
Hooi Hooi Lean
Jeremy Clark

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Department of Economics and Finance
College of Business and Law
University of Canterbury
Private Bag 4800, Christchurch
New Zealand

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The Evolution of the Natural Resource Curse Thesis: A Critical Literature Survey

Ramez Badeeb[1]
Hooi Hooi Lean[1]
Jeremy Clark*[2]

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Abstract: This paper surveys the literature of the natural resource curse hypothesis. We review the theoretical mechanisms through which natural resource wealth might slow economic growth, and then the empirical studies that test for an effect overall, or an effect on factors typically associated with economic growth. We also review more recent studies suggesting that the findings supporting the resource curse may reflect only empirical mis-specification. The literature has produced conflicting evidence, with no consensus on the net effect of natural resources in an economy. Overall we argue that evidence for a negative effect of natural resource dependence on economic growth remains convincing, particularly for developing economies and particularly working through factors closely associated with growth. We take recent contrarian studies to demonstrate, however, both that a resource curse is not inevitable, and that future studies should better address issues of endogeneity of dependence measures, years of study, and potential non-monotonic relationships.

Keywords: natural resource curse; natural resource dependence; natural resource abundance; economic growth; literature survey

JEL Classifications: O13, O47, Q32, Q33

[1] Economics Program, School of Social Sciences, Universiti Sains Malaysia, MALAYSIA

[2] Department of Economics and Finance, University of Canterbury, Christchurch, NEW ZEALAND

* Corresponding Author: Jeremy Clark, Email: jeremy.clark@canterbury.ac.nz

1. Introduction

There has been a deep belief since Adam Smith and David Ricardo that countries blessed with natural resources such as oil and gas can base their development on these resources, and use them as a key path for sustained economic growth. At the same time, the role that energy plays in development today arguably differs from the role it played in the late 19th and early 20th century in the United States, Australia and Canada. In recent decades, economists have observed that resource-rich nations, especially in Africa, Latin America and the Middle East tend to grow at a slower rate than countries with fewer natural resources. These countries are said to suffer from what Auty (1993) coined a "resource curse". This curse refers to an inverse association between natural resource dependence and economic growth. A more specific "oil curse" has been attributed to countries whose economies are heavily reliant on oil production.

A sizable literature has thus emerged since the 1980's challenging the conventional view that natural resources are a blessing for developing countries. This literature has increased significantly over time. Economists and other social scientists have identified different causal channels by which a resource curse might operate, and different outcome variables related to economic growth that it might affect.

Two important survey studies have attempted to summarize and evaluate this growing literature. The first is an NBER working paper by Jeffrey Frankel (2010), and the second is a Journal of Economic Literature survey by Frederick Van der Ploeg (2011). While Frankel's (2010) survey is intended for general audiences, Van der Ploeg's (2011) is written for economic theorists. Frankel diagnoses the resource curse, summarizing potential mechanisms for an inverse relationship between natural resource dependence and economic growth. He surveys economic arguments related to the role of commodity prices such as their effects on non-resource sectors (the Dutch disease), their exacerbation of economic cycles, and their effects

on institutional performance and macroeconomic instability, as well as political arguments. Frankel then provides ideas to help a country overcome the curse such as

> "*indexation of oil contracts, hedging of export proceeds, denomination of debt in terms of oil, Chile style fiscal rules, a monetary target that emphasizes product prices, transparent commodity funds, and lump-sum distribution.*"

For his part, Van der Ploeg (2011) introduces answers for additional questions related to the resource curse, and emphasizes its contingent nature. Like Frankel, he also offers some fiscal rules for harnessing resource windfalls in developed and developing countries. Van der Ploeg argues that the resource curse is not inevitable when he states that:

> *"resource rich countries with good institutions, trade openness and high investments in exploration technology seem to enjoy the fruits of their natural resource wealth."*

Our survey extends these two works by including more recent studies, and focusing on the evolution of economists' thinking about the resource curse, including recent critiques of its very existence. We also survey empirical studies not addressed by Frankel (2010) and Van der Ploeg (2011). Overall, we argue that the lack of consensus in the literature, obvious counter examples, and recent methodological critiques caution against viewing the resource curse as inevitable. Nonetheless, the sheer weight of disparate studies finding poor growth records of most countries with high resource dependence leads us to argue that the resource curse has not been invalidated. Rather, future studies are required that more carefully address issues of endogeneity in measures of resource dependence in production and export, clearly distinguishing it from measures of resource abundance. Future studies also need to better vary

years of data studied, and possible non-monotonic relationships between dependence and growth.

The rest of this paper is organized as follows: the basic resource curse thesis is rehearsed in section 2. In section 3 we provide an overview of the evolution of the resource curse thesis. The mechanisms through which the curse is thought to operate are discussed in section 4. Section 5 surveys empirical studies testing for negative effects of natural resources on economic growth, as well as on broader indicators related to economic growth. Section 5 also surveys recent studies providing methodological critiques of the thesis. Finally, section 6 concludes with suggestions for future research.

