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Eirik Nøren Stenersen, November 2011.

Contents

1 Introduction

Arguably one of the most important points for an economist is to find out why some countries grow rich while others stay poor. Therefore, the paradox that countries abundant in natural resources tend to grow slower than others is of great interest. This paradox was named the "resource curse" by Auty (1994). There is something counterintuitive about the resource curse in the sense that riches lead to slower growth. Though different from industrial goods, natural riches are riches nonetheless, as noted by Lederman and Maloney (2009). Although some question the statistical evidence of the resource curse, there are several examples of resource abundant countries that have done poorly in terms of economic growth. Nigeria's GDP in 2000 was 30% lower than in 1965, despite the oil revenues. Venezuela's terms of trade grew 13,7% per year during 1970-1990, due to oil exports, but output per capita fell by 1,4% per year. OPEC as a whole experienced per capita GNP decreases of 1,3% per year during 1965-1998, while income increased at an average rate of 2,2% per year in all lower- and middle income countries (Deacon, 2011, p.2). On the other hand, countries like Botswana and Norway have proved that is is possible to achieve success with natural resources. Natural resources are therefore not deterministic regarding economic performance, what matters most is what countries do with their natural resources. Though some countries have benefited from natural resources, the notion that having more of any natural resource could be disadvantageous in any circumstance is sufficiently puzzling to invite further study (Deacon, 2011, p.2). According to Matsen and Torvik (2005) the most interesting aspect of the resource curse is not to explain why resource income may lower growth, but why some countries have escaped the resource curse while others have not. Thus what has emerged is a view of the 'conditional resource curse'.

The conditional resource curse is the topic for this thesis, and the problem investigated is what it is that causes the conditionality. In the literature there is not yet an agreed upon answer to this and finding the answer, or increasing the knowledge only partially is important since many countries are still very dependent on their natural resources. The possible causes of the conditionality which will be investigated in this paper are the quality of property rights- and financial institutions, debt and volatility. What I do is to use the study by Mehlum et al. (2006) and their model as a benchmark. They found that natural resources is a problem for countries which have too weak 'property rights institutions'. To test this claim, variables for debt, volatility and financial development are included into the bechmark model to see if the results change. In doing this I lend the hypotheses from Manzano and Rigobon (2001) and van der Ploeg and Poelhekke (2009) in particular. The former study argues that natural resources is foremost a problem of debt, since natural resource abundance enables excessive borrowing, while the latter claims that natural resources is foremost a problem of volatility. The conditionality of the resource curse is then related to whether a country has the sufficient mechanisms to avoid excessive debt and severe volatility. What is evident is that the variables of interest are somewhat different. While property rights institutions are shown to matter because their interaction with natural resources

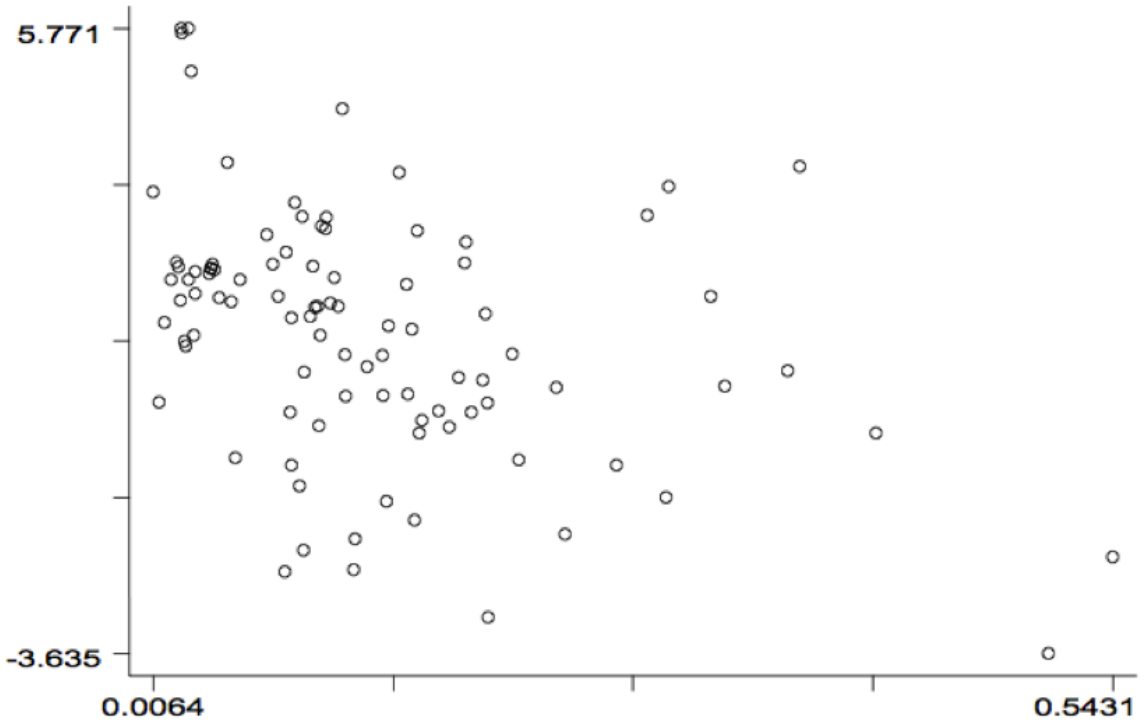
creates a predicted threshold value of institutional quality, debt and volatility are shown to matter because their inclusion has made the impact of natural resource abundance insignificant. In order to allow for an explicit interaction between financial variables and resource abundance as well, the measure of financial development is included to capture their institutional features. What is found is that the quality of property rights institutions seems to be the best predictor variable for the conditional resource curse. Its predicted threshold is significant even in the presence of the financial variables and the results appear to be robust to alternative model specifications and samples.

The rest of this thesis is organized as follows. Section 2 gives an overview of the previous research on the resource curse. The first part is structured around the model in Sachs and Warner (1995) as it has been an important study for much of the research on the resource curse. The rest of the section gives an overview of what the literature says about property rights institutions, financial institutions, debt and volatility as well as how institutions and natural resources affect each other. In section 3 I discuss some of the many challenges with the research on the resource curse before section 4 present the method used in this paper more thoroughly as well as the belonging challenges. Section 5 presents the dataset and the variables for resource abundance, institutions, debt and volatility in more detail, before the empirical results are estimated, presented and tested in section 6. In section 7 there is a discussion of the results before section 8 summarizes and concludes.

2 Previous research on the resource curse

The literature on the link between resource abundance and growth experienced a rapid expansion after the econometric evidence presented by Sachs and Warner (1995) of the robust negative association between resource abundance and economic growth. The pattern of the resource curse they present, is depicted in figure 1. The graph shows a clear negative relationship between the average annual growth in GDP per economically active population between 1970-90 (y-axis), and natural resource based exports[1] share of GNP in 1970 (x-axis). The sample consists of 95 developing countries. In order to investigate this observation further, Sachs

Figure 1: Annual Growth Rate and Natural Resource Based Exports



Source: Sachs and Warner (1995)

and Warner list a number of hypothesis aimed at describing the negative link between resource abundance and growth. Is it the case that resource abundance leads to increased rent-seeking and corruption? Does resource abundance encourage protectionist policies? Is it the case that resource abundance is distorting the price ratio of traded to non-traded goods or do resource abundance divert labor away from industries with a higher degree of learning by doing? What is found in Sachs and Warner (1995) is that resource abundance itself has a stronger effect on economic growth than the indirect effects working through for example rent-seeking and inefficient policies. The authors then claim that the resource curse looks like a problem of dutch disease and that it is not essentially a political phenomenon. However, as the terms of trade effects generally are not significant in economic growth regressions, the explanation for the resource curse through dutch disease has been criticized (Bulte et al., 2005; Deacon, 2011, p.4).

[1]The products that constitutes the natural resource-based exports corresponds to SITC categories 0, 1, 2, 3, 4 and 68. For more information, see appendix C, on *Resource abundance - sxp.*

The basic methodology used in Sachs and Warner (1995) is worth describing as the paper has been widely used as a benchmark for later research on the resource curse. The approach lends much from Barro (1991), and is based on running regressions at cross-country datasets with specifications like equation (1).

$$\frac{1}{T} log \frac{Y_{i,T}}{Y_{i,0}} = \delta_0 + \delta_1 log(Y_i) + \delta' Z_i + \epsilon_i \tag{1}$$

The dependent variable is average annual economic growth and the explanatory variables are initial income along with a vector of other characteristics of the economy. Among these are resource abundance. In order to quantify resource abundance, the ratio of primary exports to GNP in 1970 is used. The robustness of the results is tested by using alternative measures of resource abundance, controlling for initial income level, openness of the country, investments, institutions, terms of trade and inequality. Also countries with extreme observations are excluded from the sample, and the variable for resource abundance is used in growth regressions from other studies. Through all the tests, the negative relationship between natural resource abundance and economic growth prevails. The results are confirmed in Sachs and Warner (1997, 2001) and in a more recent paper by Norrbin et al. (2008). By extending the data in Sachs and Warner (1995) from 1990 until 2000, they check the presence of the resource curse when regressions are run over a longer time span. They find the curse to still be present. However, for the period from 1970 to 2000, they find the data to be sensitive to the exclusion of specific countries.[2]

Even though the results presented in Sachs and Warner (1995) has been very influential, they have been criticized for a number of reasons, mostly for the estimation technique and their quantification of resource abundance. Both these topics are discussed in Manzano and Rigobon (2001). Starting with the latter, Manzano and Rigobon find that the effect of natural resource abundance on economic growth disappear when panel data with fixed effects estimatiors are used instead of cross sectional data with standard OLS estimators.[3] Their model show that the "curse" is created by the interaction between the credit marked and the bubble in natural resource prices that was experienced during the 1970s. Resource abundant countries built up too much debt which became harder to service as the price of natural resources fell in the 1980s. Thus, in their view, there is no resource curse, only a problem of debt overhang. The other critique is related to how resource abundance is measured. The problem by measuring resource abundance by primary export as a share of GNP, as it is done in Sachs and Warner (1995), is that GNP contains the resource sector of the economy. This sector will therefore affect the growth and especially when the share of primary export is high.[4] To overcome this problem, Manzano

[2]The resource curse is no longer significant if either China, Hong Kong and Korea or Gambia, Malaysia and Zambia are excluded from the sample (Norrbin et al., 2008, p.190).

[3]For a discussion of panel data estimators versus cross-sectional OLS estimators, see section 3.6.

[4]A more thorough examination of different measures of resource abundance is given in section 3.1.

and Rigobon (2001) run regressions that include growth in the part of the economy which is not including natural resources. However, changing the measure of resource abundance does not change the result. Resource abundance have a negative impact on growth in the non-resource side of the economy when using cross section estimators, but the effect disappears when using a panel with fixed effects.

What neither Sachs and Warner (1995) nor Manzano and Rigobon (2001) find to be of decisive importance is institutions, a conclusion that has been widely challenged and discussed in the literature. Building on Sachs and Warner (1995), Mehlum et al. (2006) are critical to the conclusions and present both a theoretical and an empirical model showing that institutions do indeed matter. What they introduce, as opposed to Sachs and Warner (1995), Manzano and Rigobon (2001) and several other studies, is the interaction between resource abundance and institutions. The theoretical model in Mehlum et al. (2006) says that if a country's institutional quality is below some critical level, then the rents that accrue from natural resource abundance will divert entrepreneurial talent into unproductive rent-seeking and thus hamper economic growth. The prediction is tested empirically by running regressions similar to (1), but with the interaction term between natural resource abundance and institutional quality. They do find a positive interaction term and a negative sign of the resource abundance variable, which is measured as primary products exports in GNP. The results survive different robustness tests and supports their theoretical predictions of a threshold value of institutional quality. Among the 87 countries in the sample, only 15 had an institutional quality high enough to actually gain from natural resources. Their findings are supported by the hypothesis of *institutional appropriability* presented in Boschini et al. (2007), which says that natural resource abundance should only be negative for economic development in countries with poor institutions. Thus we have suggestive evidence of a conditional resource curse.

Taking a slightly different approach than Mehlum et al. (2006), van der Ploeg and Poelhekke (2009) also argue that there are something missing in the results from Sachs and Warner (1995). Building on the same model, but extending the sample to run from 1970-2003, they add a variable for the standard deviation of actual growth in GDP per capita over the 33 years, aimed at capturing the degree of volatility. In doing this the negative effect of natural resource abundance vanish (van der Ploeg and Poelhekke, 2009, p.738-739). However, where Mehlum et al. (2006) emphasize the role of property rights institutions, van der Ploeg and Poelhekke (2009, p.754) claims that the most important is to have a sound financial system.

Since 1995, when Sachs and Warner (1995) became accessible, numerous studies have tried to sort out what it is that lies behind the puzzle of the resource curse. It is behind the scope of this thesis to go into detail about each and all of the possible explanations for the resource curse. Instead I will focus on institutions and especially the adverse effects that might arise in the absence of strong institutions. A closer look at institutions is worthwhile since today most of the research agrees to the fact that institutions matter in some way or another, even

though not everybody agrees on it being the single most important factor, see Glaeser et al. (2004) and Arezki and Van der Ploeg (2007). Sala-i Martin and Subramanian (2003) was one of the first papers that tried to identify a political link in the connection between growth and resource abundance. Using basically the same method as in Sachs and Warner (1995), they found that resource abundance is a curse for economic growth, but the entire effect operated through institutions; once the indirect institutional effect is controlled for, no further direct effect is evident. The result is confirmed by Bulte et al. (2005), who use the same technique, but different measures of economic development than growth in GDP. Rodrik et al. (2003) claim that institutions trump everything else and this is largely supported by Acemoglu et al. (2002), Easterly and Levine (2003) and Hall and Jones (1999). However, the workings and contributions from institutions are by no means the same for all countries. The evidence presented in Manzano and Rigobon (2001) and van der Ploeg and Poelhekke (2009) is thus interesting to follow, because there might be important institutional differences to find in how countries use their resource income and what they do to mitigate volatility. Despite a general agreement that natural resource rents most likely will cause problems if institutions are weak and the opposite when institutions are strong, the channels through which this effect operates are by no means certain (Deacon, 2011, p.60).

Institutions is a vague term without a formal written definition, nevertheless there is a growing consensus among economists and political scientists that "institutions could be the social, economic, legal, and political organization of a society", as cited from North (1981). All of these are primary determinants of economic performance according to Acemoglu and Johnson (2004, p.1) However, there is no consensus regarding what are the most important institutions or what are the relative contributions of the different types of institutions. The problem is that it might be hard to quantify the individual contributions of different institutions and their partial effects on economic growth as institutions are highly complex and might affect one another in some way or other. Frankel (2010, p.14) lists several studies investigating the effect of institutions, and it is found that the effect on economic growth goes through such variables as struggle for ownership, corruption, inequality and education. However, using a broad categorization, there are two types of institutions that are often held as being important, property rights institutions and financial institutions.

2.1 Property rights institutions and why they matter

A property right could be defined as the exclusive authority to determine how a resource is used, whether that resource is owned by government or by individuals (Alchian, 2008). However, when it comes to setting this into an institutional context, there are several features that could be claimed to be 'property rights institutions'. Acemoglu and Johnson (2004) define them as institutions that protect citizens against expropriation by governments and powerful elites. This non-interfering is often held as important in addition to a trusted legal system that could solve

disputes and protect contractual rights when needed. Looking at the results from Acemoglu and Johnson (2004), they find that property rights institutions have a first-order effect on long-run economic growth, investment and financial development, while 'contracting' institutions appear to matter only for the form of financial intermediation. Contraction institutions are defined as institutions which enable private contracts between citizens. Further, North (1990, p.54) says that "the inability of societies to develop effective, low-cost enforcement of contracts is the most important source of both historical stagnation and contemporary underdevelopment in the Third World...". Using this quote as an introduction to their paper, Knack and Keefer (1995), take five different indexes and construct an average index aimed at capturing the quality of a country's property rights institutions.[5] The five indexes are corruption in government, quality of bureaucracy, repudiation of contracts by government, expropriation risk and rule of law. This gives a broader measure than the one used by Acemoglu and Johnson (2004). What they find is that institutions to protect property rights are crucial to investments and economic growth.

2.1.1 The problems associated with lack of property rights

One of the topics which is often mentioned in connection with weak institutions is rent-seeking. As noted by van der Ploeg (2007, p.25-26), "massive natural resource rents combined with badly defined property rights, imperfect markets and poorly functional legal systems provide ideal opportunities for rent-seeking behavior of producers, thus diverting resources away from more productive economic activities". A theoretical model dealing with these problems is the model presented in Mehlum et al. (2006). They classify institutions on a scale between perfectly producer friendly and perfectly grabber friendly. The more producer friendly the institutions are, the more complementary are the activities of rent-seeking and production and the better is the institutional framework. While the more grabber friendly the institutions are, the higher is the competition between production and rent-seeking. A grabber friendly institutional framework is defined as a poor institutional framework, and the weaker the institutions, the more of the resource rents could be pocketed by the 'grabbers'. The problem for growth is the misallocation of entrepreneurial talent that weak institutions could lead to. Instead of operating modern enterprises that create positive growth externalities, the entrepreneurs are tempted by the resource rents and divert their talent to unproductive rent-seeking which lowers the potential growth rate of the economy. Further, a similar mechanism as described in Mehlum et al. (2006) is used by Karl (1997) to describe the fall of Spain after their gold and silver boom in the 16^{th} century. Another feature of rent-seeking is captured by the voracity effect, which was first described in Tornell and Velasco (1992). Following van der Ploeg (2007, p.26), "this effect implies that dysfunctional institutions and poor definition of property rights lead to a classical commons problem whereby there is too much grabbing and rapacious rent-seeking of natural resource revenues". An augmented version of Tornell and Velasco (1992) is investigated in

[5] This index is the same as the one used in Mehlum et al. (2006) for institutional quality.

Tornell and Lane (1999), who point to the fact that slow growth in developing economies in the last decades can be attributed to the absence of strong legal and political institutions combined with the presence of multiple powerful groups in society. The problem originates with a windfall in what Tornell and Lane (1999) call the 'formal sector'. In the model there are two sectors, a "formal sector employs the efficient production technology, but is subject to taxation, the shadow sector enjoys a less productive technology but is nontaxable" (Tornell and Lane, 1999, p.23). Powerful interest groups will struggle to get a hold on some of the increased rents in the formal sector, and without proper institutions, this could lead to higher taxation or other transfers with the result of an inefficient redistribution. Capital would then be reallocated to the less efficient informal sector, and thus the growth rate of the economy would be lower than with institutions that avoid discretionary redistribution. However, when drawing parallels from the voracity model to natural resources, one should be aware that in the strict sense, non-renewable resources do not fit exactly as they are not themselves productive (Deacon, 2011). What is important with the model of rent-seeking from Mehlum et al. (2006) and the voracity effect in Tornell and Lane (1999) is the conditionality. Natural resources need not be a curse as long as the institutional framework of the society is good enough. On general terms, it is also reasonable to assume that countries that have a lack of property rights are less attractive to investors, which would act as an additional drag on growth. Further none of the models presented include governments as distinct policy making agents, and there are several contributions in the literature which also look at the importance of institutions in a political economy context, for example in preventing armed conflicts over resources. For a more thorough discussion of political economy models, see van der Ploeg (2007) and Deacon (2011).

