Beating up a Dead Horse – Natural Resource Curse Revisited

Cross Country Study of Natural Resource Booms and Welfare in Africa

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List of Acronyms

FAO	Food and Agriculture Organization
ISS	Institute of Social Studies
UNDP	United Nations Development Programme
WB	World Bank
UNESCO	United Nations Educational, Scientific, and Cultural Organization
ISD	Indices of Social Development
IMF	International Monetary Fund

Abstract

This paper set out to ask a question whether natural resource booms are likely to increase the welfare of countries experiencing them. Literature review and empirical study showed that there is ample evidence and arguments for both sides, depending on how the study is conducted. The empirical findings in this study provided mixed results, which indicate that those countries in Africa that experienced a natural resource boom between 2000 and 2009 increased their gross national income more than countries that did not experience a boom. At the same time, the booming countries failed to improve their performance in terms of social welfare indicators to the same extent as the non-booming countries. This could be explained by a time lag in translating the growth to welfare, or there might be other unobserved variables explaining the result. The conclusion is that it is difficult to determine whether natural resources are a curse or a blessing for their respective countries.

Relevance to Development Studies

Natural resources have been one of the key ingredients of many a developing story. Conventional wisdom and the economic theory from the early days of development economics advocated natural resources as a blessing for the country that possesses them. In the last thirty years, this has been turned around, and a wide range of literature on natural resource curse has developed. This is an open debate, which puzzles development economists, as well as other development theorists.

Keywords

Growth, Natural Resource Curse, Dutch Disease, Africa, Development, Welfare

Chapter 1
Introduction

The relationship between natural resources and economic development has been an issue of academic debate for quite some time. The arguments demonstrating evidence that natural resources are either good or bad for development have been tossed back and forth for at least half a century – and yet the evidence seems inconclusive.

In fact, it the literature has diversified into a plethora of sub-literatures, all of which are quite extensive in their own right. Rosser identifies three distinct strands of literatures in this field: natural resources and economic performance, natural resources and political regimes, and natural resources and civil wars (Rosser 2006).

Why I chose to write this paper on the topic of natural resource curse is because the extensive studies and economic modeling on the topic, the literature still seemed to be unable to provide an answer to the simple question whether people living in countries which experience (or are about to experience) a boom in their natural resource sector can reasonably expect that boom to improve their quality of life and standard of living. As there are several widely used measurements for standard of living, I will use those and see whether booming countries have managed to improve their standard of living more than their counterparts which did not undergo a natural resource boom.

Therefore, to use Rosser's terminology mentioned above, I will in this paper, mainly focus on the relationship between natural resources and economic performance. There other sub-literatures on civil wars and political regimes would warrant similar studies of their own. Although as development studies and development economics should try to be interdisciplinary and open for ideas from other disciplines, occasional crossings will be unavoidable.

While none of these areas of literature are conclusive, at least in terms of economic performance, the current consensus seems to be on the side of natural resource curse existing. One of the most noted arguments for this came from Sachs and Warner, who in 1995 claimed for a fact that natural resource poor countries have in recent times by and far outperformed those countries which larger natural resource endowments (Sachs and Warner 1995). On the economic development front, the current consensus, with few dissenting voices, is that natural resources and economic growth have a negative relationship. This view is purported in the seminal works of such authors as Sachs and Warner (1995, 1999 and 2001), Auty (1990, 1993 and 2001), Gylfason (2001), Stijns (2001 and 2005), Frankel (2012). Nevertheless, Alexeev and Conrad (2009) successfully challenge the negative relationship between natural resource endowments and long-term growth.

Going deeper into the field seems like beating up a dead horse. But on the interesting side, there the interesting side, there is a somewhat forgotten dissenter in the literature, Graham A. Davis, who in 1995, whose work has gone somewhat unnoticed and is undervalued (Stijns 2006). Davis found evidence to show that mineral intensive developing economies did considerably better than their non-mineral counterparts between 1970 and 1991 (Davis 1995).

I find this approach of Davis directly studying the relationship between natural resource intensity and indicators that measure wellbeing directly still relevant today. It can also be developed further: Davis classified countries as mineral intensive, or mineral non-intensive, but there seem to be no studies evaluating the welfare effects of relatively short term natural resource booms. Natural resource booms are as relevant for development today, as they ever have been, and there remains the question which begs to be asked and answered: are people better of living in developing countries which undergo natural resource booms, or in countries without those booms?

One is tempted to extrapolate from the conventional natural resource curse literature that there would be a negative relationship on the natural resource booms and development. Although, as Sachs and Warner have studied, the natural resource booms have the potential to act as catalysts for big push industrialization (Sachs and Warner 1999). The conventional consensus in the literature still seems to lie on the side of negative relationship between growth and natural resources (Frankel 2012).

This seems to suggest that people in countries with no natural resources are better off than people in those countries that do have the natural resource base. Although authors, even authors who in the late 1980's argued strongly in support of natural resource curse, have since softened their stances. One such example is Auty, who coined the term Natural Resource Curse in the late 1980's concluded a decade later that policy choices seem to be more deterministic than the resources in determining the outcome (Auty 1997).

As Davis (2002) notes, there are still unresolved issues in the literature, which can be seen from the mere fact that more articles are being published on it. The natural resources provide the countries with the opportunity to use them in a way that benefits them, or in a way that would be detrimental to growth (Davis 2002). In this paper I will look at recent empirical evidence from Africa to see what effects the natural resource booms have had on the welfare.

This paper is organized as follows: in the next section I will go over some history of natural resource curse literature. In the third section, I will look at the most recent models and transfer mechanisms of natural resource curse in the literature. In the fourth section I will introduce the variables used, the data, and the methodology used. The fifth section discusses the findings and the sixth section concludes.

Chapter 2 History

As mentioned above, the literature dates back more than half a century. In the 1950's the conventional view was that natural resources are good for growth and economic development. That view was expressed by geographers like Norton Ginsburg, and mainstream economists like Jacob Viner and Arthur Lewis alike. In the 1960's the development theorist Walter Rostow, saw natural resource endowments as a means for underdeveloped economies to an industrial take off, and transition into development. To an extent this had happened in Australia, USA, and Great Britain (Frankel 2012). Also the neoclassical economists, such as Anne Krueger, in the 1980's continued with a similar take on natural resources and development (Frankel 2012).

It should come as no surprise, as since the very early days, there have been radical voices challenging this conventional view of natural resources being simply beneficial. Of the critics, I will first mention Raul Prebisch, who is also credited as the originator of development economics (Hunt 1989). Prebisch studied the British trade data from 1876 to 1947, and deduced that the terms of trade for primary commodity exporters were declining over time. He theorized that therefore countries seeking development, such as his native Argentina, should not specialize in primary commodity exports, but seek industrialization through government intervention. Interestingly, this goes against the neoclassical theory of comparative advantage, and was the origin of structuralist school (Hunt 1989). This hypothesis was also presented and supported by Hans Singer in 1950. He also argued that the world demand for manufactures would grow faster than the demand for primary products, resulting in inevitably worsening terms of trade (Frankel 2012). Hirschman (1958) introduced the linkages approach for economic development, claiming that manufacturing sector provides beneficial backward and forward linkages to the rest of the economy therefore fostering development. Hirschman also argued against mining, as it tends to take place in enclaves and has weak links to the rest of the economy (Davis 1995).

These were minority views, but nevertheless, they got some attention in the developing country political circles. This resulted in many of those countries trying to diversify away from the primary sector through prolonged import substitution industrialization. Sachs and Warner deemed these attempts mostly unsuccessful (Sachs and Warner 1995).

The next change in the literature was the development of theoretical Dutch Disease models in the 1980's.

The Dutch Disease Models

At this stage, it is useful to note the distinction between the Dutch Disease models, and the Natural Resource Curse literature. In their core, the Dutch Disease models denote the coexistence of booming export sector and lagging sectors in an economy (Corden 1984). Basically the models describe the causes and structural effects of boom-induced growth, while the disease part comes from the pain of adjustment of the lagging sector to another equilibrium (Corden 1984). Davis notes that this is simply a shift in comparative advantage

(from manufactures to mining in Davis's case), which can be temporary or permanent (1995).

The Economist magazine coined the term Dutch Disease in 1977 after the Dutch tradable sector shrinking as a response to increases in the oil and gas production from the Groningen oilfields. But similar effects have been noted much earlier, from the influx of American gold to middle ages, to gold discoveries in Australia in the 1800's (Corden 1984, Davis 1995).

The core model of the Dutch Disease (here modeled after Corden and Neary 1982 and Corden 1984) includes three sectors in an economy, the booming natural resource sector, lagging manufacturing sector, and a non-traded domestic sector. The booming sector creates a spending effect and a resource movement effect (factors can move freely between the sectors). The spending effect occurs when the windfall gains from the booming sector are spent, which will cause real appreciation in the economy. This will draw resources from the booming and lagging sectors into the non-traded sector (Corden and Neary 1982).

The resource movement effect occurs when, in real terms, the marginal productivity of labor increases in the booming sector, which induces movements of labor. As the labor moves from the lagging sector to the booming sector, this is direct deindustrialization (for this to occur, there does not have to be real exchange appreciation). When the labor moves from the lagging sector into the non-traded sector (due to the spending effect), it is called indirect deindustrialization (Corden and Neary 1982).

Therefore, as a consequence of the natural resource boom, the manufacturing sector of the economy has shrunk. As mentioned above, the Dutch Disease does not have to be growth inhibiting, but there is evidence of it being a true disease (Corden 1984). Interestingly, when it comes to Hirschman and mining, the Dutch Disease effects might not be as strong as otherwise would, exactly because of the enclave nature of mining, when the linkages between the mining sector and rest of the economy are weak (Neary 1982).[1]

The Dutch Disease core model has been built on by Van Wijnberger (1984), Krugman (1987), and Matsuyama (1992), who consider learning by doing together with the Dutch Disease. The seminal work of Matsuyama introduced a two-sector model, where learning by doing influences the manufacturing sector by doing, but not agriculture. In this setting agricultural productivity gains would lead to positive development outcomes in a closed economy and negative outcomes in an open economy (Matsuyama 1992). The effect of learning by doing, which is only associated with the manufacturing sector, means that the countries moving away from manufactures and into natural resource sector, would miss out on learning by doing and end up on a lower growth path (Krugman 1987).

[1] Further dimensions of Dutch Disease and resource movement can be found in Corden 1984, where he discusses international capital mobility, immigration, endogenous terms of trade effects, domestic absorption, unemployment, and protection of the lagging sector.