2. Natural Resources and their Mixed Legacy

To begin, it is useful to clarify with the Oxford Dictionary that the term "natural resources" refers broadly to natural assets such as materials, minerals, forests, water, and fertile land that occur in nature and can be used for economic gain. Some natural assets such as oil, gas and minerals can be depleted or exhausted. These non-renewable assets have no alternative use that can yield a similar marginal revenue product. In contrast, fertile land can be used to cultivate alternate crops. In practice, the resource curse thesis tends to focus on non-renewable natural resources following the lead of case studies first used to illustrate it.[1]

To understand the proposed curse, we first need to distinguish how resource wealth differs from other types of wealth. Humphreys et al. (2007) identify two key differences. First, unlike other resources, natural resources do not need to be produced, but only extracted. Because the

[1] Manzano and Rigobon (2001) proved empirically that the curse is not exist in any other kind of resources; however, the resource curse effect is entirely through minerals (see also: Leite and Weidmann, 2002; Isham et al .2005; Bulte et al. 2005).

generation of natural resource wealth is not a result of production, it can occur relatively independently of other economic processes and does little to create employment. Conversely, the extraction of e.g. oil and gas are among the world's most capital-intensive industries. Thus, this sector creates few jobs per unit of capital invested, and the skills required for these jobs usually do not fit the profile of a country's unemployed (Karl, 2007). The second key difference of natural resource wealth identified by Humphreys et al. stems from the fact that many are non-renewable, particularly oil and gas. They point out (2007, p.4):

> "*From an economic aspect, [natural resources] are thus less like a source of income and more like an asset.*"

In principle, such assets should offer three large benefits for poor economies. First, the income stream from resource extraction can boost real living standards by financing higher levels of public and private consumption. Second, resource extraction can finance higher levels of investment, both directly out of natural resource income, and indirectly from borrowing made possible by that income. Third, since resource income typically accrues largely to the public sector, and indeed to the public budget, it can obviate a huge barrier to development: the lack of fiscal resources needed to finance core public goods, including infrastructure (Sachs 2007).

However, for some decades, it has been observed that the possession of natural resources is neither necessary nor sufficient to confer economic success. Many countries in Africa and Middle East are rich in oil and other natural resources, and yet their people continue to experience low per capita income and a low quality of life. This puzzling phenomenon was labelled a "natural resource curse" by Auty (1993). The term refers to the paradox that countries endowed with natural resources such as oil, natural gas, mineral etc. tend to have lower economic growth and worse development outcomes than countries with fewer natural resources. Angola, Congo, Nigeria, Venezuela and some Middle Eastern countries are good instances of

natural resource-based economies that suffer low or negative GDP growth and widespread poverty. In contrast, East Asian economies such as Japan, Korea, Taiwan, Singapore and Hong Kong have achieved high standards of living despite having few exportable natural resources. Finally, it is worth mentioning that even the most convinced resource curse scholars are not making the case that states rich in natural resources would be better off without them. Instead, the resource curse literature only attempts to explain why many resource-curse states experience failure in development (Karl, 2005).

3. The Evolution of the Resource Curse Hypothesis

As already observed, economists have held two divergent perspectives on the role of natural resources in an economy. The more positive perspective can be traced back to Adam Smith and David Ricardo, who asserted that natural resources play a beneficial role in the process of economic development. Many postwar economists supported this view well into the 1970's (see for example Viner (1952) and Rostow (1961)). In 1961, Walter Rostow summarized this popular belief by arguing that natural resource endowments would enable developing countries to make the crucial transition from under-development to industrial take-off, just as they had done for countries such as Australia, the United States, and Britain. A consensus view held that natural resources would facilitate industrial development, create markets and encourage investment.

Although there was some opposition to this conventional wisdom (see Singer, 1950; Prebisch, 1959; and Nankani, 1979), the optimistic view prevailed until the early 1980's. At this time, the so-called Dutch disease – named after the decline of Dutch manufacturing after the discovery of natural gas at Groningen -- emerged to pave the way for the second more pessimistic perspective (see Cordon and Neary, 1982; Cordon, 1984; Neary and Wijnbergen, 1986).

The Dutch disease (to be explained shortly) can be considered an immediate predecessor of the resource curse thesis. In 1988, Alan Gelb first analyzed the economic effects of oil rents in his book *Oil Windfalls: Blessing or Curse*. Through his descriptive analysis, Gelb (1988) established a resource curse thesis. He found that mineral economies experienced a more serious deterioration in the efficiency of their domestic capital formation during the boom period of 1971–1983 than did non-mineral economies. Gelb argued that the cost of using oil windfalls can offset the gains from the windfalls themselves. However, the term "resource curse" was first used in 1993 by a Birch economist, Richard Auty to describe how countries rich in natural resources seemed unable to use that wealth to boost their economies, and how these countries had lower economic growth than countries without natural resources. In analyzing oil-producing countries in particular, Auty followed Gelb by examining the industrial policies implemented by these countries and their consequences. Auty also stressed the volatile nature of mineral revenues, and characterized the mining sector as having enclave tendencies. He showed that governments of mineral-rich countries tended to collect low withholding revenues because foreign-owned mining companies repatriated their earnings overseas.

Inspired by these findings and arguments, Jeffery Sachs and Andrew Warner launched a series of cross sectional studies (Sachs and Warner; 1995, 1997, 1999, 2001). The purpose of these works was to test empirically the existence of a negative relationship between natural resource dependence and economic growth. Sachs and Warner (1995) arguably produced the first scholarly work confirming the adverse effects of resource dependence based on empirical evidence. Following Sachs and Warner's empirical studies, other scholars found the same results using related quantitative techniques and larger data sets.

After 2001, the resource curse literature incorporated and extended the works of an Icelandic economist, Thorvaldur Gylfason (Gylfason, 2001; Gylfason, 2006; and Gylfason and

Zoega, 2006). Gylfason focused attention on broader channels through which natural resource dependence could be affecting sustained economic growth: savings, investment and human capital formation. This focus is currently dominating the resource curse literature, in addition to a continued stream of studies proposing policies to mitigate or avoid the negative externalities associated with the curse (see Stiglitz, 2005; Sachs, 2007). Figure 1 illustrates the evolution of ideas regarding the resource curse thesis. Most recently, a few studies have appeared challenging the assumptions and estimation procedures used by Sachs and Warner (1995) and others to confirm the resource curse hypothesis. These studies will be discussed in Section 5.3.