2.2 Financial institutions and why they matter

According to North (1981), as we saw earlier, institutions could be the social, economic, legal, and political organization of a society. In relating financial institutions to the resource curse, one could think of it as the economic organization of the economy. As for the resource curse, it is the lack of good financial institutions that is the problem, or the lack of financial development as it is often referred to in the literature. Typically, evidence is presented for the positive effect financial development has in mitigating volatility and fostering sound credit policies. These topics will be discussed below. However, there are controversies regarding the importance of finance. We saw above that Acemoglu and Johnson (2004) found financial development to be an externality of property rights institutions, and also historically, economists have argued over the importance of finance. As described by Levine (1997, p.688), Walter Bagehot, Joseph Schumpeter and John Hicks, all saw finance as important for economic growth. On the other hand, economists such as Joan Robinson, claim that finance follows growth, not the other way around, and Robert Lucas thinks that economists "badly over-stress" the role of financial factors in economic growth. Joining the former group, Levine says that, "the weight of evidence suggests that financial

systems are a fundamental feature of the process of economic development" (Levine, 1997, p.690). To structure how one should think about financial development, five ways in which the financial system help to spur growth can be identified (Levine, 1997, p.691). The first is through facilitating the trading, hedging, diversifying and pooling of risk. The second is through allocation of resources, the third is through monitoring managers and exerting corporate control. The fourth is through the mobilization of savings and the fifth through the exchange of goods and services. Looking at more recent studies, support for the importance of finance is found by Beck et al. (2000) who investigate whether the level of banking sector development can offer insight into cross-country differences in total factor productivity. What they find is that higher levels of banking sector development produce faster rate of economic growth by influencing the total factor productivity growth (Beck et al., 2000, p. 5-6). As a conclusion, they say that their results strengthen the hypothesis of a statistical and economically significant causal impact of financial development on growth.

2.2.1 Volatility as a curse

Prices of natural resources are volatile. The world market price for oil and natural gas is more volatile than for any other mineral and agricultural commodity and the other mineral and commodity prices are in turn far more volatile than prices of most manufactured products or services (Frankel, 2010, p.9). The question is then if volatility itself is bad for economic growth. van der Ploeg and Poelhekke (2010) claim that volatility of prices leads to volatility of growth rates and thus slower economic growth on average. In support of this, Ramey and Ramey (1995) found that volatility has a negative impact on growth, using a panel of 92 countries as well as a subset of OECD countries. Further, Blattman et al. (2007) found that among 35 countries investigated in the period 1870-1939, the countries who specialized in commodities with large price volatility had more volatility in their terms of trade, less FDI and a lower economic growth compared to countries that specialized in commodities with more stable prices. Combining the ideas from both Ramey and Ramey (1995) and Blattman et al. (2007), the paper mentioned earlier by van der Ploeg and Poelhekke (2009) investigate both the direct effect that natural resource abundance might have on growth, and the indirect effect that works through volatility. Their conclusion is that the curse of natural resources is foremost a problem of volatility as the indirect negative effect of resource dependence on growth, via volatility, is much larger than what they find to be a direct positive effect. An important factor in escaping the curse of volatility they find, is a better financial system within the resource abundant countries. In similar vein Aghion et al. (2006) shows that real exchange rate volatility could be harmful for long-term economic growth and that the effects are larger the lower the degree of financial development in the country. This is interesting, since the long run volatility of the real exchange rate of developing countries has been found to be approximately three times greater for developing countries than for industrialized countries (Hausman et al., 2004). Looking closer at what negative effects that

come with high volatility, the lack of investments is often mentioned. Seen in the perspective of firms, Aghion et al. (2006) claim that they will abstain from investments that could lead to growth promoting innovations because they are more likely to face liquidity constraints when economic conditions change rapidly due to volatility in the real exchange rate. Finally, Dollar (1992) also show that countries with high levels of real exchange rate volatility have on average slower economic growth.

2.2.2 Debt as a curse

As already discussed, Manzano and Rigobon (2001) emphasize the role debt play in relation to the resource curse. Their argument is that "if investments and debt decisions in the late 70's were based on the recent estimated price increases, than it should become clear that during the first slow down in the early 80's the countries had problems rolling over their debt" (Manzano and Rigobon, 2001, p.23). What made the borrowing possible in the first place were high prices on natural resources, coupled with new discoveries for some countries. Sudden increases in income, stemming from such as a rise in prices of natural resources or new discoveries are often called windfalls. An important feature of windfalls is that the gains do not come all at once, but gradually. According to Frankel (2010) the fact that the income accrue gradually might lead to suboptimal policy choices like procyclicality of spending. Further, Manzano and Rigobon (2001) say that it was the perceived continuation of high prices on natural resources that made it possible for resource abundant countries to get access to credit as easy as they did. The debt and procyclicality stories are somewhat connected, as changes in prices have been claimed to be one of the reasons behind both. Frankel (2010, p.20) notes that an important reason for procyclical spending is that government receipts from taxes or royalties rise in booms, and the government cannot resist the temptation or political pressure to increase spending proportionally, or more than proportionally. The more than proportionally would in this case mean that the governments would have to take up debt to maintain their excess spending. This was what happened during the years 1975 to 1981 where, according to Frankel (2010), capital flows to developing countries mainly went to finance their current account deficits. Looking at it this way, the resource curse would be the adverse effects arising when the prices drop or when the resource is exhausted. Spending bonanzas also have an effect in exacerbating volatility according to van der Ploeg and Poelhekke (2009, p. 754). This because the fall when the revenue inevitably drops would be larger than without the excess spending during good times. However, if the money is invested to expand and improve the productive capacity, countries should be able to withstand severe downturns if prices drop. Gelb (1988) investigates this empirically by looking at how six oil dependent countries responded to the oil windfalls of 1973-74 and 1979-80. The conclusion is that the governments mishandled the opportunity of the windfall by absorbing the windfall too quickly domestically and investing a substantial part in disastrous projects. The results from Gelb (1988) is supported by Harberger's examination of Mexico and Venezuela (Harberger,

1985) and Tornell and Lane (1998), who look at how terms of trade improvements from a temporary windfall affect the current account in resource abundant countries.

2.3 Natural resources and institutions - a mutual dependence

When studying the previous literature on the the interaction between natural resources and institutions, there are two patterns that often emerge and that are worth considering in more detail. The first is that the impact of natural resources is dependent upon institutions, as already noted this has been used as an explanation for the conditional resource curse. The second is the fact that different natural resources might have different impacts on institutions.

The impact of natural resources differs according to institutions

Looking back at the model in Mehlum et al. (2006), they predict a gap between countries with good institutions, who would benefit from natural resources, and those with bad institutions who would suffer from having natural resources. The results presented in Tsui (2011) give further credibility to the theory that natural resources might make a different impact depending on institutions, though with a slightly different interpretation of institutions. The study shows that on average, discovering oil would push the democracy level of a country almost 20 percentage points below prior trend. Still, even though oil discoveries might lead to autocracy and thus a *political* curse, Tsui (2011) shows that natural resources need not be an *economic* curse for autocracies that have the institutions to remove poorly-performing leaders from office. A pattern that appears is that a natural resource discovery in already weak countries might lead to a further deterioration of economic conditions, while countries with strong institutions remain unharmed or gain. This is supported by Karl (1997), who describes the change in political climate in six oil rich countries following the price shocks of the early 1970s and 1980s and Ross (2001), who looks at the institutional decline in the Philippines, Malaysia and Indonesia following hardwood timber booms. Also a part of the literature that does not support the natural resource curse, but rather view it as a natural resource blessing, agrees to the fact that the impact of natural resources differ between countries with respect to their institutions, though in a slightly different manner. After stating the obvious, that they don't mean that good institutions hurt long-term growth, Alexeev and Conrad (2009, p.592) claim that countries with good institutions, that would have been rich anyway, tend to benefit less from the positive effect of natural resources than countries with weak institutions that would otherwise have been poor. Taking the discussion in a slightly different direction, Andersen and Aslaksen (2008) look at the interaction between natural resources and institutional *design* rather than institutional *performance*. What they find is that the resource curse, as presented in Sachs and Warner (1995) is mainly driven by presidential countries and non-democratic regimes, and that being parliamentary rather then presidential is more important for realizing gains from natural resources then being democratic

rather than autocratic. Thus the conditional resource curse could not only be explained by institutional performance, but also by institutional design. Still, even though the evidence presented supports a conditional resource curse, according to Deacon (2011, p.68), a problem is that many of the empirical studies often fail to incorporate the feature that 'well-governed' and 'poorly-governed countries' will respond to resource booms differently.

Natural resources differ in their impact on institutions

In the previous part we saw that good institutions might prevent the natural resource curse, but also that natural resources could deteriorate the quality of institutions. What is important to remember is that when talking about natural resources, one is talking about a number of commodities that do vary greatly between one another, and there have been raised questions as to whether it is right to lump them all together in one variable when discussing resource abundance. Isham et al. (2003), who originally tested empirically for links from resource abundance to several measures of political institutions, also found that different types of resources affected institutions differently. What they found harmful to institutional development is what they called "point source" resources, defined as fuel, minerals and plantation crops. Sala-i Martin and Subramanian (2003) and Bulte et al. (2005) confirm the negative effect coming from point source resources, but not from agricultural resources, while Murshed (2004) use a panel data set to show that point source type resources, in this case minerals, coffee and cocoa, retard economic, democratic and institutional development which again becomes a drag on growth. Another way of distinguishing between different types of natural resources is given by Boschini et al. (2007). They argue that that the impact of natural resources is determined by the interaction between the type of resource and the institutions of a country, called the *appropriability* of the resource. The characteristics of the resource itself is called the *technical appropriability*. What they find is that the more technically appropriable the resource is, the larger is the potential damage on institutions and growth. A higher degree of technical appropriability means that it is easier to realize large economic gains within a relatively short period of time from the resource, and that it is relatively easy to maintain control over the resource. Resources said to be highly *appropriable* are such as diamonds and minerals which are both very valuable and easy to smuggle and sell (Boschini et al., 2007, p.595).

3 Challenges with the research on the resource curse

What is both interesting and frustrating at the same time is that there is no clear consensus on what it is that causes the resource curse. Even though most of the literature speaks in favor of the existence of the natural resource curse, there are even some who claim that natural resources are a blessing, rather than a curse (Brunnschweiler and Bulte, 2008; Alexeev and Conrad, 2009). This illustrates that there are still challenges to overcome and that the conclusions one could draw from empirical research might be sensitive to how the models are specified and how the variables are measured.

3.1 How to measure resource abundance?

The natural resource curse is presented as the phenomenon that resource abundant countries grow slower than similar countries without natural resources. To make such an observation, one would have to have some sort of measure for resource abundance and the problem is that it has proven extremely difficult to find an exogenous proxy. The main controversy regarding how to measure resource abundance is whether the method used in Sachs and Warner (1995) and related studies captures what it is supposed to do. To measure resource abundance, Sachs and Warner use the value of a country's primary products exports to GNP,[6] henceforth referred to as *sxp*, following their terminology. The most common critique is that they actually measure resource dependence, and hence *sxp* is more an indicator of economic backwardness or a sign of failure to develop technically advanced sectors, than of abundance (Alexeev and Conrad, 2009; Deacon, 2011). Another problem, noted by Norman (2008), is that *sxp* is a measure of extraction intensity, and not of or extraction values. As a consequence, countries which process their mineral resources rather than exporting them will be mistaken for being less resource abundant than what is true. On the opposite would for example an oil producing country that has a relatively small GDP and sluggish economic growth, for reasons unrelated to oil, have a large ratio of oil exports to GDP and thus introduce a negative bias for the relationship between oil abundance and growth. With this in mind one should expect *sxp* to contain some misleading observations, and it does. Lederman and Maloney (2009, p.12) point out that Singapore turns out to be resource abundant, due to large re-export of processed natural resources. As a result, Singapore, and also Trinidad and Tobago, are included with their net exports instead of gross exports in Sachs and Warner (1995). As for the estimation procedures, *sxp* suffers from not being an exogenous indicator of resource abundance. Primary products production and export correspond to extraction which is an endogenous choice variable, further it is also reasonable to believe that extraction is determined in part by variables such as institutions (Deacon, 2011;

[6] Though the actual measure is primary products to GNP, the literature often refer to it as primary product to GDP. I follow the terminology used in the respective papers as the arguments are independent of whether GDP or GNP is used.

Brunnschweiler and Bulte, 2008). Thus, the possible problems of endogeneity is complicated even further by using *sxp*. That said, as noted by van der Ploeg and Poelhekke (2009), dependence is actually the main channel through which the story of the resource curse runs, in the sense that the income derived from natural resources does not seem to deliver growth in the same way as income derived from manufacturing or services. Thus what is confusing according to van der Ploeg and Poelhekke (2009) is that the literature use the words abundance and dependence interchangeably, making it hard to grasp what the true interpretation of the curse should be.

Resource wealth

As noted above, Norman (2008) is one of the critics of using *sxp* as a measure of resource abundance. However, instead of neglecting the impact of *sxp*, she develops a model in which *sxp* is included and interpreted as a *resource flow* variable.[7] The measure of resource abundance is instead a stock measure aimed at indicating the total 1970 resource stocks. To construct the measure, Norman uses information on current reserves and past extraction flows. Further, instead of physical quantities, stock values are used to enhance the comparability across resources, although a problem is that large in-period changes in values lead to biased estimates (Norman, 2008, p.186-187). By looking at the period from 1970 to 2000 running regressions with economic growth and the rule of law as dependent variables, *sxp* do not have a significant impact on the rule of law when stocks are controlled for, but it is associated with lower growth with a coefficient comparable to those in Sachs and Warner (1995, 1997, 2001). On the other hand, mineral abundance has a negative effect on rule of law, but not a direct effect on growth (Norman, 2008, p. 203). Nevertheless, the conclusion is that considering resource stocks and flows simultaneously is an improvement since the stock variable captures something different than *sxp*.

What we see is that Norman (2008) does not dismiss the resource curse. Contrary to that are the works by Alexeev and Conrad (2009), Brunnschweiler and Bulte (2008) and Ding and Field (2005), who all find that changing the measure from resource abundance to resource wealth would turn the curse into a blessing or make it insignificant. Their main argument against the research using *sxp*-like measures, is that it indicates resource dependence. Brunnschweiler and Bulte (2008) use instead estimates of the net present value of natural capital in US dollar per capita in 1994, including subsoil assets, forest resources, protected areas, and agricultural land, with a constant discount factor of 4%. The data is taken from the World Bank and the sample period is from 1970 to 2000. What they find is that more natural resources leads to better institutions and more rapid growth. In similar vein, Alexeev and Conrad (2009) also attacks

[7] According to Norman (2008) trade in commodities, production of minerals, the size of the work force employed in resource extraction as well as shares of primary products (or primary product exports) in GDP (or total exports) in an historic period, such as *sxp* are all flow variables.

the traditional view of a resource curse by investigating determinants of GDP per capita in year 2000. Instead of *sxp*, they use several measures of oil and mineral resource endowments such as the logarithm of 1 plus the country's per capita production of oil in 2000 at world market prices. While some of their measures includes GDP, they prefer measures not expressed as shares of GDP. The reason for this they claim, is that what we are interested in is the effect of natural resources on GDP, and measures including GDP have the tendency of indicating resource dependence rather than endowments. What they find is that oil and mineral resource wealth have enhanced rather than inhibited long-term growth and had a neutral effect with respect to institutions. Ding and Field (2005) actually use some of the same methodology as Norman (2008) by including *sxp* in the models. In addition they use the same World Bank data as Brunnschweiler and Bulte (2008) to quantify resource wealth. Running a model similar to that in Sachs and Warner (1995) they find a significant negative effect on growth from *sxp*, but a significant positive effect of resource wealth. However, with a model aimed at capturing the alleged endogeneity problems of growth regressions, they find that both the effects of natural resources becomes statistically insignificant.

As for the study by Brunnschweiler and Bulte, van der Ploeg and Poelhekke (2009, p.737) argue that their procedure of measuring resource abundance has problems both because of the several assumptions it makes and the limited time span. The same critique would apply to Ding and Field (2005) and Alexeev and Conrad (2009). The latter study have also been criticized for not capturing that fact that the resource curse is a phenomenon that evolves over time. One way to view the resource curse is that a resource discovery leads to rent-seeking which in turn leads to declining institutional quality, diminished investments and lower long-run income. This is taken from Deacon (2011, p.74-75) who says that such a story would not be captured in models that evaluate the link between current income and current (or recent past) levels of resource extraction or abundance. Further, Norman (2008) claims that using current reserves raises the possibility of significant endogeneity problems and that using present-day reserves do not account for depletion in the intervening period. Finally, van der Ploeg and Poelhekke (2009, p.739), notes that there should come as no surprise that a positive effect is found when natural resource wealth per capita is used instead of primary exports to GDP, this because "resource wealth is much less volatile than natural resource export revenues and more likely to boost the rate of economic growth".

Net exports per worker

What Lederman and Maloney (2009) use as an explanatory variable in their models is the natural logarithm of the absolute value of net exports of natural resources per worker, henceforth referred to as net exports per worker. Like *sxp*, this is a flow variable, and would thus be subject to the same critique as labeled at *sxp* in Norman (2008). Nevertheless, Lederman and Maloney (2009, p.14) claim that this is a good proxy for relative resource endowments or endowment per

worker. When speaking of endowments, they mean the stock of natural resources. The selling point of the indicator is that it can be shown, in a theoretical context, to be strictly increasing in *resource endowment per worker*. Their conclusion, after running several different models, is that the evidence in support of a resource curse is weak at best, emphasizing the difficulties in measuring relative resource endowments and the potential heterogeneity in the effects of such endowments on development and growth. Further, the authors point to the fact that what they in some cases find as evidence of a blessing of natural resources disappears when controls for macroeconomic volatility and factor accumulation is included.

Though, as the Lederman and Maloney also points out, their measure is by no means flawless. A problem is that a rise in endowments might also give rise to increased imports and, symmetrically, decreased exports of natural resources. This then damp down the degree to which movements in net exports per worker reflect movements in endowment per worker (Lederman and Maloney, 2009, p.11). To illustrate the problems with the measure further, I follow the comments from Cameron A. Shelton, given to Lederman and Maloney (2009) on how foreign direct investments can lead to inaccurate measures when using net exports per worker. This can be illustrated by the following example (Lederman and Maloney, 2009, p.50-52): There are two countries, A and B. Looking at horizontal FDI, we assume country A to be heavily forested and produce domestically the final good furniture, which it exports to country B. Then, the furniture industry spreads to country B, and only wood is exported. Because wood, but not furniture, is classified as a resource-intensive good, the horizontal FDI alters country A's net exports of resource-intensive goods. Looking at vertical FDI, we assume country B to be endowed with abundant grazing land and many cattle and that it generates the entire production chain, from hides to clothing domestically. That leads to exports of the final good, clothes. Then the leather industry migrates to country A, and the production chain is broken up leading to trade in both intermediate and final goods. As a result, the net exports of country B now includes hide which is classified as a resource-intensive good. As these examples illustrate, the natural resource content in a country's exports could be altered even when there are no change in endowments. Finally, one could argue that using a per capita measure is not relevant, since what we might be interested in is the importance of natural resources in an economy, not just per capita.