Relating to this model, Wood and Berge (1997) found that resource abundant countries were less likely to export manufactured goods than resource poor countries (Wood and Berge 1997). But still, one of the most influential works on this field came from Jeffrey Sachs and Andrew Warner in 1995. They found support for natural resources being a curse through the Dutch Disease phenomena. In their 1995 paper, where the model was built on Matsuyamas model, they also found conditional convergence on growth, as suggested by the neoclassical growth theory (Sachs and Warner 1995). In the 1995 paper Sachs and Warner conducted a cross-country study of growth between 1971 and 1989 and the share of natural resource exports in 1971. Their result was a negative relationship between natural resource intensity and subsequent growth (Sachs and Warner 1995). Another determining factor of their study was the openness to trade. Sachs and Warner got related findings in their 1997 study of Africa, their 1999 study of natural resource booms acting as the catalysts for big-push development. Sachs and Warner wrote their conclusive paper in 2001, where they summarized the arguments they had developed over the years and concluded that natural resources have a negative relationship with economic growth, which cannot really be explained by other explanatory variables (Sachs and Warner 2001). Their line of argument will be looked more closely in the beginning of the third section of this research paper.

In a nutshell, the Dutch Disease framework can explain why and how resource rich economies can underperform compared with non-resource abundant economies through the Dutch Disease phenomena. Next I will proceed to the Natural Resource Curse literature. Davis (1995) mentions the difference between the two being that Dutch Disease is a set of relationships that explain the shift from long-run equilibrium to another. Natural resource curse assumes that these shifts (induced by natural resource booms) create a net economic loss, as the positive effects of the boom are more than offset by the present value of its negative effects (Davis 1995).

The Natural Resource Curse Literature

The term natural resource curse was coined by Auty in (1993) in his paper about sustainable development in mineral economies (Frankel 2012). The natural resource curse is another complex set of issues relating to natural resource based economies. In addition to de-industrialization via Dutch Disease, natural resource based economies face a plethora of other developmental challenges, which range into the fields of civil war and the quality of institutions (Rosser 2006).

Corruption, or rent seeking, and the quality of institutions have been much studied. For example, Torvik found out that in natural resource based economies more of the entrepreneurs focus on rent seeking than on running productive firms, and this has a negative impact on income and development (Torvik 2001). In a further study Mehlun, Moene and Torvik (2006) examined deeper the differences between the winners and losers between natural resource abundant countries. Their conclusion was that main reason for the divergence amongst the performance amongst the natural resource abundant countries is dependent on the quality of their institutions. Some countries have

producer friendly institutions, and in those conditions natural resources can push the aggregate income up, while in countries with grabber friendly institutions natural resource push the aggregate income down (Mehlun et al. 2006). This conclusion is in contrast to the work of Sachs and Warner, which will be presented shortly.

To combat the natural resource curse, most authors present their set of selected policy recommendations, which should alleviate the natural resource curse as they have studied it. For example, Auty recommended the resource rich developing countries to diversify their economies in order to reduce their natural resource dependency (Auty 1994). This recommendation is going back to the roots of development economics and the structuralist school, who in their day advocated similar policies. Also Ross (2001) took the same approach, and went even further, as he claimed that extractive industries should be avoided and instead the developing countries should focus on developing their agricultural and manufacturing sectors (Ross 2001). Ross also found that oil wealth and non-fuel mineral wealth are associated with bad outcomes for the poor in terms of poverty and human development levels. Ross's findings concluded that oil wealth and non-fuel mineral wealth are associated with bad outcomes for the poor but not agricultural resources (Ross 2003).

This evidence between natural resource abundance here is mixed in terms of the type of natural resources, as well as in how the natural resources are managed. In that sense the literature has become increasingly subjective, instead of introducing binding laws. Also Auty concluded in 1998 that the trap of natural resources is less deterministic than he had assumed previously and policy choices play a bigger role in the development of a country than its natural resource abundance. In fact, Auty concluded that natural resources per se do not seem to have a significant influence on growth rates (Auty 1997). In his literature survey Rosser (2006) confirms this view, as according to him, both economists and political scientists have for the most part agreed that the immediate cause of poor economic performance in resource abundant countries has been poor economic management. In particular the scholars have pointed to fiscal profligacy, overvalued exchange rates, excessive protection, and inefficient use of resource windfalls (Rosser 2006).

Besides management policies, there is also the question of the type of natural resources. Some natural resources are more prone to cause natural resource curse than others. One rough way of classifying natural resources is to divide them into two categories according to their occurrence and the revenue patterns they create in the economy: point source and diffuse natural resources (Murshed 2002). Oil, sub-soil minerals and plantation crops are examples of point source natural resources, and wheat, rice, and timber of diffuse resources. These two types have different implications to the economy. Fore example De Soysa found out that (2000 and 2002) countries rich in sub-soil minerals, especially oil, are more prone to civil war than countries with non-point source resources. Murshed also notes that point source endowed countries tend to be more likely to face growth failure than the diffuse, but this curse also occurs as a result of inappropriate policies, which are the products of poor institutions (Murshed 2002). The academic consensus at the moment appears to be that point source natural resources are more detrimental to growth, corruption, and conflict than other type of natural resources.

The natural resource curse can also occur through the neglect of education, when natural capital crowds out human capital. Gylfason (1999 and 2001) was one of the first ones to research this channel. Gylfason showed that countries rich in natural resources indeed invest less in education, and he also showed that there was a positive correlation between human capital accumulation and economic growth (Gylfason 2001). In 2005 Stijns reversed Gylfasons conclusions, on the basis that Gylfason based his calculations on the shares of natural vs. human capital. Therefore Stijns repudiated Gylfasons' claims on the basis that Gylfason had chosen a poor set of indicators. Gylfason's work, as well as Stijns's critique of it will also be looked at with more detail in the third section of this research paper.

To conclude the historical overview, there are six channels through which the natural resource curse phenomenon operates. Frankel (2012) has summarized the channels as follows: (i) long-term trends in world prices, (ii) price volatility, (iii) permanent crowding out of manufacturing, (iv) autocratic/oligarchic institutions, (v) anarchic institutions, and (vi) cyclical Dutch Disease (Frankel 2012). All of these channels have been subjects of extensive studies. The literature in most of them stands in favor of natural resource curse existing and being a real scare for the people living in natural resource abundant countries.

In this research paper, I posed the simple question: has the welfare in those countries in Africa, which have experienced natural resource booms improved more or less than the welfare in countries which have not experienced natural resource booms. Therefore in the following section, I will present in more detail some of the most recent and influential works on economic growth and natural resources, as well as on human capital accumulation and natural resources. I will also present Davis's work from 1995, which has been under appreciated (Stijns 2005), but is one of the most thought provoking findings on natural resources and welfare. Indeed he is one of the very few, who manage to produce convincing empirical evidence showing positive association between natural resources and economic growth and welfare.

Chapter 3 Literature Review

Sachs and Warner on Natural Resource Curse

Sachs and Warner are some of the most notable proponents of the natural resource curse. Their paper in 1995 in which they modeled the natural resource curse/Dutch disease effects was one of the catalysts that kicked off the academic debate. Since their initial paper, they have published a series of three papers on the same field (Sachs and Warner 1997, 1999, and 2001). All of these papers approach the natural resource phenomena from slightly different angles and shed light on different sides of it. Their overall conclusion is that the natural resource curse remains, and is one of the most robust estimators in econometrics.

Sachs and Warner began their work with an empirical study between growth and natural resource abundance. They use growth ant natural resource data, a selection of control variables, and an econometric model that was developed based on Matsuyama's two-sector model. They simply concluded that their data suggests that natural resources might be bad for growth, but open trade policies would ameliorate the situation.

The Sachs and Warner paper in 1997 introduced attempts to explain natural resource curse with controls for geography, which they hypothesized could be an explanation for hindering growth. They controlled for geography by including previous growth patterns in their regressions These controls included previous growth patterns, as well as direct geographical attributes, but nevertheless, the natural resources remained robust as explanatory variables for the comparatively slower growth (Sachs and Warner 1997).

The 1999 paper focused on natural resource booms as potential catalysts for the "big push" style industrialization. They hypothesize that natural resource booms could be a factor stimulating demand in similar way as large public spending programs, or foreign aid (Sachs and Warner 1999).

The empirical evidence in this paper is drawn from a group of eleven Latin American economies. Four of those countries experienced at least one clear boom during the period from 1960 to 1994, three had ambiguous booms, and four clearly had no booms. Sachs and Warner defined a natural resource boom as a rise in natural resource exports relative to GDP of at least 4%, from beginning to the peak of the boom, with duration of at least three years (Sachs and Warner 1999). Out of the booming countries, only Ecuador achieved higher growth rates after the boom, as is suggested by the big push logic of industrialization. Rate of growth in Mexico remained the same before and after the boom, while Bolivia and Venezuela suffered from lower growth rates in the post-boom period (Sachs and Warner 1999). Based on this, and their previous work, Sachs and Warner state strongly that natural resources are not beneficial for development, and this is hard to explain by any omitted growth deterrents. They claim it as a fact that natural resource abundant countries systematically miss out on manufacturing export led growth is due to their natural resources (Sachs and Warner 1999).

Sachs and Warner published their last paper and a kind of conclusion to their argument in 2001. They argued that countries with great natural wealth tend to grow more slowly than resource poor countries, and this difference is not easily explained by other factors, or alternative ways of measuring resource abundance (Sachs and Warner 2001). In this study they controlled for previous growth patterns, and direct geographic variables, in an attempt to control for unobserved variables affecting growth, but found that the natural resource abundance remained a significant factor (Sachs and Warner 2001).

Despite being a repetition of more of the same, this last paper includes other interesting additions to the literature. In terms of defining the natural resource variable, they conclude that for most countries the changes in the definition of natural resources is less important that one might think. Namely, whether agriculture and minerals are separated from each other in the definition of natural resources, only matters for those countries which have high non-mineral natural resource exports, and they provide Iceland (fisheries), Fiji, Cote d'Ivoire, and Mauritania as examples of such countries (Sachs and Warner 2001).[2]

In this paper, Sachs and Warner also summarize the current logic of how natural resource curse operates at its simplest: natural resources crowd out activity x, activity x drives growth (Sachs and Warner 2001). Answer to natural resource curse therefore can be answered only when one has a general and encompassing answer to question what are the x-factors that drive growth. Sachs and Warner proceed to discuss the Dutch Disease models, and the relationship between natural resources and economic growth. They conclude that natural resource abundant countries tend to miss out on manufacturing export led growth, due to higher prices and production costs in their economies. This seems to be their selected explanation, but they do not dismiss Gylfason's hypothesis of x-being human capital accumulation.[3] On increased authoritarianism and inequality, Sachs and Warner conclude that while they are strongly associated with natural resources, they only have weak link on growth itself (Sachs and Warner 2001).

Stijns on Growth and Natural Resource Curse

Stijns produced authoritative work on natural resource curse, relating both to growth and human capital accumulation. In his paper published in 2005, Stijns concludes that natural resources and economic growth have a complex set of relationships, which are hard to capture in typical growth regressions, and they can affect growth through positive and negative channels (Stijns 2005). According to Stijns, the ability of a country to successfully benefit from its natural

[2] For further discussion on this topic see Ross (2003), and Subramanian (2003). Ross argued that point source natural resources are detrimental to the poor, while agricultural resources are not. Subramanian reached a conclusion that point source natural resources are correlated with poor economic growth, while diffuse natural resources are not.