4. Proposed Economic and Political Mechanisms of the Curse

In studying the role of natural resources in economic growth, it is not enough to show evidence that a relationship exists between these two factors. It is important to investigate the mechanisms that link resource dependence to poor economic performance. These mechanisms can be divided into two distinct but overlapping categories: economic and political explanations. Economically, the main reasons why resource-based paths of development inhibit long run economic growth are traced to the Dutch disease phenomenon, the volatility of commodity prices, failures of economic policy, and the neglect of education. Politically, the main mechanisms are traced to rent seeking, weak institutions and corruption.

i. The "Dutch Disease"

Corden and Neary (1982) and Corden (1984) first developed a model of the Dutch disease. The term originated from a 1977 edition of "The Economist" concerning the decline of the Dutch manufacturing sector after the discovery of natural gas sources. Iimi (2007) considers the Dutch disease to be the most prominent economic channel for the natural resource curse.

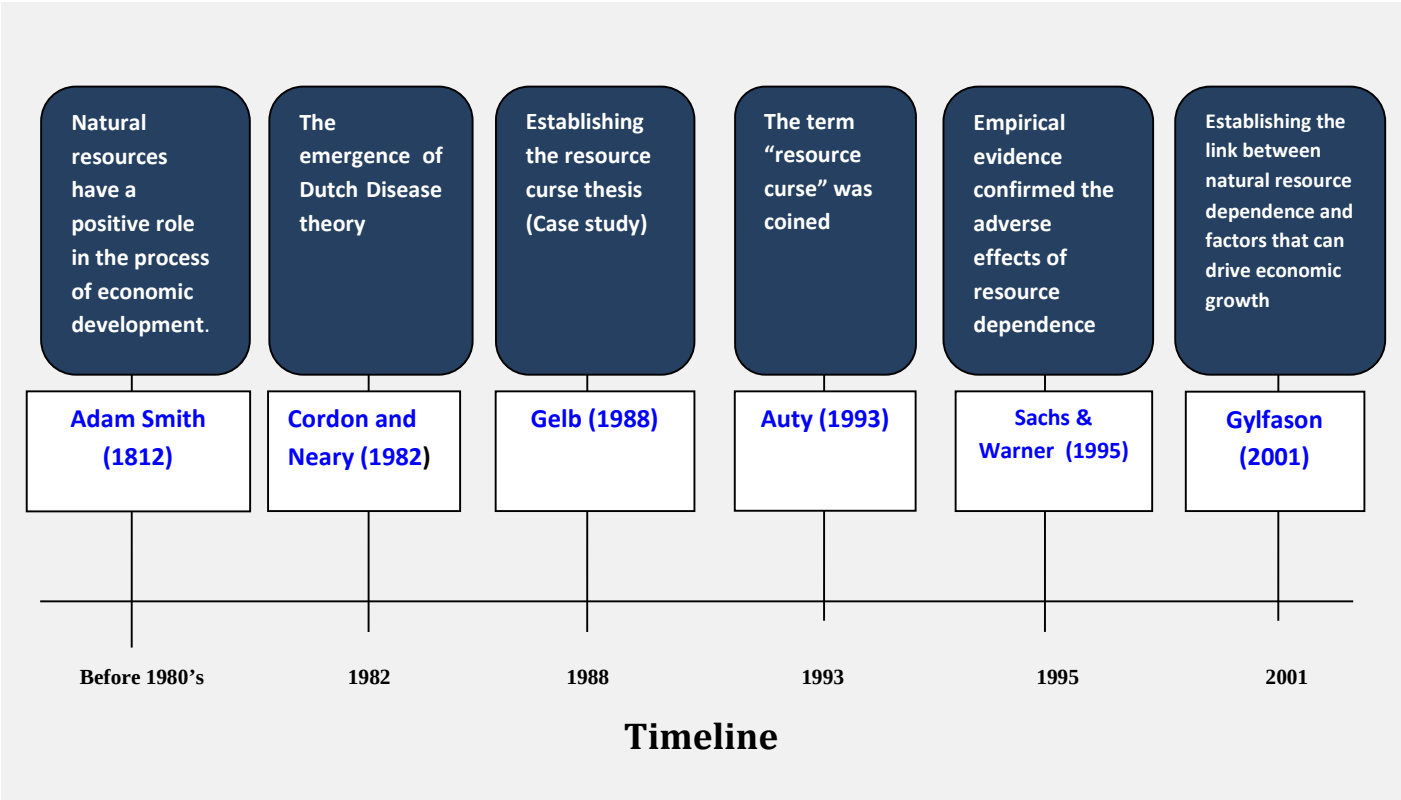

Figure 1. The Evolution of the Resource Curse Thesis

As summarized by Sachs and Warner (1995), Gylfason (2001), Papyrakis and Gerlagh, (2004) and Frankel (2010), the Dutch disease occurs when natural resource booms increase domestic income and the demand for goods. This increase generates inflation and appreciation of the real exchange rate. As a result, the relative prices of non-resource commodities increase, and their export becomes expensive relative to world market prices. This leads to a decrease in the competitiveness of these non-resource commodities, and in the investment they attract. This negative effect on the resource-rich country's economic growth is called the "spending effect" (see Figure 2).

