



LUND UNIVERSITY
School of Economics and Management

Diamonds are a country's best friends!

An empirical study of economic growth and natural
resources in Sub-Saharan Africa

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Abstract

This thesis analyses the impact of several natural resources on economic growth in the empirically rather poor Sub-Saharan Africa during the time period of 1990-2010. By performing panel regression analyses based on economic and political data from the countries in Sub-Saharan Africa, the conclusion that the production of diamonds promotes economic growth the most could be made. As an example, the extraordinary and for this region rather unusual development of Botswana will be discussed. This country managed to transform itself from one of the poorest countries in the world to an upper-middle income country with extremely high growth rates by combining diamond extractions with stable political policies.

Theories of economic growth and natural resources, such as the Dutch Disease and the curse of natural resources, will be analysed. Furthermore, some guidance in future decision making in policy questions will be performed – if a Sub-Saharan African country in the future happens to find both oil and diamonds, this thesis concludes that the country should invest in the production of diamonds because of its statistically significant greater impact on economic growth and development.

Keywords: Sub-Saharan Africa, economic growth, development, natural resources, diamonds, Botswana

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1. Introduction

Sub-Saharan Africa is a dynamic region, full of contradictions. The region is rich in natural resources and strong economic growth has taken place in recent years, but the region still hosts some of the absolutely poorest countries in the world. Several of the countries in Sub-Saharan Africa have had difficulties in developing their economies and have actually stagnated, despite the potential of the rich natural resources. For many years the general opinion has been that natural resources often have a tendency of harming economic growth because countries tend to become too dependent on their natural resources. However, there seems to be one exception – diamonds.

Diamonds have been precious and highly valued and the world market price of diamonds has remained at a high stable level for many years. The production of diamonds may be a factor contributing to a brighter development in some of the countries in the rather problematic region.

The purpose of this thesis is to analyse the impact of the natural resources and especially diamonds on the economic growth in Sub-Saharan Africa. Panel regression analyses based on economic and political data from the countries in Sub-Saharan Africa are being used to investigate the impact of different natural resources on economic growth and development.

The question of which of the studied natural resources has had the greatest impact on economic growth, and has promoted it in the best way during the time period from 1990 to 2010 in the best way, will be discussed and analysed. The hypothesis of this thesis is that the production of diamonds will encourage economic growth the most, mainly because the world market price of diamonds is more stable over time and does not fluctuate as much as the price of other natural resources, for example oil. Diamond production combined with good, stable political leadership promotes economic growth, which the country Botswana in southern Africa has managed to show extremely well during the many recent decades.

Furthermore, the problem when countries become too dependent on their natural resources and the phenomenon of the Dutch Disease will be discussed. Some guidance in future decision making in policy questions will be performed – if a Sub-Saharan African country in the future happens to find both oil and diamonds, the hypothesis of this thesis states that the country should invest in the production of diamonds because of its significant greater impact on economic growth.

Botswana has been known as the success story of Sub-Saharan Africa and for its rapid, stable level of economic growth and well performed political and macroeconomic policies during recent decades. The economic success of Botswana, which is rather unusual in this region of the world, will be discussed and some possible future problems for its highly diamond-dependent economy will be highlighted.

The thesis begins with some background information, description of theories and earlier research in the field of natural resources, economic growth and Sub-Saharan Africa. Then the diamond production in Sub-Saharan Africa will be described. The econometrical model and the variables are then explained followed by the results of the investigation and an analytical part. The remarkable development of Botswana is then discussed and finally, the thesis is ended with a summary and some conclusions.

2. Background

Since the years of independence during the 1960's, and a few decades later in the southern part of the region, there have been many changes in the countries of Sub-Saharan Africa and some of the countries have actually shown a remarkably good level of economic growth the past years. Botswana, the success story of Sub-Saharan Africa, managed to keep an average yearly growth rate of 9 per cent during 40 years, from 1970-2010¹. This is an extremely good average growth rate that hardly any other country in the world can compete with.

In the beginning of the 21st century many of the poorest countries in the world are still located in Sub-Saharan Africa with very low rates of GDP per capita, as can be seen in the graph below.

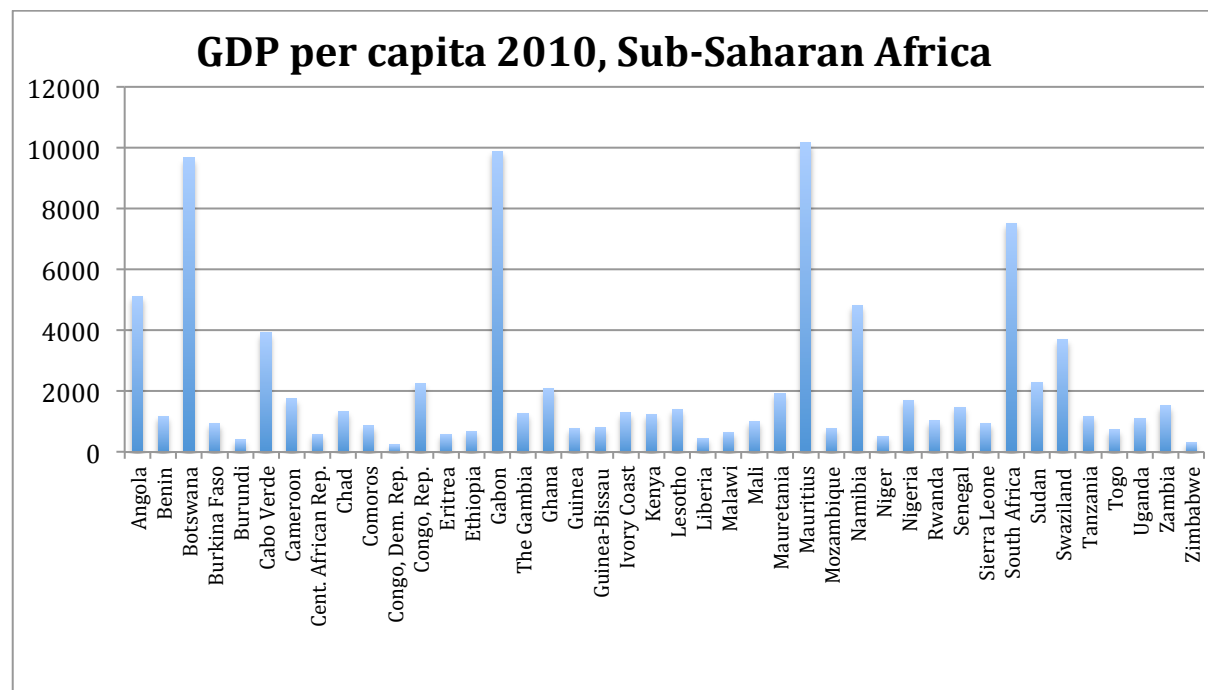


Figure 1. GDP per capita 2010, Sub-Saharan Africa, measured in 2005 international dollar per person, collected from Penn World Tables 7.1.

However, it has not been uncommon that countries are experiencing years of slow economic growth – recessions, falling oil prices or the absence of precipitation can affect and shock economies. Together with Sub-Saharan Africa, empirically Latin America has also shown relatively low growth rates and unfortunately does not show signs of convergence towards

¹ Kojo, Naoko C., (2010), p. 3.

the GDP per capita of the developed world. However, the poor growth in Latin America has partly been explained by high inflation and the lack of property rights. A lot of researchers have tried to explain the slow growth and the non-tendency of convergence of the countries in Sub-Saharan Africa. Various explanations have been highlighted – such as political instability, the colonial heritage, macroeconomic mismanagement, weak governmental institutions, high levels of corruption, the absence of investments and even geographical factors like the hot climate around the equator – but consensus has not yet been achieved and the situation is still to be explained.