[3] More detailed analysis of Gylfason follows later in this paper.

resources is dependent on the nature of the learning process involved (Stijns 2005).

Stijns set out to test the negative relationship that Sachs and Warner found in their set of papers, which is described above. He examined whether the negative relationship holds when natural resources are measured by their abundance (natural resource reserves, or production), instead of just natural resource trade flows. This was his main challenge to Sachs and Warner's work, and Stijn concludes that indeed, when natural resources are measured by their abundance, they do not have a significant influence on economic growth (Stijns 2005). At the same time, he concedes that when the phenomenon is looked in terms of trade, the negative relationship does hold, confirming the conclusion Sachs and Warner reached.

Stijn sees three reasons why the natural resource abundance is a better indicator for natural resource curse than primary exports. First, the natural resources can be used as inputs in domestic manufactures, and exported as finished products, instead of raw material. This would not be visible in Sachs and Warner's trade data. Second, he quotes Wright (2001) who noted that if countries fail to build upon their resource base, then the measures of resource dependence are mere proxies for development failure (and show the negative relationship), but the reason for failure might not have anything to do with the resources themselves. Third, the relationship between resource abundance and economic growth depends on the growth model adopted. Stijns provides an example of Gallup and Sachs (1998), who find a positive relationship between per capita income and certain mineral deposits when used with economic growth models that include convergence (Stijns 2005).

The traditional model used by Sachs and Warner is one where learning by doing is proportional to the size of the manufacturing sector. In the big push model would lead to higher growth rates, post-boom, as the natural resources have been used to create a sizeable manufacturing sector. But Stijns argues that there is no evidence proving that learning by doing is not restricted to the manufacturing sector, as is assumed in the Sachs and Warner model[4] (Stijns 2005). In Stjins's regressions, only land had negative coefficients with economic growth, while coal, oil, and natural gas can have positive and negative influences on growth. Dutch disease symptoms are present in the cases of land, oil, and gas, while coal has mixed results. Stijns research goes to show that there are both positive and negative channels through which natural resources can affect economic growth (Stijns 2005).

Natural Resource Abundance and Human Capital Accumulation

This strand of literature was first, kicked off by Gylfason in 1999. But before focusing in on Gylfasons work, it is worth to take note of the seminal study by

[4] In Sachs and Warner's big push model, the learning by doing can be attributed either to manufacturing, or agricultural sector, but not for both at the same time.

Birdsall et al. in 2001, which concluded that resource abundant countries, on average, invest less in education than other countries (Birdsall 2001). Birdsalls and Gylfasons respective studies focused on the relationship between natural resources and education. Birdsall concluded that resource abundant countries, on average, invest less in education than other countries (Birdsall 2001).

Gylfason on the other hand outlined four mechanisms through which the natural resource curse operates: 1) Cyclical Dutch Disease booming natural resource sector draws resources from manufacturing and shifts the production structure away from manufactures. 2) Rent seeking, producers in natural resource rich societies are more prone to gain their rents through non-productive activities and the public sector tends to be supportive/weak against it. 3) Overconfidence, the natural resources provide a false sense of security to the producers and politicians, who might be tempted to overstretch their capacities and abandon other development-friendly policies. "Rich parents sometimes spoil their kids. Mother Nature is no exception (Gylfason 2001). The other mechanisms have been discussed in previous sections of this paper; here I will focus on education.

The fourth finding was the crux of Gylfasons study: natural resource rich countries tend to (inadvertently or perhaps deliberately) underinvest in education. He showed a negative relationship between those two variables. Gylfason showed that there is a positive correlation between secondary school enrollment and growth. Gylfason used a selection of countries, varying from 52 to 86, depending on the availability of data, for the time period between 1980 and 1997.

The key finding for Gylfason was the negative relationship between public expenditure on education, expected years of schooling, gross secondary education and the ratio of natural capital in national wealth. He also found a negative relationship between the ratio of natural capital in national wealth and growth, and positive correlation between secondary school enrollment and growth. His findings were statistically significant, and he concluded that natural capital tends to crowd out human capital, and that natural resources lead to lower economic growth rates (Gylfason 2001).

Stijns on the other hand reversed Gylfason's argument to its head in his study between the relationship of human capital accumulation and natural resource abundance. Stijns called into question Gylfason definition of resource abundance. Stijns pointed out that using the ratios of natural capital in the share of national wealth as a measure leads to distortions. When human capital is in the denominator of the ratio, and the ratio is correlated with the human capital accumulation itself. As Stijns puts it:

> "*Indeed, if Country A is more successful at investing a share of its natural wealth in education than Country B, then ceteris paribus Gylfason's ratio will identify Country B as more resource abundant than Country A. This renders suspicious claims made using this ratio that resource-abundant." (Stijns 2006).*

Stijns then introduces his own selection of twelve natural resource wealth indicators, some of which have had data available for only 1994, some with

data from the period 1975-2000.[5] Stijns then correlates these estimates of natural resource abundance with a selection of common human development indicators, from the period 1975-2000 for a selection of developing and developed countries.[6] In the end, Stijns concludes that in order to find negative and significant correlations between resource abundance and human capital accumulation, one has to arbitrarily pick indicators on both sides of the correlation, and such claims are not robust to change in the choice of indicators (Stijns 2006). Stijn claims that Gylfason, as well as Birdsall et al were both too hasty in their conclusions favoring the negative correlation between natural resource abundance and human capital accumulation (Stijns 2006).

Davis: Learning to love the Dutch Disease

The literature mentioned above (with the exception of Stijns) predominantly supports the existence of natural resource curse. But naturally there are also views and evidence that challenge the natural resource curse phenomena. Davis is one of the authors presenting such views. In 1995 he showed that with a selection of social and economic measures, a number of mining based economies outperformed their non-natural resource intensive counterparts between 1970 and 1991.

Davis first categorized the countries as either as newly mineral-based, ongoing mineral based, or ex-mineral based economies. His taxonomy was based on the value of minerals as a percentage of merchandise exports and the value of minerals as a percentage of GDP in 1970 and in 1991. From these two statistics, he compiled a "mineral dependence index", which then determined the placement of the country in the taxonomy. To qualify as a mineral based economy, the mineral share of the GDP had to be a minimum 8-10% of GDP, and the mineral share of merchandize exports had to be at least 40%. These arguably arbitrary shares were used in the literature by other authors, such as Auty, Gelb, and Nankani, as well as the World Bank (Davis 1995).

Davis averaged those two values in his mineral dependence index, and countries that scored above 24 qualified as mineral dependent. Davis intended to look at the 127 economies that the UNDP had classified as developing countries in 1993. Out of those 127, only 91 had sufficient data, and were included in the study. Out of the 91 with sufficient data, Davis identified 22 countries that were ranked mineral dependent in 1970 and 1991. There were

[5] For the year 1994: Share of natural capital in national wealth, Natural capital: physical capital ratio, Subsoil wealth: physical capital ratio, Green capital: physical capital ratio, Subsoil wealth per capita.
For the period 1975-2000: Arable land per capita, Primary export intensity, Agricultural export intensity, Mineral export share, Mineral export intensity, Resource rent intensity, and Resource rents per capita.

[6] Total years of education, Total years of education for females, Secondary enrolment rate (net), Adult literacy rate, Life expectancy at birth, Public expenditure on Education (% of GDP).

also 57 that were not mineral dependent in either year. The remaining twelve countries either became mineral dependent during the study period, or became non-mineral dependent. The fact is that eleven of them became mineral dependent, and only one country (Tunisia) diversified away from minerals.

Davis then compared the performance of the countries on in terms of the above mentioned social welfare indicators.[7] The methodology is simple and the conclusion was startlingly convincing: not only had the mineral based economies a higher starting level (mean and median values) for all of the indicators, but also the mineral dependent economies had had a bigger improvement during the time period for most of the indicators. Interestingly Davis does not show the change in access to water and access to sanitation, which leaves room for thought that the non-mineral based economies had actually enjoyed a bigger increase in those areas.

Davis is careful in drawing his conclusions. He simply notes that the mineral dependent countries are not doing any worse than their non-mineral intensive counterparts, and neither has their situation deteriorated during the study period despite them being mineral intensive. This goes counter to what the traditional Dutch Disease and natural resource curse literature suggests. Davis stresses that his results do not imply causality between mineral intensity and economic development or growth. He simply notes that mineral endowed countries, at least in his sample, during that time period, are not cursed, but have done rather well (Davis 1995). He notes that this might be a spurious correlation, have nothing to do with minerals, or there might be reverse causality: better developmental status attracts more investments in minerals. Also, the question what happens when the mineral resources are used up is still not answered (with the exception of Tunisia). This is simple, but if it holds up in other parts of the world and other time periods, it might offer a clue how to refine the natural resource curse literature further.

Of course there are some questions, as to what about the 36 countries that had no data? It is close to 30% of developing countries at the time. While the sample that had data seemed to perform well, the case might be very different if there was complete data for all of the countries. Also what about the countries that became mineral dependent during this time period? Or did Tunisia grow and perform better before, during, or after its mineral dependent phase?

Davis's study gives a starting point in terms of methodology to my research paper, as he provides a selection of variables on which he compares during that time period. Indeed, I will repeat a modification of Davis's study on a different sample (Africa), and on another time period (2000-2009), and see whether I find similar results to those of Davis. Additionally, I shall not look at a static measure of natural resource (or mining) intensity of the economy. Instead I shall use the definition of natural resource boom from Sachs and Warner (1999). This way I can see whether the countries that undergo a natural resource boom perform better or worse than those countries that do

[7] For your convenience, I reproduce the list here: GDP per capita, life expectancy at birth, infant mortality rate, calorie supply per capita, population with access to safe water, population with access to sanitation, primary school enrolment, adult literacy rate, and the Human Development Index.

not undergo a boom during the same period. From those findings, it can be seen how countries undergoing natural resource booms, on average, fare compared to non-booming countries.

Chapter 4
Methodology and Data

Methodology

In this research paper, I will try to shed light on one of the few questions that remain unanswered in the Natural Resource Curse and Dutch Disease literature. According to most of the natural resource curse literature, natural resources have potential for both, good and bad. Countries can become rich, live on the rents of the natural resources, initiate industrialization and increase welfare of their citizens. Or, as seems to be more likely, countries can succumb to the temptations of easy rents and debilitate their competitiveness and industrial base through excessive spending,[8] or cripple the whole society through rent seeking or fueling conflicts. There are theoretical and empirical foundations for both. Davis found a sample in his study, which is one of the few that demonstrates a positive association between natural resources and welfare. He looked at developing countries that remained mineral intensive between 1970 and 1991. I will look at countries that experience a natural resource boom between 2000 and 2009 in Africa, and see if I can find similar results.

