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The Effect of Natural Resource Dependence on Education in Indonesia

by

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Abstract: Empirical evidence on the effect of natural resource dependence on education so far has revealed mixed results. As a result of the ongoing controversy, this examination offers the opportunity to extend knowledge about the relationship between natural resource dependence and education. Using a panel dataset of 26 Indonesian provinces from 1996 to 2012 a fixed effects regression is performed to investigate the local relationship between human capital accumulation and resource dependency. Additionally, the analysis is complemented by a small cross-country panel estimation including Indonesia, Malaysia, Thailand, the Philippines and Vietnam to compare the results. A Pooled Mean Group Estimator is applied in this section to analyse the long-run relationship between 1984 and 2017. The findings reveal that natural resource dependence, estimated through different measures, has a significant impact on human capital accumulation. However, the presented evidence offers mixed results on the sign of the effect. While a positive linkage is detected on the province-level in Indonesia, the cross-country analysis indicates a primarily negative impact of resource dependency on human capital accumulation. Furthermore, the findings suggest institutional quality significantly diminishes the impact of resource dependence in the cross-country sample.

Keywords: Natural Resource Dependence, Resource Curse, Human Capital, Indonesia, Southeast Asia, Pooled Mean Group Estimator, Fixed Effects

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Abbreviations

AIC	Akaike Information Criterion
ARDL	Autoregressive Distributed Lag Model
BPS	Badan Pusat Statistik (Statistics Indonesia)
BIC	Bayesian Information Criterion
DFE	Dynamic Fixed Effects Estimator
GDP	Gross Domestic Product
GNI	Gross National Income
HQIC	Hannan-Quinn Information Criterion
IPS	Im-Pesaran-Shin (2003) Unit Root Test
IDR	Indonesian Rupiah
LLC	Levin-Lin-Chu (2002) Unit Root Test
MG	Mean Group Estimator
OECD	Organization for Economic Cooperation and Development
OVB	Omitted Variable Bias
PMG	Pooled Mean Group Estimator
UNESCO	United Nations Educational, Scientific and Cultural Organisation

1 Introduction

The attention of researchers, politicians as well as international institutions have been attracted by the fact that the impact of natural resource abundance on economic growth differs significantly across countries and regions (Brunnschweiler & Bulte, 2008). While some countries rich in natural resources manage to follow a path of sustainable development, other countries suffer from a lack of sustained economic growth (Gylfason & Zoega, 2001). The phenomenon of the resource curse, a slowdown of economic growth due to several negative effects caused by abundant natural resources, appears to go against the common belief in economic theory that natural resources can be an important production factor and create substantial rents for the economy (Stijns, 2006).

1.1.1 Research Problem and Research Gap

In this context, one transmission channel of the resource curse is the investments and savings mechanism which concerns the underinvestment in education. Researchers argue that countries rich in natural resources can suffer from insufficient management of the generated rents through unsustainable investment and savings decisions (Shao & Yang, 2014). In this context, it is argued that decision-makers in these countries do not prioritise educational investments, which can lead to a negative effect on human capital accumulation (Gylfason, 2001a). At the same time, the negative effect of natural resource wealth on economic development is not inevitable. Examples, such as Norway, show that resource richness can be translated into successful economic development paths with an advanced human capital stock (Gylfason, 2001a). In this context, policy measures, namely a generational fund, and strong institutions appear to have been of importance for the resource blessing (Holden, 2013). However, unless this development is used to invest in factors such as education, the path will be unsustainable (Ranis, Stewart & Ramirez, 2000). Human capital in form of education has been established as a significant factor for promoting economic growth and many studies stress the importance of education for the development process of countries (see for example Easterlin, 1981; Hanushek & Kimko, 2000; Barro, 2001). Particularly to improve incomes of poorer provinces and the reduction of disparities of incomes across provinces investments into human capital can be an efficient tool (Garcia & Soelistianingsih, 1998). From this, it can be concluded that in a globalised and knowledge-based economy investment in education is a central factor in promoting sustainable economic development. As a result, a relatively new strand of literature concerning the connection between natural resource abundance and the investments in education has emerged.

The importance of further research on the topic is justified by the fact that conducted studies on the issue so far have not reached an unambiguous conclusion and have revealed some limitations (Ding & Field, 2005). In other words, the research gap lies in the lack of substantial research including education expenditure, a consensus on the effect as well as study design issues. For instance, studies usually only employ large cross-country estimations with countries that are difficult to compare due to unique political, economic and cultural aspects (Ding & Field, 2005).

1.1.2 Research Aim, Motivation and Scope

The ongoing debate on the issue illustrates that further research on the long-run relationship is needed. Hence, the research question asks what the effect of resource dependence of a country on human capital is. More specifically, the question examines whether the effect of resource dependence on human capital measures exists in Indonesia and the cross-country sample.

According to this question, the objective of the thesis is to explore the impact of resource dependence on education expenditure in Indonesia and the cross-country sample empirically. Indeed, the study attempts to reveal whether the sign of the effect is positive or negative in Indonesia as well as the magnitude of the effect. The country is one of the most naturally resource-rich countries (Resosudarmo, 2005, p. 2). This not only includes extractive industries, such as oil, gas and mining but also products such as plywood, palm oil, tin and copper. Being one of the most important exporters of these resources, it can be concluded that Indonesia possesses a rich and unique set of resources for economic development (Duek & Rusli, 2010). As a result, the motivation in examining Indonesia stems from this and lies in the fact that the country has been able to grow significantly despite or because of the abundance in natural resources accompanied by improvements of human capital measures (World Bank, 1993, p. 26). Nevertheless, the development process in connection with the natural resource management is surrounded by a discussion. Some authors argue that the management quality has not always been beneficial due to wasted revenues and unsustainable investments, such as into education (see for instance Seda, 2005, p. 189). Furthermore, the educational development can be characterised as complex. Although positive developments have been observed, investments into the education system and low secondary school completion rates are remaining issues (Temple, 2001; Suryadarma, Suryahadi, & Sumarto, 2006).