2.1 Economic growth

In this section the theoretical background of economic growth and natural resources will be presented.

2.1.1 Rich and poor countries

The economists Charles I Jones, Stanford University, and Dietrich Vollrath, University of Houston, have described and explained economic growth and the development of different countries. They claim the rather solid fact that countries that invest a large part of their GDP as well as time in human capital and the accumulation of skills, and have a high level of productivity and solid, trustworthy institutions tend to be richer than other countries.² The essence of economic growth is new ideas and innovations that drive the development of new technology forward. A large population generates more inventions and new ideas and thus, in the long run, the rate of economic growth is proportional to the growth rate of the population.

Robert J Barro also drew the conclusion that economic growth is positively correlated with human capital and furthermore that countries with high rates of human capital also have lower fertility rates.³ Xavier X. Sala-I-Martin did from his comprehensive survey, in which he ran four million regressions, reach the conclusion that several variables were robustly correlated with economic growth and the three fixed variables *initial GDP*, *life expectancy* and *the primary school enrolment rate*, which were present in all regressions.⁴ Several

² The following part is based on Jones, Charles I., Vollrath, Dietrich, (2013), *Introduction to economic growth*, p. 257-58, unless otherwise stated.

³ Barro, Robert J., (1991), p. 437.

⁴ Sala-I-Martin, Xavier X, (1997), p. 8.

variables, for example, *openness*, *investments* and various political variables such as *the rule of law* and *political rights*, were found to be positively correlated with economic growth. Other variables, such as *real exchange rate distortions*, *fraction of primary products in total exports* and political variables as for example *number of revolutions and military coups*, had a significantly negative impact on economic growth.⁵

2.1.2 Convergence

The theory of absolute convergence predicts poorer countries to grow faster than others and that these poorer countries eventually will converge to the GDP-level of other countries. Poorer countries are often situated below their level of “steady state” – the concept of equilibrium – and tend to grow faster than richer countries which in turn often are above their level of “steady state” and therefore tend to show a slower rate of growth. Thereby, the theory of convergence predicts poorer countries to eventually “catch up” with richer countries.⁶

The evidences of the theory of absolute convergence across the whole world have empirically been weak and, in reality, poorer countries have not shown any particular evidence of growing faster than richer countries. The theory explains, on the contrary, fairly well the differences in growth rates between industrialized countries, for example the members of the OECD.

However, the slightly more realistic theory of *conditional* convergence seems to hold better in reality – income per capita in “steady state” differs across the countries in the world and countries that are relatively poor in relation to their *own* “steady state” actually tend to grow faster. A good example of this is the well-known growth miracle of Botswana, in the 1960’s a very poor country below its level of “steady state” which then started a rapid economic growth towards its own steady state and has now developed into an upper-middle income country⁷.

⁵ Sala-I-Martin, Xavier X, (1997), p. 10-12.

⁶ The following part is based on Jones, Charles I, Vollrath, Dietrich, (2013), p. 63, 65-66 and 69, unless otherwise stated.

⁷ “Botswana”, The World Bank

2.2 Natural resources

This section will describe natural resources and economic growth. The positive effects of natural resources will be described as well as problems that may occur in economies rich in natural resources.

2.2.1 The positive effect of natural resources

The extraction of natural resources is not everlasting and the natural resources are thus precious and highly valued. The aggregated demand for, for example, oil and gas is very high since people and the running of factories are greatly dependent on these natural resources. Diamonds are among the most expensive products in the world. The simplest of economic theories applies to natural resources – when the supply of a product is scarce the price increases, making the product precious.

One could thus believe that a country rich in natural resources would possibly be expected to secure a rather stable economic growth and development for many years. Especially diamonds would be expected to have a positive impact on economic growth, due to its extremely high and historically rather stable price.

2.2.2 The Dutch Disease

If a country happens to find natural resources, a relatively rapid and large cash flow into the country is often guaranteed. An intensive extraction of the resources usually takes place, but the country can easily become too dependent on the new source of monetary success. Other parts of the economy often become displaced and remain suppressed, since they are no longer as profitable as before.

When the country starts to exploit its new natural resource and exports it to other countries, the exporting sector of the economy often expands very rapidly in the hope of receiving high profits. The significant cash flow into the country affects the real exchange rate and makes it appreciate. Consequently, this will affect other parts of the economy negatively – a highly valued, or maybe even overvalued, currency often has a negative impact on the economic situation of other sectors of the economy. For example it becomes more difficult to export the

products of these sectors when they are no longer as competitive as before. Countries rich in natural resources often have problems in developing industrial sectors⁸.

Historically, there have been several examples of situations where countries have been plagued by the Dutch Disease. The Economist first coined the term in 1977⁹ when the magazine explained and described the economic situation of the Netherlands as the country in the 1960s discovered large reserves of natural gas in the North Sea. The Netherlands exploited its new sources of gas and an intensive export took place giving the country large revenues. The cash flow into the Netherlands affected the real exchange rate and made it appreciate, which in turn had negative effects on other sectors of the economy. Goods from other sectors now became more difficult to export because they no longer were as competitive as before on the international markets.¹⁰

Since the episode of the Dutch Disease in the Netherlands, there have been many examples of countries with a lot of natural resources which have suffered from the Dutch Disease – for example the UK and Norway have been heavily dependent on their oil and Russia currently exemplifies a more recent example with its dependency on oil and natural gas. The phenomenon of the Dutch Disease is not uncommon among developing countries. Sub-Saharan Africa has not been spared from the disease – to name a few examples, Zambia has suffered from the Dutch Disease with its dependency on the copper production and so has Kenya with its dependency on the production of coffee¹¹.

However, Norway has successfully managed to avoid too much suffering from the Dutch Disease when the country in 1990 established the Government Petroleum Fund – later renamed The Government Pension Fund. The fund seeks to provide a stable long-term development for the country and to use and invest the huge amount of money from the oil production wisely. The revenues from the petrol production contributes to the financing of the rising public pension expenditures and to smoothing out the inequalities across generations making it possible for future generations to also benefit from the profits of the petrol exports.¹²

⁸ Burda, Michael, Wyplosz, Charles, (2013), p. 389.

⁹ "What the Dutch disease is, and why it's bad", *The Economist*, November 5, 2014

¹⁰ Falck, Hans, (2000), p. 2.

¹¹ Falck, (2000), p. 3.

¹² *The Government Pension Fund*, The Government of Norway

2.2.3 The curse of natural resources

One could believe that countries blessed with a lot of natural resources would tend to be richer and economically experience a more rapid growth than other countries. This is a well-discussed question but in the recent years researchers seem to have reached consensus whether this is true or not. Paradoxically, countries rich in natural resources have empirically not experienced sustained economic growth – high resource intensity on the contrary, actually seems to correlate with slow economic growth.¹³ The blessing of the precious natural resources often becomes a curse for economic growth and development. Sachs and Warner argued for example in 2001 that practically every single one of the countries in the world that are highly dependent on their natural resources has stagnated in economic growth since the 1970s.¹⁴

As the phenomenon of the Dutch Disease describes, resource-rich countries have a tendency to become too dependent on their natural resources, something that often affects other sectors of the economy negatively thus diminishing economic growth. These sectors are often crowded out by the sectors of the natural resources.¹⁵ When countries refrain from diversifying the sectors of their economies, the development and economic growth becomes harmed – abundance in natural resources often drive the economies into stagnation.