To answer this question, I will use the definition of natural resource booms created and used by Sachs and Warner in 1999. I combine this definition with the methodology and indicators used by Davis in 1995, with slight improvements in the choice of indicators. I will use Africa as the sample, as it is reasonably sized, has plenty of natural resources, but it has not been extensively studied in this respect. Africa has 54 states, 50 of which have sufficient data for the period and are included in the sample.

Data - Explaining the variables

First I will go over the list of social welfare indicators that are used here.

[8] There is yet another set of studies focused on this relationship: Arezki and Bruckner (2010) demonstrate how in polarized countries windfall gains from natural resource booms lead to political corruption. Arezki and Ismail (2010) show that government spending tends to increase as a result of positive revenue shocks from natural resources, while the government spending is downward sticky even when natural resource rents are reduced.

Treatment Variable (dummy for natural resource booms)

Although there is a lot of theoretical literature on natural resource curse and Dutch Disease, very few of the authors have bothered to develop a numeric measurement for natural resource booms. Surprisingly, many authors define the booms very loosely as increases in the world price, or as new discoveries of resources (Corden 1984, Goderis 2011), but fail to define how big these increases and discoveries have to be to constitute a boom. Some of the few to define this, are Sachs and Warner, who used in their paper a clear definition of the natural resource boom, with magnitude and duration, as well as the sector where the boom occurs. In their view:

> *"A natural resource boom is a rise in the realized natural resource exports to GDP of at least 4% of GDP, from beginning to the peak of the boom, with a duration of at least three years." (Sachs and Warner 1999)*

This definition measures the intensity of natural resource exports, which might not reflect the actual share of natural resources produced in the economy accurately because it is influenced by trade barriers and policies. Therefore I decided to use the same metric of measurement, but instead of exports, focus on natural resource rents. The definition of natural resource booms that is used in this paper reads:

> *"A natural resource boom is a rise in the realized natural resource rents to GDP of at least 4% of GDP, from beginning to the peak of the boom, with a duration of at least three years."*

This is a dummy variable, called treatment in the dataset, and it has a value of 1 for the countries who have experienced a boom during the study period (2000-2009).

Total natural resources rents as a percentage of GDP

The total natural resource rents are gathered from the World Bank World Development Indicators database. These natural resources included in this definition include: oil, natural gas, coal (hard and soft), minerals, and forest.

The methodology the WB uses to calculate the rent differs slightly from that used in the System for National Accounts. The WB estimates are calculated as the difference between the price of a commodity and the average cost of producing it (World Bank, 2011).

Rent ≡ World price – mining costs
– milling and beneficiation costs
– smelting costs – transport to port
– "normal" return to capital. (Stijns 2006)

This rent is then multiplied by the quantities the countries extract or harvest, and divided by the GNP to determine the rents of each commodity as a share of the total GNP. Further details on the sources and methods are described in "The Changing Wealth of Nations: Measuring Sustainable Development in the New Millennium" (World Bank, 2011). As can be seen from the definition, world prices affect production greatly, but so do the domestic production costs.

Human Development Index

The Human Development Index is a composite index that is geared towards measuring the level of development in countries. It has three components, which measure the average achievements in long healthy life, access to knowledge, and a decent standard of living. Davis used it as one of his indicators for social welfare, and he showed that the mineral intensive countries had a higher initial level of human development, and also that they managed to increase their human development index more than their non-mineral counterparts. The HDI estimates are obtained from the UNDP Human Development Reports database.

This gives rise to ne obvious criticism of his work and methodology. As Anand and Sen (1994) point out in their explanation of the methodology behind the Human Development Index, the index is the measurement of literacy, life expectancy, and GDP. These three variables normalized and scaled into the index in a way that the results of the countries affect each other. In practice, the index is a ranking of the relative performance of the countries at a point in time. It is calculated every year anew, and there are no fixed goalposts, which would make those rankings comparable over time. Therefore the index lends itself readily for cross-country comparisons, but it cannot be used intertemporally, unless the researcher defines and recalculates the index with fixed goalposts for all the three components of the index for the whole period that he or she intends to study (Anand and Sen 1994).

I have included the HDI in the calculations in this paper as well, but those results have to be interpreted with this caveat in mind. Changes in the HDI are changes in the comparative performance of the countries, and do not tell anything about the absolute changes in the values of any of the variables.

Infant mortality rate (per 1000 live births)

Infant mortality is quite self-explanatory measure of social wellbeing. It is the number of infants dying before reaching one year of age, per 1,000 live births in a given year. Mortality rates are important proxy indicators of the health status in countries, which can be used to identify vulnerable populations and compare socioeconomic development across countries (World Bank 2011).

The estimates used here are drawn from the World Bank World Development Indicators database, but the data and estimates are developed by the UN Inter-agency Group for Child Mortality Estimation (UNICEF, WHO, World Bank, UN DESA Population Division). The main sources of mortality data are vital registration systems and direct or indirect estimates based on sample surveys or censuses (World Bank 2011).

Life expectancy at birth, total (years)

Life expectancy at birth indicates the number of years a newborn infant would live if the prevailing patterns of mortality at the time of its birth were to stay constant throughout the entire life of the infant. Life expectancy reflects the overall mortality level of a population and summarizes the mortality pattern that prevails across all age groups in a given year. It is calculated in a period life table that reflects a snapshot of a mortality pattern of a population at a given time (World Bank). It is one of the frequently used indicators to compare development across countries, and both, Stijns and Davis used it in their calculations.

The data here is obtained from the World Bank World Development Indicators database, and they derive their estimates from several sources, such as: (1) United Nations Population Division. World Population Prospects, (2) United Nations Statistical Division. Population and Vital Statistics Report (various years), (3) Census reports and other statistical publications from national statistical offices, (4) Eurostat: Demographic Statistics, (5) Secretariat of the Pacific Community: Statistics and Demography Programme, and (6) U.S. Census Bureau: International Database (World Bank 2011).

Access to improved sanitation facilities

Access to sanitation is another indicator used by Davis, although for some reason he chose not to show the difference in differences for the mineral based and non-mineral based economies in his study. Sanitation is also a fundamental part of human development, it is considered to be a human right (World Bank 2011). Improved sanitation has a direct effect on the quality of life of people, and based on superficial knowledge, it should develop quite quickly when given the chance.

The indicator refers to the percentage of the population using improved sanitation facilities. The improved sanitation facilities include flush/pour flush (to piped sewer system, septic tank, pit latrine), ventilated improved pit (VIP) latrine, pit latrine with slab, and composting toilet (World Bank, 2011). Data used here is obtained from the World Bank World Development Indicators Database.

Improved water source (% of population with access)

Access to an improved water source refers to the percentage of the population using an improved drinking water source. The improved drinking water source includes piped water on premises (piped household water connection located inside the user's dwelling, plot or yard), and other improved drinking water sources (public taps or standpipes, tube wells or boreholes, protected dug wells, protected springs, and rainwater collection) (World Bank).

The data is accessed from the World Bank World Development Indicators database, who have derived the estimates from the Joint Monitoring Programme of the World Health Organization (WHO) and United Nations Children's Fund (UNICEF) based on national censuses and nationally representative household surveys (World Bank 2011).

Expected Years of Schooling of children (years)

Davis used adult literacy rate and primary school enrollment as his measure of education (or human capital accumulation). School enrollment rates are not the best measures of education, as they do not tell how many of those enrolled actually graduate, or how many of the graduates proceed to higher schooling. Adult literacy rate on the other hand is not very a good indicator for such a short study period. It is usually defined as literacy rate of population over 15 years of age, and therefore although even if there were improvement in schooling and literacy rate during the study period, the adult literacy rate probably would not show them.

Instead of those two measures, I will use the expected years of schooling. By definition, it is the number of years of schooling that a child of school entrance age can expect to receive if prevailing patterns of age-specific enrolment rates persist throughout the child's life (UNESCO 2012). This is a more responsive and applicable measure for this study. The expected years of schooling estimates are obtained from UNESCO Institute for Statistics.

Gender Equality Index

Gender equality was largely disregarded by most of the authors in the literature in this literature survey, including Davis, Stijns, and Sachs and Warner. I believe gender equality is an important indicator of development and quality of life in any given country. To measure gender equality, I use the Gender Equality Index, from the Indices of Social Development database, which is developed and maintained by the Institute of Social Studies.

Gender Equality refers to the extent to which women and men face the same opportunities and constraints within families, the workplace, and society at large. The Gender Equality Index measures gender equality by a wide range of indicators, which include measures such as access to jobs, educational placement, fair wage, as well as input measures which track the existence of discriminatory norms within society regarding a woman's right to equal treatment in the workplace, in access to education, and in the family. Gender discrimination is multifaceted, therefore attitudinal data also can form a useful proxy for the persistence of broader forms of discrimination, such as domestic violence, for which we have little or no comparative information. Where gender discrimination has been reduced, people are better able to fulfill their potential in life and make the most of their skills and capabilities (ISD 2012).

GNI per capita

Davis, in 1995, used the GNP per capita (in US dollars) to compare the economies between 1970 and 1991. He noted that a better and more accurate comparison could be done using GNP per capita at purchasing power parity, but the data at the time was not available to the extent that he could have included it in his study. In the last few decades, also the statistics have developed admirably. In this research paper, I will use two different measures of gross national income, both of which are gathered from the World Bank World Development Indicators database. First, there is the GNI per capita, calculated using the Atlas method (of exchange rates). Second, I have available the GNI per capita at purchasing power parity, which Davis did not have available.

The general GNI calculation method used by the World Bank is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad (World Bank 2011). Data are in current dollars, and there are two different ways in which the data are converted, which are described below.

Atlas method (current US$)

This is a special Atlas method of conversion used by the World Bank. The Atlas method smooths the fluctuations in prices and exchange rates by applying a conversion factor that averages the exchange rate for the given year and the two preceding years and adjusts for differences in rates of inflation between the country and the Euro area, Japan, the United Kingdom, and the

United States. A country's inflation rate is measured by the change in its GDP deflator, and for the comparison countries, it is measured as the change in the International Monetary Fund's Special Drawing Rights deflator. The resulting GNI in US dollars is divided by the mid-year population in order to derive the GNI per capita (World Bank 2011).

GNI per capita, purchasing power parity (current international $)

Purchasing power parity rates provide a standard measure allowing comparison of real levels of expenditure between countries, just as conventional price indexes allow comparison of real values over time. PPP rates are calculated by simultaneously comparing the prices of similar goods and services among a large number of countries. The latest round of comparisons (International Comparison Program) was conducted in 2005 and it covered most of African countries. The values for the missing countries are imputed statistically, and the yearly development is extrapolated statistically. GNI at purchasing power parity is a gross national income converted to international dollars using purchasing power parity rates. An international dollar has the same purchasing power over gross national income as a U.S. dollar has in the United States (World Bank 2011).