In addition, internal domestic inputs such as labor and materials are shifted to the natural resource sector. The prices of these inputs rise in the domestic market. As a result, the production costs of other traditional export sectors such as manufacturing and agriculture

increase, contracting these sectors. This adverse effect on non-resource sectors is called the resource "pull effect" (Humphreys et al., 2007) (see Figure 3).

ii. Volatility in Commodity Prices

The second economic channel through which the resource curse may operate is the volatile nature of natural resource prices in global markets. Economists have suggested that this volatility reduces economic growth, quite apart from trends in commodity prices (Davis and Tilton, 2005; Frankel, 2010). Market instability increases uncertainty, makes it difficult to measure revenues from the natural resource sector, and hampers effective planning for economic development. Davis and Tilton (2005) claim that volatility shrinks government revenues and foreign exchange earnings, reducing nations' abilities to meet the conditions required for expansionary monetary policy when it would otherwise be beneficial. Moreover, Humphreys et al. (2007) argue that the magnitude of resource price fluctuations can be amplified by international lending. When commodity prices are high, commodity-rich countries borrow from abroad, exacerbating the boom. When prices fall, international lenders demand repayment and force expenditure reductions, thus increasing the magnitude of downturns. This response/counter response pushed many resource rich countries into debt crises in the 1980's (Van der Ploeg, 2011).

iii. Economic Mismanagement

Iimi (2007) argues that natural resource revenues may imbue policymakers with overconfidence in their economies. Ready access to resource rents may relieve pressures on governments regarding tax collection and the need for fiscal discipline. Governments may exploit this reduced constraint on expenditures or reduced need to impose non-resource taxes

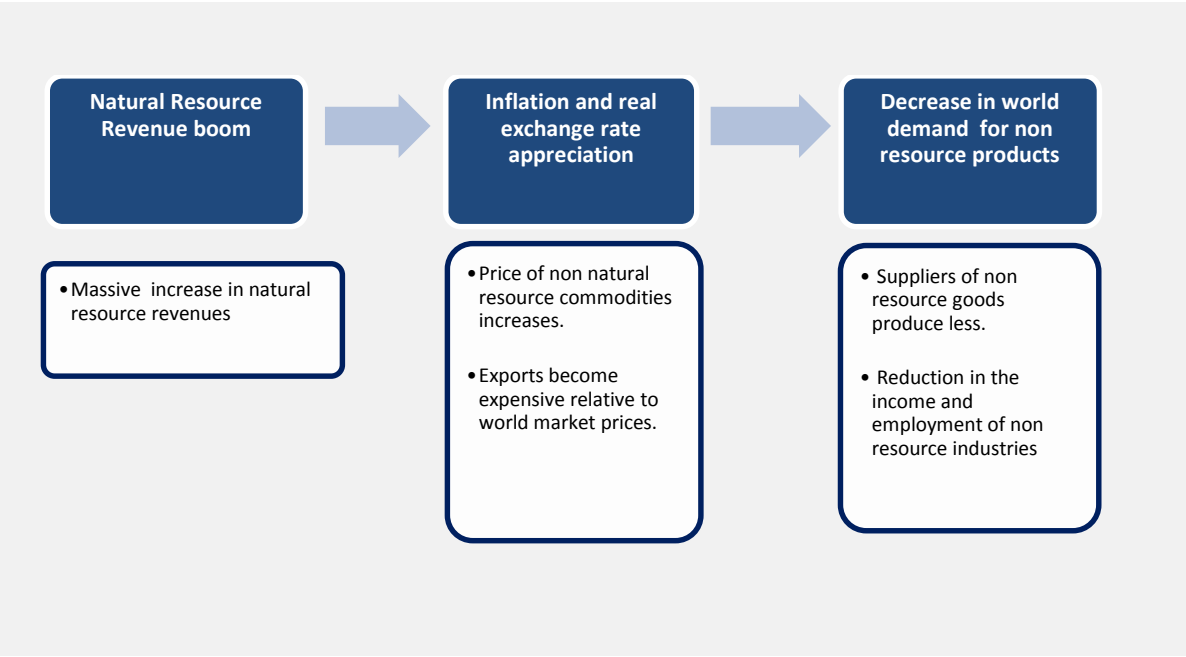

Figure. 2 The Dutch Disease Mechanism (Spending Effect)

Figure. 3 The Dutch Disease Mechanism (Pulling Effect)

to offset pressures they would otherwise face for political reforms. For example, resource-funded fiscal cushions can enable governments to ignore or delay urbanization, pressure for higher levels of education, and the supply of other infrastructure requirements that would otherwise facilitate long term economic development (Ross, 2007). Of course, a curse skeptic

might argue that a government differently minded might precisely use resource rents to invest in needed infrastructure, or use resource rent windfalls to ease the implementation of needed political reforms in Pareto improving ways that compensate losers. Resource rents may thus provide governments with greater scope for good or ill, and not inherently be responsible for the ill.

On the demand side, natural resource dependence may also reduce people's incentives to accumulate human capital due to high levels of non-wage income or resource-based wages. Empirical evidence shows that school enrolment at all levels is inversely related to natural resource dependence (Gylfason et al., 1999). Perhaps reflecting both supply and demand side factors, there is evidence that public expenditure on education relative to national income is inversely related to natural capital (Gylfason, 2001).

iv. Rent Seeking

Moving further along the spectrum from economic to political causal channels for the resource curse, we come to rent seeking, or the "Political Dutch Disease" as labelled by Lam and Wantchekon (2003). People seek political rents when they try to obtain benefits for themselves through their political influence. Many economists, such as Gylfason (2001), Hodler (2006), Iimi (2007), Deacon and Rode (2012), argue that in some countries, the windfall of resource revenues increases the power of elites, who have the capacity to widen income inequalities. The elites or powerful groups generally take a large share of these revenues and distribute it for the benefit of their immediate circles rather than investing it to upgrade infrastructure and sustainable economic development. Windfall resource revenues are also considered a main cause for conflict between domestic stakeholders such as politicians, local tribes, and citizens more broadly (Sala-i-Martin and Subramanian, 2003; Davis and Tilton, 2005; Iimi, 2007). A political analysis by Paul Collier of Oxford University finds that for any

given five-year period, the chance of a civil war in an African country ranges from less than 1% in countries without resource wealth to nearly 25% in those countries with it (see also Ross et al., 2011).

v. Corruption and Institutional Quality

The role of institutions in determining how natural resources affect economic growth has been a point of divergence in the resource curse literature. Some emphasize that resource rents have a corrosive effect on the quality of a country's institutions, and thus its economic growth. Others downplay the mediating role of institutions in the resource curse hypothesis. Yet others emphasize that it is the (exogenous) quality of institutions that determines whether resource rents pose a resource curse or blessing.