Based on this, the question of how the dependency and natural resource management has affected the human capital development in the country during the time of the economic boom is the central question of this study. A regional panel examination on the province-level over the period from 1996 until 2012 is proposed in order the analyse the effect of natural resources on education. This is complemented by a small cross-country analysis including Indonesia, Malaysia, Thailand, the Philippines and Vietnam from 1984 to 2017 with the purpose to present a full picture of the development process in the region as a comparison. This can be justified by limited availability of province-level datasets over a longer time frame. Moreover, it is motivated by the availability of institutional measures on the international level. Applying the cross-country study as a complementary measure can help to provide a better overview of the long-term relationship between natural resources and human capital accumulation.

An analysis of the long-run relationship between human capital investments and natural resource endowments could have an impact on policy design for natural resource-rich developing and emerging economies and thus is highly relevant. Although the thesis aims at examining a specific case, the study could reveal insights on the resource management and the educational development in Indonesia and the region so far. Furthermore, the study has the potential to expand the knowledge about the natural resource curse and its transmission channel of investments into education for this sample and possible recommendations for the natural resource management in the future can be derived. As a result, this thesis tries to contribute to the wider discussion on the importance of natural resources for the economic development process of a country.

1.1.3 Outline

The thesis proceeds as follows: The second chapter presents a detailed review of the relevant literature on the resource curse, the different transmission channels as well as the country case of Indonesia. Thereafter, the dataset is introduced with a description of all the variables used. The following chapter explains the two different model specifications that are applied in this study. This is followed by a thorough review of the obtained results, including the descriptive statistics, the empirical results from the regression as well as the evidence from the sensitivity analysis. The next chapter discusses the results and aims at placing the evidence into the context of the hypotheses and the background chapter. In the last chapter of this thesis, the study is summarised and a short set of recommendations for future research is provided.

2 Literature Review

2.1 The Resource Curse

The relationship between the abundance of non-renewable natural resources and the rate of economic development has attracted substantial attention in research (Brunnschweiler & Bulte, 2008). Natural resources in this context are defined as the "stocks of materials that exist in the natural environment that are both scarce and economically, useful in production or consumption, either in their raw state or after a minimal amount of processing" (World Trade Organisation, 2010, p. 46). Examples for this are oil, gas or minerals among others. The interest arises because some resource-rich countries, such as Venezuela, have failed to benefit fully, although generated resources revenues should lead to the promotion of economic development (Brunnschweiler & Bulte, 2008). Instead, countries have often performed equally or worse compared to countries without vast amounts of resources in terms of economic progress and the reduction of poverty (Brunnschweiler & Bulte, 2008). Popular examples can be found in Latin America, such as Venezuela, but also other regions, such as the Democratic Republic in Congo in Africa. Hence, the literature on this topic has coined the term 'resource curse' (Auty, 1993) in order to describe this reoccurring phenomenon.

A major discussion and important distinction concern the terms of natural resource abundance and dependency. This point is illustrated by Wright & Czelusta (2004) who criticise the economic literature on the resource curse so far has paid little attention to the two different concepts. Most studies on the topic have utilised some sort of commodity export share measure to analyse the effect of natural resources on economic growth or education (see for example Sachs & Warner, 1995; Boschini, Pettersson & Roine, 2007). However, some researchers argue that this measures resource dependence rather than actual abundance (see for example Stijns, 2005). Indeed, in some countries sizes of other sectors of the economy might be small and countries that have not developed other sectors automatically appear as resource-dependent (Wright & Czelusta, 2004). As a result, the analysis might compare development success versus failure rather than the effect of natural resources. Using different measures, for example, the reserves per capita, researchers have found evidence against the resource curse and a positive effect on economic growth (Brunnschweiler, 2008) or educational investments (Stijns, 2006).

Among the first researchers who were concerned about this issue were Prebisch (1962) and Singer (1950) who developed the theory that primary-product exporting countries are disadvantaged when it comes to trade with developed countries. Prebisch (1962), for example, argued that resource-rich countries in Latin America suffered from a systematic problem due to the issue that primary goods prices historically fell faster compared to manufactured goods.

This result was confirmed by several studies that examined the relationship between natural resource dependence and economic growth (see for instance Sachs & Warner, 1995; Auty, 1997; Gylfason, Herbertsson & Zoega 1999). Also, a strand of literature concerning oil-rich countries has attracted substantial attention since the first oil price shock in the 70s (Brunnschweiler & Bulte, 2008). The theory of the Dutch Disease is one result of research on this topic. It describes a mechanism of exchange rate appreciation caused by the increasing rents generated in the natural resource sector (Gylfason, 2004). More specifically, the generated resource revenues cause a higher exchange rate through a rise in inflowing foreign currencies (Gylfason, 2004). This in turn, can discourage foreign direct investments and causes other sectors in the economy to increase in relative costs. At the same time, the natural volatility of the world commodity prices will lead to a more volatile exchange rate. This has the potential to further reduce investment incentives from foreign investors and into other sectors of the economy. The result of this development is a stronger natural resource sector and the weakening of other sectors, such as manufacturing or agriculture (Gylfason, 2004). Gelb et al. (1988, p. 134) find supporting evidence for the resource curse in oil-exporting countries. Studying the period from 1971 to 1983, they reveal that the growth performance of the countries was below the average of developing countries in the period before the resource boom (Gelb et al., 1988, pp. 139-141).