Calorie Supply per capita per day (crops equivalent)

Davis used the calorie supply per capita as one of his determinants of social welfare. Therefore it is also included here. The calorie supply per capita estimates are the estimates of how many calories there is produced per capita in a given country, in terms of crops equivalent. They are found from the United Nations Food and Agricultural Organizations database. The values represent the aggregate disposable production for any use except as seed and feed (to avoid double counting of production) (FAO). The latest data for calorie supply per capita was from the year 2009.

The FAO indices of agricultural production show the relative level of the aggregate volume of agricultural production for each year in comparison with the base period 1999-2001. They are based on the sum of price-weighted quantities of different agricultural commodities produced after deductions of quantities used as seed and feed weighted in a similar manner. It should be noted that when calculating indices of agricultural, food and nonfood production, all intermediate primary inputs of agricultural origin are deducted (FAO).

Performance

Relative performance of booming and non-booming countries

Descriptive statistics

With the definition of natural resource boom explained above, eleven countries were identified as having experienced a natural resource boom during the study period. Those countries are listed in Table 1 below, which indicates the name of the country, as well as the dating of the boom.

Table 1

List of Countries with natural resource booms

	countryname	boomyears
1.	Egypt. Arab Rep.	2005–2008
2.	Guinea–Bissau	2000–2002
3.	Angola	2000–2002
4.	Libya	2004–2008
5.	Gabon	2005–2008
6.	Zambia	2006–2009
7.	Mauritania	2007–2009
8.	Equatorial Guinea	2001–2006
9.	Liberia	2001–2003
10.	Algeria	2005–2009
11.	Chad	2004–2009

The graphs of the countries total natural resource rents as a percentage of GDP are listed in Appendix A.

Table 2 contains the names of the countries in the group, which did not experience a boom. Together these lists include 50 out of the 54 countries of Africa. The exceptions are due to missing data, and include Seychelles, Sao Tome and Principe, Somalia, and South Sudan. Nevertheless, the sample is quite representative and covers by far most of the continent.

Table 2

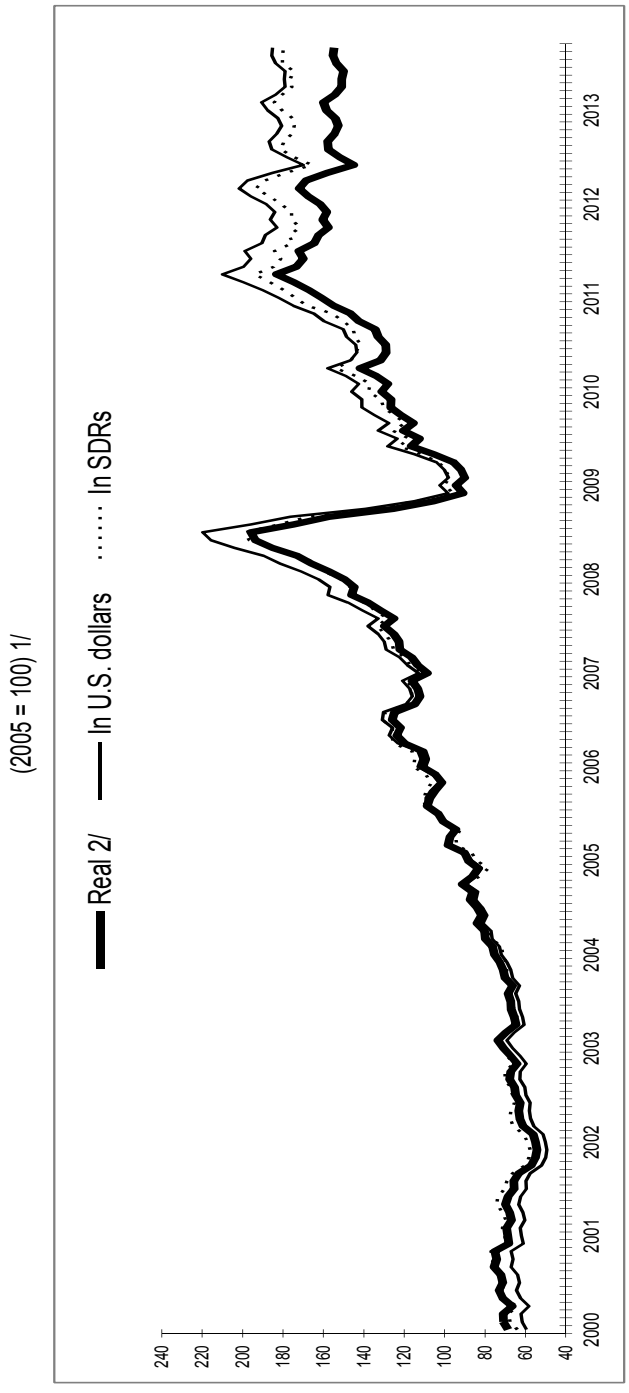
List of Countries with no natural resource booms

	countryname
1.	Cape Verde
2.	Nigeria
3.	Niger
4.	Namibia
5.	Djibouti
6.	Madagascar
7.	Congo. Dem. Rep.
8.	Benin
9.	Mali
10.	Morocco
11.	Gambia. The
12.	Sudan
13.	Senegal
14.	Lesotho
15.	Malawi
16.	Guinea
17.	Tunisia
18.	Ghana
19.	Tanzania
20.	Central African Republic
21.	Swaziland
22.	Eritrea
23.	Mauritius
24.	Rwanda
25.	Congo. Rep.
26.	Uganda
27.	Botswana
28.	Cote d'Ivoire
29.	Sierra Leone
30.	South Africa
31.	Burundi
32.	Togo
33.	Burkina Faso
34.	Ethiopia
35.	Cameroon
36.	Kenya
37.	Zimbabwe
38.	Mozambique
39.	Comoros

As we can recall from the literature, natural resources are responsive to fluctuations in the world prices. Below Figure 1 presents the International Monetary Funds world commodity price index for the study time period. Especially with mining, the prices and demand tend to go hand-in-hand, when demand is high, then prices are high, when demand low, prices are low as well. This increases the volatility in the producing countries and creates additional challenges for the governments in the planning their budgets (Davis 2002).

Figure 1

World Commodity Price Index



1/ Combines indices of non-fuel primary commodity prices and petroleum prices.
2/ Deflated by U.S. CPI.

Source IMF.

Nevertheless, in this study, all the countries face the same price trends, and the period covers an upward price cycle. While majority of the booms overlap with the price peak in 2008, the cases of Liberia (2001-2003), Angola (2000-2002), Guinea-Bissau (2000-2002), and Equatorial Guinea (2001-2006) demonstrate that there are other factors at play as well besides the world price. Table 3 presents the baseline performance of the control and booming countries in the year 2000.

Table 3[9]

Initial Level of Social Welfare Indicators

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
infantm~2000	39	79.69308	27.20424	16.03	142.6
lifeexp2000	39	53.04321	7.566848	38.11161	72.6
sanitat~2000	39	32.60974	22.02676	7	89.1
water2000	39	65.43077	17.10679	28.9	99.2
schooli~2000	39	6.995641	3.071236	2.05	13.02
kcalsup~2000	38	2247.053	355.9002	1506	3236
hdi2000	33	.4089091	.122245	.234	.676
gendereq2000	39	.5920578	.0541865	.5033885	.7144808

[9] The variable names are intended to be self explanatory, but for the sake of clarity, I list them here:
Infantm2000 = infant mortality in 2000
lifeexp2000 = life expectancy in 2000
sanitat2000 = access to sanitation in 2000
water2000 = access to water in 2000
schooli2000 = expected years of schooling in 2000
kcalsup2000 = calorie supply in 2000
hdi2000 = human development index in 2000
gendereq2000 = gender equality index in 2000
This method of naming variables is used throughout this paper, with 2010 (or 2009) denoting the values at the end of the study period and –dif denoting the difference between the end and the beginning.

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
infantm~2000	11	79.19091	36.56844	24.4	120.9
lifeexp2000	11	55.83122	10.55592	41.78312	71.96622
sanitat~2000	11	48.54636	35.47073	9.07	96.5
water2000	11	61.19091	19.58578	40.4	96.1
schooli~2000	11	8.503637	3.275141	4.06	15.06
kcalsup~2000	10	2500.5	544.8366	1811	3318
hdi2000	9	.4562222	.1338841	.29	.627
gendereq2000	11	.5715416	.0499437	.4895831	.6736915

Countries in the treatment group have higher initial values on most of the indicators (with the exception of gender equality and infant mortality).

Table 4 shows the gross national income, calculated with the Atlas exchange rate method, as well as with the purchasing power parity method for both groups of countries.

Table 4[10]

Initial Level of GNI

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
GNIatlas2000	39	747.9487	914.6129	90	3870
gniPPP2000	38	1773.158	2010.697	220	8070

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
GNIatlas2000	10	913	943.8344	160	3100
gniPPP2000	10	3014	3074.343	290	10030

From Table 4 we can see that the countries that will undergo a natural resource boom have also higher initial GNI per capita (on average), calculated in

[10] Same system of notation is used for the GNI variables.
GNIatlas2000 = GNI per capita, calculated using the Atlas method for the year 2000
gniPPP2000 = GNI per capita at purchasing power parity in 2000
Again, 2010 will denote the year 2010 and –dif will denote the difference between the GNI in 2010 and 2000.

two different ways. Next, table 5 will show the values these countries have at the end of the study period.

Table 5

Final Values of Social Welfare Indicators

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
infantm~2010	39	58.06667	22.95107	12.09	122.7
lifeexp2010	38	57.69758	7.140512	46.44029	74.60244
sanitat~2010	38	37.51395	23.08184	9.05	90.5
water2010	38	72.98158	15.89878	46	99.7
schooli~2010	39	9.044872	2.445766	4.05	14.05
gendereq2010	39	.6312344	.0978089	.4499802	.8760756
kcalsup~2009	38	2407.763	378.0459	1604	3314
hdi2010	39	.456	.1094005	.295	.732

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
infantm~2010	11	58.75	31.29072	14.05	104.6
lifeexp2010	11	59.79235	8.90571	49.76986	74.79249
sanitat~2010	10	49.135	34.63811	11.05	96.6
water2010	9	69.88889	17.8522	49.6	99.3
schooli~2010	11	10.30909	2.889479	7.04	16.02
gendereq2010	11	.5966889	.0763837	.4440148	.7346791
kcalsup~2009	10	2611.5	533.6525	1879	3349
hdi2010	11	.5304545	.1538125	.336	.773

The natural resource booming countries still perform slightly better in general. But it seems that the non-booming countries have narrowed the gap, and in the case of infant mortality, they have passed the booming countries. Now the non-booming countries rank better in terms of gender equality, water supply, and infant mortality.

The GNI per capita at the end of the period are presented in table 6.