In the first vein, resource rents are thought to bring not only conflict but also corruption and downward pressures on institutional quality (Hodler, 2006; Iimi, 2007; Frankel, 2012). Arezki and Brückner (2011) examine the effect of oil rent on corruption and state stability for a panel of 31 oil-exporting countries between 1992 and 2005. They find that an increase in oil rents significantly increases a Political Risk Services sourced corruption score, especially in countries with a high share of state participation in oil production.

Drawing distinctions by political system, Bhattacharyya and Hodler (2010) suggest that natural resources only induce corruption in countries with enduring non-democratic regimes. Corroborating evidence has been found by Arezki and Galyfason (2011) for a panel of 29 sub-Saharan countries. Finally, based on the Nigerian experience, Sala-i-Martin and Subermanian (2003) show that natural resources exert a negative and nonlinear impact on growth via their deleterious impact on institutional quality.

In the second vein, Sachs and Warner (1995, 1997) and Brunnschweiler (2008) contend that institutions do not play a significant causal role in the resource curse outcome.

In the third vein, Mehlum et al. (2006) and Mavrotas et al. (2011) argue that institutions are decisive for determining whether resource revenues bring curse or blessing. In particular, the difference in growth performance among resource rich countries is attributed primarily to how their resource rents are distributed through institutional arrangements.

Consistent with this view, Torvik (2009) argues that a good institutional apparatus forestalls the negative effects of natural resource endowments on growth. Similarly, Sarmidi et al. (2014) argue that as institutional quality improves, the negative effect of resource abundance on growth should dissipate.

5. Empirical Tests of the Resource Curse

The empirical evidence regarding the resource curse overall or its specific causal channels is rather mixed, and can be categorized into three groups. The first group follows Sachs and Warner's cross-sectional specification, and varies the measures used to capture resource abundance or resource dependence. The second group focuses on various economic factors related to growth that might be affected by natural resource wealth. The third group tends to shed doubt on the validity of the resource curse hypothesis.

Before surveying these studies, it is necessary to distinguish between two key measures of countries' natural resources: resource *dependence* in output and resource *abundance* in stock. These two terms are used interchangeably in misleading ways when evaluating various resource curse hypotheses. Resource dependence refers to the degree to which a country actually relies on resource revenues. Resource abundance on the other hand, refers to a country's estimated finite endowment of subsoil wealth or deposits of minerals, oil and gas (Brunnschweiler and Bulte, 2008). Leaving aside the issue that estimates of a country's resource abundance is itself endogenous to exploration activities influenced by resource prices, a nation that is resource abundant may not be resource dependent if it diversifies its production structure.

Natural resource abundance tends to be measured by estimated natural resource capital per capita, while natural resource dependence tends to be measured by the ratio of natural resource exports to gross domestic product (GDP). See Table 1 for examples. For countries that rely on natural resources rents, resource dependence ranges from a low of 4.9% in Cameroon, a resource-dependent country running out of natural resources, to a high of 86% in Equatorial Guinea, one of the newest oil producers (Karl, 2007). Dependence can also be captured by examining the composition of a country's exports, with natural resources generally comprising 60% - 95% of resource dependent countries' total exports. For its part, the International Monetary Fund (IMF) takes the average share over multiple years of a country's resource revenues over total revenues (Barma et al. (2012)). The IMF defines a country as resource dependent if this measure is greater than 25%. Who are the resource dependent? Steven and Dietsche (2008) identify countries whose merchandise export of fuel and mineral have exceeded 30 per cent of their total exports at any time between 1965 and 1995. They identify 54 countries who could be classified as resource dependent using this criterion. The countries are listed in Box 1 below. Geographically, resource dependent countries can be found in all regions of the world, but are most commonly associated with the Middle East and, more recently, Africa.

5.1 Empirical evidence for the effect of natural resources on economic growth

Empirical work on the natural resource thesis started with case studies by Gelb (1988) and Auty (1993). However, the cross section analysis of Sachs and Warner (1995) is considered the seminal empirical investigation of the natural resource curse thesis.

Table 1. Commonly Used Indicators to Measure Natural Resource Dependence and Abundance

	Proxy	Definition	Authors
Natural Resource Dependence	Primary exports over GDP	Agricultural, mineral, and energy exports, divided by GDP.	Sachs and Warner (1995); Neumayer (2004); Arezki and Van der Ploeg (2011); Beck (2011); Boschini et al. (2013)
	Rents from natural resources over GDP	Difference between the value of crude natural resource production at world prices and total cost of production divided by GDP.	Ross (2006); Auty (2007); Collier and Hoeffler (2009); Boos and Holm-Müller (2013); Bhattacharyya and Hodler (2014); Bhattacharyya and Collier (2014)
	Share of natural capital in national wealth	Natural capital over the sum of natural capital and the perpetual inventory value of produced assets and ''human resources.''	Gylfason (2001); Gylfason and Zoege (2006)
	Share of mineral exports in total exports	This ratio is aimed at measuring the extent of a country's trade specialization in mineral exports.	Dietz et al. (2007); Barajas et al.(2013); Daniele (2011)
Natural Resource Abundance	Total natural capital and mineral resource assets in US$ per capita	This aggregates the estimate for subsoil assets, cropland, pastureland, timber and non-timber forest resources, and protected areas.	Stijns (2005); Brunnschweiler (2008)
	Subsoil wealth	This values the principal fuel and non-fuel mineral stocks present in a country.	Stigns(2005); Brunnschweiler and Bulte (2008); Beck 2011