The curse of natural resources is unfortunately rather common among developing countries – the temptation in receiving high, rapid profits by exploiting natural resources, is huge and often dominates over long run strategic economic decisions. If the political leader of the country happens to be a dictator or rules in an authoritarian way, this temptation may become even stronger – the personal profits of the dictator are thus allowed to become the most important issue for the country. The dictator Joseph-Désiré Mobutu who ruled the Democratic Republic of Congo (DRC) for several decades during the 21st century is a very good example of the problem with corruption and rich natural resources.

¹³ Sachs, Jeffery D., Warner, Andrew M., (2001), p. 828.

¹⁴ Sachs, Jeffery D., Warner, Andrew M., (2001), p. 837.

¹⁵ Sachs, Jeffery D., Warner, Andrew M., (2001), p. 833.

3. Earlier research

This section will present earlier studies of the problem with the low economic growth and development of Sub-Saharan Africa in general and furthermore, research on natural resources and economic growth will be presented.

Several researchers have tried to solve the mystery of Sub-Saharan Africa's falling behind. Well-known negative factors for development such as high levels of corruption, macroeconomic mismanagement and bad politicians – for example the earlier mentioned President Joseph-Désiré Mobutu in the Democratic Republic of Congo (then Zaire) and President Robert Mugabe in Zimbabwe who both have looted and destroyed their countries – give an explanation to parts of the failing of the region. Other traditional factors, for example the colonial history and the co-operation problem between different tribes, have also empirically contributed to the rather depressing situation in the region. In 1997 Jeffery D. Sachs and Andrew M. Warner argued that poor economic policies, such as the lack of openness to international markets as well as landlockedness and high natural resource dependence have played important roles for the current situation.¹⁶

Furthermore, Sachs and Warner do mention that the poor policies and institutions in the countries of Sub-Saharan Africa can explain the slow economic growth in the region.¹⁷ Roel van der Veen, professor of history at the University of Amsterdam who additionally works at the Ministry of Foreign Affairs in the Netherlands, also supports this conclusion and states that internal factors of the region have obstructed the development. Van der Veen argues that the weak institutions and the failing of the state as a source of societal stability, can explain why Sub-Saharan Africa has not experienced stable long-term economic growth and development. The old African traditions and political and economic rules highly influenced the state and made it work less effectively. This, in combination with the institutional heritage from the colonial era caused the decay of the Sub-Saharan African states, a decay that, since the years of independence, have affected the societies and created a highly unstable region.¹⁸

When it comes to natural resources, Van der Veen states that the most important obstacle for the development of the resource-rich countries of Sub-Saharan Africa is the lack of

¹⁶ Sachs, Jeffery D., Warner, Andrew M., (1997), p. 359.

¹⁷ Sachs, Jeffery D., Warner, Andrew M., (1997), p. 336.

¹⁸ Veen, Roel van der, (2004), p. 428.

interest and incentive among the political elites. He argues that some of the states, for example the oil-rich Nigeria, may become “successful failed states” – states that fail to develop the country, but the failing occurs in a successful way, id est. without problem for the political elite.¹⁹

In 2001, Sachs and Warner claimed “the curse of natural resources” to be a reasonably solid fact and that almost all of the natural resource dependent countries in the world have stagnated economically since the 1970s. They further argue that countries, which are very dependent on their natural resources, often tend to have rather high price levels, which in turn affect their exporting sectors negatively because it then becomes more difficult for these countries to export their products. Unfortunately, these countries thereby never fully develop high export-led growth.²⁰

Several countries in Sub-Saharan Africa have empirically experienced forms of the earlier described Dutch Disease. Hans Falck at the University of Lund, mentions Zambia with its production of copper and Kenya’s dependency on the coffee-production. Furthermore, Falck has also evaluated the possibility whether or not Mozambique has suffered from a Dutch Disease due to the large inflow of foreign aid, which has affected prices in the country and the exchange rate and made it appreciate. Hans Falck’s analysis gives a mixed result but he concludes that the foreign aid to Mozambique has to some extent increased the risk for the Dutch Disease in the country.²¹

The development economist Ola Olsson at the University of Gothenburg has analysed the diamond industry in Sub-Saharan Africa and, in more detail studied “conflict diamonds”. Olsson argues that diamonds are the ideal reward for rebels during conflicts and civil wars – they are precious and extremely highly valued, small and thus easy to smuggle and furthermore, they can easily be converted into money or weapons.²² Diamonds are not only precious and highly valued, they have other advantages too – the price of diamonds has been stable at a very high level for many years, mostly because the company DeBeers has dominated the market for diamonds.²³

Despite all research on Sub-Saharan Africa’s arduous development and its rich natural resources, a fully satisfying and truly adequate explanation of the reasons for the stagnation

¹⁹ Veen, Roel van der, (2004), p. 12.

²⁰ Sachs, Jeffery D., Warner, Andrew M., (2001), p. 837.

²¹ Falck, Hans, (2000), p. 39.

²² Olsson, Ola, (2007), p. 268.

²³ Olsson, Ola, (2007), p. 278.

of Sub-Saharan Africa is still to be found, disagreements on its causes need to be worked on and solutions to its problems sought.

According to the theories of the curse of natural resources and the Dutch Disease, natural resources can damage the future development and economic growth of the countries and force them into stagnation. Earlier research during the years has often focused on the negative impact of natural resources on economic growth and whether a negative relationship between these two variables exists or not and, furthermore, also on the causes of the possible negative impact of the natural resources.

In the hope of contributing to the field of natural resources and economic growth in Sub-Saharan Africa, this thesis aims at analysing whether *all* natural resources are actually negative for the economic growth of a country or whether there are differences among the impacts of the natural resources. Furthermore, the question whether there are perhaps some resources, which do not have quite as negative effects as others, will be discussed. An attempt is made to analyse the impact of natural resources on economic growth covering a more recent time period than earlier researchers have done, for example the very important economists in this field, Jeffery D Sachs and Andrew M Warner during the 1990s and early 2000s.

The hypothesis is that the production of diamonds due, for example, to its relatively high price stability compared to prices of other natural resources, has a greater and more positive impact on economic growth of the countries in Sub-Saharan Africa than the rest of the natural resources dealt with in this thesis.

4. Diamond production

The following section will present some background information on the diamond production in Sub-Saharan Africa.