In contrast to this, the theory and findings also have been criticised by different authors. Indeed, Rosser (2006, p. 14) reveals that Prebisch's argument (1962) can be questioned since the fall in commodity prices involved mainly commodities that were exported by developed countries. Moreover, studies on the topic are sensitive. The period from 1970 to 1990, which has been used for several analyses, was defined by struggling oil-dependent economies due to for example the fluctuating oil prices during this time. Hence, studies that are based on it might show distorted results. For instance, Ross (2012, pp. 189-190) states that oil-exporting countries, such as Saudi-Arabia or Norway, in the period from 1990 to 2006 have not suffered from the resource curse and have grown ca. 40 % more than countries that were not dependent on oil production. Hence, it is explained that many countries have learned from previous mistakes and design more favourable policies which enables them to manage the abundance in natural resources in a more economy friendly way compared to times before 1990 (Luciani, 2011). Another critical point mentioned in the literature are statistical problems with many of the studies. Issues such as selection bias, endogeneity and correlation rather than causation have been pointed out in cross-country studies (Wright & Czelusta, 2002; Van der Ploeg & Poelhekke, 2010). On this matter, Gylfason (2001b) analyses therefore that instead of the natural resource abundance, the institutional quality and management of it is of importance for economic growth. Similarly, Mehlum, Moene & Torvik (2006) build their argument around the importance of institutions. The diverging experiences of countries in their analysis can be explained by the decisive role the quality of institutions play for the resource curse. According to them, good quality is defined as producer friendly institutions where the production and rent-seeking are complementing each other (Mehlum, Moene & Torvik, 2006).

This leads to the conclusion that the evidence on the resource curse reveals mixed results. Overall, it appears that the curse has existed in many natural resource rent generating countries during certain periods and famous examples, such as Venezuela, have failed to turn this development around. However, the resource curse cannot be seen as an inevitable outcome for countries rich in natural resources, it rather describes a strong tendency (Rosser, 2006, p. 14). The blessing rather than a curse, for example, has been observed in these countries, for example Norway, that have established favourable and pro-poor policies and overcome obstacles during the process (Gylfason, 2001b; Luciani, 2011).

2.2 Natural Resources and Education

The relationship between natural resource endowments and investments in education has received substantially less research attention compared to mechanisms such as the Dutch disease and the volatility of commodity prices. Nevertheless, the channel of neglected investments can be seen as one important factor in the literature. Some researchers describe the possible crowding-out effect of human capital due to natural resource abundance as one significant mechanism impacting the direction of the effect of resources on the economy. Indeed, Papyrakis & Gerlagh (2004) argue that investment decisions, including the underinvestment in human capital, are an important factor in countries where the resource curse is prevalent.

Studies have attempted to define the theoretical linkages between the two factors. For instance, Birdsall, Pinckney & Sabot (2001) provide a conceptual framework for it. They show that the virtuous cycle that exists between income inequality, education and economic growth can be diminished by the abundance of natural resources in a country. This is due to limited incentives to invest and unfavourable policy decisions that differ from the optimal options in the virtuous cycle. As a result, countries invest less in education and suffer from higher illiteracy rates of adults because the resource-dependent growth and a rise in social inequalities decrease the rate of return to investments into education. This is one model that describes one of the theoretical linkages between natural resources and education.

In a second model, which is based on the assumption that high natural resource shares affect the income level positively but economic growth negatively, Bravo-Ortega & De Gregorio (2005) illustrate that human capital in the form of education matters for avoiding the negative impact of the resource curse on economic growth. Empirical testing of the theory, furthermore, confirms the expected effect of sufficiently high human capital levels. In accordance with this, Gylfason & Zoega (2001) reveal a decreasing effect of high natural resource levels on education measures, such as public education expenditure, gross secondary school enrolment as well as years of schooling. In a follow-up study, they also argue that the incentives for investments decrease since the resource rents offer new ways of profit for the elites in power (Gylfason & Zoega, 2006). This causes a decrease in the interest rates and savings and investment rates.

Further confirmation of this is presented in Atkinson & Hamilton (2003). They analyse that government revenues, stemming from natural resources, might be spent in unbeneficial ways which can lead to unsustainable investments and low rates of savings. This third case results in the conclusion that certain investments, for example into human capital, matter for the development process in natural resource-rich countries and have a negative impact, depending on how the income is invested. In addition, a panel data approach by Cockx & Francken (2016) found a negative effect of resource dependence on public educational investments. In a study focusing on oil-exporting countries and a period from 1970 to 2004, Behbudi, Mamipour & Karami (2010) also state that education measures can be an important factor in explaining of poor growth performances in resource-rich countries. In accordance with this, Shao & Yang's (2014) results of their mixed-method study based on conceptual and mathematical models depict that the rate of return on investments in education can play a decisive role in the allocation process and in escaping the recourse curse

In contrast to this, another strand of literature that analyses the effect of natural resources on education and concludes that the negative impact is not inevitable. Several studies argue that the relationship does not exist or that research on this issue has major weaknesses. In this context, Stijns (2006) claims that the results discussed before are not robust to different econometric specifications. As a result, he concludes that mineral abundancy and education are positively connected. Similarly, Blanco & Grier (2012) demonstrate that in general the measure for natural resource dependence has no significant effect on education. However, it needs to be stated that dividing the sample into sub-categories changes the result to a direct impact of oil-dependence on the long-term development of human capital. Furthermore, Kim & Lin (2017) present a panel data study with a positive impact of natural resources on education. However, some doubts remain about the results because the effect is conditional on the economic, social and political quality of the institutional framework. As a result, the relationship differs across countries depending on the institutions, a fact that is also stressed by Cabrales & Hauk (2010).