Table 6

Final Values of GNI

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
GNIatlas2010	38	1538.158	1878.649	190	7950
gniPPP2010	37	2865.405	3565.044	350	14380

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
GNIatlas2010	10	3224	3376.544	270	9840
gniPPP2010	10	5396	5246.834	470	15730

The booming countries are still better off after the boom than the non-booming countries in terms of GNI per capita. In this case, the gap between the two groups has widened.

Next in Table 7, the difference between the final and the starting values are listed. This shows how much each of the groups has improved (or deteriorated) during the time period.

Table 7

Difference in Social Welfare Performance

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
infantmort~f	39	-21.61026	13.5383	-64.5	-1.5
lifeexpdif	38	4.422152	6.002302	-15.30346	21.0571
sanitation~f	38	4.011579	4.307816	-3.5	17.03
waterdif	38	6.986316	6.366435	-7.1	19.03
schoolingdif	39	1.731282	1.480528	0	6.04
gendereqdif	39	.0391766	.0717376	-.0797407	.2814885
kcalsupdif	39	156.5897	143.4452	-115	462
hdidif	33	.1952424	.1967538	.01	.59

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
infantmort~f	11	-20.31818	15.03036	-58.7	-8.2
lifeexpdif	11	3.961133	3.114173	1.350317	11.81
sanitation~f	10	4.246	5.157847	-2.9	15
waterdif	9	6.52	6.678164	-5.6	18
schoolingdif	11	1.407273	1.692927	0	5.06
gendereqdif	11	.0251473	.071373	-.0834308	.1350349
kcalsupdif	11	100.9091	107.6935	-18	317
hdidif	9	.2561111	.2088226	.062	.49

With the exception of sanitation, the non-booming countries have improved their performance on all indicators more than the booming countries. The differences are nevertheless quite small. Table 8 shows the change in GNI per capita.

Table 8

Difference in GNI

-> treatment = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
gniatlasdif	38	790.5263	984.0483	-90	4080
gnipppdif	37	1088.108	1561.523	-40	6440

-> treatment = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
gniatlasdif	10	2311	2745.455	90	8580
gnipppdif	10	2382	3032.325	180	10350

This table shows that the booming countries have improved their GNI per capita considerably more than the non-booming countries.

Chapter 5 Discussion

The findings in the above tables are quite interesting, despite the simplicity of the methodology used. Clearly, the conclusions that can be drawn from this are somewhat limited. But first: the study did not yield quite similar results what Davis got in his paper. In his study, the mineral intensive countries performed uniformly better in terms of increases in the average of all indicators than the non-mineral intensive countries.[11] This he took as evidence against natural resource curse.

Nevertheless, the booming countries managed to improve their GNI per capita considerably more than the non-booming countries. This raises the question that possibly there is a lag in translating the increased monetary wealth into improvements of the standards of living.

To test this hypothesis, I divided the booming countries into two groups: in boomperiod 2 are those countries that experienced the boom prior to the years 2008-2009, and in boomperiod 1 are countries which experienced the boom in that period. The performance of these new groups are listed in tables 9 and 10. Table 11 shows the results for the control group again.

Table 9

Countries in Early Boomperiod

```
-> boomperiod = 2
```

	countryname	boomyears
1.	Angola	2000–2002
2.	Liberia	2001–2003
3.	Guinea–Bissau	2000–2002
4.	Equatorial Guinea	2001–2006

[11] With the possible exceptions of access to sanitation, and access to water, for which he did show the change.

-> boomperiod = 2

Variable	Obs	Mean	Std. Dev.	Min	Max
gniatlasdif	4	3125	3941.611	90	8580
gnipppdif	4	3525	4767.113	180	10350
infantmort~f	4	-29.45	19.6763	-58.7	-16.3
lifeexpdif	4	4.588866	2.120147	2.111512	7.025195
sanitation~f	3	9.006667	5.190389	6	15
waterdif	3	12.04667	5.955001	6.09	18
schoolingdif	4	2.0425	2.464581	0	5.06
gendereqdif	4	.0808363	.0531154	.0306792	.1350349

Table 10

Countries in Late Boomperiod

	countryname	boomyears
1.	Gabon	2005–2008
2.	Libya	2004–2008
3.	Zambia	2006–2009
4.	Mauritania	2007–2009
5.	Chad	2004–2009
6.	Algeria	2005–2009
7.	Egypt. Arab Rep.	2005–2008

-> boomperiod = 1

Variable	Obs	Mean	Std. Dev.	Min	Max
gniatlasdif	6	1768.333	1833.657	470	5120
gnipppdif	6	1620	1083.439	510	2810
infantmort~f	7	-15.1	9.776503	-36.5	-8.2
lifeexpdif	7	3.602429	3.674661	1.350317	11.81
sanitation~f	7	2.205714	3.838814	-2.9	9.03
waterdif	6	3.756667	5.448133	-5.6	9.06
schoolingdif	7	1.044286	1.147546	.05	3.04
gendereqdif	7	-.006675	.0618919	-.0834308	.080501

Table 11

Countries with No Boom

-> boomperiod = 0

Variable	Obs	Mean	Std. Dev.	Min	Max
gniatlasdif	38	790.5263	984.0483	-90	4080
gnipppdif	37	1088.108	1561.523	-40	6440
infantmort~f	39	-21.61026	13.5383	-64.5	-1.5
lifeexpdif	38	4.422152	6.002302	-15.30346	21.0571
sanitation~f	38	4.011579	4.307816	-3.5	17.03
waterdif	38	6.986316	6.366435	-7.1	19.03
schoolingdif	39	1.731282	1.480528	0	6.04
gendereqdif	39	.0391766	.0717376	-.0797407	.2814885

Tables 9, 10, and 11 show that the highest average increase was experienced by the group of countries in boomperiod 2, which are the countries who experienced their boom prior to 2008 and 2009. Those countries experienced the highest average gains in terms of GNI per capita, and in terms of the social welfare indicators. If this were the case, it would mean that Davis's research and findings are reproducible in another geographical area, at a different time period, and with an alternative measure for natural resources (booms instead of mineral intensiveness). Let us, for arguments sake, assume these results are true. Then it would mean that the natural resource booms do not lead into natural resource curse. Of course, there might be Dutch Disease effects on the manufacturing sector, but those we cannot observe from this set of variables. What these variables tell us is that countries that have experienced a natural resource boom, have experienced the highest improvements in terms of social welfare indicators and GNI after being given some time to adjust. And this has happened regardless of what happened to their manufacturing sector. In a few years, when the data for the year 2013 or 2014 is available for the countries listed in Table 10, it can be seen whether they will experience higher gains as countries in Table 9, or whether they look more like countries in Table 11.

Of course from this natural experiment, and the method is most like casual observation, from which we cannot imply any causality between the boom and the welfare gains. There could possibly exist any number of alternative explanatory variables, which have completely been omitted from this analysis.

From this set of data, one could also draw another set of conclusions. Consider Table 7 for a moment for arguments sake (or alternatively compare Tables 10 and 11). These data show that countries that have experienced a natural resource boom have performed worse in terms of social indicators, than those countries without a boom. This would naturally give rise to the idea that natural resource booms are detrimental to development. Especially gender equality (from Tables 10 and 11), would give reason to worry, as the gender

equality index in the booming countries has fallen on average! Or consider education, countries in Table 10 have increased their expected years of schooling by 1.04 years on average, while non-booming countries (Table 11) have during the same period experienced an increase of 1.74 years. This would certainly support the idea that natural capital crowds out human capital, and countries with natural resources invest less in educating their people. This could suggest that Gylfason was right with his theory of natural resource curse after all. If natural capital crowds out human capital, one could extrapolate that natural resource booms reduce expected years of schooling.

It seems that from this simple exercise evidence could be draw to deny natural resource boom a la Davis, or to support it following the logic of Gylfason.

The work of Sachs and Warner seems to be the only major piece of theory that it is hard to find support for from this data. The countries experiencing the natural resource booms scored systematically higher average gains compared with the countries that did not boom. But on one hand, Sachs and Warner did find Ecuador improving its growth as a result of a boom, while two countries experienced no change in their growth and only one country decelerating its growth as a result of the boom. Without exaggeration similar result could be drawn out from Table 9 of this paper. One of the countries in Table 9 increased their GNI by 90 dollars per capita (atlas method), although the mean was over 3000 dollars, and maximum over 8000 dollars. Therefore, based on that, with different methodological and ideological approach, conclusions could be drawn for, as well as against natural resource curse. Lederman and Maloney (2002) found that simply changing the statistical test to a more appropriate one than used by Sachs and Warner, the negative relationship between resource abundance and economic growth disappeared (Lederman and Maloney 2002).

But on the other hand, Sachs and Warner did not do cross sectional analysis when they studied the relationship of natural resource booms and natural resource curse. Although the countries that experienced the natural resource booms grew more than the non-booming countries, they did not compare the growth rates across the countries. Possibly the countries that had a natural resource boom would have grown even more (on average) had they not had the boom.

Stijns found both positive and negative channels for natural resources and in their relation to growth, as well as human capital accumulation. These channels varied depending on the definition and measurements of natural resources (abundance, exports, production/rents), the measures of human capital indicators, selection econometric techniques and the theoretical interpretation of the results. Therefore both sides of the argument can be argued easily.

One more variable in the equation of is probably the intention of the researcher, which Davis also notes. He sets out to raise mining out the pariah status it has received in the economics of development discipline, which already began with Prebisch and Hirschman half a century earlier. But as this defense came from the Colorado School of Mines, and it did not introduce new theory, those observations did not gain the attention they might have deserved (Stijns 2005).

From the data above (Table 7), it is clear that the highest gains in terms of Gross National Income, as well as all the human development indicators listed were experienced by countries which experienced a natural resource boom during the study period. It holds true for the growth of GNI. This can be used as evidence to deny the natural resource booms. Other than that, even from these simple tables, evidence can also be drawn to support natural resource booms existence, as the non-booming countries improved their performance on the social welfare indicators more than the booming countries. And all this can be done without complex econometrics, but as Stijns noted, the story behind economic growth and natural resources is not easily captured by typical growth regressions (Stijns 2005).

This brings us back to the point of Sach and Warner's factor x, which is crowded out by natural resources. This crowding out of x can affect manufacturing, entrepreneurial spirit, education, or some other factor, and as such it does not have to be growth inhibiting (Davis 2002). All in all, this conclusion brings us back to the very early days of development economics, and to what Charles Kindleberger wrote already in 1958:

> *"Anyone who claims to understand economic development in toto, or to have the key to the secret of growth, is almost certainly wrong"* (Kindleberger 1958, quoted in Davis 2002).

Based on the evidence from this study, as well as the literature reviewed, the natural resources have the potential to help development, as well as hinder it. The debate remains open, and most likely will remain open, as the questions are immensely complex. Studying natural resource booms on average seems to be like beating up a dead horse, as it seems to be possible to always come up with countering theory and evidence, or case study.