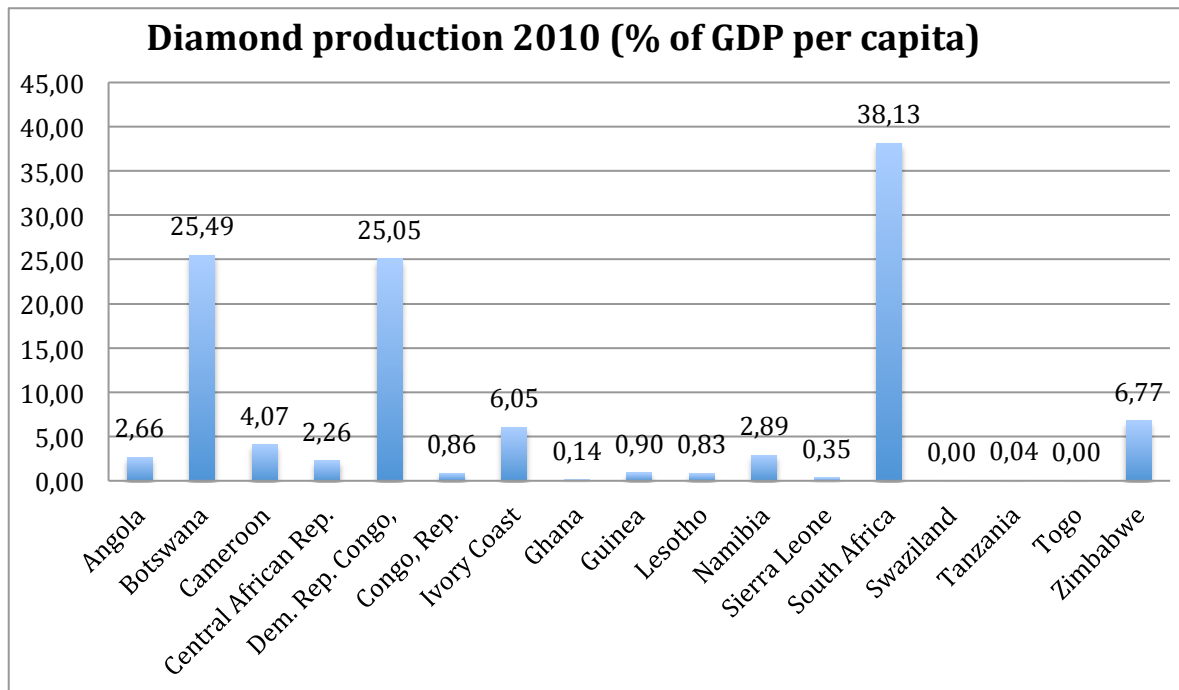


Figure 2. Diamond production in percentage of the countries' GDP per capita, measured in 2005 international dollar per person. Data collected from the British Geological Survey, Statista and the World Bank.

Figure 2 above presents the diamond production in 2010 in percentage of the countries' GDP per capita, which is measured in international dollar. As can be seen from the figure, there were three large producers of diamonds in Sub-Saharan Africa in 2010. South Africa had the largest diamond production relative to its GDP per capita (38,13 per cent), followed by Botswana (25,49 per cent) and the Democratic Republic of Congo (25,05 per cent). The rest of the countries had a production of around 0-6 per cent of their GDP per capita.

4.1 Diamond producing countries in Sub-Saharan Africa

Figure 3. below illustrates the development of GDP per capita of the diamond producing countries in Sub-Saharan Africa.

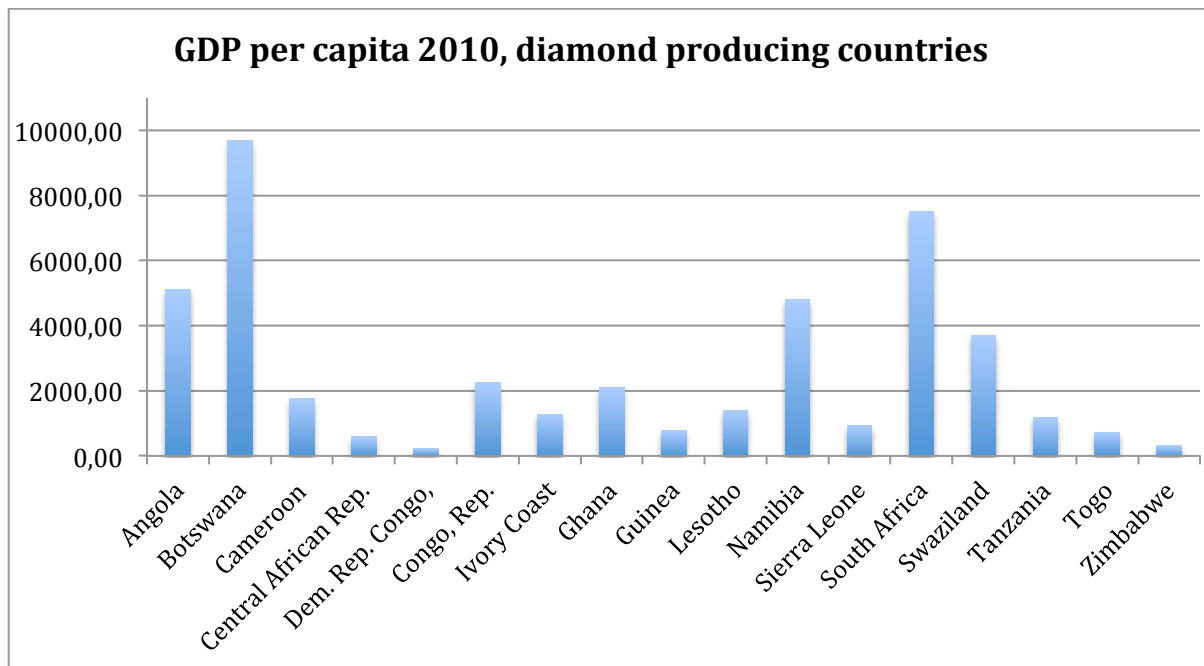


Figure 3. GDP per capita 2010, diamond producing countries in Sub-Saharan Africa, measured in 2005 international dollar per person.

Botswana has a noteworthy higher level of GDP per capita than the other diamond producing countries in Sub-Saharan Africa. South Africa has the second highest GDP per capita and is a more diversified economy. Angola, which has the third highest level of GDP per capita, is a large exporter of oil but the country's GDP per capita is still only around half of Botswana's level. For many years Angola has shown signs of the curse of natural resources²⁴ and the country's development and level of GDP per capita has thus not increased as it potentially could have done.

Several of the diamond producing countries in Sub-Saharan Africa have experienced some rather chaotic years – the civil war in Sierra Leone, total chaos in the Democratic Republic of Congo and the problematic situation in Zimbabwe, to only name a few. Even though several of these countries have diversified their economies to a greater extent than Botswana, Botswana still has the highest level of GDP per capita and due to its, in this region, rather unusual political policies, the population has come to benefit relatively more from the wealth of the country.

Furthermore, when evaluating the production of diamonds, the highly problematic “blood diamonds” or conflict diamonds need particular attention. Conflict diamonds have empirically played an important role in several wars and conflicts in Sub-Saharan Africa.

²⁴ See for example: Hammond, John L., (2011), *The Resource Curse and Oil Revenues in Angola and Venezuela*

Sierra Leone, Liberia and the Democratic Republic of Congo have all experienced the problem with conflict diamonds when warlords and rebel groups have fought over the extremely precious and easy-smuggled diamonds.²⁵ This does not only result in high civil and societal uncertainty – where child soldiers often have been used and exploited in the bloody process – but also in lowered GDP and loss of revenues, in terms of for example foregone taxes, for the government.

To prevent the business with “conflict diamonds” and to secure that diamonds are not being sold on the international markets and thereby are financing rebel groups, the Kimberley Process was established in 2000 in Kimberley, South Africa. With its 54 participants, the Kimberley Process aims at controlling the rough diamond production and trade by the establishment of the Kimberley Process Certification Scheme (KPSC).²⁶ The development economist Ola Olsson though argues that “conflict diamonds” from Angola, Democratic Republic of Congo, Liberia and Sierra Leone have been transported to neighbouring countries like Central African Republic, Republic of the Congo and Uganda, which are not under sanctions. The “conflict diamonds” have then been exported to countries including Belgium and Netherlands and thus entered the international markets.²⁷ The sanctions and the Kimberley Process are thereby in some way being undermined.