Box1: Countries at risk of contracting the 'Resource Curse'

Algeria, Angola, Australia, Bahrain, Bolivia, Botswana, Brunei, Cameroon, Canada, Chile, Colombia, Congo, Democratic Republic of Congo, Republic of Cyprus, Ecuador, Egypt, Gabon, Greenland, Guyana, Indonesia, Iran, Iraq, Jordan, Kiribati, Kuwait, Lao PDR, Liberia, Libya, Malaysia, Mauritania, Mexico, Morocco, New Caledonia, Niger, Nigeria, Norway, Oman, Papua New Guinea, Peru, Qatar, Saudi Arabia, Senegal, Seychelles, Sierra Leone, Suriname, Syria, Togo, Trinidad and Tobago, Tunisia, United Arab Emirates, Venezuela, Virgin Islands, Yemen, Zambia.

Source: Steven and Dietsche (2008)

Sachs and Warner (1995, 2001) followed a large panel of natural resource economies between1970-1989 and found that natural resource dependence was negatively correlated with economic growth. Following their influential studies, a large volume of subsequent research has been inspired to examine the direct and indirect relationships between natural resource dependence and economic growth. Gylfason (1999, 2001) and Mehlum et al. (2006) have argued that since 1970, countries that have based their economies on natural resources have tended to be examples of development failure. For oil in particular, Nili and Rastad (2007) find that oil exporting countries have witnessed a fall in average per capita income of 29% over the period 1975-2000. This compares to the rest of the world whose average per capita income increased by 34% over the same twenty five year period.

Arezki and Nabli (2012) address the economic performance of resource abundant (rather than dependent) countries in the Middle East and North Africa (MENA) over more than forty years (1960-2008). They find that using standard income level measures alone, many countries maintained high income per capita, but that others performed poorly when assessed using a broader range of outcome measures. Moreover, these countries had experienced relatively low and non-inclusive economic growth, and high macroeconomic volatility. Indeed Arezki and Nabli's findings confirm the statement of Karl (2005):

> *"Countries dependent on oil export revenue not only have performed worse than their resource-poor counterparts, they have performed far worse than they should have, given their revenue streams"* (p.23)

Along similar lines, Apergis and Payne (2014) re-examine the impact of oil abundance on economic growth in a number of MENA countries for the later period 1990-2013. They find negative effects on economic growth from 1990 to 2003. After 2003, the impact of oil

abundance on growth becomes positive. The authors attributed this change to the improvement in the quality of institutions and economic reforms that have occurred in MENA countries.

A non-linear relationship between growth in oil revenues and overall economic growth has also been found by Mehrara (2009). In a panel study of thirteen oil-exporting countries in five year intervals between 1965 and 2005, Mehrara finds that there is a threshold of growth in oil revenue above which it exerts a negative effect on output. That threshold growth rate is around 18–19%.

In addition to these multi-country comparisons, resource curse relationships have been discussed in numerous single country studies. Early studies preceding Sachs and Warner tended to be descriptive, as in Gelb (1988) and Auty (1995). In Africa, a number of these studies have attributed poor development performance of large resource-rich nations such as Nigeria, Democratic Republic of Congo, Angola and Ghana to the resource curse. Some also compare more- and less successful resource-rich countries, often using the counter-example of Botswana. Examples include Bevan et al. (1999); Sala-i-Martin and Subramanian, (2003); Hammond (2011), Fosu and Gyapong, (2011), and Dartey-Baah et al. (2012). In Latin America, Rodrigues and Sachs (1999) discuss the case of Venezuela. Because low growth in various of these case studies is attributed to an interplay between the resource curse and unsuitable fiscal and industrial policies, these papers sometimes offer heterodox macroeconomic advice on counter-acting its effects. Examples include managing the real exchange rate and abandoning an inflation-targeting monetary regime, and complementing such a policy stance with greater regulation of the capital account.

Several single country studies have also sought to learn lessons for avoiding the resource curse by focusing on resource abundant nations that have avoided it; e.g. Papyrakis and Gerlagh (2007) for the United States; Pegg (2010) for Botswana; De Gregorio and Labbe

(2011) for Chile; Gylfason (2011) for Norway, James and Aadland (2011) for the United States, Botswana and Mauritius; Loyeza et al. (2013) for Peru; and Liu (2014) for China.

5.2 Empirical evidence for the effect of resources on variables related to growth

Many studies also find evidence of a negative relationship between resource dependence and variables thought to be closely related to growth performance. This broader set of outcome variables include human capital development (Gylfason, 2001; Stijns, 2006; Daniele, 2011; Blanco and Grier, 2012 and Shao and Yang, 2014), savings rates (Atkinson and Hamilton, 2003; Gylfason and Zoege, 2006; Dietz et al., 2007 Boos and Holm-Müller, 2013), growth of manufacturing exports (Wood and Berge, 1997), investment, schooling and openness (Papyrakis and Gerlagh, 2007), fiscal policy (Bornhorst et al., 2008), and institutional quality (Mehlum, 2006; Boschini et al., 2013). Most of these studies document a negative effect of natural resource abundance or dependence on the variables of interest. Results are summarized in Table 2. From this we conclude that the negative effect of natural resource dependence or abundance on economic growth likely comes from their adverse effects on contributing factors that themselves drive sustained economic growth.