Finding the right measure

The discussion on the right measure is so vivid because the results from the empirical studies vary greatly depending on the measure in use. Though the critique labeled at Sachs and Warner's *sxp* measure seems justified in some respects, nobody has yet come up with an exogenous measure of resource abundance and thus all measures of resource abundance have both their pros and cons, and one should be aware of these before carrying out empirical research.

3.2 How to measure economic performance?

Sluggish economic growth in resource abundant countries is the prime argument for the resource curse, however, not everybody agrees on using economic growth as the indicator of poor economic performance. As most of the research on the resource curse use either 1965 or 1970 as their initial period, a problem is that for some countries this period lies outside the time when the resources were discovered and commercialized. As noted by Alexeev and Conrad (2009), it is possible that countries had slower growth in the period starting in 65 or 70, but they claim the interesting part is to see how the countries performed in the whole period, from the first discovery and onwards. This should be of interest because even though resource abundant countries may have lower per capita growth their income per capita might still be higher. The level argument given by Alexeev and Conrad (2009, p.595) is that if country A has a higher per capita GDP than country B, country A must have experienced faster growth over the long term than country B. A better method according to them is to measure long-term growth via GDP per capita *levels* rather than per capita *growth rates* over a given period of time. Still, if you choose to measure growth rates, there are different ways to do this as well. The most common way is to use logarithmic approximation, taking the natural logarithm of the end period GDP minus the natural logarithm of the initial period GDP. However, Beck et al. (2000, p.9) compute growth for each country by running a least squares regression of the logarithm of real per capita GDP on a constant and a time trend and then using the estimated coefficient of the time trend as the growth rate. Nevertheless, the two approaches yield virtually identical results.

3.3 The importance of control variables

The econometric method that, at least traditionally, has been most widely used when evaluating the resource curse, is simple ordinary least squares (OLS)[8] on a cross-sectional data set. However such models have important statistical challenges that one would have to be aware of. The aim of the resource curse literature is to evaluate the impact of natural resources on economic growth. However, including only resource abundance as an explanatory variable in a regression would lead to biased estimates. The bias occurs because 'relevant' variables are excluded from the model. This kind of problem is referred to as omitted variable bias.[9] Omitting relevant variables leads to biased estimators, and thus arguments based on the sign or magnitude of the estimators would not be valid. In the context of omitted variable bias, relevant variables mean variables that both have an effect on the dependent variable and correlates with one or more of the explanatory variables. Another thing is that even though there might be no variables causing an omitted variable bias in our simple regression of economic growth on resource abundance, we should always include independent variables that affect the dependent variable and that are

[8] For a description of the estimation procedure, see appendix B.1.

[9] For a mathematical derivation of the omitted variable bias, see Wooldridge (2009, p.114).

uncorrelated with all the independent variables of interest. This is because they reduce the error variance and thus leads to better estimates (Wooldridge, 2009, p.205). However, it is a hard task finding out which parameters to include in growth regressions. Durlauf et al. (2005) note that approximately as many growth determinants have been proposed as there are countries for which data are available, and it is hard to identify the subset that truly matters. In their study they group a wide variety of growth regressors into 43 'growth theories', and find that all of them have been found to be significant in at least one study. What complicates the identification is the 'openendedness' of the growth theories, which means that growth theories are usually compatible with one another, in the sense that if one variable influence growth, this does not typically mean that other variables don't (Durlauf et al., 2005, p.76). When searching for relevant variables to include, one should also have in mind not to include 'irrelevant' variables, which are variables that have no partial effect on the dependent variable. Controlling for too many factors do not alter the unbiasedness of the estimators, but it does increase the variance of the OLS estimators, as inclusion of more variables to the regression would always produce a variance of the OLS estimator bigger than or equal to what it was before the inclusion (Wooldridge, 2009, p.100). Including too many regressors may also cause the problem of multicollinearity. This might occur if there is a high degree of linear relationship among the variables and the problem is that the variance of the OLS estimates becomes very large, causing problems for the validity of standard inference procedures. Thus, in empirical research, there might be a trade off between omitted variable bias and multicollinearity.

3.4 How to separate causality from correlation?

This problem arises because many of the variables typically included in growth regressions are endogenous. As noted by Durlauf (2000, p.3), "It is hard to think of reasons why savings rates, political characteristics, inequality and the like would not be determined jointly with growth rates. Therefore, any movement from the observation of statistical significance of a variable coefficient in a regression to claims about causality is not warranted". This applies to institutions as well, which is one of the prime variables of this study. Thus one would have to be aware that institutions might be endogenous and a result of economic growth rather than the cause, leading to a problem of reverse causality. For example institutions such as the structure of financial markets, mechanisms of income redistributions and social safety nets, tax systems and intellectual property rights tend to evolve endogenously in response to the level of income (Frankel, 2010, p.13). The general problem that apply not only to institutions is that two variables might be correlated, but determined jointly by a third. In this case, you would probably find significant relationships between the two variables when running regressions, but this would not be informative when it comes to determining the structural determinants of growth (Durlauf et al., 2005). One approach which is often used to overcome the problem is the instrumental variable

approach.[10] Though appealing, the use of instrumental variables might not be an ideal solution either. Durlauf (2000, p.5) explains this by pointing to the 'openendedness' of growth theories, which was discussed above. A valid instrument should not be correlated with the error term in the regression, a term which can be viewed as the cumulation of the unmodelled factors that affect economic growth. Durlauf says further that even though the instrument is determined outside the socioeconomic system, this does not imply that it is uncorrelated with the error term. Thus for an instrument to be valid, one would have to assume that it is uncorrelated with all the omitted growth determinants, and that is a very strong assumption (Durlauf, 2000, p.5).

3.5 Sample size and measurement

When doing estimations, drawing valid conclusions rely on the fact that estimators would be right if the sample is large enough (Wooldridge, 2009, p.168). Still there is no correct answer for what it is that constitutes a large enough sample. What is certain is that when doing cross-country research on economic growth, the sample is constrained by the number of countries in the world, but more important, the number of countries in the world for which we have data. This is problematic in other ways as well, because instead of a process where we take all the countries in the world and delete countries at random, a process that according to Durlauf et al. (2005), typically would have increased the standard errors but not biased the estimators, countries are missing in a systematic way. This is a violation of the assumption of random sampling, which causes the simple OLS estimates to be biased.[11] It is for example typically countries who face a civil war or other conflicts that might not give priority to data collection. At best, if randomness is preserved the data would probably suffer from some degree of measurement error which is another problem that might create biased estimates.[12] This is particularly problematic because measurement error in one variable would typically bias all the parameter estimates in a multiple regression (Durlauf et al., 2005).

3.6 The choice of an econometric model

As noted, the traditional econometric approach when looking at the resource curse has been to apply simple OLS estimators at a cross-sectional data set. However, this procedure has been criticized for various reason. Referring to the discussion of control variables, Deacon (2011, p.68) note that it is impossible to include control variables that would represent all differences in all countries, and thus we would always have unobserved country-level heterogeneity that simple OLS would fail to control for. One way to overcome part of this problem is to use panel

[10] For a description of estimation with instrumental variables, see appendix B.2.

[11] The assumption of random sampling one of the Gauss-Markov assumptions. For a description of the assumptions, see appendix A.

[12] For more on different kinds of measurement error and it consequences, see Wooldridge (2009, p.316-322).

data with fixed effect estimators.[13] This method is applied by Manzano and Rigobon (2001), among others. They find the effect of resource abundance to be present in the cross-section and not in the panel when fixed effects estimators are applied. This could confirm the concern of uncontrolled cross-country heterogeneity in the cross-section estimators, but it could also be that the variation in the data is found in the cross-section and not over time. If this is the case, fixed effects estimators would transform this away, and you would end up with insignificant variables. As using fixed-effects or within-country estimators, necessitates temporal variations one would have to switch emphasis away from an historic measure of permanent resource abundance and towards natural resource windfalls as the potential factor (Deacon, 2011). However, without windfalls to measure, it might be that the variations in the data after the within transformation are so small that there is not enough to detect any patterns. Another thing is that there is a limited time span for which we have data, and researchers often put several years together to represent one time unit. As an example, in Manzano and Rigobon (2001) years are grouped together at either five or ten year intervals, making the number of time elements in the sample either 4 or 2. A problem according to Durlauf et al. (2005, p.106) is that when the number of time elements is small, panel data with fixed effect will often give imprecise estimates. Thus, both panel data and cross-section estimators have their weaknesses as well as strengths.

[13] For a mathematical description of how the fixed effects estimator works, see appendix B.3.

4 Method and identification strategy

Having seen all the problems with the econometrics of growth regressions, one could be tempted to give up the whole project. Still, there might be some use of the 'simple' approaches according to Durlauf et al. (2005). They note that one should "accept that reliable causal statements are almost impossible to make, but use partial correlations of the growth literature to rule out some possible hypotheses about the world" (Durlauf et al., 2005, p.117). In this thesis I investigate whether differences in property rights institutions, debt accumulation, volatility and financial development, are related to differences in economic growth. Finding an answer to this could help explaining the conditional resource curse and possibly serve as a policy advice for countries wanting to escape the resource curse.

The dataset which is used is taken from Mehlum et al. (2006) and augmented with variables for debt, volatility and financial development, henceforth referred to as the financial variables. Using the data in its original form, property rights institutions are found to be the cause of the conditional resource curse. To see whether some of the financial variables can explain this conditionality, or add some additional insight to the existing framework, each of them is evaluated in at least two model specifications. The first type of regressions investigates whether any of the financial variables have a significant impact on growth and the significance of resource abundance. In these models, the interaction term from the benchmark model between the quality of property rights institutions and resource abundance is excluded. In the second type of regressions, the financial variables are included one at the time in addition to the interaction term. This in order to see whether we still get a significant prediction of a threshold value for the quality of property rights institutions. In addition, an interaction between financial development and resource abundance is constructed and tested to see if it yields the same prediction of a threshold as the quality of property rights institutions.

As for the econometric model, simple OLS is used to obtain the estimators from the cross-sectional dataset. Further, the structural equations resemble equation (1), and are a linear growth models using average annual growth in real GDP per capita between 1965 and 1990 as the measure of economic performance and dependent variable. As noted above, this method has several weaknesses, but I found it to be the most relevant for the problems I want to investigate. The main reason why I choose not to use panel data with fixed effects estimators is the problem of finding reliable data on the changing quality of institutions. Since these variables do not change much over time, fixed effects would transform the effect of institutions out of the regression (Knack and Keefer, 1995). As my goal is to see whether other institutional variables or other factors could be of similar importance as the property rights index in Mehlum et al. (2006), using a method that would transform away the variables would not produce any interesting results. Further, there are those who suggest that the problem of omitted variable bias is not so serious, although this is a strong assumption, see (Knack and Keefer, 1995, p.215). Lending

from the argumentation in Knack and Keefer (1995), there are also other reasons why it might be reasonable to choose the standard OLS procedure instead of fixed effects. First of all, the principal objective of this paper is to estimate the influence of property rights institutions and the financial variables within the same framework as in Mehlum et al. (2006). Secondly, if it is so that the new variables included are significant, then the problem of omitted variable bias would be reduced even further. As for the problem of cross-country heterogeneity, some of this is captured by the use of dummy variables and interaction terms.

Interaction terms

This is the label of regressors which are a product of two explanatory variables. The additional insight given by Mehlum et al. (2006) was the use of an interaction term, and I will use the same procedure in the empirical section. When using interaction terms, one would have to be careful not to draw conclusions by looking at the individual contributions of the variables entering the interaction term. Each of those variables must be interpreted as a sum of their individual contribution and the contribution from the interaction term given a level on the variable it is multiplied with. Take the example from Mehlum et al. (2006), if one looks at the resource abundance coefficient alone, one would conclude that natural resources are always bad for growth. This is however not a valid conclusion as one would have to look at the interaction term and add the effect of natural resources given the country's institutional quality. Doing this, Mehlum et al. (2006) find that natural resources actually can be a blessing. Using interaction terms thus enhance the ability to find conditional effects of the resource curse and it allows us to test for neglected parameter heterogeneity.

Dummy variables

Dummy variables are used to represent qualitative data, and are included in the regressions with a value 1 or 0. One example could be whether a country has gone through debt reductions or not. Then the dummy variable could take the value 1 if the country has gone through debt reductions, and the value zero if not. The interpretation of the dummy in this case would be that it represents the difference in economic growth between countries that have gone through debt reductions and not, given common values on the additional explanatory variables in the regression. This was an example of a dummy included alone, but one could also multiply dummy variables with other explanatory variables, creating an interaction term.

4.1 Challenges with the method

Given that the Gauss-Markov assumptions are fulfilled,[14] the Gauss-Markov theorem states that simple OLS estimators would be the best linear unbiased estimators. However the assumptions would not all be fulfilled with this sample. As the specification of the model follows the one depicted in equation (1), the first assumption saying that the model should be linear in parameters is fulfilled. Further, assumption 3 of no perfect collinearity is not violated. Then if we look at assumption 2, which states that we should have random sampling, this is not fulfilled as the sample is constructed not through randomness, but through collection of the countries for which we have data. Still this is a problem for all empirical growth models, and little can be done to avoid it. As for assumption 4 of zero conditional mean, this would in general be violated if at least one of the following three effects are present. The first is measurement error, the second is that economic growth as well as one of the explanatory variables are jointly determined by a third variable, and the third is omitted variable bias. If we suppose measurement errors to be present, this is often hard to correct as variables for such as GDP and investments often rely on statistics given by the same provider, which could typically be national authorities. As for the second problem, a way to overcome this is by using the instrumental variable approach. However, as discussed in section 3.4, due to the 'openendedness' of the growth theories and the related problems of finding valid instruments, this might not solve the problem. Omitted variable bias on the other hand could be mitigated by including additional explanatory variables, but we might never know for sure that the problem is removed. Finally, assumption 5 of homoskedasticity is most likely violated, but there are methods to control for this that I will use. If this assumption fails, we do not get the problem of biased or inconsistent OLS estimators, but what is a problem is that standard inference is no longer valid as the standard errors of the OLS estimators are affected. One way to overcome this problem is to use heteroskedasticity robust standard errors. There are different ways to do this, but I use the method attributed to White (1980). Heteroskedasticity is a common problem in growth regressions as the regressions often suffers from neglected parameter heterogeneity, which in turn causes heteroskedasticity. This is likely to be a problem with the regressions in this thesis as well. The reason is that when running simple growth regressions like equation (1), one assume that the data are realizations from a common data generating process, which is unlikely when one thinks about the different countries in the sample. Still even though there are possible violations to the Gauss-Markov assumptions, I still find the simple OLS estimators to be the most applicable for the use in this thesis.

[14] See appendix A for a description of the assumptions.

4.2 Test of significance

When running regressions, as in this case with economic growth as the dependent variable, one assume that the explanatory variables included are important for describing variation in growth rates. This requires a way to test whether our hypotheses of the importance of a variable is true or not. The method I will use is the simple t-test of single parameter significance.[15] The null hypothesis when running these tests is that the variable of interest is zero. When variables are referred to as significant, it thus means that the null hypothesis is rejected. On the other hand, when variables are referred to as insignificant, is it because we fail to reject the null hypothesis. Often estimates are reported to be significant at a certain percentage level. This percentage represents the probability that we have rejected the null hypothesis when it is in fact the true. Further, due to possible problems of heteroskedasticity, as discussed in section 4.1, the t-values are computed using heteroskedasticity robust standard errors. Finally, a word of caution on significance is given by Durlauf et al. (2005). They say that the problem is that when we use standard inference procedures based on a single model, we also assume that the model is true. However, finding the 'true' growth model has proven very difficult. We might thus have the wrong model, which would overstate the precision of our inference.

4.3 Goodness of fit

Sometimes one would have to decide between two models which one is best at predicting the true relationship. One way of distinguishing between models is to look at the R^2, which is a goodness of fit measure that indicates how much of the variation in the dependent variable that could be explained by the independent variables included in the model. One problem with R^2 is that it never decrease when additional explanatory variables are included to the model. A better measure is thus the adjusted R^2 which would only increase if the t-statistic of the new variable is greater than one in absolute value (Wooldridge, 2009, p.201). Therefore the adjusted R^2 reported for each regression in this thesis.

[15] For a description of the mathematical procedure, see Wooldridge (2009, p.121-128).

5 Data, variables and descriptive statistics

The dataset used in this thesis is an augmented version of the one from Mehlum et al. (2006),[16] which again is an augmented version of the dataset used in Sachs and Warner (1997). The sample consists of 87 countries, which are listed in appendix D. In this section the most important explanatory variables are discussed, while the construction of the variables as well as a description of the additional control variables can be found in appendix C. Further, the descriptive statistics of the variables are depicted in table 14 on page 52. Since not all the models allow for the same amount of observations, descriptive statistics of the variables are reported several times according to the sample size.

Resource abundance - *sxp*

In following Mehlum et al. (2006), I use the share of exports of primary products in GNP in 1970 to measure resource abundance. The definition of the variable corresponds to *sxp*, taken from Sachs and Warner (1995, 1997, 2001). I deliberately refer to it as resource abundance thus following the terminology in the benchmark study by Mehlum et al. (2006), though some would think resource dependence is more appropriate. Besides the advantage of using *sxp* for ease of comparisons, none of the other candidates were supreme, as they all had their faults. Still, there is a limitation in the data when it comes to finding the right variables to capture the resource part, and one should be wary of the fact that what is done by using *sxp* is to investigate the countries where natural resources are important for the economy, not the countries where natural resources historically have been a key to their success. Take for example Norway. It is clearly a resource abundant country, but rank only number 41 among the 87 countries in the sample according to *sxp*. Further, though a problem might be that the importance of natural resources in an economy may be caused by factors unrelated to natural resources, and this consideration bias estimates in favor of the curse, this is more a challenge to include the right control variables rather than changing the whole measure of resource abundance. Finally, *sxp* remained significant when included as explanatory variables in several other studies by Sachs and Warner (1995), and thus it seems to have a robust impact on economic growth.