5. Empirical model

This section will describe the regression analyses and the econometrical model. The regression models, which this thesis are based on, were performed in the econometric programme EViews. Panel data regressions on the dependent variable *economic growth* were performed. These models are more complex than other regression models because they combine cross-sectional data and time series data.²⁸ In such regressions, a number of countries can be followed during many years and differences both among the countries and within the single countries can be detected.

The panel regression on the dependent variable *economic growth (Y)* was estimated in EViews as follows:

²⁵ Olsson, Ola, (2007), p. 268.

²⁶ *The Kimberley Process*

²⁷ Olsson, Ola, (2007), p. 279.

²⁸ Dougherty, Christopher, (2011), p. 514

$$\begin{aligned}
Y_{it} = & \alpha_{it} + \beta_1 * diamonds_{it} + \beta_2 * oil rents_{it} + \beta_3 * gas rents_{it} + \beta_4 * coal rents_{it} + \beta_5 \\
& * forest rents_{it} + \beta_6 * mineral rents_{it} + \beta_7 * investments_{it} + \beta_8 \\
& * average years of education_{it} + \beta_9 * dummy for political variable_{it} + \varepsilon_{it}
\end{aligned}
\tag{1}$$

where:

Y_{it} : the dependent variable *economic growth*, where i = country and t = time

α_{it} : the intercept of the dependent variable *economic growth*

β : the coefficients for the independent variables

ε_{it} : the error term

5.1 Presentation of the variables

The regression model consists of data from 42 Sub-Saharan African countries during the time period of 1990-2010. In order to correctly analyse economic growth, which is a long-term phenomenon, time periods of 50-100 years are desirable, but this thesis will focus on the development of the Sub-Saharan African countries during the second half of their independence.

The four countries Somalia, South Sudan, Seychelles and Sao Tomé and Príncipe were excluded from the analysis due to the absence of data. During the time period in question, Somalia has experienced a period of total statelessness and chaos and South Sudan declared its independence as late as in 2011. Sao Tomé and Príncipe and Seychelles were not included due to the lack of political data. It can also be argued that these two island states do not represent the region correctly when estimating natural resources and that it thereby is acceptable to exclude them from the analysis.

All variables were divided into periods of five years. The dependent variable *economic growth* was then calculated as a yearly average growth rate of these periods of five years. All of the other variables were calculated as averages of the five-year periods, except the political variables *Polity* and *Xrreg*, which, as will be described later, had to be transformed to dummy variables.

5.1.1 Economic growth

The dependent variable *economic growth* was calculated as the average yearly growth rate of five year-periods in GDP per capita of the countries, which in turn was collected from Penn World Tables 7.1. By dividing the observations of the growth in GDP per capita in periods of five years, the effect of temporary shocks will be avoided and can thus not affect the long-term development very much.

5.1.2 Natural resources

The data over the natural resources in Sub-Saharan Africa was collected from the databank of the World Bank.

The variables oil rents, natural gas rents, coal rents, mineral rents and forest rents were calculated by The World Bank as the difference between the value of the production at world market prices and total costs of production.²⁹ The group of minerals contain tin, gold, zinc, iron, copper, lead, nickel, silver, phosphate and bauxite³⁰. The variable of the production of coal does both include hard and soft coal. Furthermore, the World Bank defines the forest rents as “roundwood harvest times the product of average prices and a region-specific rental rate”³¹.

According to the theory of the curse of natural resources and the Dutch Disease, natural resources are expected to have a negative impact on the dependent variable economic growth.

5.1.3 Diamonds

The production of diamonds is not included among the natural resources in the databank from the World Bank. The production of diamonds thereby had to be calculated as the countries’ total production of diamonds, measured in carat, times the world market price for diamonds in carat each year during the time period. The diamond production in carat was collected from the British Geological Survey and the world market price for diamonds in carat from

²⁹ See for example: “Oil rents (% of GDP)”, *The World Bank*, <http://data.worldbank.org/indicator/NY.GDP.PETR.RT.ZS>

³⁰ “Mineral rents (% of GDP)”, *The World Bank*, <http://data.worldbank.org/indicator/NY.GDP.MINR.RT.ZS>

³¹ “Forest rents (% of GDO)”, *The World Bank*: <http://data.worldbank.org/indicator/NY.GDP.FRST.RT.ZS>

Statista. However, the world market price for diamonds was only observed for the years 1990, 2000 and 2010 – as a consequence, weighted averages ranging from 1985-1995, 1995-2005 and 2005-2010 had to be calculated, where the first group was assigned the value for year 1990 and so on. A procedure like this is perhaps not optimal, but the risk of bias should nevertheless be quite small when using weighted averages.

The diamond production in terms of percentage of GDP was calculated by dividing the diamond production by GDP for all of the diamond producing countries. Diamonds are, as mentioned earlier, expected to have a positive impact on economic growth.

The production costs of the diamond industry were very difficult to collect due to the non-existence of data. The production costs do probably vary to some extent among the countries in the sample – they have for example different geographical conditions – but because of the absence of data these differences were difficult to take into account. If production costs would have been estimated, say for example 20 per cent of the total production value, it would have to be assumed to apply for all of the diamond producing countries. This would in turn not change the outcome of the regression model – if the production were to decrease by the same amount for all countries, the outcome would still be the same. The production costs were thus not included and assumed to be zero. However, this is not realistic but since it would not affect the outcome, this absence of production costs was acceptable.

An important remark about the measuring process of diamonds is necessary to be highlighted here. The value of diamonds often increases the more carats a diamond possesses, the development of the value of diamonds are not exactly linear – a three carat diamond is often worth more than three times a one carat diamond. This was extremely difficult to take into account when measuring the diamond production of the countries in Sub-Saharan Africa, because the data from the British Geological Survey was measured in *total* production of diamonds in carat. Consequently, measurement error may have occurred in this variable, but since this applies to all diamond producing countries, this bias should not be too problematic.

5.1.4 Political variables

Politics and leadership can have a remarkable impact on a country's economic situation and the extraction of natural resources. Botswana and the Democratic Republic of Congo illustrate this issue very well. During quite a number of decades, Botswana has been seen as the country of success and the “growth miracle” of Sub-Saharan Africa. By combining rich sources of diamonds with good and stable governance, Botswana has developed extremely

well in comparison to other countries in the region. The Democratic Republic of Congo can be viewed as a totally failed state – the country is very fortunate with incredibly rich natural resources, but extremely high levels of corruption and political and economic mismanagement have destroyed the country.

However, political variables are of great importance for the regression on economic growth. The variable *polity*, collected from the Polity IV Project, gives an indication of a country's political situation. A polity-score of +10 means that the country is “strongly democratic” and a score of -10, on the other hand, indicates that the country is strongly autocratic.³²

Another important political component is how chief executives are chosen in the countries. Several Sub-Saharan African countries have a history of undemocratic, unfair and often violent elections or changes of political leaders. The variable *Xrreg* from the above mentioned Polity IV Project measures the transferring of executive powers in the countries³³.