5.3 The critics strike back: a statistical mirage?

By the late 2000's, the theoretical and empirical literature investigating aspects of the resource curse thesis had almost begun to take for granted a negative impact of natural resource wealth on growth, particularly in developing countries. The issue became understanding the exact mechanisms through which it operated, or the institutional

Table 2. Summary of Recent Literature on Natural Resources and Different Economic Variables

Authors	Periods	Sample	Variable	Natural Resource Measure	Main Findings
Gylfason (2001)	1980-1997	65 resource-rich countries	Human capital development	Share of natural capital in national wealth	The adverse effects of natural resource abundance on economic growth may in part reflect a negative effect on education.
Atkinson and Hamilton, (2003)	1980-1995	103 countries	Genuine savings	Share of natural resource rent in GDP	The countries where growth has lagged have a combination of natural resource, macro-economic and public expenditure policies have led to a low rate of genuine savings (net savings adjusted for resource depletion).
Gylfason and Zoege (2006)	1965-1998	85 countries	Savings and investment	Share of natural capital in national wealth	A heavy dependence on natural resources may hurt saving and investment indirectly by slowing development of the financial system.
Stijns (2006)	1970-1999	102 Countries	Human capital	Natural resource rent per capita	Resource wealth and its corresponding rents make a significantly *positive* difference in allowing countries to invest in human capital.
Dietz et al. (2007)	1970-2001	115 countries	Genuine savings	Share of fuel and mineral products in total exports	Negative effect of natural resource dependence on genuine savings.
Papyrakis and Gerlagh (2007)	1986-2001	United States	Investment, human capital and openness	The share of the primary sector's production in GDP	Natural resource dependence decreases investment, schooling, and openness.
Bornhorst et al. (2008)	1992-2005	30 hydro-carbon producing countries	Fiscal policy	Share of hydrocarbon revenue in GDP	There is a statistically significant negative relationship between non-hydrocarbon revenues and hydrocarbon revenues.
Daniele (2011)	1980-2004	Countries grouped by income Level	Human development	Share of ores and fuel in total merchandise Exports; Subsoil assets per capita	Results show that human development measures are negatively correlated with natural resource dependence, but positively correlated with resource abundance.
Blanco and Grier (2012)	1975-2004	17 Latin American countries	Investment and human capital	Total exports of primary commodities divided by GDP	Overall, resource dependence has no significant direct effect on physical and human capital. When disaggregating, petroleum export dependence has a significant positive effect on physical capital, but negative effect on human capital.
Boos and Holm-Müller, (2013)	1970-1990	87 developing countries	Genuine savings	Share of natural resource rents in GDP	The determinants that are responsible for the resource curse also have a negative effect on genuine savings.
Apergis et al. (2014)	1970-2011	MENA countries	Agriculture value added	Share of oil rent in GDP	Finds a negative relationship between oil rents and agriculture value added in long run
Bhattacharyya and Hodler (2014)	1970-2005	133 countries	Financial development	Share of natural resource rents in GDP	Resource rents hinder financial development only if institution quality is relatively poor.
Apergis et al. (2014)	1970-2011	MENA countries	Agriculture value added	Share of oil rent in GDP	Finds a negative relationship between oil rents and agriculture value added.
Bhattacharyya and Collier (2014)	1970-2005	45 developed & developing countries	Public capital	Share of natural resource rents in GDP	Resource rents significantly reduce the public capital stock, but this effect is mitigated by good institutions.
Farhadi et al. (2015)	1970-2010	99 countries	Productivity growth	Share of natural resource rents in GDP	Finds that negative effects of resource rents on productivity growth may turn positive in countries with greater economic freedom.

arrangements and policies that could forestall it. However, a new trend in the resource curse literature has emerged more recently. This trend is to challenge the entire curse thesis as a "statistical mirage."

Brunnschweiler and Bulte (2008) challenge Sachs and Warner's work by arguing that a commonly used resource measure -- the ratio of resource exports to GDP -- is endogenous. In particular, Brunnschweiler and Bulte argue that the GDP denominator of the export/GDP dependence measure explicitly measures the magnitude of other activities in an economy. Consequently, the export scaling exercise—dividing by the size of the economy—implies that the ratio is not independent of a country's economic policies and the institutions that affect both GDP level and growth. These authors thus argue that Sachs and Warner's cross sectional regressions of growth on dependence suffer from third factors like economic policies and institutions that will affect both sides of the regressions. Brunnschweiler and Bulte attempt to overcome this problem using instrumental variables. They distinguish between resource abundance, proxied by subsoil asset estimates of the World Bank (1997), and resource dependence, proxied by the value of natural resource exports. They regress institutional quality on latitude and resource abundance, resource dependence on openness, abundance, and political system, and finally growth on resource abundance, dependence, and institutional quality. In this final regression, the authors find that resource abundance has a positive effect on growth, an effect which is not transmitted through resource dependence or institutional quality, and that resource dependence has no significant effect. Brunnschweiler and Bulte thus return to the earlier view that resource abundance is a blessing for economic development, and not a curse.

While Brunnschweiler and Bulte's criticism of the endogeneity of a common resource dependence measure is well taken, their proposed remedy for endogeneity itself came under subsequent criticism for similar reasons. In particular, Van der ploege and Poelhekke (2010)

point out that their proxy of resource abundance, subsoil wealth, is itself closely related to current resource rents. Since resource rents are endogenous, their measure of resource abundance itself is not exogenous.[2]

A different critical approach relates to the time samples used for resource curse investigations. Alexeev and Conrad (2009) argue that the claims made by the natural resource curse literature are due mostly to misinterpretation of data. The bulk of the literature finding a curse uses a time interval beginning in 1965 or 1970. Alexeev and Conrad (2009) argue that this interval is troublesome because commercial exploitation began in the majority of oil-exporting states prior to 1950, leaving more than 15 years out of the analysis (see the year sample issue also in Stijns, 2005; Lederman and Maloney, 2007; Boyce and Emery, 2011; Cavalcanti et al., 2011; James 2014). Most of these later studies show that if resource abundance (proxied by a measure of natural resource wealth) is used in place of measures of resource dependence, the effect of natural resources on growth performance is positive. Table 3 provides a summary of these studies.