Institutional quality

This is the variable meant to capture to what extent private property rights are respected. The variable is an unweighted average of five different indexes, taken from Knack and Keefer (1995). The version I use is the Mehlum et al. (2006) version, where the value of the average index is set to be between zero and one. A higher value means better institutions. The

[16]The dataset for the variables taken from Mehlum et al. (2006) is found in Mehlum et al. (2006, p.18-19). The dataset for the additional financial variables is given in appendix F.

five indexes included in the variable are corruption in government, quality of bureaucracy, repudiation of contracts by government, expropriation risk and rule of law. Following Knack and Keefer (1995), the arguments for the inclusion of the separate indexes are the following: Higher risk of expropriation by governments as well as a lack of peaceful mechanisms for settling disputes are likely to cause lower investments in physical and perhaps human capital. As a result, capital that could have been used to spur productivity might flow to less productive sources. Similar arguments of a shortfall of investments could apply to countries with low scores on repudiation of contracts by the government. Finally, corruption in government and the quality of bureaucracy are proxies for the general efficiency of governments and the services they provide. Insufficient provision of public goods could be captured by these variables. In addition, external investors would find it less attractive to invest in corrupt countries where contracts are given mainly to supporters of the ruling party or president (Knack and Keefer, 1995, p.210-211). Looking at the results in Mehlum et al. (2006), the importance of property rights institutions, as emphasized by Knack and Keefer (1995) is confirmed. One could claim that it would have been interesting to see which of the individual indexes that performed the best, but according to Knack and Keefer (1995, p.212) a high degree of correlation between the measures would have created problems with multicollinearity. And in risk of omitting one which is important, it is best to include them all in one index. Most of the countries have data from 1982, some from 1984 and a few from 1985 (Knack and Keefer, 1995, p.226). Still this should be able to capture the institutional framework in the countries for the sample period we are looking at. As noted by Rodrik et al. (2003), current institutions could be treated as a stock which has been created by the operation past institutions. Thus it is reasonable to expect that the countries having a low score on institutions in 1982, also had low scores in the 1970s and is likely to have low scores also in the near future, which in this case would be until 1990.

Financial development

This is the measure which is supposed to capture the institutional feature of finance. I choose to use *Financial development* as it is in line with the terminology in the literature. The variable is similar to the one in van der Ploeg and Poelhekke (2009), and proxy financial development with the domestic credit to private sector as % of GDP, taken from World Bank (2011). In this thesis the variable is the average of the years between 1970 and 1990, and from figure 2 on page 53, we see that there seems to be a positive correlation between *Financial development* and economic growth. This measure also resemble the one used in Beck et al. (2000) of banking sector development. Comparing the *Financial development* with banking sector development yields a correlation coefficient of 0,93. Though, due to lack of data the banking sector development variable from Beck et al. (2000) is not evaluated in this thesis. In table 1, the top and bottom quartile according to *Financial development* is reported. The table is organized chronologically, Japan is the most financially developed country, while Zaire is the least. Further, U.K.

is the least developed of the top quartile and Turkey is the most developed of the lower quartile. When using domestic credit to the private sector, we see that countries are grouped in a way that is in line with the common perceptions of financially developed and underdeveloped countries, perhaps with the exception of the north African countries Algeria and Tunisia in the top quartile.

Table 1: Financial Development - Top and Bottom Quartiles

Top Quartile		Bottom Quartile	
Japan	Canada	Zaire	Guatemala
Switzerland	Portugal	Sierra Leone	Zambia
U.S.A.	Italy	Uganda	Peru
France	Algeria	Ghana	Bolivia
Sweden	Israel	Syria	Madagascar
West Germany	Finland	Malawi	Morocco
Netherlands	Malaysia	Tanzania	Sri Lanka
Spain	Brazil	Botswana	Gambia
Singapore	Tunisia	Nigeria	Paraguay
South Africa	U.K.	Burkina Faso	Turkey
Austria		Niger	

Credit Constraint

The intuition for including such a variable comes from Manzano and Rigobon (2001) and is described thoroughly in section 2.2.2. The variable chosen to capture the effect is the external debt stocks as percentage of GNI in 1981, taken from World Bank (2011). Since the statistics are only reported for developing countries, the sample size is reduced to 56. Thus the regressions with the *Credit Constraint* are only including developing countries. The top and bottom quartile when ranked according to debt as percentage of GNI in 1981, is presented in table 2. Guyana was the country with the highest value, while China had the lowest. What is worth noting is that none of the Asian countries are found in the top quartile, while there are five of them in the bottom quartile, suggesting that Asian countries in general might have had low levels of external debt. Further, there are large differences with respect to debt between the top and bottom quartile, with averages for the *Credit constraint* of 102,35 and 19,13 respectively. Finally, looking at the relationship between the *Credit constraint* and economic growth, it seems as though more debt is associated with lower growth. The relationship is depicted in figure 3 on page 53.

Table 2: Credit Constraint - Top and Bottom Quartiles

Top Quartile		Bottom Quartile	
Guyana	Zambia	China	Paraguay
Somalia	Jamaica	India	Uruguay
Costa Rica	Gambia	Botswana	Bangladesh
Togo	Congo	Guatemala	Colombia
Nicaragua	Morocco	Zimbabwe	Indonesia
Ivory Coast	Malawi	Burkina Faso	Turkey
Egypt	Honduras	Nigeria	Thailand

Volatility

I have chosen to use two different measures of volatility in my regressions, volatility in output and volatility in the real exchange rate. The motivation for including the two measures is that both of them have been shown to be significant explanatory variables for economic growth, as discussed in section 2.2.1. Though not a proof of significance, figures 4 and 5 on page 54 suggest that there is a negative correlation between volatility and economic growth. Further, the correlation between the two measures of volatility is 0,38, and thus the two could be expected to capture different aspects of volatility. Volatility in output is the standard deviation of growth in real GDP per worker, while volatility in the real exchange rate is taken from Dollar (1992). To compare the two measures, the top and bottom quartile for each measure is reported in table 3. In the table, the most volatile country, is listed on top of the *Top Quartile* column, while the least volatile country is listed on top of the *Bottom Quartile* column. Thus the most volatile country, independent of measure is Uganda, while the least volatile when measured by output volatility is Sweden and the county with the lowest volatility in the real exchange rate was Korea rep. We see that dependent on how volatility is measured, the results vary greatly. While the high volatility in output is foremost dominated by African countries, real exchange rate volatility is dominated by Latin America. Also we see that the European dominance in the bottom quartile for volatility in output is not repeated for volatility in the real exchange rate. Looking at the averages of volatility in output and volatility in the real exchange rate between Asian, African, Latin American and developed countries,[17] developed countries have the lowest volatility, with averages of 0,25 and 0,10 respectively. Following the developed countries are the Asians, with averages of 0,62 and 0,11. As for volatility in output, Africa have the highest volatility with an average of 0,91, while Latin America has 0,70. They switch place when looking at volatility in the real exchange rate, with Latin America on top with 0,23 and Africa with 0,15. Though the patters are to be expected, there are notable individual outliers. For example, countries like Belgium and Kenya appear both in the top and the bottom quartile dependent upon the measure.

[17]This follows the classification in Dollar (1992) and thus Ireland, Jordan, Syria, Portugal, Greece, Turkey and Spain is not included in any of the reported categories, but grouped together as *Middle East/Europe*. The group has an average of 0,64 in output volatility and 0,11 in real exchange rate volatility.

Table 3: Volatility - Top and Bottom Quartiles

Top Quartile: Output	Bottom Quartile: Output	Top Quartile: RER	Bottom Quartile: RER
Uganda	Sweden	Uganda	Korea rep.
Somalia	France	Bolivia	Kenya
Guyana	Netherlands	El Salvador	Togo
Gambia	Japan	Nicaragua	Australia
Niger	Norway	Guyana	Ireland
Nigeria	Colombia	Somalia	Niger
Jordan	Austria	Nigeria	Ivory Coast
Bangladesh	West Germany	Ghana	U.S.A.
Nicaragua	Australia	Egypt	Burkina Faso
Botswana	Belgium	Guatemala	Italy
Hong Kong	Denmark	Honduras	Zimbabwe
Gabon	Canada	Haiti	Cameroon
Syria	U.S.A.	Sierra Leone	Jordan
Haiti	U.K.	Venezuela	Thailand
Ghana	Ireland	Argentina	Israel
Sierra Leone	Switzerland	Trinidad & Tobago	Colombia
Tanzania	Finland	Zaire	Malaysia
Kenya	Italy	Paraguay	Gambia
Chile	Spain	Belgium	Congo
Paraguay	New Zealand	Dominican Rep.	Canada
Peru	Israel	Dominican Rep.	Finland
Trinidad & Tobago	Greece	Jamaica	Japan

6 Empirical results

6.1 The results from Mehlum et al. (2006) revised

The results in Mehlum et al. (2006) that would serve as our benchmark are taken from their table 1, regression 3 and 4. These results are reproduced and shown in table 4 as regression 1 and 2 respectively. What we see is that except from *Institutional quality*, all the coefficients in both regressions are significantly different from zero at the 5% level. The new insight offered by Mehlum et al. (2006) is the interaction term in regression 2 between resource abundance and the quality of property rights institutions. Running a regression like 1, and one would dismiss institutions as not important, but with the interaction term one sees how institutions matter for growth. A marginal increase in resource abundance now implies an effect on growth equal to -14,37 + 15,41 $\times$ *Institutional quality*. This means that we get a threshold value. Countries with an *Institutional quality* higher than 14,37/15,41 = 0,93 would benefit from more natural resources, while for countries with a lower institutional quality than 0,93, resources would be a curse. In the sample, 15 countries have a better score then 0,93 on *Institutional quality*.

Table 4: A Re-Run of the Results from Mehlum et al. (2006)

Dependent variable: GDP Growth			
	Regression 1	Regression 2	Regression 3
Initial income level	-1,28*	-1,26*	-1,33*
	(-6,39)	(-6,35)	(-7,43)
Openness	1,45*	1,66*	1,45*
	(3,78)	(4,39)	(4,45)
Resource abundance	-6,69*	-14,37*	-11,81*
	(-5,64)	(-6,44)	(-6,90)
Institutional quality	0,59	-1,34	
	(0,70)	(-1,21)	
Investments	0,15*	0,16*	0,15*
	(7,71)	(7,97)	(8,03)
Interaction term		15,41*	10,61*
		(3,41)	(3,12)
Observations	87	87	87
Adjusted R^2	0,69	0,71	0,71

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level.

As for the determinants of economic growth, we see from regression 2 that the growth performance has on average been better in countries who initially had a low income level, were open to trade and had high investments. The negative effect of initial income, supports the neoclassical argument of convergence. Turning to the effect of natural resource abundance, we can compare two countries which both have the mean level 0,58 on institutional quality and all else

equal besides natural resources. Say that one country has a measure of resource abundance that is one standard deviation higher than the other. This country would then have a predicted annual growth rate, -14,37$\times$ 0,10 + 15,41 $\times$ (0,58$\times$0,10) = 0,54%-points lower, an effect which is both statistically and economically significant. According to the model, the only way to escape the curse is through better institutions. What is problematic is that for countries with low levels of resource abundance, improving institutions is not predicted to have an effect on growth. *Institutional quality* is insignificant and even has a negative sign. This highlights the weaknesses of the results, and regression 3 is included to illustrate this further. When removing the insignificant variable for the institutional quality in regression 3, we see that there is no longer a threshold value of institutional quality. Better institutions would reduce the negative impact of natural resources, but it would never turn them into a blessing. As we know that there are countries that have escaped the curse, this motivates an extended search for other possible explanations for the conditional resource curse.

6.2 Debt

The debt argument offered in Manzano and Rigobon (2001) is particularly interesting as it questions the whole foundation of the resource curse by arguing that debt was the fundamental problem for resource abundant countries. Though Manzano and Rigobon (2001) investigate the role of institutions, they find them not to be significant in explaining the resource curse, or more precisely, the lack of a resource curse. They proxy institutions by bureaucratic efficiency, but what they fail to acknowledge is that debt might be linked to institutions. Referring to the voracity model and the procyclicality of spending, one would expect that countries with weak institutions also were the ones with the highest debt. Running a simple regression of *Credit constraint* on *Institutional quality* and *Financial development*, we get the results presented in table 5. Though simple, these regressions support the results from Manzano and Rigobon (2001), more natural resources means a higher external debt. In addition, the debt measure they use does not seem to be explained by our institutional measures. Though they both have the expected signs, none of them are significant. It is thus worth taking a closer look at how the *Credit constraint* performs in growth regressions. The original dataset from Manzano and Rigobon (2001) has not been obtained, but a similar dataset has been constructed according to their methodology. However, what is found when running their model is that the resource curse still persists. The *Credit constraint* do have a negative and significant effect, but it does not remove the resource curse as suggested by Manzano and Rigobon (2001). Using the same model with *sxp* as the measure of resource abundance, the *Credit constraint* is not significant while we do have both an economically and statistically significant negative effect of resource abundance.[18]

[18]For a description of how the variables are constructed, see appendix C. The results can be found in table 16 in appendix E.

Table 5: On the Causes of Debt

Dependent variable: Credit constraint	
	Regression 1
Resource abundance	163,99*
	(3,48)
Institutional quality	-22,26
	(0,68)
Financial development	-0,13
	(-0,57)
Observations	55
Adjusted R^2	0,28

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level.

Introducing the *Credit constraint* into our benchmark model gives the results shown in table 6. As with the reproduction of the results in Manzano and Rigobon (2001), we see from regression 3 and 4 that the *Credit constraint* is not significant. Further, using this sample, which includes only developing countries, the interaction term has the expected sign, though the threshold has increased from 0,93 to 0,96 in regression 2. Another interesting feature is that *Institutional quality* now has a positive sign throughout the models, and a significant positive effect when the interaction term is not included. This suggests that there are heterogeneity in the sample, which is not surprising. Developing countries have in general lower quality of their institutions than developed countries, and if one assumes that the effects of improving institutions are positive, but decreasing a marginal improvement would have a bigger impact on economic growth in this sample than in the aggregate.

As the debt overhang story was robust in Manzano and Rigobon (2001), but not in the reproduction, one could ask if the results are sensitive because the variable *Credit constraint* is not a good indicator for countries facing debt distress. As noted by Budina et al. (2007), debt overhang problems can arise in countries with relatively little debt since what matters is the short term cash flow needs. The reason is that a modest debt, but which all comes due in the near future, is more damaging than a much higher debt with amortization smoothly stretched. As a rough test of the *Credit constraint* variable, one could compare it to the countries that have had debt reductions through the Heavily Indebted Poor Countries program at some point in time (IMF, 2011).[19] In the sample of countries for which the debt statistics were available, 19 countries have at some point in time gone through debt reductions.[20] As for the *Credit constraint* the mean in the sample is 52,56 and 13 of the 19 countries had debt ratios that were above the mean. Further, of the 12 most resource abundant countries in the sample, when classified by *sxp*, 8 of

[19]The initiative was launched in 1996, thus after our sample period. The use of this measure is justified by the fact that the debt burdens must have been built up during preceding years. However, no formal control is done to investigate this, understating that this should only be viewed as a rough indicator of debt overhang.

[20]In the full sample of 87 countries, 21 have gone through debt reduction schemes.

Table 6: Introducing the *Credit constraint* to Mehlum et al. (2006)

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	-0,98*	-1,02*	-0,95*	-0,98*
	(-4,67)	(-4,68)	(-4,50)	(-4,53)
Openness	1,91*	1,77*	1,86*	1,75*
	(4,22)	(4,18)	(4,44)	(4,35)
Resource abundance	-6,57*	-12,56*	-5,50*	-10,62*
	(-6,98)	(-4,00)	(-3,84)	(-2,60)
Institutional quality	2,57*	0,29	2,43*	0,56
	(2,16)	(0,15)	(2,11)	(0,29)
Investments	0,13*	0,14*	0,13*	0,14*
	(6,14)	(6,39)	(6,07)	(6,18)
Interaction term		13,12**		10,88
		(1,87)		(1,42)
Credit constraint (1981)			-0,007	-0,006
			(-1,30)	(-1,03)
Observations	56	56	56	56
Adjusted R^2	0,63	0,64	0,64	0,64

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

them had both gone through debt reduction schemes and had a value of debt as a share of GNI higher than the mean in 1981. This both confirms that more resources tend to be associated with more debt, and that the debt variable captures the majority of the countries that actually had the worst problems with debt. Still, *Credit constraint* was not significant in the growth regressions. To investigate the debt story further, a dummy variable is introduced, taking the value 1 for the countries that have gone through debt reductions, and zero else. If the debt hypothesis holds in the strict way presented in Manzano and Rigobon (2001), one should expect a negative sign on the dummy and insignificance of the resource abundance measure. If instead one believes in the conditional resource curse, a way to support this hypothesis would be that the impact of resource abundance were positive, with a negative sign on what can be constructed as an interaction between the debt reduction dummy and resource abundance. The results are shown in figure 7 where the dummy for debt relief is included as well as an interaction term between debt relief and resource abundance. What we see is that countries that have been through debt reductions also have on average had lower growth, but the resource curse could not be dismissed. In both regression 1 and 2, we see that also for countries that have not ended up with debt reductions, natural resources have been a drag on growth. Introducing only the dummy for debt reductions and the interaction term from the benchmark model, we see that there is no longer a conditional curse. Even without debt problems, and with perfect institutions, natural resources

are predicted to have a slightly negative effect on economic growth.

Table 7: Using Dummies for Debt Relief in Mehlum et al. (2006)

Dependent variable: GDP Growth			
	Regression 1	Regression 2	Regression 3[§]
Initial income level	-1,50*	-1,38*	-1,45*
	(-7,42)	(-6,74)	(-6,98)
Openness	1,54*	1,57*	1,65*
	(4,56)	(4,27)	(4,93)
Resource abundance	-4,67*	-3,72*	-9,74*
	(-3,46)	(-2,16)	(-3,00)
Institutional quality	1,28	0,91	-0,02
	(1,73)	(1,10)	(-0,02)
Investments	0,12*	0,13*	0,12*
	(4,90)	(6,15)	(4,81)
Debt relief dummy	-1,21*		-1,02*
	(-2,60)		(-2,02)
Resource abundance*Debt relief		-3,75*	
		(-2,44)	
Interaction term			9,55**
			(1,83)
Observations	87	87	87
Adjusted R^2	0,73	0,70	0,73

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

[§] Excluding *Institutional quality* would not change the magnitude of the coefficients, but would make the interaction term significant at the 5% level.

6.3 Volatility

As mentioned, at least two measures of volatility have been found to have a significant impact on economic growth in the literature, volatility measured by the standard deviation of GDP growth, henceforth referred to as unanticipated output growth or volatility in output, and volatility in the real exchange rate. Intuitively one would expect volatility to depend on natural resources, financial development as well as institutional quality. In table 8, simple regressions are run to indicate what influences volatility. The results show that *Institutional quality* has the effect of mitigating both types of volatility, while *Financial development* does not seem to have an effect. Further, *Resource abundance* enhance volatility in output, but has seemingly no effect on volatility of the real exchange rate. Thus the two measures have slightly different properties, which is to be expected given the differences between the countries lying in the top and bottom quartiles for the two measures in table 3.