The scale of the variable *Xrreg* ranges from 1 to 3, where 1 indicates an unregulated political transition in which the power has been seized by force and may thereafter become legitimized by for example a non-competitive election. A country can get a score of 2 if the next political leader is chosen within the political elite of the country, in for example one-party systems or a manipulated multiparty election. If the next political leader or chief executive is chosen by competitive elections, the country will be assigned a score of 3.³⁴

In the event of a political crisis, for example the civil war in Sierra Leone or the second Congo War, the countries will get a negative score, outside of the scale in the variables *Polity* and *Xrreg*, to mark the problematic political situation. When the observations are divided into periods of five years and averages are calculated, some of the countries will get negative scores outside of the scale (+10 to -10 for *Polity* and 1 to 3 for *Xrreg*) and this will just indicate nonsense for the regression analysis and any confident conclusions cannot be made. To get a correct interpretation of the regression analysis, the two variables *Polity* and *Xrreg* therefore had to be coded as dummy variables, where 0 indicates a “normal” political situation (a score within the scale) and 1 indicates some kind of political crisis (a score outside of the scale).

Political crises and societal instability are expected to prevent economic growth and development. The dummy variable for *Polity* and *Xrreg* are thus expected to have a negative impact on economic growth.

³² Polity IV Project, p. 16-17.

³³ Polity IV Project, p. 20.

³⁴ Polity IV Project, p. 21.

However, it should be noted that the relationship between democracy and economic growth is rather vague³⁵ and on the contrary authoritarian states actually often experience rapid economic growth. Dictators are often free to rule their countries almost by themselves (or sometimes by a little the help from their closely associated elite) and consequently they can directly make all important decisions about for example the extraction and export of the natural resources in their countries. This undemocratic way of ruling a country can be very effective in the process of decision-making and, as a consequence, there will be an easier rapid economic growth in these countries at an earlier stage.

5.1.5 Other variables

Other variables, such as the level of education in the country and the investments share to GDP, are also rather important for the analysis of natural resources' impact on development and economic growth. These variables are expected to promote economic growth and thus have a positive influence in the regression analysis.

As an estimate of the level of education in the countries, the average years of education calculated by Robert J. Barro and Jong-Wha Lee has been used.³⁶ Due to the absence of observations on education levels in some of the countries³⁷, these observations were assigned the value 0. Averages of the other countries' level of education could have been used, but this would probably not have created a realistic and representable estimation – even though the countries in the sample are located on the same continent and are similar in many ways, there are many important differences across the countries in Sub-Saharan Africa. The countries do not, for example, share the same political and economic systems and they have different history and colonial heritage. It would not be reasonable to assume that the level of education has been exactly the same in for example Ethiopia, Mali, Mozambique and South Africa.

The investment's share of GDP is also essential for the analysis – if investments would not be included, then a country's diamond production would perhaps demonstrate too strong an impact on the economic growth of the country. It is highly likely for example, that the country has invested in better infrastructure but also directly in the diamond sector. If investment shares to GDP are excluded from the analysis, some “hidden” investments will

³⁵ Sachs, Jeffery D., Warner, Andrew M., (2001), p. 836.

³⁶ Barro, Robert J., Jong-Wha, Lee, (2010),

³⁷ Countries without educational level: Angola, Burkina Faso, Cabo Verde, Chad, Comoros, Eritrea, Ethiopia, Guinea, Guinea-Bissau, Nigeria,

not get enough attention. The data on the countries' investment shares to GDP used in the regression analysis was collected from Penn World Tables.

The economists Charles I. Jones and Dietrich Vollrath argue that countries that have high investment rates and invest a lot in the educational system tend to be richer in the long run³⁸. They also argue that the development of new technology is the driving force behind economic growth.³⁹ Several countries in Sub-Saharan Africa do not create new technology by themselves, but do rather absorb the ideas and inventions created by the countries of the “technological frontier”, which possesses more advanced technology. Since the progress of the level of technology in the world is seen as “the engine of growth”⁴⁰ it is very important for less developed countries to absorb as much as possible of this level of technology. The higher the level of education in the country, the easier it is to take advantage of the new inventions and ideas⁴¹.

The educational system is also connected to political trustworthiness – the first contact and relationship children get to the state and politics is in school. If the children of a country feel that they are invested in from the beginning of their lives, it is highly likely that they will create a better and more positive relationship to the state and its politicians. This in turn is important for the future development of the country, if the children believe in the state and society they are possibly more eager to contribute and to work for the development of the country.

Furthermore, the population growths of the countries, which still tend to be rather high in the countries of Sub-Saharan Africa, are included in the average growth rate of GDP per capita.

6. Result

With panel data, there are three opportunities to estimate the regression model – it can be estimated with the OLS-models as a simple pooled regression or as a regression with fixed or random effects. The regression model with fixed effects will here control for unobserved effects within the group of countries in Sub-Saharan Africa. The model with random effects

³⁸ Jones, Charles I., Vollrath, Dietrich, (2013), p. 57.

³⁹ Jones, Charles I., Vollrath, Dietrich, (2013), p. 135.

⁴⁰ Jones, Charles I., Vollrath, Dietrich, (2013), p. 135.

⁴¹ Jones, Charles I., Vollrath, Dietrich, (2013), p. 143.

assumes that the unobserved effects are random terms and uncorrelated with the independent variables.⁴²

In deciding which regression model to choose the Hausman test was performed. The Hausman test indicated that the most efficient model to use was the OLS model with fixed effects. The analysis is thereby based on the regression model with fixed effects.

The data was assumed to follow a normal distribution and the regressions were tested for autocorrelation and heteroskedasticity and no worrying signs of neither of these phenomena in the material were found.

Due to the fact that the political crises affected both of the political variables *Polity* and *Xrreg*, the dummy variables for these two variables were affected in similar ways, which resulted in a situation where the political dummies were highly correlated (see appendix A4). One of the dummies thereby had to be excluded to achieve a correct estimation.

Table 1. Regression result, dependent variable *economic growth*:

Variable	Diamonds	Regression <i>Polity</i>	Regression <i>Xrreg</i>
C	-0.015 (-1.237) [0.218]	-0.029 (-1.619) [0.108]	0.032 (-1.776) [0.078]
Diamonds	0.008 (2.361) [0.020]	0.007 (1.943) [0.054]*	0.008 (2.249) [0.026]**
Oil		0.000 (0.377) [0.707]	0.000 (0.422) [0.674]
Gas		0.004 (0.906) [0.367]	0.004 (0.845) [0.400]
Coal		0.002 (0.101) [0.920]	0.001 (0.079) [0.937]

⁴² See for example: Dougherty, Christopher, (2011), chapter 14

Forest		0.002 (1.355) [0.178]	0.002 (1.311) [0.193]
Mineral		0.002 (1.352) [0.179]	0.002 (1.386) [0.169]
Investment	0.000 (0,903) [0.368]	0.000 (0.334) [0.739]	0.000 (0.316) [0.753]
Education		0.000 (0.207) [0.837]	0.000 (0.209) [0.835]
Dummy <i>Polity</i>		-0.004 (-0.202) [0.840]	
Dummy <i>Xrreg</i>			0.016 (0.907) [0.367]
Durbin-Watson stat	2.760	2.756	2.696
R-square	0.263	0.294	0.298
Number of observations	168	168	168

Table 1. Dependent variable: economic growth. Estimated with the OLS-method. The first row in the columns represent the coefficient for every independent variable. The numbers in parentheses shows the t-statistics for the variables and the numbers in brackets are the p-values of the variables. The asterisks indicate if a coefficient is statistically significant. A coefficient with * is significant at the 10 per cent-level and a coefficient marked with ** is significant at the 5 per cent-level.