Chapter 6 **Conclusion**

This research paper set out to examine whether it is reasonable for the people living in countries to expect the boom to improve their standard of living and quality of life. Common sense and the conventional view would suggest the answer to be yes. Nevertheless, the literature from the last thirty years provides mixed evidence, which slightly leans towards the existence of natural resource curse. The policy recommendations have been very cautious towards mining. This would mean it is not reasonable to expect the living standards to improve.

The are views objecting the natural resource curse in the literature from the last thirty years as well. One such view comes from Davis (1995), who with a simple observational study found empirical evidence of mineral intensive countries outperforming their non-mineral counterparts. When Davis's methodology is applied to countries experiencing natural resource booms in Africa, the evidence is mixed. The booming countries had higher initial average values of Gross National Income and of most social welfare indicators. But during the study period, the non-booming countries improved their living standards more (in terms of social welfare indicators). The booming countries increased their GNI more (on average). The evidence is again mixed.

Based on the literature, as well as the empirical experiment, it seems that depending on the definition of natural resources, selection of sample, definition of econometric methods and economic theory, it is possible to easily argue both sides of the natural resource curse thesis, based on the selection of the author. This conclusion is basically in line with the conclusion of Stijns that natural resource abundance (booms/endowments) can have positive and negative effects on economic growth (social welfare). The terms in parenthesis are practically mutually interchangeable, and all sides have empirical evidence to back up the arguments. Natural resources do have the potential to increase welfare and sometimes they do so, but the potential for the opposite exists as well.

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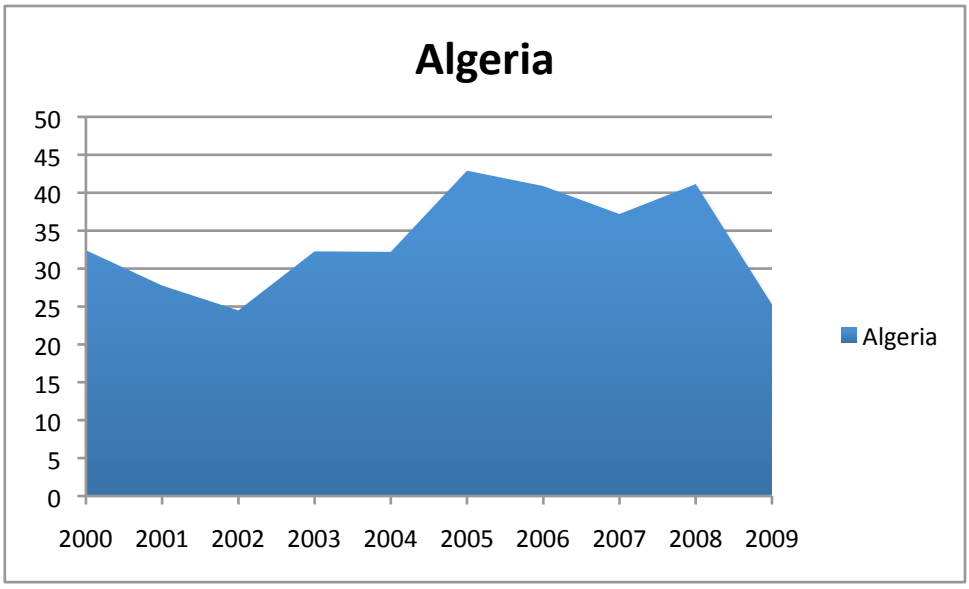
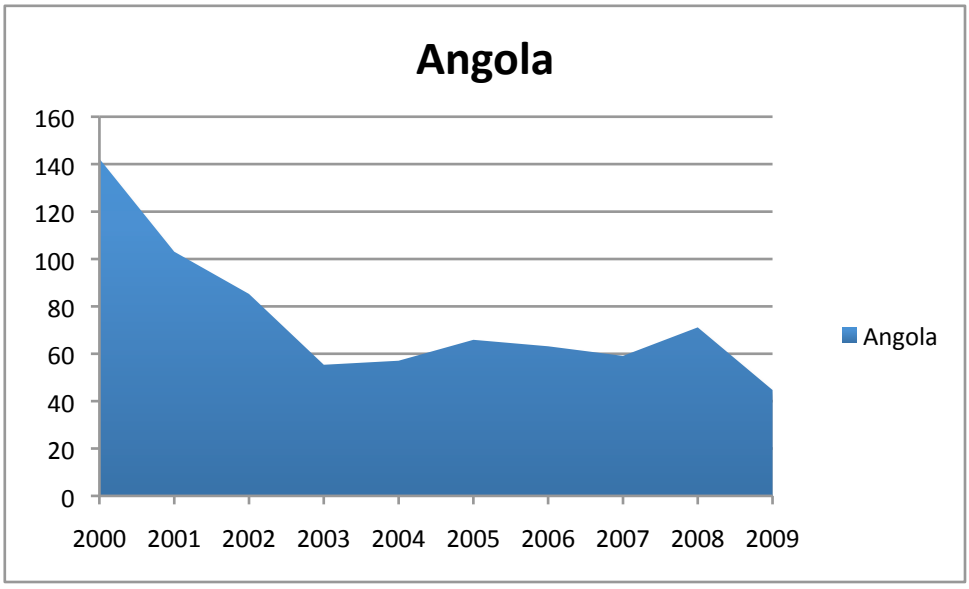
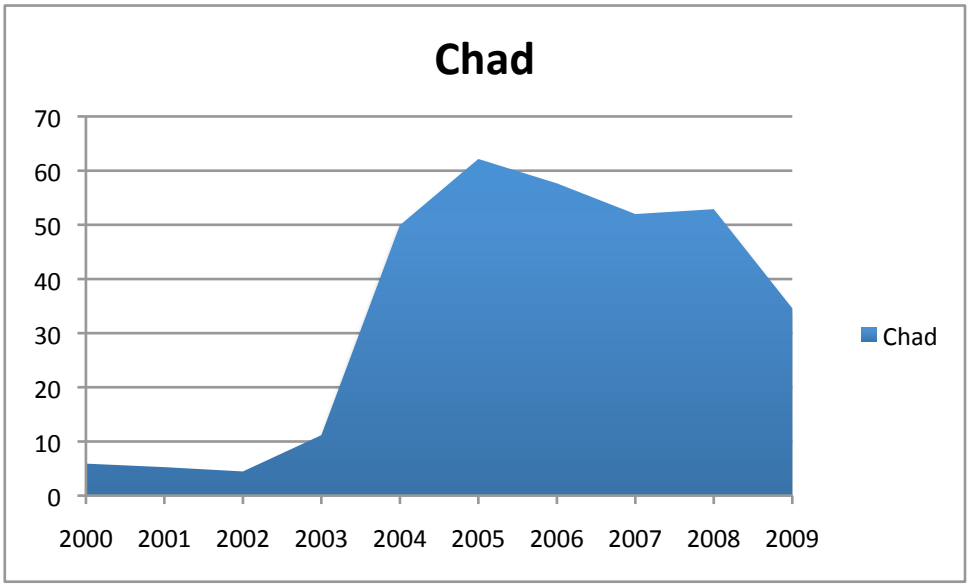
Appendix A

The graphs represent the total natural resource rents as a percentage of GDP for the booming countries. On the y-axis is the percentage of GDP, and on the x-axis time.