In conclusion, it can be argued that a lack of consensus on the relationship exists. While most papers illustrate the negative effect of natural resource endowments and education measures, other studies raise serious doubts about this. This could be explained by different transmission mechanisms, which are presented in further detail in the next section, as well as the statistical design of the studies Stijns (2006). For instance, studies mainly examine the relationship through large cross-country. Unique economic, social and political circumstances make it, however, raise doubts about the results (Stijns, 2006). Thus, this study aims at offering informative new insights on the linkages for the county case of Indonesia and a comparison with other countries in the region, thus, attempting to expand the concept of the natural resource curse and education.

2.3 Transmission Channels

The different channels through which substantial resource revenues can impact the economic outcomes are important to understand since the issue is multidimensional and not every mechanism applies in every case (Frankel, 2012). The most important factors are presented to provide an overview of the mechanism between natural resources and education, but also other important channels impacting the development process. This can be justified by a possible indirect effect on human capital as well as the needed establishment of a clear overview of the complexity of the resource curse. Searching the literature has led to the conclusion to focus on the following mechanisms:

2.3.1 Commodity Price Volatility

One economic channel is the volatility in commodity prices in the global market. The volatility of commodity prices is high, particularly for oil and gas but also for other products, such as metals (Frankel, 2012). The price differences create uncertainty in the economy, increases the difficulty to plan investments with the resource revenues. According to some authors, resource-rich countries often borrow money from international lenders during periods of high commodity prices (Humphreys, Sachs & Stiglitz, 2007, p. 8; Van der Ploeg, 2011). When the prices drop, the countries are often required to pay back their debts which can result in the necessity to decrease expenditures and in a debt crisis. This, for example, happened to many resource-abundant countries in the 1980s (Van der Ploeg, 2011). Empirical studies on the subject have shown supportive evidence for the channel. Van der Ploeg & Poelhekke (2009) state that the volatility of world market prices of natural resources impacts the volatility of unanticipated growth of output which in return is negatively linked to output growth. Their study shows that resource-scarce countries only have a standard deviation of output growth of 2,83% compared to a deviation of 7.37% for countries with a natural resource exports rate of more than 19%.

2.3.2 Dutch Disease

The transmission channel Dutch disease, as mentioned before, is a major factor in the prevalence of the resource curse. The crowding out of other sectors through the appreciation of the real exchange rate is proven to have an impact on the general policy-making of a country since it slows down the processes (Sachs & Warner, 1995). It is argued that substantial resource revenues decrease the perceived importance policies that foster sustainable long-term development in the economy. A resulting lack of investments such as into education might have negative long-term consequences and the importance of the natural capital sector is likely to grow even further which exacerbates the problem (Gylfason, 2001a). The underdevelopment of the manufacturing sector, in this case, can also have further negative impacts on future developments since it provides more positive externalities for long-term growth. This is because the natural resource sector usually creates fewer employment opportunities and positive spillovers, such as skill acquisitions, to other parts of the economy compared to the manufacturing sector (Gylfason, 2001a). In their study, Sachs & Warner (2001) confirm that natural resource abundance can cause higher price levels and exchange rate volatility, even after controlling for the generally higher price levels in developed countries. As a result, relying on natural resources can be negative for the growth of the manufacturing exports as well as the manufacturing sector as a whole. This in return can harm economic growth through the direct effects from slower growth of the manufacturing sector as well as the indirect effects through, for example, a lack of technological progress.

2.3.3 Economic Mismanagement – Investment and Savings

Papryakis & Gerlagh (2003) find in their study on the impact of natural resource abundance on economic growth that decreases in investments represent 47% of the negative effect on economic growth. The authors explain this by the fact that natural resource abundance might decrease the apparent need for investments and savings because of the revenues the natural resources generate. However, the natural price volatility of commodities can turn a current boom into a recession for an economy that relies on the rents. The resulting volatility of income can then also create an uncertain environment for investors. Besides that, Gylfason, Herbertsson & Zoega (1999) state that the domestic investment rates are inversely related to the resource export dependence. Atkinson & Hamilton (2003) find a negative effect of natural resources on investments and savings. Yet, the effect can be diminished for savings and even turned around for investments when countries are equipped with good institutions

The second strand of literature on this topic deals with unproductive investment decisions. Rosser (2007) detects a tendency of investments into projects with relatively low rates of return instead of projects such as infrastructural improvements. Confirmed was this result by Lal & Myint (1996, p. 395) who discovered that many resource-rich countries lack investment efficiency. Similarly, it is described that fiscal policy in resource-dependent economies often follows a procyclical path (Arezki, Hamilton & Kazimov, 2011). Governments are tempted to spend and invest all the revenues during booms instead of saving the rents for later or paying off debts. For example, it has been shown that in Indonesia the oil boom revenues have partly been used to finance public sector wages (Rosser, 2007).

Closely connected to this issue is the investment decision into education. Governments might not recognise the long-term educational benefits and disregard this investment due to the immediate visibility of the resource revenues. This can be intensified through the capital intensity of the resource sector which can assign more capital in this sector rather than using it for education. Birdsall, Pinckney & Sabot (2001), furthermore, describe that education can turn from an investment into a consumption good due to the impression to young adults that investing into their education changes little on their labour market outcomes. This can be explained by the control of the sector and the jobs in the natural resource industry by the elites. From this, the conclusion can be drawn that the investment transmission channel plays an important role in connection with natural resource dependence and it is highly relevant to examine this issue further.