Table 8: On the Causes of Volatility

Dependent variable: Standard deviation in GDP growth (Regression 1) Real exchange rate volatility (Regression 2)		
	Regression 1	Regression 2
Resource abundance	1,04*	0,14
	(2,06)	(1,30)
Institutional quality	-0,62*	-0,20*
	(-2,72)	(-3,07)
Financial development	-0,002	0,0003
	(-1,31)	(0,73)
Observations	82	82
Adjusted R^2	0,34	0,21

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level

The possible adverse effects of unanticipated output growth is examined by van der Ploeg and Poelhekke (2009). They show that by including the standard deviation of actual annual growth in GDP per capita for the 33 year period from 1970 to 1999, the effect of natural resources cease to be significant in a cross-section of 58 countries. Though they do not dismiss the resource curse, they find that it works through volatility in output. Where Mehlum et al. (2006) find that resource abundance would be a blessing for countries with good institutions, van der Ploeg and Poelhekke (2009) find that natural resource abundance is a curse for volatile countries, but a gain for countries with relatively low volatility and a high degree of financial development. Their results indicate that volatility should depend positively on resource abundance, which is confirmed by the results in table 8. As for the volatility in the real exchange rate, Dollar (1992, p.534) use a sample of 95 developing economies and run regressions with per capita GDP growth between 1976 and 1985 on distortions and volatility in the real exchange rate, investments, plus a dummy for the sample outliers. What he find is a significant, negative relationship between the volatility in the real exchange rate and growth of per capita GDP. From table 8, volatility in the real exchange rate does not seem to be linked to natural resources in the same way as volatility in output, though *Institutional quality* seems to have a subduing effect. Now, if we introduce the measures of volatility used in van der Ploeg and Poelhekke (2009) and Dollar (1992) respectively into our benchmark model we find the results presented in table 9. What we see is that with this sample, there is no evidence for the claim that volatility should be important for growth, when other factors are controlled for. Though both the measures of volatility are negative as expected, none of them are significant. Interestingly, the conditional resource curse predicted by the model in Mehlum et al. (2006), still holds with threshold values of *Institutional quality* equal to 0,91 and 0,92. Further, when leaving out both *Institutional quality* and the *Interaction term*, letting the volatility measures act as a proxies for institutions, none of them becomes significant.

Table 9: The Importance of Volatility

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	-1,25*	-1,26*	-1,20*	-1,17*
	(-5,73)	(-6,46)	(-5,44)	(-6,67)
Openness	1,54*	1,42*	1,58*	1,45*
	(4,01)	(3,85)	(4,07)	(4,07)
Resource abundance	-14,15*	-6,33*	-14,35*	-6,40*
	(-5,58)	(-4,48)	(-5,64)	(-5,03)
Institutional quality	-1,51		-1,60	
	(-1,34)		(-1,40)	
Investments	0,16*	0,15*	0,16*	0,15*
	(7,19)	(7,13)	(7,39)	(7,05)
Volatility (Output)	-0,26	-0,41		
	(-0,65)	(-1,12)		
Volatility (RER)			-0,54	-1,78
			(-0,32)	(-1,36)
Interaction term	-15,63*		-15,64*	
	(-3,34)		(-3,17)	
Observations	85	85	85	85
Adjusted R^2	0,70	0,68	0,70	0,68

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level

6.4 Financial development

Together with property rights institutions, financial institutions have been emphasized as important for economic growth and especially the importance of a developed financial system. Financial development have been found to be significant both in its own respect and especially through the ability to tame volatility (Beck et al., 2000; Levine, 1997; van der Ploeg and Poelhekke, 2007). Though neither debt nor volatility was found to have the same effect in this model as have been found in other models, it might be that financial development still is of importance. Introducing the variable for financial development into the benchmark model of Mehlum et al. (2006), we get the results displayed in table 10.

As we see from regression 1, *Financial development* is insignificant when included alone, and so is *Institutional quality*. Further, from regression 2, we see that the conditional resource curse based on the quality of property rights institutions is preserved, though with a threshold lower than before, 16,44/19,67 = 0,84 as opposed to 0,93. Still this is a small change when it comes to additional countries that would benefit from natural resources. Only Singapore is added, making a total of 16 countries. The interesting part is when we drop the interaction between resource abundance and property rights institutions and instead add an interaction between natural

Table 10: The Importance of Financial Development

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	-1,25*	-1,25*	-1,30*	-1,26*
	(-6,38)	(-5,72)	(-5,81)	(-5,56)
Openness	1,20*	1,39*	1,26*	1,38*
	(3,17)	(3,89)	(3,51)	(3,81)
Resource abundance	-6,87*	-16,44*	-10,54*	-16,18*
	(-5,14)	(-6,97)	(-6,74)	(-7,06)
Institutional quality	0,45	-2,26**	0,37	-1,99
	(0,51)	(-1,93)	(0,90)	(-1,40)
Investments	0,15*	0,16*	0,15*	0,16*
	(7,63)	(7,54)	(6,87)	(7,26)
Financial development	-0,001	0,005	-0,008	0,003
	(-0,26)	(0,86)	(-1,45)	(0,43)
Interaction (IQ)		19,67*		17,59*
		(4,15)		(2,75)
Interaction (FD)			0,14*	0,03
			(2,98)	(0,49)
Observations	82	82	82	82
Adjusted R^2	0,69	0,72	0,71	0,72

Note: The number in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level

resources and financial development (FD). As in regression 1, neither *Institutional quality* nor *Financial development* is significant alone, but the interaction term is now significant which delivers another prediction for the conditional resource curse. While the results in Mehlum et al. (2006) was that countries with private property rights better than 0,93 would benefit from natural resources, the threshold is now to have a value of domestic credit to private sector as a percentage of GDP higher than 10,54/0,14 = 75,29. Having this threshold, only five countries would be able to exploit natural resources for the benefit of themselves which does seem to be too few. Further, the problem is that, as in the benchmark model where institutions alone had a negative though insignificant effect on growth, *Financial development* now has a negative, though insignificant effect on growth for countries without natural resources. And similar to regression 3 in table 4, excluding *Financial development* from the regression makes an already implausibly high threshold even higher (result not shown). However, what we see in regression 4 is that when we introduce the interaction between institutional quality and resource abundance (IQ), the effect of financial development disappears. What it seems like is that the variable *Institutional quality* is better able at capturing the factors that are important for economic growth.

6.5 Robustness

Referring to the discussion in section 3 and section 4.1, both the econometric method applied and the structure of the data do have several possible pitfalls that might lead to biased estimates and thus the wrong conclusions. To overcome problems associated with non-random sampling and measurement errors are difficult because the number of countries and relevant variables are limited. But there are ways to cope with the possible problems of heterogeneity. This is done by restricting the samples and using dummies to elicit regional specific effects. In addition, tests are carried out to control for possible omitted variable bias and to see how sensitive the results are to the exclusion of variables and the measure of resource abundance. This section thus serves two purposes, the first is to see if the effect of some of the financial variables are different when using alternative model specifications and samples, and the second is to check the robustness of the 'property rights institutions threshold'.

Developing countries

In the discussion of the benchmark results in table 4, we saw that the *Institutional quality* variable behaved unnaturally and that even though it is was insignificant, the exclusion of it removed the threshold effect. A more plausible behavior of *Institutional quality* was found when we investigated the importance of debt, using the sample of developing countries only. It is thus of interest to see if any of the other effects have a more significant impact when we restrict our analysis to the developing countries in the sample.[21] To make such a distinction between developed and developing countries is important according to Dollar (1992, p.534), who says that his measure of volatility is most relevant for developing countries. However, running the models including volatility and financial development as in the previous section, does not change the results fundamentally.[22] Using the benchmark specification from regression 2 in table 4, the threshold is predicted to be at 0,96 or 0,94 depending on whether China and Somalia is included or not.[23] As for volatility, neither output volatility nor real exchange rate volatility becomes significant. *Financial development* on the other hand, is significant at the 10%-level, though a plausible and significant threshold effect has not been found. Property rights institutions have thus been found to be important, also when looking at a sample of developing countries. One of the problems of the benchmark model was that removing the insignificant *Institutional quality* variable also removed the conditional resource. Using the developing sample however, the threshold is instead reduced to 0,92 when China and Somalia are included, and it remains at 0,94 when they are excluded. Thus the statistical evidence of the importance of improving property rights institutions is preserved using samples of developing countries.

[21] As the introduction of the *Credit constraint* was done using a developing countries only sample, this exercise is not repeated.

[22] The estimated models can be found in table 17 in appendix E.

[23] When evaluating volatility and financial development, China and Somalia is excluded due to missing values and the threshold is predicted to be 0,94. The threshold of 0,96 was found in table 6.

Regional dummies

Using a sample of only developing countries do reduce the sample size, and thus removes some of the variation in the sample. Another method of controlling for unobserved heterogeneity is to use dummies for different regions.[24] The investigation of region specific effects is carried out in two ways. The first is to construct interactions between the regional dummies and the explanatory variables for debt and volatility and include them into regressions similar to regression 1 in table 4. The aim of this is to see if the variables could be found to be significant in some regions as well as to see if the negative effect of resource abundance survives when more of the sample heterogeneity is controlled for.[25] As for the models with the *Credit constraint*, the results add nothing new to what is already found in table 6. Turning to output volatility, including regional dummies predicts no general significance of the volatility effect, neither for the whole sample, or for the specific regions. The exception is when the dummy for the developed countries as well as the interaction with volatility is included. Then we get a significant negative growth effect from being a developed country and a positive and significant interaction term, which thus predicts that the negative growth effect is mitigated with higher volatility. This is not plausible, and the important part is that for the rest of the sample, the effect of output volatility is insignificant. As for volatility in the real exchange rate, the results from table 9 are supported, *Resource abundance* is negative and significant, while the effect of volatility in the real exchange rate is insignificant. We do get a significant effect of volatility in the case of Africa, but this disappears once the insignificant interaction term between Africa and volatility is removed. Even though using dummies did not alter the insignificance of the variables for debt and volatility, it is interesting to see how our benchmark model is altered when regional specific dummies are included. Thus the second use of the dummies is in models like regression 2 from table 4.[26] What is evident is that the threshold value is not as robust when the dummies are included. When running the model with the dummies, using developed countries as the reference group, there is no threshold, only a question of more or less of a curse. Then, by excluding the insignificant *Institutional quality*, the threshold returns, though with a value of 0,97 which means that countries like Norway and Australia are predicted not to be able to benefit from natural resources. This is in conflict with the common perception of the growth history in both countries. Further, when excluding the insignificant dummies for Africa and Latin America, we are not able to find a conditionality in the relationship between property rights institutions and resource abundance with respect to economic growth. What is interesting though is that excluding the same dummies as well as the interaction term, mimicking regression 1 from table 4, yields a positive and significant effect of *Institutional quality*.

[24] Regions are separated as Africa, Asia and Latin America. In addition, developed countries are grouped together.

[25] The estimated models can be found in table 18, 19 and 20 in appendix E.

[26] The estimated models can be found in table 21 in appendix E.

These results are interesting for at least two reasons. The first is that by including a dummy for Asia, we were able to show that an improvement of property rights institutions in itself have a significant positive effect on growth, which improves the findings in the benchmark model. The second is that the conditional resource curse as explained through the quality of property rights institutions is sensitive to the control of regional specific effects.

Significance of the threshold[27]

So far we have seen that the effect of property rights institutions supposed to explain the conditional resource curse disappears in two of the model specifications, when a dummy is included for the countries that have gone through debt reductions, and when a dummy is included for the Asian countries. However, that the conditionality disappears with the inclusion of the debt dummy is not surprising given that the countries who have gone through these reductions have below average values of *Institutional quality* and economic growth as well as an above average value of *Resource abundance*. These are typically the countries that are supposed to benefit from an improvement of property rights institutions and thus some of the explanatory variation is absorbed in the dummy. On the other hand, one could still suggest that even though the whole resource curse is not driven by these countries, the quality of property rights institutions is no longer able to give an explanation for the conditional resource curse without them. This claim is refused when running the model without the countries that have gone through debt reductions. Doing this preserves a significant threshold at the a level of *Institutional quality* equal to 0,93. When it comes to the Asian countries, this is a group of countries that on average represent the opposite of the countries covered by the debt reduction dummy. They have higher economic growth, less natural resources and a quality of property rights institutions that is the same as the average of the whole sample. Contrary to the exclusion of the 'debt' countries, the exclusion of the Asian countries do not bring back a predicted threshold value of *Institutional quality*. However, by closer examination one sees that among the Asian countries are Malaysia, that with a level of *Resource abundance* of 0,37, an *Institutional quality* of 0,69 and an average annual economic growth rate of 4,49 represents the exception among the resource abundant countries when it comes to economic growth in the presence of natural resources. Including Malaysia, but leaving the rest of the Asian countries outside the sample, reintroduces a significant threshold with a predicted value of 0,82. Thus we see that the conclusions may be sensitive to the exclusion of specific countries.

As for the sensitivity to exclusion of observations, this was also pointed out by Norrbin et al. (2008), as noted in section 2. They found the resource curse to be sensitive to the exclusion of either China, Hong Kong and Korea, or Gambia, Malaysia and Zambia. By carrying out the same exercise for this sample, the exclusion of China, Hong Kong and Korea preserves the significant negative impact of natural resources, and a significant interaction term with a

[27]The estimated models can be found in table 22 in appendix E.

predicted threshold of 0,92. However, when excluding Gambia, Malaysia and Zambia, the significant negative impact of natural resources is preserved, but there is no longer a value of *Institutional quality* that would turn the effect of natural resources positive. The same results are obtained by the exclusion of Malaysia alone. Thus that the resource curse itself should vanish by the exclusion of these countries, like predicted by Norrbin et al. (2008), is not confirmed, but we do see that the prediction of the conditional resource curse is sensitive to the exclusion of countries, and especially Malaysia.

Political systems

Andersen and Aslaksen (2008) show that whether countries have a parliamentary, presidential or non-democratic political system matters for the resources curse. While the curse is still present in the sample of presidential and non-democratic countries, it disappears in parliamentary countries. As in this thesis, their basic model specification follows Sachs and Warner (1995), and the periods they investigate are 1970-1990 and 1990-2000. Taking a closer look at the averages of the variables that we have investigated, it is evident from table 11 that there are large differences between the the countries, with the parliamentary countries scoring better than both the presidential and non-democratic countries on all the measures.[28] Especially interesting is the difference between the institutional quality in parliamentary regimes on one hand, and presidential and non-democratic on the other hand.

Table 11: Different Political Systems

Average values			
	Parliamentary	Presidential	Non-democratic
Initial income level	8,73	8,26	7,54
Openness	0,72	0,25	0,13
Resource abundance	0,08	0,14	0,17
Institutional quality	0,77	0,47	0,47
Investments	22,22	16,54	13,62
Credit constraint	$0,41^{\#}$	$0,54^{\pm}$	$0,50^{\pm}$
Volatility (Output)	$0,39^{\S}$	0,65	$0,88^{\oplus}$
Volatility Rer	$0,12^{\S}$	0,20	$0,13^{\oplus}$
Financial development	$50,33^{\S}$	32,57	$23,94^{\oplus}$
Observations	32	24	24

§ 31 observations, $^{\#}$ 10 observations, $^{\pm}$ 21 observations, $^{\oplus}$ 23 observations,

Since there are apparently large differences, it is possible that effects which are present in some of the political subsamples might be washed away when models are run on the whole sample.

[28] Assuming here that the less resource abundant, the better.

To investigate this, models are run on the subsamples according to political regimes.[29] As for the parliamentary countries, neither *Resource abundance* nor *Institutional quality* was significant, this confirms the results from Andersen and Aslaksen (2008). Further, when financial development and the two measures of volatility is included, none of them have any explanatory power either. On the opposite, in the presidential sample, both *Resource abundance* or *Institutional quality* is significant and they continue to be so through the inclusion of *Financial development* and the volatility measures. A notable feature is that in this sample, output volatility was found to have a significant impact, reducing the coefficient of *Resource abundance* a little, although not enough to offset both its statistical and economic significance. Finally, I turn to the sample of nondemocratic countries and as expected, their performance is hard to track. The only variables whose variation seem to explain some of the variation in economic growth is *Resource abundance* and *Investments*, and none of the included financial variables. It is worth emphasizing that these are simple models with few observations, so that the results can not be counted upon as evidence of causal relationships. Probably there are other explanatory variables that should be included in the models, but to search for them is outside the scope of this thesis. However, what the models do is to confirm the pattern one could read from table 11, that there are large differences between the countries when classified by their political system.

Controlling for resource wealth

What has been shown so far is that the importance of volatility, debt and financial development that have been found in other studies is not robust in our models. What appears to be robust is the index aimed at capturing the quality of property rights institutions. However, as discussed in section 3.1, several objections have been raised to the use of *sxp* to capture resource abundance. Norman (2008), argued that *sxp* measures resource dependence, and that a variable to capture the value of the natural capital should be included in addition. In order to sort this out, Norman (2008) introduce the *fuelminratio*, which is the total value of estimated 1970 commodity stocks divided by total GDP.[30] Introducing the *fuelminratio* into our benchmark model, yields the results displayed in table 12. The results do not change substantially, and the predicted threshold of *institutional quality* is 0,89 in regression 1. Further, removing *sxp* as the measure of resource abundance, and using the *fuelminratio* instead does not alter the basic results. An increase in the *fuelminratio* by one standard deviation would reduce the annual growth rate by 0,96%-points, and the predicted threshold of the quality of property rights institutions is lowered to 0,57. Further, introducing volatility, debt and financial development does not change the results (results not shown). Debt however becomes significant at the 10%-level with a negative sign. Though the threshold of *Institutional quality* is still present.

[29]The estimated models can be found in table 23, 24 and 25 in appendix E. The *Credit constraint* is not included in the models due to lack of observations.

[30]The commodities included are oil, coal, gas and mined minerals. For more on how the measure is constructed, see Norman (2008).

Table 12: Introducing the *fuelminratio* as an explanatory variable

Dependent variable: GDP Growth		
	Regression 1	Regression 2
Initial income level	-1,18*	-1,14*
	(-5,42)	(-4,42)
Openness	1,40*	1,71*
	(3,82)	(4,57)
Resource abundance	-15,88*	
	(-5,91)	
Institutional quality	-1,24	0,66
	(-1,09)	(0,64)
Investments	0,14*	0,13*
	(6,42)	(4,83)
Interaction term	17,89*	
	(3,40)	
Fuelminratio	0,002	0,013*
	(1,11)	(-5,86)
Interaction (Fuelmin*IQ)		0,023*
		(4,10)
Observations	74	74
Adjusted R^2	0,68	0,57

Note: The number in brackets are t-values. * indicates significance at the 5%-level.

In Mehlum et al. (2006, p.15), they also tested another specification of resources abundance. Motivated by the possibility that the effects of property rights institutions could be biased by agrarian products, they used mineral production in GDP instead of primary products to GNP. What they found was that the direct negative effect of natural resources became even stronger while the threshold was lowered to an institutional quality of 0,60, which thus supports the theory of a conditional resource curse through improvement of property rights institutions.

Additional control variables

Including control variables is a way to mitigate omitted variable bias and control for cross-country heterogeneity and thus including the 'right' control variables is of importance. As for our models, we have used the same control variables and thus there might be omitted variables that have a stronger predictive effect on economic growth than those already included. Testing for such is therefore important. However, as already noted, there are as many variables suggested to be important for growth as there are countries in the world (Durlauf et al., 2005). The findings in Sala-i Martin (1997) are helpful in this respect. Using more than 60 variables, he investigates which of them that are strongly correlated with growth. The results are that

regional, political and religious variables appear to be significant in addition to variables for market distortions and market performance, types of investments, primary sector production, openness, type of economic organization and finally whether the countries have been former Spanish colonies or not (Sala-i Martin, 1997, p.181-182). When running a regression including one variable or more from the different categories,[31] we do however find that the threshold is preserved with a predicted value of 0,91 for *Institutional quality*.[32] Further, in addition to the tests carried out in this thesis, the benchmark study by Mehlum et al. (2006) controlled for whether the results were due to a particular African effect and whether education, as a proxy for human capital, and fractionalization, both in terms of language and ethnology could change the results. The conclusion was that a significant threshold based on the quality of property rights institutions was preserved.