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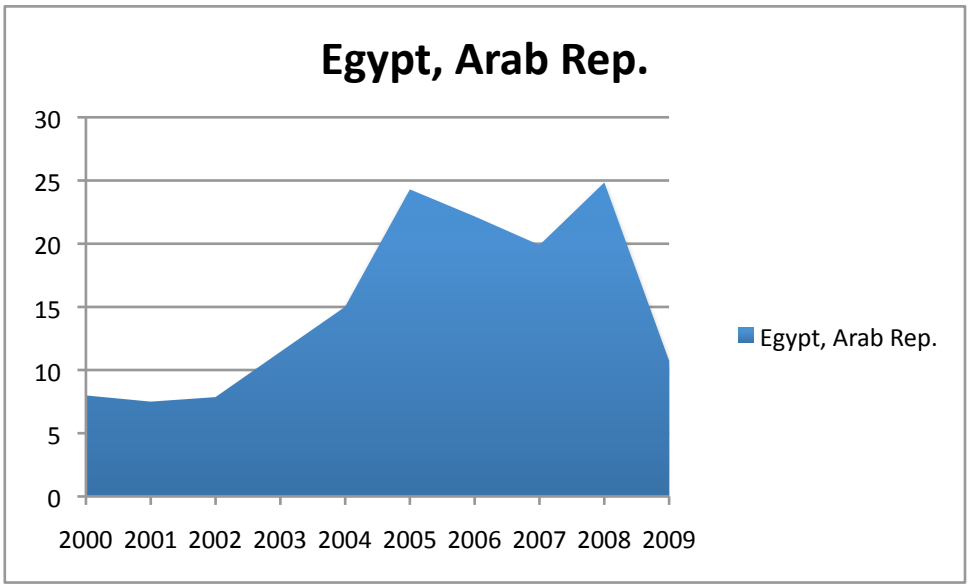
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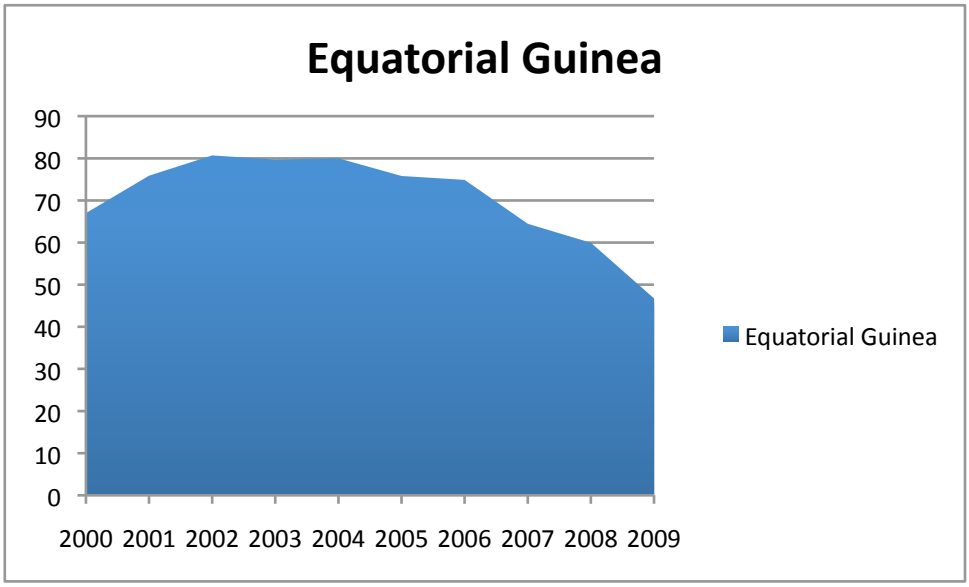
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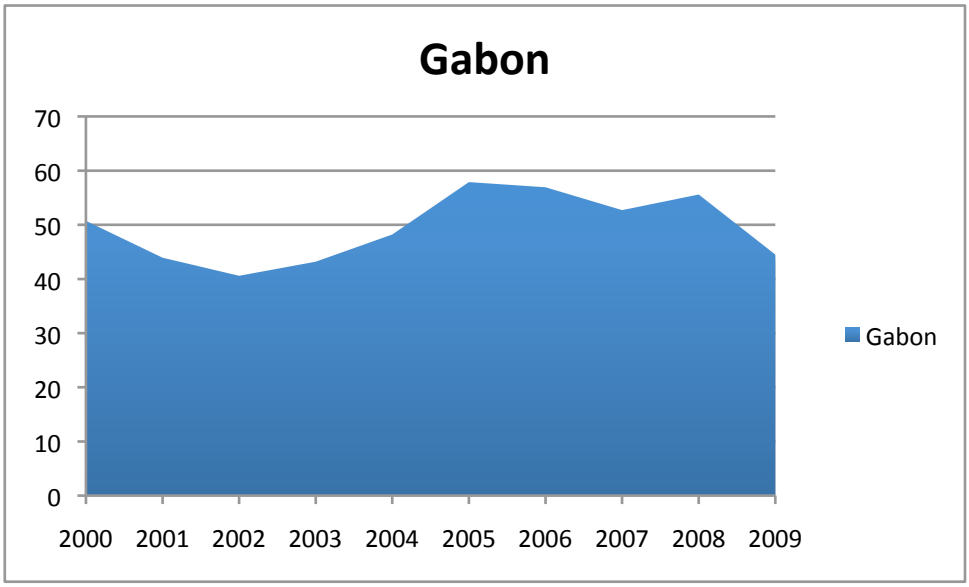
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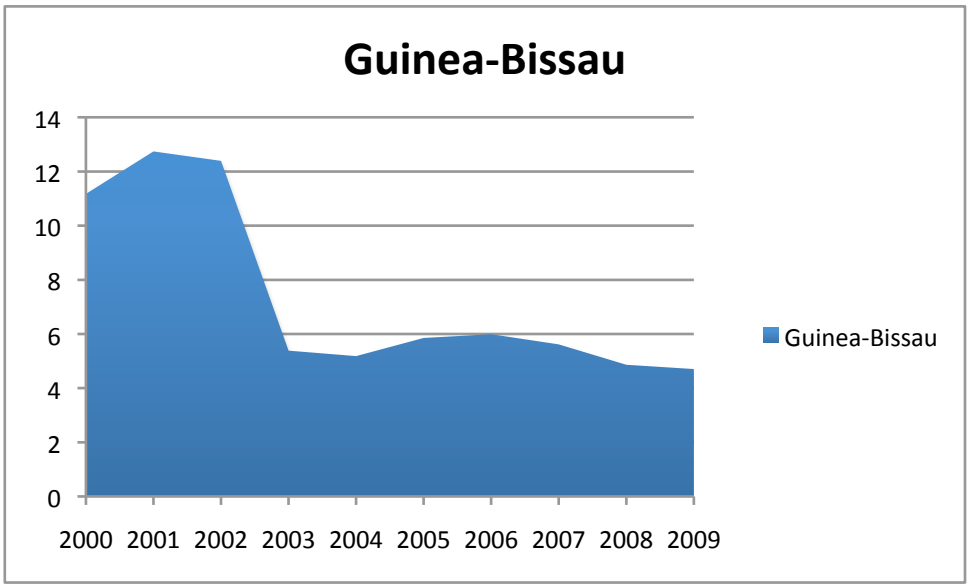
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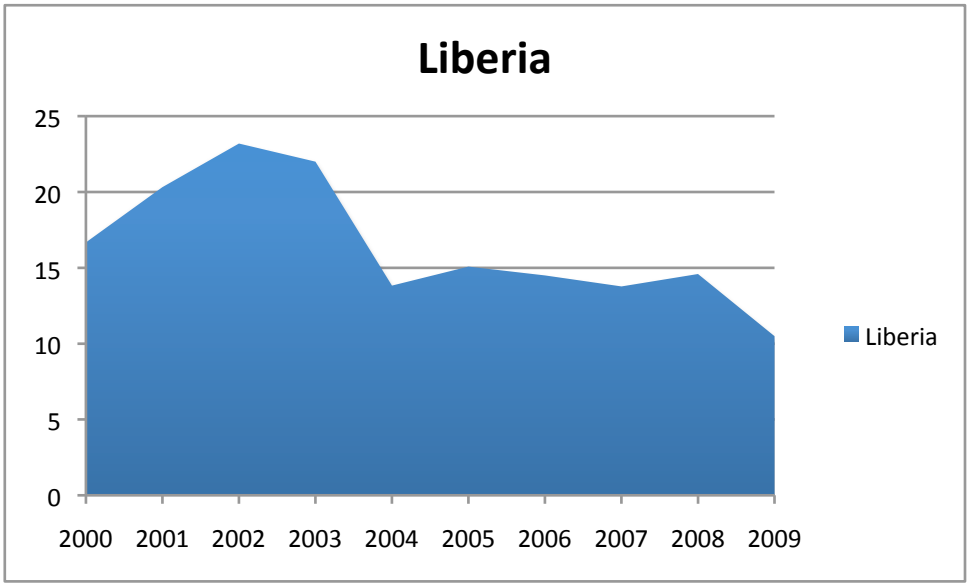
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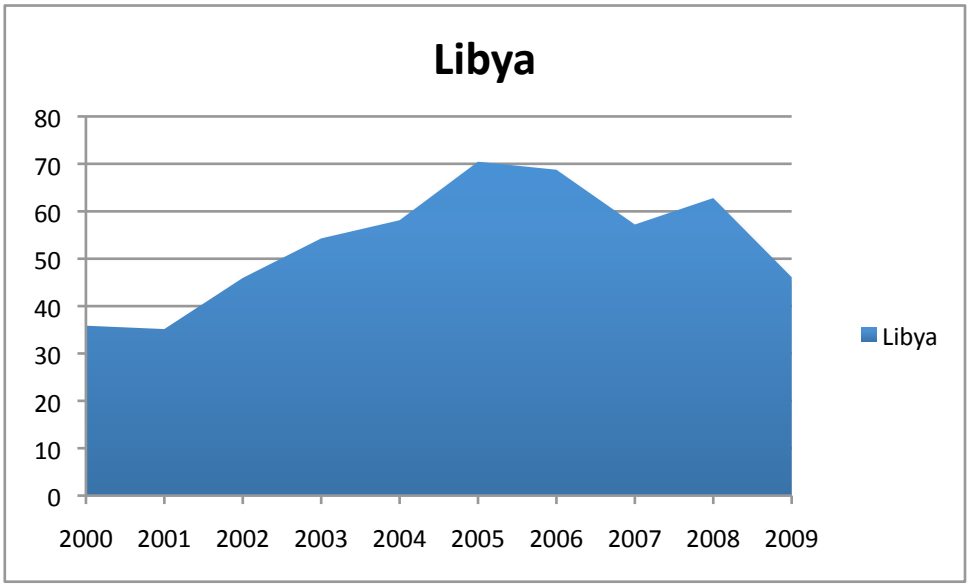
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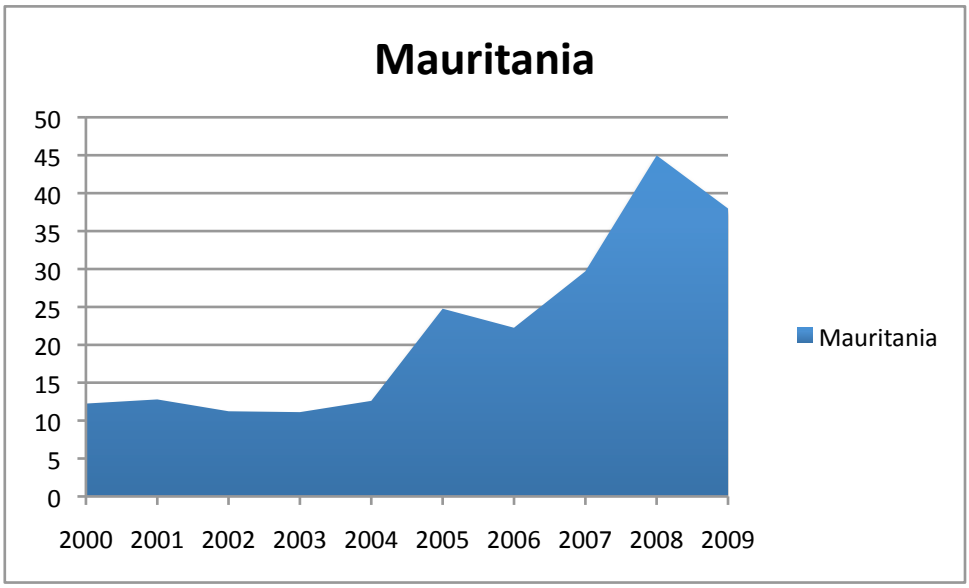
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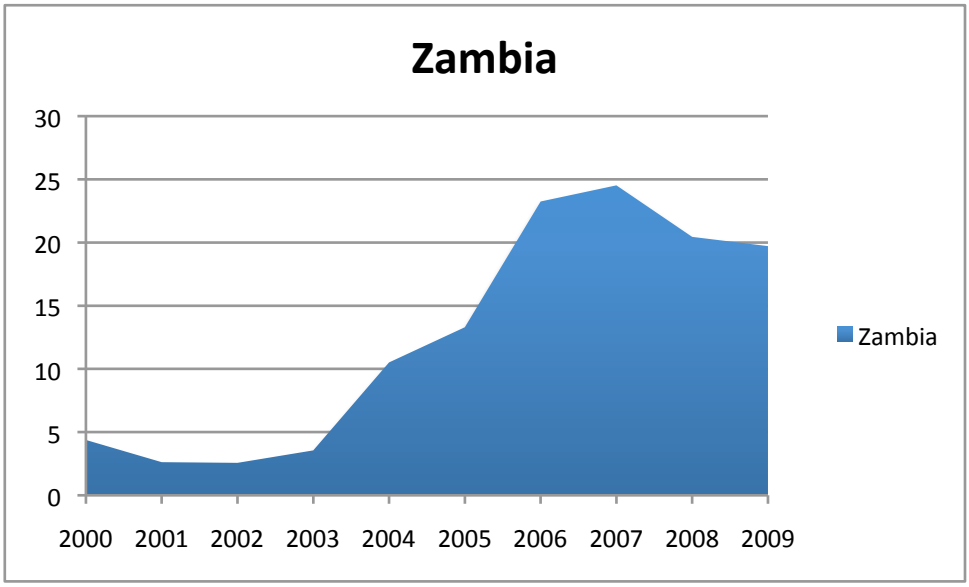
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