2.3.4 Rent-Seeking and Corruption

As mentioned in the previous section, rent-seeking and corruption are seen as possible political transmission mechanisms that lead to poor growth performance. Authors, such as Gylfason (2001b), state in their studies that certain countries might be subject to a rise in the elite's power. This in return might cause them to claim a larger part of the generated revenues for themselves. Since the money could be used to invest in infrastructure and social redistribution policies, this rent-seeking behaviour could open the possibility of rising income inequality. Since for authoritarian political leaders in natural resource-abundant countries can often rely more on the resource than the tax revenues, a transition towards more democratic accountability can be hindered (Ross, 2001). A closely connected point is the prevalence of corruption. For example, Arezki & Brückner (2011) argue that for 31 oil-exporting countries over the period from 1992 to 2005 the corruption index, measured by the Political Risk Services, increased substantially when the oil rents rose. However, other authors claim that these issues only occur in countries where undemocratic tendencies were prevalent before the resource rents (see for example Bhattacharyya & Hodler, 2010). Moreover, Papyrakis & Gerlagh (2003) find a significantly negative effect of corruption on economic development as a result of natural resource abundance. It can eliminate up to 40% of the positive effect of natural resource rents on economic growth.

2.3.5 Institutions

The transmission channel of institutional quality has been attributed a significant role in determining whether natural resources are a curse or a blessing in the literature. Robinson, Torvik & Verdier (2006) illustrate this relationship with the argument that the revenues can lead to rent-seeking within the ruling elites which can cause the resource curse. A similar case and hence result on the importance is reached by Mehlum, Moene & Torvik (2006), Boschhini, Pettersson, & Roine, (2007) and Collier & Goeris (2007), which illustrates a common census about the effect. Another point concerning the relationship is the direct effect of natural resource abundance on institutional quality. Researchers, such as Sala-i-Martin & Subramanian (2013), analyse that the curse is transmitted through the negative effect on institutions, particularly for oil-rich countries. Similarly, Gylfason & Zoega (2006) point out that at least to some extent the negative natural resource effect is caused through the impact on institutional quality directly.

While the common consensus is clear on the association of natural resource with poor institutional quality, it needs to be pointed out that a debate about the direction of the effect exists (Frankel, 2012). It remains unclear whether institutions impact the curse negatively or whether the resource curse affects the development of institutions of low quality. As some evidence suggests, it appears to be the case that resource-dependent countries often fail to develop their institutions further (Frankel, 2012). However, evidence on the weakening of institutions as a result of resource dependence and institutions turning into poor quality after discovering the natural resources remains an important research question.

The presented transmission channels illustrate the multidimensional character of natural resource dependence and its effect of education as well as the development process in general. Education appears to be mainly affected by the savings and investment mechanism. Nevertheless, institutional quality and corruption, for instance, could impact the relationship between natural resources and education as well. Taking this into account for the regressions and derived from the literature review the following hypotheses are tested in the empirical part of the thesis:

Hypothesis 1: Natural resource dependence has a negative effect on investments into education as well as other human capital measures.

Based on the literature review, no clear consensus has been found. Nevertheless, it can be argued that a majority of studies find a negative relationship between resource dependence and human capital measures.

Hypothesis 2: Good institutions, in the sense of property rights and the legal system, diminish the effect of natural resource dependence.

Several studies (see for example Kim & Lin, 2017) indicate that good governance and institutions open the possibility to overcome the resource curse. As a result, the effect on human capital measures could be mitigated through a set of good institutions.

2.4 The Country Case of Indonesia

As mentioned beforehand, Indonesia is a unique case due to its significant abundance in natural resources as well as the remarkable economic development over the past decades which opposes the conclusions drawn from the first part of the literature review. Consequently, a closer look at the economic and political development, the natural resource management as well as the educational development is needed to provide the background for the quantitative analysis in the following chapters.

2.4.1 Economic Development and Natural Resource Management

Indonesia is abundant in natural resources, namely oil, gas and minerals as well as forest and marine resources (Resosudarmo, 2005, p. 2). With the new government of Suharto coming to power in 1966/67, the extraction of natural resources intensified substantially through the state-owned company Pertamina and foreign investors (Rosser, 2007). During the 1970s and 1980s, Indonesia achieved a remarkable period of economic growth while the natural resource exports, mainly oil and gas, contributed around 80 % to the total amount of exports. Moreover, it accounted for around 70 % of the government revenues during this time (Rosser, 2007).

Figure 1: GDP Growth Rate (World Bank, 2019c)

In the 1980s growth rates slowed down, however, they remained stable which can be observed in Figure 1 (World Bank, 2019c). Exceptions are the years 1982 and 1985 when the rates dropped to around 2-2.5%. This can be explained by the international oil price shocks in these years. The growth process was so successful that it was even described as one part of the East Asian "miracle" by the World Bank (1993, p. 26). As a result, it could be argued that Indonesia successfully avoided symptoms predicted by the Dutch disease. However, the views on this development also differ. For instance, Stevens (2003) states that Indonesia suffered from symptoms of the Dutch Disease. This argument is confirmed by Azis & Salim (2005, p. 127) who acknowledge the effects to have affected the economy to some extent. The effects were diminished by the significant subsidies in the agricultural and infrastructure sectors as well as some savings from the windfall rents of the previous oil boom (Azis & Salim (2005, p. 127). Seda (2005, p. 189) also sees the natural resource management of Indonesia as more negative. The author states that, for example, Pertamina's income increased substantially during the oil boom, however, the rents were invested in unprofitable investment projects. This was reduced in later decades, nevertheless, the prevalence of corruption has remained a major issue of the company and therefore in the economy. A similar development could be observed in all parts of the government and economy. As a result, corruption has been a challenge for Indonesia ever since and has wasted parts of the resource revenues (Seda, 2005, p. 189). According to Seda (2005, p. 189), this leads to the conclusion that the population has only benefitted from the generated resource rents to a certain extent.