A related recent criticism is that the time-sensitivity of curse findings points to other causal factors at work. Manzano and Rigobon (2007) argue that it is possible that the resource curse model of Sachs and Warner (1995) is merely reflecting the consequences of the global oil price shocks of the 1970's and early 1980's, rather than an inherent tendency for natural-resource countries to suffer reduced growth.

When surveying the resource curse literature, Frankel (2010) attributes the later contrarian results to different type of resources being produced, and to countries' different levels of human capital and export diversification. The resource curse remains a valid concern for countries with low human capital, enclave resource sectors, and low export diversification.

[2] Van der ploege and Poelhekke (2010) further complain that Brunnschweiler and Bulte's equations suffer from omitted variables bias in their equations, weak instruments, violation of exclusion restrictions and misspecification error.

Table 3. Summary of Literature of Natural Resource Curse Critics

Author	Sample	Period	Natural resource measure	Findings
Lederman and Maloney (2007)	cross-section and panel	1980-1999	Primary exports divided by total merchandise exports + Primary exports divided by GDP	There is no evidence in cross-section of a negative impact of this variable on growth, nor in the panel systems estimator.
Brunnschweiler and Bulte (2008)	60 countries from five regions: Europe, North America, Central and South America, Africa and the Middle East, Asia and Oceania	1970-1989	The GDP shares of total natural resource and mineral resource exports+ the logs of total natural capital and mineral resource assets per capita	Resource dependence does not affect growth, and resource abundance positively affects growth and institutional quality.
Alexeev and Conrad (2009)	OPEC members and the major non-OPEC oil producers of more than 2 million barrels of oil per day.		hydrocarbon deposits per capita+ Oil/GDP ratio	The effect of a large endowment of oil and other mineral resources on long-term economic growth of countries has been on balance positive.
Cavalcanti et al., (2011)	53 oil exporting and importing countries	1980-2006	Real value of oil production per capita	Oil abundance has a positive effect on both income levels and economic growth.
Boyce and Emery (2011)	Panel data for U.S. states	1970-2001	Real natural resource price, natural resource sector employment.	The resources curse can only be determined by an investigation of the correlation between resource abundance and income levels, and they found that this relationship is positive.
James (2015)	111 resource producing countries	Different growth periods from 1970-2010	Natural resource goods as share of income	In all growth periods, the relationship between resource dependence and economic growth in resource production sectors is non negative.

6. Conclusions

For some decades, it has been observed that the possession of natural resources does not necessarily confer economic success for countries that base their development on those resources. To the contrary, their people continue to experience low per capita income and a low quality of life according to various indicators. This puzzling phenomenon is called the "natural resource curse." It stands in contrast to the sunny optimism expressed by early economists about the advantages of resource wealth for spurring economic take off and sustained growth.

This paper surveys the literature on the natural resource curse. Many studies have examined the relationship between natural resource dependence/abundance on the one hand, and economic growth or factors closely associated with economic growth on the other hand. The bulk of this literature confirms an inverse relationship between these variables, though a few studies have attempted to prove the opposite, particularly where resource abundance rather than dependence is the explanatory variable of interest. These later studies' contradictory results can be attributed to different type of resources being examined, different economic backgrounds, and the choice of measure of key variables such as natural resource importance, economic growth, or years over which studies have been conducted.

It is fair to say that as a general conclusion, there is currently no consensus regarding the existence of a natural resource curse. If the curse is a relevant concern, the disparate literature certainly indicates that its ubiquity should not be exaggerated. Obviously, not all resource rich countries are cursed with slow growth, even among developing countries. The experience of successful resource rich countries proves that the resource curse is not inevitable.

Policymakers in resource-based countries seek efficient macro-economic management to avoid pro-cyclical resource policies and achieve better quality investments in human and physical capitals. Many look for innovative policies to achieve diversification and economic transformation of their economies beyond extraction and export of single volatile commodities. To assist policy makers understand the urgency or lack of urgency of this undertaking, future empirical research should look for ways to better address the potential endogeneity of measures of resource dependence or abundance, and take into account possible non-linear or non monotonic relationships between resource extraction and economic growth.

Our own view is that the later empirical critiques cast legitimate doubt on the evidence amassed to date that claims to prove a causal, near universal 'resource curse'. Yet the theoretical mechanisms proposed by which resource dependence can hamper growth directly

or via key determinants of growth seem to us to remain plausibly valid until proven otherwise. That is, in spite of the empirical critiques regarding endogeneity or unrepresentative sample period selection, we argue that a resource curse of some variety likely exists. However, we argue that it does not refer to a country's possession of natural resource, but rather its overwhelming dependence on one or two of them (Karl, 2005). That is, the curse likely lies in resource dependence rather than abundance; the latter may have favourable effects[3].

More work ultimately needs to be done in different countries, (or between regions of large federated countries), using different time periods and different growth determinants in order to be able to conclusively falsify the resource curse hypothesis. In particular, research is needed that studies the effect of resource dependence on key determinants of economic growth. Recent case studies argue convincingly that the resource curse may be operating via negative effects on productivity, financial sector development, and human capital development (see Yuxiang and Chen, 2011; Blanco and Grier, 2012; Farhadi et al., 2015; Duraisami, 2015).

In addition, in recent years some resource rich countries have experienced positive and rapid economic growth. Thus, the negative effect of natural resources on economic growth may disappear as cross sectional studies start to use greater periods of time after 2000. Beyond cross section, we also believe that the curse hypothesis needs to be studied more in time series and panel frameworks in order to have a clearer picture of its existence and robustness.

[3] Beck (2011) confirmed empirically that resource abundance has a *positive* impact on economic growth, whereas resource dependence has a *negative* impact.

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