[31]The variables included are life expectancy, school enrollment, a dummy for Sub-Saharan Africa, Latin America and former Spanish colonies, civil liberties, fraction of muslims in the population, real exchange rate distortions, mineral abundance, the degree of capitalism. A description of the variables can be found in Perez (2011). In addition, *Initial income*, *Resource abundance*, *Investments*, *Openness* and the *Interaction term* is included.

[32]The estimated model can be found in table 26 in appendix E.

7 Discussion of the results

The pattern that emerge from the empirical section is that improving property rights institutions seems important for developing countries, but that the conditional resource curse based on the interaction between *Institutional quality* and *Resource abundance* is sensitive to the sample selection and model specification. What we saw was that excluding Malaysia from the sample removed the threshold for the whole sample.[33] On one hand this could question the claim of a conditional resource curse going through institutions. On the other hand, Malaysia is an example of a country who has managed to combine a value of resource abundance three times the average with a growth rate almost two and a half times the average. In addition it has a quality of property rights institutions which is the fourth among the countries with resource abundance above the mean, beaten only by New Zealand, Ireland and the Netherlands. Similar countries to Malaysia is not found in the sample, and thus removing the prime example should be expected to change the results. What is more challenging is that even though the threshold was found to be significant, the lowest value in any sample, excluding the robustness section, was found to be 0,84. Comparing the countries of which Matsen and Torvik (2005) claim to have escaped the resource curse and those who have not, the 'escapers', Thailand, Chile, Malaysia, Botswana and Ireland all have a value of *Institutional quality* lower than 0,84. On the other hand all the countries that have escaped the resource curse had better institutions than those who had not, suggesting that institutions make a difference.[34] It is also worth noting that when Mehlum et al. (2006) changed the measure of resource abundance to mineral abundance, the predicted threshold was lowered to 0,60 and when using the *fuelminratio* the threshold was 0,57, which both are less than the *Institutional quality* of all the 'escapers'. On the other hand, what it is that constitutes 'good institutions' and what other factors institutions affect that enhance economic growth is still unclear. This is discussed in Andersen and Aslaksen (2008, p.228). They argue that in addition to problems of endogeneity, using measures of institutions such as the *Institutional quality* variable is problematic because "it is unclear which aspects of institutional performance that are important for economic growth." Instead they reckon that "investigating institutional design, as opposed to measures of institutional performance is a key to solving some of the problems in the resource curse literature." The results in Andersen and Aslaksen (2008) is very interesting, but they do not invalidate the results found in Mehlum et al. (2006) and in this thesis. As opposed to saying that measuring institutional performance is wrong and measuring institutional design is right, it should be possible to take both the measures into account. First of all, the aspects of institutional performance captured by the property rights index could in the strict sense be obtained from its components. Separating the five different measures to find their relative importance would not give reliable results because they are highly correlated and would cause problems of multicollinearity (Knack and Keefer, 1995). But due to the high correlation

[33] It can also be shown that the threshold disappears in the sample of developing countries.

[34] A list of the countries that Matsen and Torvik (2005) argue to be escapers and non-escapers of the resource curse is presented in table 27 in appendix E.

among the measures, it is plausible to assume that they go hand in hand. For example, it is likely that if you establish a better rule of law, there would also be less repudiation of contracts by government. Similarly, increasing the quality of the bureaucracy would probably lead to less corruption. As for policy prescriptions, it would be wrong to draw the causality found is Andersen and Aslaksen (2008) as far as saying that being presidential instead of parliamentary is detrimental for growth. Among the presidential countries, we have U.S.A., Korea and Switzerland, which be no means are growth failures. Interestingly, U.S.A. is actually said to be one of the countries that have managed to escape the resource curse (Matsen and Torvik, 2005). It is probably more efficient to be especially aware of possible violations to the measures included in the *Institutional quality* index in presidential regimes, than to change the constitution and the political system. Though it might be that countries on a transition from non-democratic to democratic rule should be encouraged to form a parliamentary rule, that discussion is beyond the scope of this thesis. However, what aspects of improving property rights institutions that are important for economic growth is still unanswered. It is possible to find some of the many likely answers by looking at the interaction with the additional explanatory variables included in this study.

It might seem surprising that volatility and other measures of financial development is significant in other studies, but not in this one. What might be the case is that improving financial institutions is of second order importance and that property rights institutions need to be in place first. Many of the studies on the importance of finance tends to ignore this. Looking at volatility, proponents of the importance of taming volatility say that one of the reasons why severe volatility arise is because economies are not diversified. The argument in van der Ploeg and Poelhekke (2009, p. 736) for how resource dependent countries could cope with the problem of volatility is as follows, "To get round such natural resource curses, the government could resort to stabilization and saving policy and improve the efficiency of financial markets. It also helps to have a fully diversified economy, since then shocks to non-traded demand can be accommodated through changes in the structure of production rather than expenditure switching". But, what is forgotten is that you might need to have property rights institutions in place in order to start the whole process of diversifying an economy. If you ask, what is needed to diversify an economy, many would say more investments. This is also emphasized by the proponents of taming the volatility, but what is missing is the question of what is needed to attract more investments. Most people would probably agree that respect of private property is important in this respect. This is confirmed in table 13 by running a simple regression using investments as the dependent variable and the property rights index as well as the two volatility measures as explanatory variables. The results imply that an increase in institutional quality by one standard deviation would increase investments by $21{,}97 \times 0{,}23 = 5{,}05$, which is both economically and statistically significant. On the other hand, none of the volatility variables produce any significant impact on investments on average. That financial institutions might be a second order effect is confirmed by Acemoglu and Johnson (2004) who finds that the property rights proxy

also has implications for the stock market and the supply of credit (Acemoglu and Johnson, 2004, p.3). What is plausible is that other institutions need to be in place before the importance of financial institutions kicks in.

Table 13: Determinants of Investments

Dependent variable: Investments	
	Regression 1
Institutional quality	21,97*
	(7,00)
Volatility (Output)	-2,53
	(-1,45)
Volatility (RER)	0,87
	(0,12)
Observations	85
Adjusted R^2	0,48

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level.

One of the features of the resource curse is that is is conditional, and what has been emphasized is that a realistic model of the curse should be able to explain why some resource abundant countries grow rich, while others do not. Property rights institutions have been found to have this feature, even when controlling for financial development, debt and volatility. *Financial development* delivered a significant prediction of a threshold, but even though the values of *Financial development* needed to achieve growth seemed too high, the most important point was that the effect was no longer robust when the interaction between property rights institutions and resource abundance was included. The correlation between *Institutional quality* and *Financial development* is as high as 0,71, and thus both variables capture a lot of the same aspects of the growth process, but in this study it seems that the quality of property rights institutions captures is better. As for the volatility, the correlation between *Institutional quality* and output volatility is -0,53 in the full sample, while the correlation between volatility in the real exchange rate and *Institutional quality* is -0,48, although it is hard to judge when a correlation is too high for both effects to have a significant impact, the fact that *Institutional quality* was found to have a significant impact on both measures of volatility in table 8, suggests that high volatility is foremost a problem in countries with weak institutions. This would also explain why volatility did not have any significant impact on growth after controlling for the quality of property rights institutions in our models. In this respect it is telling that the correlation between *Institutional quality* and output volatility is reduced to -0,37 in the sample of presidential countries, where it was shown to have a significant negative impact on growth. Nevertheless, even though output volatility became significant in the subsample of presidential countries, it did not have the effect of offsetting the negative impact of natural resource abundance, as predicted by van der Ploeg and Poelhekke (2009). Finally, the debt story found in Manzano and Rigobon (2001) has

not been confirmed by this study. Still, one should not ignore the possible adverse effects of extensive debt. Even though *Credit constraint* did not become significant when included into the benchmark model, almost all the countries that went through debt reductions, were also countries that had a high degree of resource dependence. Thus, this is a link one should not dismiss even though debt seems of less importance in this study.

8 Summary and conclusion

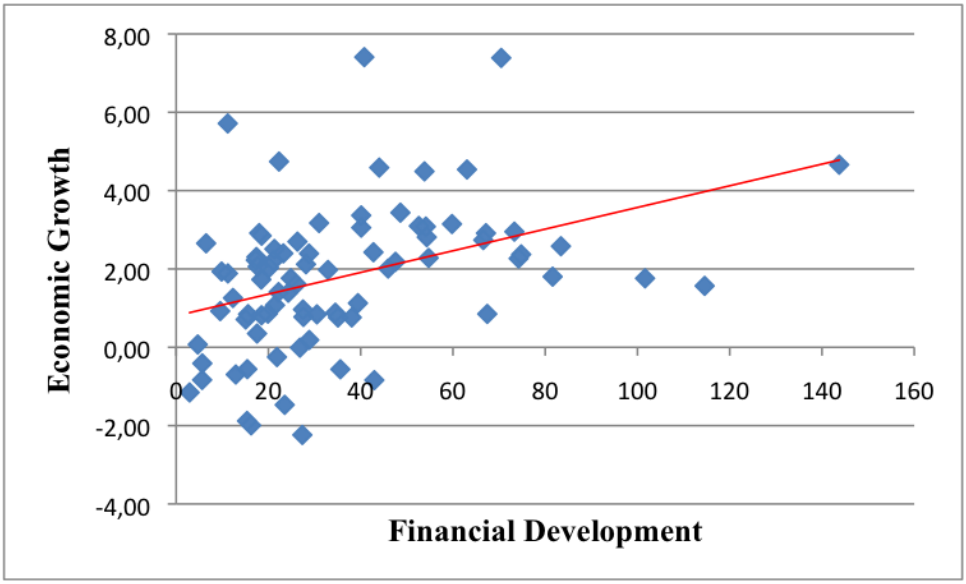
The aim of this thesis has been to investigate the causes of the conditional resource curse. Using the model in Mehlum et al. (2006) as a benchmark, their claim of the importance of property rights institutions has been challenged through the inclusion of different financial variables. The variables included were supposed to capture problems of excessive borrowing, volatility and lack of financial development. Common for all of these is that other studies have found them to be important for growth in resource abundant countries. However, what this thesis shows is that the results from Mehlum et al. (2006) are robust to the inclusion of the financial variables, and that neither debt, volatility nor financial development were significant when controlling for the quality of property rights institutions. The conclusion is therefore that the conditional resource curse seems to be operating through the quality of property rights institutions and thus improving them should be the main priority for countries trying to escape the resource curse. However, what is important to have in mind is that this is one study with one set of data, and the results are just measures of average effects and no definite proof of causal links. Further, as have been thoroughly discussed in this thesis, both the estimation technique and the measure of resource abundance used in the model are controversial, and one should be aware that the robustness tests of the results are no guarantee for the absence of problems such as omitted variable bias or the presence of severe heterogeneity in the sample. It is also a fact that even though the variable for the quality of property rights institutions have been better than its competitors to explain the conditional resource curse, the size of the threshold could be argued to be too high. Nevertheless, one should continue to evaluate the importance of property rights institutions and its attributes, as well as investigating further whether natural resources leads to poor institutions or whether poor institutions cause the natural resource curse.

Finally, this thesis does not try to prescribe a medicine to cure the natural resource curse, but to detect patterns and separate between important and not so important factors. Thus, ignoring volatility and debt accumulation in countries that seem to have the appropriate institutions would not be a recommended strategy. What is needed is careful assessments of each individual country using these results as guidelines. As noted by Durlauf (2000, p.15), growth is an obvious area where econometric analysis should be supplemented by historical work and case studies to a much greater extent than has been done so far.

Table 14: Descriptive statistics

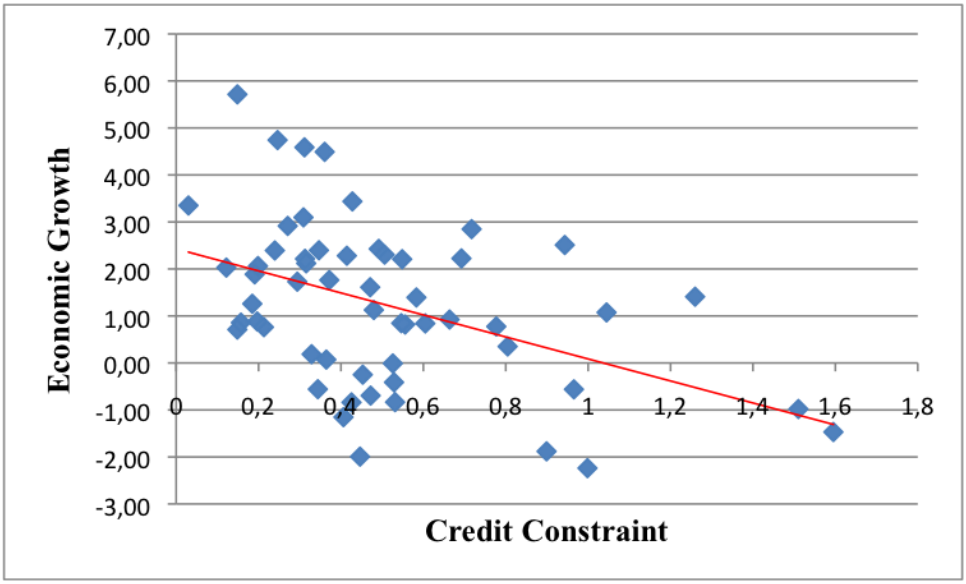
	Mean	Median	Standard deviation	Max	Min	Observations
GDP growth	1,85	1,97	1,94	7,41	-2,24	87
GDP growth	1,78	1,93	1,89	7,41	-2,24	85
GDP growth	1,79	1,95	1,83	7,41	-2,24	82
GDP growth	1,25	1,19	1,74	5,71	-2,24	56
Initial income	8,16	8,06	0,87	9,87	6,52	87
Initial income	8,17	8,10	0,87	9,87	6,52	85
Initial income	8,19	8,11	0,88	9,87	6,52	82
Initial income	7,75	7,71	0,62	9,60	6,52	56
Openness	0,39	0,12	0,44	1,00	0,00	87
Openness	0,38	0,12	0,44	1,00	0,00	85
Openness	0,39	0,12	0,44	1,00	0,00	82
Openness	0,17	0,04	0,28	1,00	0,00	56
Resource abundance	0,12	0,10	0,10	0,54	0,01	87
Resource abundance	0,12	0,10	0,10	0,54	0,01	85
Resource abundance	0,13	0,10	0,10	0,54	0,01	82
Resource abundance	0,15	0,13	0,11	0,54	0,01	56
Resource abundance	0,15	0,13	0,11	0,54	0,01	55
Institutional quality	0,58	0,54	0,23	1,00	0,23	87
Institutional quality	0,58	0,54	0,23	1,00	0,23	85
Institutional quality	0,58	0,54	0,23	1,00	0,23	82
Institutional quality	0,45	0,45	0,12	0,70	0,23	56
Institutional quality	0,46	0,45	0,12	0,70	0,23	55
Investments	17,50	17,49	8,04	36,01	1,37	87
Investments	17,39	17,26	8,09	36,01	1,37	85
Investments	17,57	17,37	8,10	36,01	1,37	82
Investments	14,00	14,70	6,61	28,18	1,37	56
Financial development	35,73	27,43	26,02	143,73	2,91	82
Financial development	24,73	21,43	13,48	64,35	2,91	55
Credit Constraint	52,56	44,85	35,65	179,15	2,99	56
Credit Constraint	50,75	44,37	33,28	179,15	2,99	55
Volatility (Output)	0,65	0,52	0,44	2,66	0,16	85
Volatility (Output)	0,64	0,51	0,42	2,66	0,16	82
Volatility (RER)	0,15	0,12	0,10	0,50	0,04	85
Volatility (RER)	0,15	0,12	0,10	0,50	0,04	82

Figure 2: Financial Development and Economic Growth



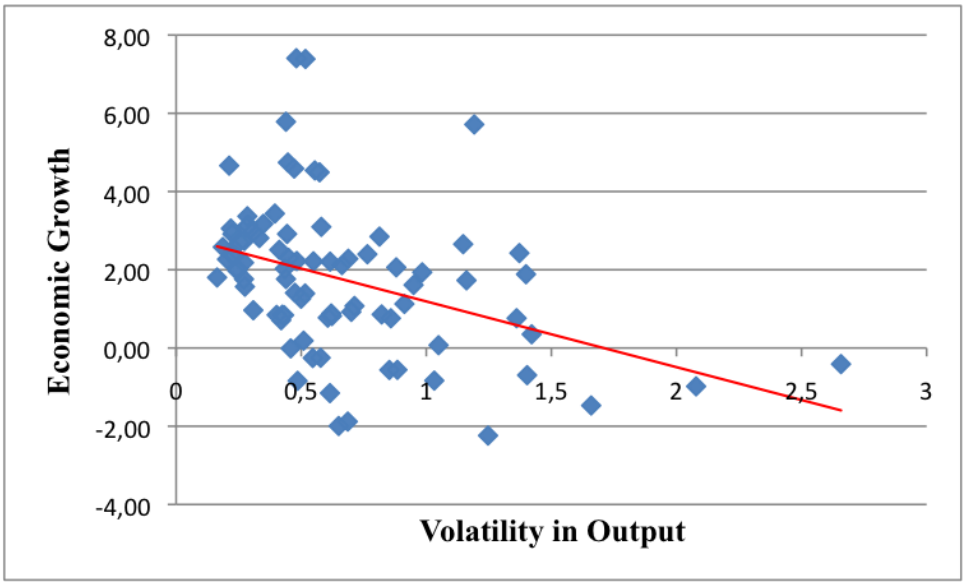
The line is the linear trend. (Slope = 0,03 adjusted R^2 = 0,14)

Figure 3: Credit Constraint and Economic Growth



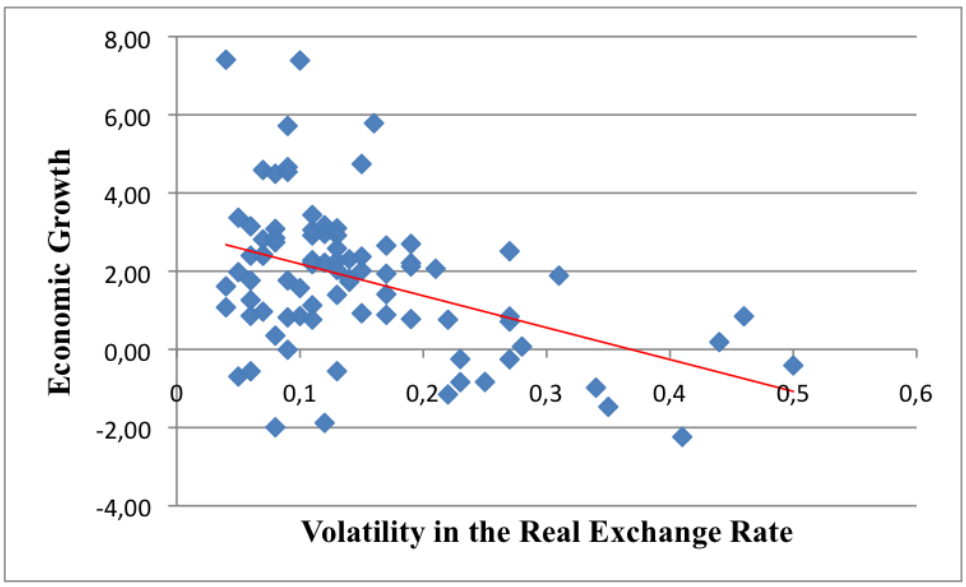
The line is the linear trend. (Slope = -0,02 adjusted R^2 = 0,17)

Figure 4: Volatility in Output and Economic Growth



The line is the linear trend. (Slope = -1,68, adjusted R^2 = 0,14)

Figure 5: Volatility in the Real Exchange Rate and Economic Growth



The line is the linear trend. (Slope = -1,46, adjusted R^2 = 0,09)

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Appendices

A The Gauss-Markov Assumptions

The description of the Gauss-Markov assumptions follows Wooldridge (2009, p.104-105)

Assumption 1: Linear in Parameters

The model in the population can be written as:

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + ... + \beta_k x_k + u$$

where, $\beta_0, \beta_1, ..., \beta_k$ are the unknown parameters (constants) of interest, $x_1, x_2, ..., x_k$ are the independent variables, and u is an unobserved random error or disturbance term.