Over time the manufacturing sector began to play a more important role in the Indonesian economy. During the 1980s and 90s, the country started to open up further to the international markets which led to a more export-oriented economic structure (Quibria, 2002). At the same time, substantial resource revenues were used to accelerate the structural transformation process (Haraguchi & Rezonja, 2010). The manufacturing share of GDP has been rising consistently over time with the rise in income. Today, the manufacturing sector is the second most important behind the service sector, but its meaning has started to decline over the past 20 years (Haraguchi & Rezonja, 2010). More and more, the service sector has become the driver of the per capita growth rates in the country (Suryahadi, Hadiwidjaja & Sumarto, 2012).

While the positive economic trend continued during the 1990s, the financial crisis hit the country in 1997/1998 and this led to the first and only year of economic shrinking in 1998. With a drop of 13% in GDP, Indonesia was heavily affected by the Asian financial crisis (Temple, 2001). Additionally, by the mid-1990s, the country experienced issues connected to the extraction rate of natural resources and the unequal distribution of benefits (Resosudarmo, 2005, p. 4). In addition to the economic struggles caused by the financial crisis, the country has had to deal with the political change from a stable authoritarian government to democracy during this period (Quibria, 2002). The natural resource management undertook changes as well because of the decentralisation process that followed the Suharto-era (Komarulzaman & Alisjahbana, 2006). The process has led to a greater power of local governments as well as restructuring of the districts and the provinces. The number of provinces increased from 26 to 34 while the districts rose from 290 to around 500 causing a significant internal change of the territorial structure (Komarulzaman & Alisjahbana, 2006). The transition from an authoritarian regime to a democratic and decentralised government reformed the local structure including the emergence of new political actors and improvements in the supply and efficient use of public services including education (Duek & Rusli, 2010; Kimura, 2010). At the same time, the criticism that has emerged mainly concerns inefficiencies that stem from Suharto era policies that continue to play a role in Indonesia. The process emphasised the historical dominance of the oil-, gas- and mining-rich areas due to a rise in power for the local communities (Duek & Rusli, 2010). In addition, some authors argue that the increased local responsibility for economic development has not necessarily led to beneficial results since the governments often do not have the capacities to invest the revenues into people's welfare (Hanif & Bria, 2016).

Since overcoming the financial crisis, the country has continued its growth process and is now a member of the G20 and a middle-income country according to the World Bank (2019h). For example, the GDP per capita has increased from $807 in 2000 to $3 877 in 2018 (World Bank, 2019h). However, issues surrounding economic development over recent years have been observed. Authors argue that the growth rates since the financial crisis in the late 1990s have not returned to pre-crisis level (OECD, 2015, p. 11). Moreover, slower growth rates during recent years and criticism concerning the natural resource management have emerged, leaving the countries with major challenges to continue the positive economic development (OECD, 2015, p. 11).

2.4.2 Development of Education

The school system in Indonesia is divided into three different sections: Primary school runs from class 1 to 6, the junior secondary school includes grades 7 to 9 and senior secondary schools last from the 10th to the 12th grade (Suryadarma, Suryahadi, & Sumarto, 2006). The rapid economic development as described has been accompanied by a positive development in education. Initial conditions, namely literacy and primary school enrolment, were favourable in 1960 already compared to countries at the same level of development, while other countries in Souteast Asia were far ahead (Quibria, 2002). Since then the rates have improved continuously (Temple, 2001). Bevan, Collier & Gunning (1999, pp. 250-251) confirm this by stating a rise of social expenditures such as schools but also infrastructure projects, for example, rural water supply. Moreover, the importance of promoting human capital has grown over time (World Bank, 2019h). Looking at Figure 3, the educational attainment rates over time show a particularly large increase for the rates of secondary schooling and above (Badan Pusat Statistik, 2019a). It illustrates the positive development over time, also of the decreasing rates of people who have never or not attended school. This is also reflected in Figure 2 which displays the Index of Human Capital. The index, taken from the Penn World Tables (Feenstra, Inklaar & Timmer, 2015), is based on the average years of schooling database by Barro & Lee (2012) and the assumed returns to primary, secondary and tertiary education data by Caselli (2005, pp. 693-694). It is measured per worker. It shows a continuous trend of increasing human capital in Indonesia. From 1970 to 2010 a substantial rise of around 1,05 has taken place (Feenstra, Inklaar & Timmer, 2015). Yet, since 2010 the trend has changed and the measure has been decreasing slowly from 2,4 to around 2,3.

Figure 2: Human Capital Index (Feenstra, Inklaar & Timmer, 2015)

A comparison of age groups in the analysis by Suryadarma, Suryahadi, & Sumarto (2006) illustrates a positive development further. By comparing the enrolment rates of different cohorts, they show that primary school graduation rates have risen from 71.7% for the age group that is 35 and older to 93.3% for the cohort that is between 20 and 24 years old. Positive developments can, furthermore, be observed for junior school enrolment. This positive development, again, is illustrated in Figure 3.