Table 1 above illustrates the output from the regression models with fixed effects. The second column shows the result from the regression with only diamonds included, the third column shows the results from the regression with the dummy for *Polity* and in the fourth column the regression with the dummy for *Xrreg* is represented.

As can be seen from the table above, the production of diamonds has, as expected, a statistically significant positive effect on economic growth – especially in the regression with

the dummy for *Xrreg* included where it is significant at the 5 per cent-level – in the 42 Sub-Saharan African countries analysed in this sample. The production of diamonds thus promotes economic growth in these countries.

Some of the other variables in the regression models, for example gas, forest and minerals have positive values but neither of these coefficients are statistically significant and any conclusions can thereby not be made.

The Durbin-Watson *d* statistic is close to 2 in the regressions, indicating that the risk for autocorrelation in the material is very small because there are no signs of autocorrelation if the Durbin-Watson *d* statistic is close to 2. If it is greater than 2, there may be signs of negative autocorrelation in the material.⁴³ The Durbin-Watson *d* statistics in the two regressions lies little above, but rather close to 2, and the risk for negative autocorrelation is thereby negligible.

The R-square is around 0,3 in the regressions, indicating that the variance in the dependent variable economic growth can be explained up to 30% by the models. In trying to improve the goodness of fit, the independent variables were combined in several ways but the goodness of fit did not increase in any noticeable way.

7. Analysis

The panel regression analysis performed shows that the production of diamonds has had a positive impact on economic growth during the observed time period in the countries of Sub-Saharan Africa.

One possible explanation for the positive impact of diamonds on economic growth is that the world market price for diamonds is more stable over time and does not fluctuate as much as the price of other natural resources, for example oil. The production of diamonds is not particularly exposed to booms and busts. Economies with sources of diamonds are thus not as vulnerable as for example oil producing countries, and compared to other countries, they can to a greater extent count on good returns almost every year.

Nevertheless, it is possible that these economies will get harder hit than other countries during difficult years or in periods of recessions – diamonds are luxury goods but these goods are not the most necessary ones and the demand for such goods has thereby a tendency to

⁴³ Dougherty, Christopher, (2011), p. 436.

decrease during hard times. The demand for other natural resources such as oil and gas are more stable during the conjunctions, the industries and the people of the world are still very dependent on petrol and gas, which implies that these natural resources are not as vulnerable as the production of luxury goods.

This indicates that countries that are heavily dependent on diamonds may receive slightly lower returns during bad years. The global financial crisis in 2008 illustrated this situation rather well when the demand for luxury goods such as diamonds decreased rapidly. If the diamond producing countries have not managed to diversify their economies in time, the consequences during and in the aftermath of economically difficult years can be rather strong for the diamond firms, as well as for the people and the whole society.

A rather surprising result about the panel regressions performed which should be noted, is that none of the other natural resources actually does affect economic growth in a negative way. It is possible that two opposite effects in the sample may have reduced each other and thereby caused the non-significance. This indicates thereby that there are no signs of evidence for the theory of the curse of natural resources in this sample of Sub-Saharan African countries during this time period from 1990 to 2010. But no significant conclusions can be made because none of the coefficients of these natural resources' impact are statistically significant, except, as mentioned earlier, for the coefficient of the production of diamonds.

Another unexpected result is that the variables *investment* and the dummy for *Polity* were not significant. Investments have empirically often been significantly positively correlated with economic growth and as Jones and Vollrath concludes, countries that have high investments rates actually do tend to grow faster than others, indicating that investments should promote economic growth.

The non-significance of the dummy for *Polity* is also rather unexpected because this dummy measures political instability and crises in the countries, which would have a negative impact on economic growth.

8. An example: Botswana – the success story

Botswana is one of the rather few countries in the world which has managed to combine rich natural resources with good, stable macroeconomic policy, democracy and good governance. Even though the population is relatively small compared to other countries in Sub-Saharan

Africa and large parts of the country is situated in the Kalahari Desert, Botswana has shown a remarkably good economic growth and development during many decades since its independence from Great Britain in 1966. There are not many other countries in the world that can compete with the remarkably high average growth rate of Botswana of 9 per cent a year, from 1970-2010. A transformation has taken place in Botswana changing it from being one of the poorest countries in the world to an upper-middle income country⁴⁴.

The world market price of diamonds has increased dramatically since the 1960's⁴⁵, which has benefited Botswana's exporting sector. Roel van der Veen, professor of history at the University of Amsterdam who also works at the Ministry of Foreign Affairs in the Netherlands, argues that Botswana used its money from the diamond production very wisely – the government conducted a careful economic policy, the macroeconomic stability being of absolutely highest priority. The country's export exceeded its imports and the revenues of the government exceeded the expenditures almost every year. As a consequence, Botswana had the possibility to save and build up its financial reserves and the country has become almost debt free.⁴⁶

Roel van der Veen believes that the explanation to Botswana's success lies in how the government rules the country and thus in the politics. The country has been stable and democratic during many years and has tolerated a free and open political debate. Even if the same political party has ruled the country during many years, the presidents have resigned peacefully and the common goal has always been to develop the country.⁴⁷

Furthermore, van der Veen highlights other factors which have contributed to the success of Botswana, such as the existence of a higher degree of ethnical homogeneity and a greater black middle-class compared to other Sub-Saharan African countries. Another important factor is the good relationship to Great Britain, the former colonial power which Botswana over the years has not been afraid of consulting for foreign expertise and advice.⁴⁸

To summarize, Botswana has become the role model and the success story of Sub-Saharan Africa by the implementation of good, stable and long-term thinking on economic and political policies that have allowed for maximizing the profits from the rich diamond production, thus in turn generating a stable positive economic growth during several decades.

⁴⁴ Kojo, Naoko C., (2010), p. 3.

⁴⁵ *Per carat diamond price from 1960 to 2014 (in U.S. dollars)*, Statista

⁴⁶ Veen, Roel van der, (2004), p. 145.

⁴⁷ Veen, Roel van der, (2004), p. 146.

⁴⁸ Veen, Roel van der, (2004), p. 146.

Even though Botswana has experienced such extraordinary development and economic growth during the past decades, some concern about the future has arisen and needs to be noted here. The country is heavily dependent on its production of diamonds but, as with all natural resources, the future production and revenues are very uncertain. If Botswana does not find new diamond reserves the diamond sources are expected to be exhausted already in the 2020s⁴⁹, only 10-15 years from now. This will of course affect the economic situation in Botswana if political and economic actions are not undertaken. Therefore, fiscal policy has become extremely important and been put high up on the political agenda of the country in order to prevent Botswana from suffering from the problematic Dutch Disease and the curse of natural resources. The senior economist at the World Bank Group, Naoko C Kojo, argues that the fiscal policy of the country needs to be adjusted by, for example, the implementation of stronger revenue collection and greater tax enforcement.⁵⁰

The government of Botswana has actually tried to diversify the economy and invested in other sectors as agriculture, manufacturing and constructing. But these sectors have had a difficult development – Kojo mentions constraints as high labour costs, a small domestic market and the shortage of skills within the country.⁵¹

Botswana has already experienced some of what may come in the future, if no actions are taken. During the global financial crisis in 2008 the worldwide demand for luxury goods such as diamonds decreased sharply and the economy of Botswana was hardly hit. Four of the mines of the enormous diamond company, Debswana, in Botswana were forced to close temporarily in late 2008, since the export of diamonds had fallen to practically zero. The revenues from the mining sector declined at the same time as the government's public spending increased, making the economic situation of the country difficult. The country could no longer count on the high revenues from the diamond production, which the country had done for the last 50 years or so.