Assumption 2: Random Sampling

We have a random sample of n observations $\{(x_{i1}, x_{i2}, ..., x_{ik}, y_i)\}$, following the population model in Assumption 1.

Assumption 3: No Perfect Collinearity

In the sample (and therefore in the population), none of the independent variables is constant, and there is no *exact linear* relationships among the independent variables.

Assumption 4: Zero Conditional Mean

The error u has an expected value of zero given any values of the independent variables. In other words,

$$E(u \mid x_1, ..., x_k) = 0$$

Assumption 5: Homoskedasticity

The error u has the same variance given any value of the explanatory variables. In other words,

$$Var(u \mid x_1, ..., x_k) = \sigma^2$$

B Estimation techniques

B.1 Ordinary least squares (OLS)

In this simple case, we assume a cross-sectional dataset, which consists of different osbservations on individuals, taken at a given point in time. In this thesis, the individuals are countries. It is important to note than when using this procedure, we assume that the Gauss-Markov assumptions hold. To illustrate how the OLS method works, I follow Wooldridge (2009) and use a simple model with y_i as the dependent variable whose values are to be explained by the variation in the explanatory variable x_i. The true model is given by equation (2), however our estimation of the true model will be like equation (3):

$$y_i = \beta_0 + \beta_1 x_i + u_i \tag{2}$$

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_i \tag{3}$$

u_i is the error term which consists of all the factors that affect y_i but is not captured by x_i, while β_1 and $\hat{\beta}_1$ is the true and estimated effect of a change in x_i on y_i respectively. If we subtract $\hat{y}_1$ from y_i, we get the residuals, $\hat{u}_i$. We would like our estimated values of β_0 and β_1 to be as close to the true ones as possible, and the method of OLS ensures this by minimizing the sum of squared residuals with respect to $\hat{\beta}_0$ and $\hat{\beta}_1$. The problem is depicted in equation (4):

$$min \sum_{i=1}^{n} (\hat{u}_i)^2 = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2 = \sum_{i=1}^{n} (y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i)^2 \tag{4}$$

Now, taking the partial derivatives of equation (4) with respect to $\hat{\beta}_0$ and $\hat{\beta}_1$, yields the following:

$$\frac{\partial}{\partial \hat{\beta}_0} = \sum_{i=1}^{n} 2(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) \cdot (-1) = 0 \tag{5}$$

$$\frac{\partial}{\partial \hat{\beta}_1} = \sum_{i=1}^{n} 2(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) \cdot (-x_i) = 0 \tag{6}$$

Now, from equation (5), we can derive the following:

$$\sum_{i=1}^{n}(y_i - \hat{\beta}_0 - \hat{\beta}_1 x_i) = 0 \tag{7}$$

$$\sum_{i=1}^{n} y_i - n\hat{\beta}_0 - \hat{\beta}_1 \sum_{i=1}^{n} x_i = 0 \tag{8}$$

$$\frac{1}{n}\sum_{i=1}^{n} y_i - \frac{1}{n} n\hat{\beta}_0 - \frac{1}{n}\hat{\beta}_1 \sum_{i=1}^{n} x_i = 0 \tag{9}$$

$$\bar{y} = \hat{\beta}_0 + \hat{\beta}_1 \bar{x} \tag{10}$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{x} \tag{11}$$

Then if we insert equation (11) back into the minimization problem in equation (4), we get:

$$min \sum_{i=1}^{n}(y_i - (\bar{y} - \hat{\beta}_1\bar{x}) - \hat{\beta}_1 x_i)^2 = \sum_{i=1}^{n}[(y_i - \bar{y}) - \hat{\beta}_1(x_i - \bar{x})]^2 \tag{12}$$

Then we can minimize equation (12) with respect to $\hat{\beta}_1$, this yields the following:

$$\sum_{i=1}^{n} 2[(y_i - \bar{y}) - \hat{\beta}_1(x_i - \bar{x})] \cdot (-1)(x_i - \bar{x}) = 0 \tag{13}$$

$$\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x}) - \hat{\beta}_1 \sum_{i=1}^{n}(x_i - \bar{x})(x_i - \bar{x}) = 0 \tag{14}$$

$$\hat{\beta}_1 = \frac{\sum_{i=1}^{n}(y_i - \bar{y})(x_i - \bar{x})}{\sum_{i=1}^{n}(x_i - \bar{x})^2} \tag{15}$$

Now we have found the OLS estimators. The estimator for β_0 can be found in equation (11), while the estimator for β_1 can be found in equation (15). An important property of the OLS estimators is the Gauss-Markov theorem which states that under the Gauss-Markov assumptions the OLS estimators are the best linear unbiased estimators of the true parameters (Wooldridge, 2009, p.103).

B.2 Estimation using instrumental variables

The approach of using instrumental variables is often applied when assumption 4 of the Gauss-Markov assumptions, is violated. Following the lecture notes by Kåre Johansen, we assume the same model as when we derived the OLS estimates.

$$y_i = \beta_0 + \beta_1 x_i + u_i \tag{16}$$

Further we assume that $E(u_i) = 0$, while $Cov(u_i, x_i) \neq 0$ which is a violation of assumption 4. If we then have another variable z_i, which fulfills the following assumptions:

1. $Cov(u_i, z_i) = 0$
2. $Cov(u_i, x_i) \neq 0$

then z_i could be used as an instrumental variable for x_i. This means that we can estimate equation (16) using the OLS procedure described in the previous section, given that x_i is replaced by z_i. It is also possible to use a combination of instruments as a single instrument for x_i. Then x_i is estimated as a function of the instruments using OLS, before the predicted values are used in the place of x_i in regression (16). This procedure of using multiple variables as an instrument for x_i is called two-stage least squares.

When there is a discussion of whether the use of instrumental variables is appropriate, the argument is over the validity of assumption 1 and 2. The problem is that there is no test that can fully check whether the assumption 2 holds.

B.3 Panel data with fixed effects

Panel data is characterized by observations of individuals that vary both between each other and over time. Following the lecture notes by Kåre Johansen, we use a simple model with two explanatory variables to illustrate estimation of panel data using fixed effects estimators:

$$y_{it} = \alpha + \beta_1 x_{it1} + \beta_2 x_{it2} + u_{it}$$
$$u_{it} = \eta_i + \varepsilon_{it}$$

Now, the error term can be decomposed into a term that is specific for each individual η_1, but constant over time, and one that might vary both over time and across individuals, ε_{it}. The advantage of the fixed effects estimator is easy to show if we now assume that the "true" model includes a term $\gamma_3 z_{i3}$. This term would then be included in η_1, since it is specific for each individual, but constant over time. Further, if we now assume that $E(\eta_i \mid x_{it1}, x_{it2}) \neq 0$, then the direct use of OLS on the model would produce biased estimators. Now, rewriting the model above so that $\alpha_i = \alpha + \eta_i$, we have:

$$y_{it} = \alpha_i + \beta_1 x_{it1} + \beta_2 x_{it2} + \varepsilon_{it} \tag{17}$$

To see how fixed effects estimation works, we start by calculating the individual specific averages as:

$$\bar{y}_i = \frac{1}{T}\sum_{t=1}^{T} y_{it}$$
$$\bar{x}_{i1} = \frac{1}{T}\sum_{t=1}^{T} x_{it1}$$
$$\bar{x}_{i2} = \frac{1}{T}\sum_{t=1}^{T} x_{it2}$$

Since α_i do not vary over time, one could say that α_i is the average. Now, if we sum over all T and divide by T on both sides of (17), this gives:

$$\bar{y}_i = \alpha_i + \beta_1 \bar{x}_{i1} + \beta_2 \bar{x}_{i2} + \bar{\varepsilon}_i \tag{18}$$

Then if we subtract (18) from (17), we get:

$$y_{it} - \bar{y}_i = \beta_1(x_{it1} - \bar{x}_{i1}) + \beta_2(x_{it2} - \bar{x}_{i2}) + (\varepsilon_{it} - \bar{\varepsilon}_1) \tag{19}$$

What we have done is called the 'within transformation'. Now if we use OLS directly on (19), we get the fixed effects estimator. What we see is that the individual specific component, α_i is transformed away from the model, and thus we would get unbiased and consistent estimators. In the context of growth regressions, we would then have transformed away the problem of effects that are specific for the individual countries and which we are not able to control for, given that these effects do not vary over time.

C Variables: Description and sources

Many of the variables used are taken from other papers, the descriptions of these thus follows the descriptions given in the original papers. When sources are referred to in the quotes, the reference is found in the respective papers from which the quote is taken from and not reported in the reference list following this thesis.

GDP growth

The following is taken from Sachs and Warner (1997, p.371), "Average annual growth in real GDP per person between 1965 and 1990. GDP data are from the *Penn World Tables*, Mark 5.6, and are adjusted for differences in the purchasing power across countries (See Summers and Heston, 1981). The population data is from the *World Data CD-ROM, 1995, World Bank*."

Initial income level

The following is taken from Sachs and Warner (1997, p.371), "The log of real GDP per head of the economically active population in 1965. GDP data are from the *Penn World Tables*, Mark 5.6, and are adjusted for differences in the purchasing power across countries (See Summers and Heston, 1981). The economically active population is defined as the population between the ages 15-64. The population data is from the *World Data CD-ROM, 1995, World Bank*."

Openness

The following is taken from Sachs and Warner (1997, p.371), "The fraction of years during the period 1965-90 in which the country is rated as open according to the criteria in Sachs and Warner (1995)."

Resource abundance - sxp

The following is taken from Sachs and Warner (1997, 371-372), "Share of exports of primary products in GNP in 1970. Primary products or natural resource exports are exports of 'fuels' and 'non-fuel primary products' from the World Data 1995 CD-ROM disk, produced by the World Bank. Non-fuel primary products correspond to SITC categories 0, 1, 2, 4 and 68. Fuels correspond to SITC category 3. The categories are from revision 1 of the SITC. GNP is taken from the same source. Both numerator and denominator are measured in nominal dollars. The World Data uses a smoothed exchange rate to convert local currency GNP to dollars. This

describes the basic data. In addition, we made the following modifications: Bangladesh: 1975 data. Botswana: exports of diamonds in 1970 taken from Modise (1996). China: 1980 data. Jordan: 1985 data. Taiwan: exports taken from *Taiwan Statistical Data Book 1995*, page 194 and GNP taken from 1996 volume, page 1. Uganda: 1980 data. South Africa: the published trade statistics do not include raw diamonds and gold, so these were added by the authors using data in *Bulletin of Statistics*, The Republic of South Africa, Pretoria, December 1972 and June 1992. Singapore: Used net exports of natural resources because Singapore simply re-exports a lot of natural resources which originate elsewhere. Trinidad: used net exports for the same reason as Singapore. Zimbabwe: 1980 data."

SITC categories: 0: Food and live animals, 1: Beverages and tobacco, 2: Crude materials inedible except fuels, 3: Mineral fuels, lubricants and related materials, 4: Animal and vegetable oil fats and waxes, 68: Non-ferrous metals (OECD, 2011).

Institutional quality

The following descriptions of the five indexes which enters into *Institutional quality* is taken from the *Data appendix* in Knack and Keefer (1995, p.225-226). When computing the average index, all the indexes are transformed into 10-point scales. A higher value of the index means better institutional quality. The data that Knack and Keefer (1995) use is from *Political Risk Services'* International Country Risk Guide (ICRG). Most of the observations are from 1982, though there are some from 1984 and a few from 1985 (Knack and Keefer, 1995, 226). The version of this thesis is the one from Mehlum et al. (2006), where the index have been divided by ten, making an index ranging from zero to unity.

Quality of the Bureaucracy

High scores indicates "autonomy from political pressure" and "strength and expertise to govern without drastic changes in policy or interruptions in governments services"; also existence of an "established mechanism for recruiting and training." (Knack and Keefer, 1995, p.225)

Corruption in Government

Lower scores indicate "high government officials are likely to demand special payments" and "illegal payments are generally expected throughout lower levels of government" in the form of "bribes connected with import and and export licenses, exchange controls, tax assessment, policy protection, or loans." (Knack and Keefer, 1995, p.225)

Rule of Law

This variable "reflects the degree to which the citizens of a country are willing to accept the established institutions to make and implement laws and adjudicate disputes." Higher scores indicate "sound political institutions, a strong court system, and provisions for an orderly succession of power." Lower scores indicate "a tradition of depending on physical force or illegal means to settle claims." Upon changes in government in countries scoring low on this measure, new leaders "may be less likely to accept the obligations of the previous regime." Original name in ICRG is "law and order tradition." (Knack and Keefer, 1995, p.225)

Expropriation Risk

Assessment of risk of "outright confiscation" or "forced nationalization." Lower scores means higher risk. (Knack and Keefer, 1995, p.226)

Repudiation of Contracts by Government

Indicates the "risk of a modification in a contract taking the form of a repudiation, postponement, or scaling down" due to "budget cutbacks, indigenization pressure, a change in government, or a change in government economic and social priorities." (Knack and Keefer, 1995, p.226)

Investments

The following is taken from Sachs and Warner (1997, p.372), 'Ratio of real gross domestic investments (public plus private) to real GDP, averaged over the period 1970-89. Source: Barro and Lee, 1994 and Summers and Heston v. 5.5."

Credit constraint

This is the *External debt stocks (% of GNI)* in 1981, taken from World Bank (2011).

Financial development

This is the average of the variable *Domestic credit to private sector (% of GDP)* taken from World Bank (2011) for the years 1970 to 1990. Modifications in the data: Uganda: years 1970-1986, Malawi: years 1988-1990, Tanzania: years 1988-1990, Zimbabwe: years 1970-1990,

Indonesia: years 1980-1990, Morocco: years 1970-1985, Tunisia: years 1970-1986, Brazil: excluding 1986 and 1987, Botswana: years 1972-1990, China: 1977-1990, Bangladesh, 1974-1990, Taiwan, Hong Kong, Haiti and Somalia are excluded due to missing data.

Volatility

Volatility in output

For each year between 1970 and 1990, GDP per worker is constructed as $log[RGDP \times \frac{100}{Population}]$. $RGDP$ is the PPP converted real GDP per capita (Chain series) at 2005 constant prices, taken from Heston et al. (2011) and $Population$ is the population ages 15-64 as % of total, taken from World Bank (2011). Calling this variable GDP, the growth is calculated as $100 \times \frac{GDP_{t+1}}{GDP_t}$, where $t = 1970....1989$. Then the standard deviation of the growth rate for the period is calculated for each country. Modifications: Botswana: years 1970-1989, Niger: years 1970-1989, Somalia: years 1970-1989, Tanzania: years 1970-1988, Zaire: years 1970-1989, Haiti: years 1970-1989, Taiwan is excluded due to missing data.

Volatility in the real exchange rate

Volatility in the real exchange rate is created as the variation of each country's real exchange rate distortion index around its mean during the period 1976-85. The measure is from Dollar (1992), and the following is taken from his description of how the index is constructed and the underlying intuition. For the original description, see Dollar (1992, p.525-530). Dollar use data from Summers and Heston (1988) to compute an index of a country's relative price level to the United States. The index is the following:

$$RPL_i = 100 \times eP_i/P_{U.S.}$$

where e is the exchange rate (dollars per unit of the domestic currency) and P_i is the consumption price index for country i. The intuition is that if all goods were tradable and there were no trade barriers, these measures would all be 100. However, the nontradable goods complicates the picture. It is reasonable to expect that factor price equalization does not hold, and thus the prices of nontradables would vary systematically with endowments. To do this correction, a regression is run using the price level as dependent variable and endowments as explanatory variables. In running the regressions, Dollar (1992) use GDP per capita as a proxy for endowments. As noted by Dollar, GDP is the value of factor services generated by an economy in a year, so that per capita GDP is a summary measure of relative per capita factor availability. The

equation which is estimated and thus underlies the index is the following.

$$RPL = \alpha + \beta_1 GDP + \beta_2 GDP^2 + \delta_1 LatinAm + \delta_2 Africa$$

The intuition is that countries above (below) the regression line has a higher (lower) price level then can be justified by its endowments and is taken to be relatively inward (outward) orientated. Finally, to construct the index, the actual price level is divided by the predicted price from the equation. Then for each country, the average value for the 10 years, 1976-85 is computed to avoid short term fluctuations. As noted, the volatility is then calculated as the variation of each country's real exchange rate distortion index around its mean during the period 1976-85.

The variables used in the reconstruction of Manzano and Rigobon (2001)

The variables *Average annual GDP growth*, *Income level (1980)*, *Openness (8089)*, and *Investments (Avg.8089)* have the same interpretation and construction as *GDP growth*, *Initial income level*, *Openness* and *Investments*, respectively. The difference is the time, or the period for which the variables are constructed for. *Resource abundance* and *Credit constraint* is exactly as described above.

Non-Agr. Exp./GNI (1970)

This is constructed using data from World Bank (2011) in the following way:

$$Non.Agr.Exp./GNI = \frac{(fuel + metores) * merchandise}{GNI}$$

fuel is the share of fuel exports in total merchandise exports in 1970, *metores* is the share of mineral and ores exports in total merchandise exports in 1970. *merchandise* is the value of merchandise exports in 1970 measured in current US$, while *GNI* is the gross national income in 1970, measured in current US$.

Agr. Exp./GNI (1970)

This is constructed using data from World Bank (2011) in the following way:

$$Agr.Exp./GNI = \frac{agr * merchandise}{GNI}$$

agr is the share of agricultural exports in total merchandise exports in 1970. *merchandise* is the value of merchandise exports in 1970 measured in current US$, while *GNI* is the gross national income in 1970, measured in current US$.