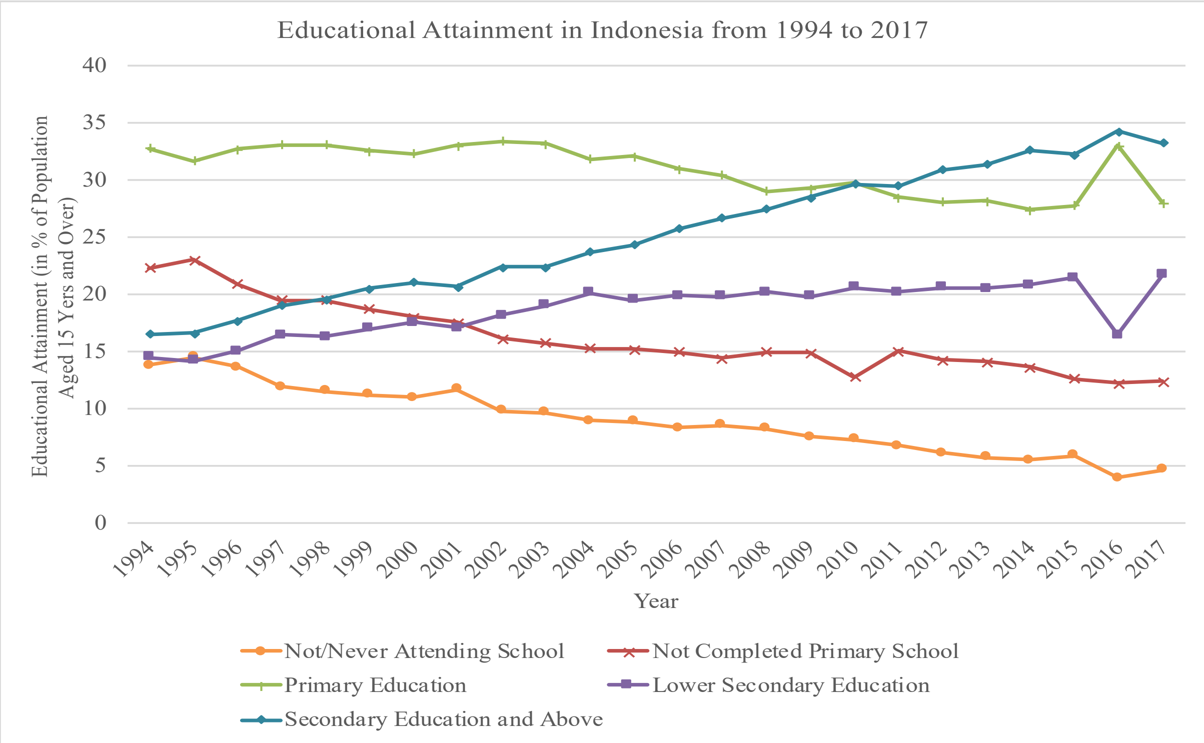

Figure 3: Educational Attainment Rates (Badan Pusat Statistik, 2019a)

However, low secondary enrolment and completion rates among Indonesian children, particularly for senior secondary school, remains a prevalent issue according to Suryadarma, Suryahadi, & Sumarto (2006). Attrition rates, which measure the number of students leaving school before a programme is completed, of 39,4 % from junior to senior secondary school, have been registered for the 20 to 24-year olds. Overall, factors such welfare, gender, ability, religious background and the number of schools play important roles in impacting the attrition rates. This observation is confirmed by the OECD analysis that educational developments have been positive over the past 20 years as a result of successful reforms of organisational and pedagogic practices (OECD, 2015, p. 29). However, compared to other countries Indonesia invests significantly less into the educational sector. Although a rule was introduced in 2002 to invest 20% of all public expenditures into education, the actual numbers are lower with, for instance, 15% in 2011 (OECD, 2015, p. 29). Compared to this, Malaysia had a rate of 21% and Thailand of 24% during the same year (OECD, 2015, p. 29). Indonesia performs comparatively well when it comes to measures such as enrolment and standardised tests for its level of GDP per capita and many measures have improved over time. At the same time, the quality of the education system as well as the investments and the completion rates of secondary and tertiary education in Indonesia remains an issue (OECD, 2015, p. 29).

3 Data

For the quantitative analysis of the relationship on the province-level in Indonesia the time-frame from 1996 to 2012 will be taken into account, motivated by the availability of the different variables on this level. This issue results in shortcomings of the analysis. For instance, corruption is a prevalent issue in Indonesia (Temple, 2001) and might impact the results because no long-term variable is available for the province-level. Hence, the study tries to account for these limitations and apply an empirical examination with cross-country regressions from 1984 to 2017 as a comparison to analyse the short- and long-term dynamics. The chosen countries are Indonesia, Malaysia, Vietnam, Thailand and the Philippines. This is due to fairly similar development processes for these countries over the last decades (Booth, 1999). Besides the fact that they all are located in the same region, the countries rely on some common economic activities, such as exports, to fuel their growth process. Although it cannot be assumed that the countries are comparable in all measures, it should reduce the shortcomings caused by significant differences of economic, political and social circumstances, to some extent. Other countries, such as Brunei and Myanmar, rely more on natural resources in the form of oil and gas and have been considered as a useful addition, but the long-term data available for these countries is rather poor. This leads to the exclusion of these countries for the analysis.

3.1 Province-Level Analysis

While Indonesia has 34 established provinces, some of them needed to be dropped due to a lack of available data. Moreover, the province reforms since the early 2000s have led to a reorganisation of the official provinces and hence, the collection and the matching of data. This leads to the consequent exclusion of the provinces Banten, Gorontalo, Kalimantan Utara, Kepulauan Bangka-Belitung, Kepulauan Riau, Maluku Utara, Papua Barat and Sulawesi Barat and leaves the study with 26 remaining provinces.

Dependent Variable

As the dependent variable, the net enrolment ratio of junior secondary schools is chosen which is presented in percentages and provided by the World Bank (2019f). This choice is based on two facts. Firstly, the reliability of this variable compared to senior secondary enrolment is higher because of some implausibly low values of the latter variable for some years. Second, the attrition between primary and junior secondary school is particularly high (Suryadarma, Suryahadi, & Sumarto, 2006). As a result, a higher variance over time could be expected and the measure should reflect the changing importance of education as a transmission channel over time.