In 2009 the economic prospects of Botswana brightened somewhat and the diamond mines re-opened. The demand for diamonds increased and so did the world market price of diamonds, but Botswana's diamond production of 2009/2010 was still lower than before and eventually summed up to only around half of the normal production.⁵²

⁴⁹ Kojo, Naoko C., (2010), p. 3.

⁵⁰ Kojo, Naoko C., (2010), p. 27.

⁵¹ Kojo, Naoko C., (2010), p. 5.

⁵² Kojo, Naoko C., (2010), p. 11.

Another fear of concern is the current situation in the advanced economies of the world. These countries drive a large part of the demand for luxury goods such as for example diamonds, but were severely hit by the recent global financial crisis in 2008. The recovery from the suffering of the crisis is still going on and consequences of the crisis can be seen among many of the advanced economies in the world – for example, the rates of unemployment are still extremely high. The slow recovery of these economies is seriously affecting the economic situation of Botswana. In combination with the predicted exhaustion of the diamond production, the future of Botswana is highly uncertain.

9. Conclusion

The aim of this thesis has been to analyse the impact of several natural resources on economic growth in 42 Sub-Saharan African countries during 20 years, from 1990 to 2010. Sub-Saharan Africa is a region full of potential but has fallen far behind the developed countries of the world. The region still hosts some of the absolutely poorest countries in the world. The theories of the curse of natural resources and the Dutch Disease can explain why resource rich countries tend to show slower growth rates than others. Some evidence of these two theories can be traced in some Sub-Saharan African countries, for example the heavily diamond-dependent Botswana during and after the global financial crisis in 2008.

Panel data regressions which combined different variables such as several natural resources, investments, educational level, as well as political variables, were performed. The analysis concluded that the production of diamonds had the highest effect on economic growth. Moreover, this was also a statistically significant effect.

Furthermore, a discussion regarding future decision making in economic policy questions have been presented. If in the future a Sub-Saharan African country happens to find new natural resources, for example diamonds and oil, and is in the decision making process whether to invest in either one of them, this thesis indicates that the country ought to make it a priority to invest in the production of diamonds. Diamonds have a high and over time stable price on the world market and thereby a significantly positive effect on a country's economic growth and development.

Future research in the field of the relationship between natural resources and economic growth are necessary. A lot of earlier research has focused on the negative effects of natural resources on economic growth and development and problematic consequences such as the crowding out of non-natural resource sectors. Future research ought to be concentrated on the extraction of natural resources combined with broad investments in different sectors of the economy as well as in human capital. This should also be in accordance with good, stable macroeconomic, political and environmental policy.

In future research regarding the impact of the production of diamonds on economic growth and development, it would be desirable to get the opportunity to more accurately calculate the exact quantity and total profits of diamond production. A way of calculating that takes the value of different carats into account would be desirable in order to estimate the effect of diamonds to economic growth exactly.

The economic situation of Botswana, the role model and story of success of Sub-Saharan Africa, has been discussed. However, Botswana needs to continue its economic policy with a high priority on macroeconomic stability. The country ought to maintain its democratic development with a free and open political debate, diversify its economy and continue implementing fiscal policy changes. The situation of Botswana could otherwise be problematic in the future as the diamond resources are expected to be exhausted in 10-15 years.

Diamonds are a country's best friends – but not forever!

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Appendix

A1. List of countries:

Angola	Liberia
Benin	Malawi
Botswana	Mali
Burkina Faso	Mauritania
Burundi	Mauritius
Cabo Verde	Mozambique
Cameroon	Namibia
Central African Republic	Niger
Chad	Nigeria
Comoros	Rwanda
Democratic Republic of Congo	Sao Tome and Principe
Republic of Congo	Senegal
Eritrea	Seychelles
Ethiopia	Sierra Leone
Gabon	South Africa
The Gambia	Sudan
Ghana	Swaziland
Guinea	Tanzania
Guinea-Bissau	Togo
Ivory Coast	Uganda
Kenya	Zambia
Lesotho	Zimbabwe

A2. List of variables:

Variable	Definition	Period	Source
Average growth rate of five years	Calculated as yearly average growth rates of five years from Penn World Table 7.1:s “PPP Converted GDP Per Capita (Chain Series), at 2005 constant prices”.	1990-2010	Penn World Table 7.1
Total natural resources (% of GDP)	The sum of oil rents, natural gas rents, coal rents (hard and soft), mineral rents, and forest rents.	1990-2010	The World Bank
Oil rents (% of GDP)	The value of crude oil production at world prices and total costs of production	1990-2010	The World Bank
Gas rents (% of GDP)	The difference between the value of natural gas production at world prices and total costs of production	1990-2010	The World Bank
Coal rents (% of GDP)	The difference between the value of both hard and soft coal production at world prices and their total costs of production	1990-2010	The World Bank
Forests rents (% of GDP)	Roundwood harvest times the product of average prices and a region-specific rental rate.	1990-2010	The World Bank
Mineral rents (& of GDP)	The difference between the value of production for a stock of minerals at world prices and their total costs of production. Minerals included in the calculation are tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate.	1990-2010	The World Bank
Diamond production (% of GDP)	See point 3 below.	1990-2010	BGS, Statista,
Investments (share of GDP)	Investment Share of PPP Converted GDP Per Capita at 2005 constant prices [rgdpl]	1990-2010	Penn World Table 7.1

Average years of schooling	Average Years of Total Schooling	1990-2010	Barro, Lee
Polity	The POLITY score is computed by subtracting the AUTOC score from the DEMOC score; the resulting unified polity scale ranges from +10 (strongly democratic) to 310 (strongly autocratic).	1990-2010	The Polity IV Project
Xrreg	Regulation of Chief Executive Recruitment. Regulation refers to the extent to which a polity has institutionalized procedures for transferring executive power. Three categories are used to differentiate the extent of institutionalization: 1. Unregulated, 2. Designational/Transitional and 3. Regulated	1990-2010	The Polity IV Project

A3. Equation for the constructed variable “diamond production (% of GDP)”:

$$\begin{aligned}
 & \text{diamond production} = \\
 & \text{yearly total production of diamonds in carat} \times \text{yearly world market price in carat}
 \end{aligned}
 \tag{2}$$

$$\text{diamond production/GDP}
 \tag{3}$$

A4. Correlogram

Correlation	DIAMONDS	OIL	GAS	COAL	FORESTS	MINERAL	INVEST- MENTS	EDU- CATION	DUMMY POLITY	DUMMY XRREG
DIAMONDS	1.000	-0.045	-0.054	0.013	0.065	0.072	0.194	0.021	0.219	0.219
OIL		1.000	0.114	-0.072	-0.191	-0.082	0.081	-0.035	-0.023	-0.023
GAS			1.000	0.168	-0.090	-0.056	-0.085	-0.019	0.020	0.020
COAL				1.000	-0.119	0.060	-0.040	0.074	-0.056	-0.056
FORESTS					1.000	0.028	-0.295	-0.023	0.375	0.368
MINERAL						1.000	0.121	0.004	-0.023	-0.027
INVEST- MENTS							1.000	0.048	-0.103	-0.117
EDUCATION								1.000	-0.034	-0.036
DUMMY POLITY									1.000	0.917
DUMMY XRREG										1.000