D Countries in the sample

Table 15: The 87 Countries Included in the Sample

Bolivia	Haiti	El Salvador	Bangladesh	Guatemala
Guyana	Philippines	Uganda	Zaire	Nicaragua
Mali	Syria	Nigeria	Peru	Honduras
Indonesia	Congo	Ghana	Somalia	Jordan
Pakistan	Zambia	Argentina	Morocco	Sri Lanka
Togo	Egypt	Algeria	Paraguay	Zimbabwe
Malawi	Dominican Rep.	Tunisia	Tanzania	Madagascar
Jamaica	Senegal	Burkina Faso	Uruguay	Turkey
Colombia	Gabon	Mexico	Sierra Leone	Ecuador
Costa Rica	Greece	Venezuela	Kenya	Gambia
Cameroon	China	India	Niger	Trinidad & Tobago
Israel	Thailand	Chile	Brazil	Korea Rep.
Ivory Coast	Malaysia	South Africa	Botswana	Spain
Portugal	Hong Kong	Italy	Taiwan	Ireland
Singapore	France	U.K.	Japan	Australia
Austria	West Germany	Norway	Sweden	New Zealand
Canada	Denmark	Finland	Belgium	U.S.A.
Netherlands	Switzerland			

E Additional tables

Table 16: A Re-Run of the Results from Manzano and Rigobon (2001)

Dependent variable: Average annual GDP Growth (1980 -1990)	Regression 1	Regression 2	Regression 3	Regression 4
Non-Agr. Exp/GNI (1970)	-0,023*	-0,022*		
	(-2,46)	(-2,60)		
Resource abundance			-9,58*	-7,50*
			(–3,83)	(-2,76)
Income level (1980)	-0,80	-0,93**	-1,00**	-1,05*
	(-1,38)	(-1,65)	(-1,85)	(-1,97)
Openness (8089)	3,34*	3,03*	3,13*	2,95*
	(2,88)	(2,82)	(2,58)	(2,54)
Investments (Avg.8089)	0,15	0,21	0,34	0,34
	(0,27)	(0,36)	(0,68)	(0,73)
Agr. Exp./GNI (1970)	0,05*	0,04*		
	(2,04)	(1,78)		
Credit constraint		-0,02*		-0,01
		(-2,77)		(-1,47)
Observations	56	56	56	56
Adjusted R^2	0,26	0,35	0,28	0,29

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%- level.

Table 17: Developing Countries Sample

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5
Initial income level	-1,06*	-1,08*	-1,11*	-1,21*	-1,02*
	(-4,41)	(-4,42)	(-4,55)	(-4,90)	(-4,63)
Openness	1,68*	1,72*	1,63*	1,65*	1,77*
	(3,87)	(4,00)	(3,74)	(3,46)	(4,21)
Resource abundance	-13,32*	-12,03*	-14,32*	-6,01*	-13,08*
	(-4,21)	(-3,67)	(-4,02)	(-2,36)	(-6,33)
Institutional quality	-0,05	0,23	0,10	2,01**	
	(-0,02)	(0,12)	(0,05)	(1,70)	
Investments	0,14*	0,14*	0,15*	0,13*	0,14*
	(6,30)	(5,70)	(6,46)	(5,16)	(7,08)
Volatility (Output)		-0,33			
		(-0,78)			
Volatility (RER)			0,89		
			(0,50)		
Financial development				0,03**	
				(1,71)	
Interaction (IQ)	14,23**	12,36**	16,07*		14,22*
	(1,96)	(1,70)	(2,03)		(3,35)
Interaction (FD)				-0,03	
				(-0,30)	
Observations	54	54	54	54	54
Adjusted R^2	0,64	0,64	0,64	0,65	0,64

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

Table 18: Using Regional Dummies - Credit Constraint

Dependent variable: GDP Growth			
	Regression 1	Regression 2	Regression 3
Initial income level	-0,94*	-0,94*	-0,73
	(-4,11)	(-3,45)	(-2,40)
Openness	1,50*	1,85*	1,85*
	(3,57)	(4,05)	(4,38)
Resource abundance	-5,33*	-5,38*	-5,65*
	(-3,49)	(-3,10)	(-3,66)
Institutional quality	2,70*	2,36**	2,02
	(2,33)	(1,78)	(1,62)
Investments	0,13*	0,13*	0,13*
	(5,89)	(5,80)	(5,81)
Credit constraint	-0,006	-0,008	-0,005
	(-1,25)	(-1,39)	(-0,67)
Asia	-0,21		
	(-0,37)		
Africa		-0,19	
		(-0,35)	
Latin America			-0,30
			(-0,58)
Region×Credit constraint	0,02	0,004	-0,002
	(1,34)	(0,39)	(-0,29)
Observations	56	56	56
Adjusted R^2	0,64	0,63	0,63

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

Table 19: Using Regional Dummies - Volatility in Output

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	-1,14*	-1,48*	-1,23*	-1,00*
	(-5,26)	(-5,43)	(-4,74)	(-4,71)
Openness	0,81*	1,17*	1,32*	1,80*
	(2,51)	(2,89)	(3,14)	(4,24)
Resource abundance	-5,59*	-5,99*	-6,22*	-6,16*
	(-4,57)	(-4,05)	(-4,27)	(-5,03)
Institutional quality	1,45**	1,34	0,17	1,91**
	(1,84)	(1,25)	(0,16)	(1,87)
Investments	0,13*	0,14*	0,15*	0,13*
	(5,92)	(6,71)	(6,96)	(6,10)
Volatility	-0,38	0,008	-0,31	-0,50
	(-0,95)	(0,02)	(-0,70)	(-1,30)
Asia	1,19			
	(1,58)			
Africa		-0,10		
		(-0,15)		
Latin America			-0,18	
			(-0,33)	
Developed countries				-3,22*
				(-4,27)
Region $\times$ Volatility	0,31	-0,49	-0,48	5,68*
	(0,30)	(-0,73)	(-0,73)	(4,48)
Observations	85	85	85	85
Adjusted R^2	0,73	0,68	0,67	0,72

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

Table 20: Using Regional Dummies - Volatility in the Real Exchange Rate

Dependent variable: GDP Growth				
	Regression 1	Regression 2[§]	Regression 3	Regression 4
Initial income level	-1,06*	-1,35*	-1,13*	-0,94*
	(-5,04)	(-4,84)	(-4,49)	(-4,26)
Openness	0,90*	1,13*	1,53*	1,89*
	(2,46)	(2,98)	(3,58)	(4,14)
Resource abundance	-5,87*	-5,55*	-6,16*	-6,57*
	(-5,32)	(-3,88)	(-4,51)	(-6,01)
Institutional quality	1,27	0,53	-0,30	1,10
	(1,28)	(0,45)	(-0,27)	(0,95)
Investments	0,13*	0,14*	0,15*	0,13*
	(6,18)	(6,77)	(7,16)	(6,45)
Volatility	-0,68	-3,63**	-0,67	-1,68
	(-0,44)	(-1,89)	(-0,35)	(-1,01)
Asia	1,24			
	(1,14)			
Africa		-1,12**		
		(-1,90)		
Latin America			-0,55	
			(-0,96)	
Developed countries				-1,24
				(-1,74)
Region $\times$ Volatility	0,93	3,37	-3,17	-1,62
	(0,11)	(1,30)	(-1,09)	(-0,33)
Observations	85	85	85	85
Adjusted R^2	0,72	0,69	0,68	0,70

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

[§] When removing the interaction term *Region*$\times$*Volatility*, the significance of *Africa* disappears.

Table 21: Using Regional Dummies

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3[§]	Regression 4[§§]	Regression 5
Initial income level	-1,01*	-0,99	-1,08*	-1,08*	-1,09*
	(-4,43)	(-4,79)	(-5,95)	(-6,45)	(-6,03)
Openness	1,35*	1,41*	1,05*	1,06*	0,85*
	(3,27)	(3,55)	(3,14)	(3,71)	(2,76)
Resource abundance	-12,06*	-12,75*	-11,84*	-11,94*	-5,95*
	(-5,32)	(-7,31)	(-5,73)	(-7,05)	(-6,06)
Institutional quality	0,41		0,05		1,59*
	(0,34)		(0,05)		(2,11)
Investments	0,13*	0,13*	0,13*	0,13*	0,13*
	(6,95)	(7,44)	(6,90)	(7,26)	(6,65)
Interaction term	11,82*	13,04*	11,73*	11,91*	
	(2,90)	(4,22)	(3,01)	(4,14)	
Africa	0,67	0,67			
	(1,04)	(1,06)			
Latin America	0,70	0,66			
	(1,41)	(1,41)			
Asia	1,75*	1,71*	1,35*	1,34*	1,45*
	(3,62)	(3,76)	(4,13)	(4,34)	(4,52)
Observations	87	87	87	87	87
Adjusted R^2	0,76	0,76	0,76	0,76	0,75

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level.

[§] It can be shown that *Africa* and *Latin America* are jointly insignificant when included.

[§§] It can be shown that *Institutional quality*, *Africa* and *Latin America* are jointly insignificant when included.

Table 22: Significance of the Threshold

Dependent variable: GDP Growth	Regression 1[§]	Regression 2[†]	Regression 3[±]	Regression 4[‡]	Regression 5[⊕]	Regression 6[⋆]
Initial income level	-1,52*	-0,98*	-1,02*	-1,21*	-1,21*	-1,24*
	(-6,29)	(-4,76)	(-4,95)	(-5,77)	(-6,02)	(-6,20)
Openness	1,56*	0,88*	1,18*	1,40*	1,42*	1,47*
	(3,89)	(2,39)	(2,98)	(3,88)	(3,69)	(3,82)
Resource abundance	-16,66*	-12,30*	-13,95*	-13,83*	-12,30*	-12,30*
	(-2,63)	(-6,15)	(-6,10)	(-6,62)	(-5,25)	(-5,96)
Institutional quality	-0,66	-0,44	-1,17	-1,20	-0,76	-0,70
	(-0,38)	(-0,40)	(-1,01)	(-1,09)	(-0,66)	(-0,61)
Investments	0,13*	0,14*	0,14*	0,16*	0,16*	0,15*
	(4,10)	(6,53)	(6,73)	(7,96)	(7,61)	(7,53)
Interaction term	17,92**	12,25*	16,96*	15,05*	9,32*	10,17*
	(1,95)	(2,93)	(3,51)	(3,39)	(2,05)	(2,30)
Observations	66	73	74	84	84	86
Adjusted R^2	0,68	0,64	0,65	0,70	0,69	0,70

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

[§] Excluding the countries that have gone through debt reductions, [†] excluding the Asian countries, [±] excluding the Asian countries, except Malaysia, [‡] excluding China, Hong Kong and Korea, [⊕] excluding Gambia, Malaysia and Zambia, [⋆] excluding Malaysia.

Table 23: Parliamentary Regimes

Dependent variable: GDP Growth				
	Regression 1	Regression 2[§]	Regression 3[§]	Regression 4[§]
Initial income level	-1,82*	-1,44*	-1,38*	-1,47*
	(-3,29)	(-5,26)	(-5,30)	(-5,22)
Openness	1,29*	1,22*	1,43*	1,39*
	(2,19)	(2,77)	(3,58)	(3,20)
Resource abundance	-2,06			
	(-1,33)			
Institutional quality	1,67			
	(0,76)			
Investments	0,12*	0,12*	0,13*	0,13*
	(3,71)	(3,66)	(3,70)	(3,83)
Financial development		0,006		
		(1,44)		
Volatility (Output)			0,62	
			(0,68)	
Volatility (RER)				2,43
				(0,63)
Observations	32	32	32	32
Adjusted R^2	0,73	0,74	0,73	0,73

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level.

[§]It can be shown that *Resource abundance* and *Institutional quality* are jointly insignificant when included.

Table 24: Presidential Regimes

Dependent variable: GDP Growth	Regression 1	Regression 2	Regression 3	Regression 4
Initial income level	-2,14*	-2,03*	-2,37*	-2,07*
	(-5,42)	(-5,11)	(-6,38)	(-4,96)
Openness	0,33			
	(0,69)			
Resource abundance	-8,29*	-8,29*	-5,11*	-8,02*
	(-6,80)	(-6,59)	(-3,12)	(-6,28)
Institutional quality	3,66*	5,26*	4,00*	3,12**
	(3,74)	(3,26)	(5,19)	(1,80)
Investments	0,13*	0,14*	0,14*	0,14*
	(2,78)	(2,59)	(2,98)	(2,66)
Financial development		-0,02		
		(-1,07)		
Volatility (Output)			-1,48*	
			(-3,46)	
Volatility (RER)				-1,53
				(-0,60)
Observations	24	24	24	24
Adjusted R^2	0,79	0,80	0,84	0,79

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

Table 25: Non-democratic Regimes

Dependent variable: GDP Growth				
	Regression 1	Regression 2§	Regression 3§	Regression 4§
Initial income level	-0,41			
	(-1,23)			
Openness	0,69			
	(1,09)			
Resource abundance	-8,45*	-9,75*	-9,73*	-9,85*
	(-6,72)	(-7,83)	(-9,45)	(-8,17)
Institutional quality	-2,34			
	(-1,35)			
Investments	0,16*	0,17*	0,16*	0,16*
	(5,59)	(4,31)	(4,56)	(4,22)
Financial development		-0,01		
		(-1,02)		
Volatility (Output)			0,33	
			(0,90)	
Volatility (RER)				2,21
				(1,18)
Observations	24	23	23	23
Adjusted R^2	0,68	0,62	0,61	0,63

Note: The numbers in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

§ It can be shown that *Initial income* and *Institutional quality* are jointly insignificant when included.

Table 26: Controlling for Determinants of Growth

Dependent variable: GDP Growth	
Initial Income	-1,85*
	(-7,57)
Resource abundance	-12,84*
	(-5,74)
Life expectancy	0,07*
	(2,77)
School enrollment	-0,08
	(-1,20)
Sub-Saharan Africa	-0,68
	(-1,15)
Latin America	-0,18
	(-0,30)
Civil liberties	0,04
	(0,31)
Muslim	0,30
	(0,49)
Real exchange rate distortions	-0,007*
	(-2,05)
Investments	0,10*
	(4,07)
Mineral abundance	2,50**
	(1,73)
Openness	1,55*
	(4,36)
Economic system	-0,14
	(-1,18)
Spanish colony	0,003
	(0,006)
Interaction term	14,08*
	(3,51)
Observations	74
Adjusted R^2	0,79

Note: The number in brackets are t-values. * indicates significance at the 5%-level, while ** indicates significance at the 10%-level.

Table 27: Escapers and non-Escapers of the Resource curse

Escapers	*Institutional quality*	Non-escapers	*Institutional quality*
Australia	0,94	Algeria	0,44
Botswana	0,70	Congo	0,37
Canada	0,97	Ecuador	0,54
Chile	0,63	Mexico	0,54
Ireland	0,83	Nigeria	0,31
Malaysia	0,69	Saudi Arabia	n.a
New Zealand	0,97	Sierra Leone	0,54
Norway	0,96	Trinidad & Tobago	0,61
Oman	n.a.	Venezuela	0,56
Thailand	0,63	Zambia	0,41
USA	0,98		

Source: Matsen and Torvik (2005)

F Dataset for the financial variables

Table 28: Dataset for the Financial Variables

Country	CC	V-OUT	V-RER	FD
Zambia	92,51	0,69	0,12	15,36
Guyana	179,15	1,66	0,35	23,53
Malaysia	37,33	0,57	0,08	53,83
Gambia	81,85	1,42	0,08	17,53
Gabon	32,13	1,16	0,14	18,46
Ivory Coast	102,91	0,85	0,06	35,59
Uganda	53,38	2,66	0,50	5,67
Venezuela	42,24	0,49	0,23	42,96
Honduras	63,50	0,43	0,27	30,52
Ghana	36,56	1,05	0,28	4,68
Malawi	71,13	0,70	0,15	9,55
Nicaragua	107,68	1,25	0,41	27,35
Costa Rica	141,25	0,47	0,17	22,20
Algeria	42,63	0,69	0,11	54,73
Togo	109,32	0,71	0,04	21,43
Bolivia	51,10	0,40	0,46	15,59
Cameroon	38,51	0,76	0,06	23,24
Kenya	48,62	0,95	0,04	26,09
Zimbabwe	16,09	0,82	0,06	19,89
El Salvador	33,86	0,51	0,44	28,85
Peru	35,85	0,88	0,13	15,42
Chile	50,45	0,9	0,11	39,41
Sri Lanka	50,88	0,45	0,14	17,40
Zaire	41,76	0,61	0,22	2,91
Nigeria	19,57	1,40	0,31	11,22
Jamaica	82,66	0,61	0,19	27,59
Senegal	54,47	0,46	0,09	26,83
Dominican Rep.	32,88	0,66	0,19	28,14
Philippines	58,72	0,52	0,13	24,31
Madagascar	45,35	0,65	0,08	16,26
Guatemala	15,00	0,42	0,27	15,06
Indonesia	25,45	0,45	0,15	22,30
Morocco	71,37	0,48	0,11	17,27

Table 28
Continued

Country	CC	V-OUT	V-RER	FD
Ecuador	57,27	0,62	0,19	21,08
Tunisia	44,37	0,39	0,11	48,61
Paraguay	19,63	0,88	0,21	17,67
Colombia	24,25	0,22	0,07	28,80
Uruguay	19,81	0,62	0,17	34,51
Sierra Leone	54,52	1,03	0,25	5,63
Jordan	48,23	1,37	0,07	42,77
Thailand	31,64	0,47	0,07	44,02
Mali	56,95	0,62	0,09	18,51
Congo	75,99	0,81	0,08	18,53
Egypt	101,55	0,41	0,27	21,29
Brazil	32,24	0,58	0,13	52,60
Argentina	46,38	0,58	0,23	21,85
Botswana	14,12	1,19	0,09	11,19
Niger	48,76	1,40	0,05	12,93
Burkina Faso	18,58	0,50	0,06	12,32
Turkey	27,64	0,44	0,13	18,00
Pakistan	34,37	0,44	0,09	24,85
Mexico	32,59	0,55	0,12	21,11
India	12,17	0,43	0,13	20,15
Bangladesh	20,94	1,36	0,11	38,06
Somalia	152,01	2,08	0,34	
China	2,99			
New Zealand		0,31	0,07	27,50
South Africa		0,42	0,10	67,44
Tanzania		0,98	0,17	9,85
Ireland		0,28	0,05	40,12
Netherlands		0,20	0,13	74,24
Belgium		0,25	0,19	26,29
Norway		0,22	0,11	40,12
Australia		0,24	0,05	32,91
Denmark		0,25	0,15	45,95
Canada		0,27	0,08	66,58
Trinidad & Tobago		0,86	0,22	35,08
Syria		1,15	0,17	6,50
Finland		0,28	0,08	54,13
Sweden		0,16	0,14	81,61
Portugal		0,55	0,09	63,05
Greece		0,35	0,12	30,98

Table 28
Continued

Country	CC	V-OUT	V-RER	FD
Israel		0,33	0,07	54,33
Austria		0,22	0,11	67,16
France		0,19	0,13	83,41
Spain		0,44	0,12	73,32
U.K.		0,27	0,11	47,57
Singapore		0,52	0,10	70,47
Switzerland		0,28	0,10	114,57
Korea Rep.		0,48	0,04	40,78
West Germany		0,24	0,15	74,80
Italy		0,29	0,06	59,80
U.S.A.		0,27	0,06	101,65
Japan		0,21	0,09	143,73
Hong Kong		0,44	0,16	
Haiti		0,55	0,27	

The variables are: CC: Credit constraint, V-OUT: Volatility in output, V-RER: Volatility in the real exchange rate, FD: Financial development.