Explanatory Variable

The independent variable is the per capita GDP of the mining and quarrying sector in the natural logarithm form. It is retrieved from the Indonesia Database for Policy and Economic Research (World Bank, 2019e). The database presents province-level variables on economic, social, fiscal, infrastructural and demographic issues for Indonesia which bases its calculations for most variables on the official Statistics Indonesia (BPS). The data is presented in constant 2000 prices and Indonesian rupiah. It consists of the four divisions crude petroleum, natural gas and geothermal, coal and lignite mining, iron ore mining as well as other mining and quarrying.

For a robustness check the per capita GDP contribution of the agricultural sector, converted to the natural logarithm and given in the same unit, is used. The data is provided by the same database as the other explanatory variable (World Bank, 2019d). The use of this measure as a robustness check is motivated by the argument that the possible negative impact of natural resources depends on the type of resource. For example, point-source resources, such as minerals and oil, are known to be more likely to generate a resource curse than diffuse ones, such as agriculture (Boschini, Pettersson & Roine, 2013). This is supposed to be caused by the more capital-intensive, concentrated and government-backed nature of point-source resources, which is argued to harm societal dynamics, conflicts and institutions. Thus, this could show that indeed only the extractive industries, measured through the mining and quarrying sector, have a negative impact on education.

For both measures, only total values are available. Therefore, the per capita terms are based on own calculations with population data from Statistics Indonesia (Badan Pusat Statistik, 2019b). Since the values are only available for the census years, the Excel function to fill the missing values with the prediction of a linear trend has been used in order to use a panel fixed-effects analysis.

Control Variables

Total GDP per capita is presented in constant prices and Indonesian rupiah. This measure is also taken from the Indonesia Database for Policy and Economic Research by the World Bank (2019i). The variable is only presented in absolute terms, hence, the per capita values are based on own calculations with the population estimates provided by Statistics Indonesia (Badan Pusat Statistik, 2019b). The variable is logged to draw in outliers.

Population density, converted to the natural logarithm of the values, is provided by BPS directly and is measured in how many people live in a province per square km (Badan Pusat Statistik, 2019c). The main limitation of this variable lies in the fact that data is only available every five years until 2000. Moreover, values for the year 2001 are missing. For the analysis the missing values have been interpolated to make the fixed effects estimation possible for the complete period.

3.2 Cross-Country Analysis

Dependent Variable

The dependent variable in this setting is the World Bank (2019a) measure 'adjusted savings: education expenditure'. This variable, based on the United Nations Statistical Yearbook and the UNESCO's Institute for Statistics estimates, describes the current operating educational expenditures and the unit is in percentages of the Gross National Income (GNI). It includes wages and salaries but capital investments and investments in buildings are not taken into account for this measure (World Bank, 2019a). Although this expenditure measure has only been used in a very limited amount of studies, offers consistent data availability and should present an improvement compared to aforehand mentioned studies, it also comes with limitations. The current expenditure not necessarily illustrates the distribution or the quality of the investments. As a result, it can be a proxy for the intentions of governments, however, it fails to tell something about the outcomes of the investments (World Bank, 2019a).

Explanatory Variable

The explanatory variable in this setting is the rent of total natural resources in percentages of GDP (World Bank, 2019j). This measure is calculated as the sum of oil, natural gas, coal, mineral and forest rents. The source for this dataset is the World Development Indicators database (World Bank, 2019j). One concern with this variable is that different natural resource types also have different implications for the education measure. As mentioned in the literature review section there is a debate concerning the indicator choice for natural resources. It has been argued that most measures of natural resource abundance are only proxies for the resource dependence of countries (Stijns, 2005). The total rents as percentages of GDP, as used in this study, are one example for it.

To minimise this limitation, the thesis also attempts to use a second model with a measure for resource depletion which is part of the adjusted savings measures. The variable is taken from the World Development Indicators and illustrates the sum of the net forest, energy and mineral depletion (World Bank, 2019b). It is presented in percentages of the GNI and is available from 1984 onwards. However, there are some missing values for Vietnam until 1988 which might restrict the explanatory power of the model.

Control Variables

The output-side real GDP per capita in the form of its natural logarithm is taken from the Penn World Table version 9.1 since it is the database with a complete set from 1984 onwards

(Feenstra, Inklaar & Timmer, 2015). It is presented in 2011US dollars and at chained purchasing power parity to make the relative living standards of different countries and over time more comparable. Originally, the variable is not presented in per capita terms, however, a population measure calculated by the Penn World Tables version 9.1 is available and made the conversion possible (Feenstra, Inklaar & Timmer, 2015).

The population density, presented in logged form, describes how many people live in a country per square km of the land area and also comes from the World Development Indicators (World Bank, 2019g).

The indicator to measure good governance and how well a country is doing when it comes to corruption is provided by The Quality of Government Institute (Dahlberg, Holmberg, Rothstein, Alvarado Pachon & Svensson, 2019). Since corruption is difficult to estimate directly, the indicator relies on opinions of inhabitants, NGOs and officials. More precisely, the database supplies a measure that is called The Bayesian Corruption Indicator (Standaert, 2015). The measure can take values between 0 and 100, where a higher value equals a rise in the level of corruption in a country. It is calculated by rescaling the 17 individual surveys the measure is based on (Standaert, 2015). The indicator is particularly useful since it is available for every year from 1984 until today with only one missing value for Vietnam (Standaert, 2015).

Institutional quality is measured by a subcategory of the Index of Economic Freedom which is taken from the Canadian Fraser Institute (Fraser Institute, 2019). The indicator is based on 42 variables bundled into five categories: the size of the government, legal system and property rights, sound money, freedom to trade internationally and regulation. The chosen subcategory for this analysis is the legal system and property rights area. This is a central part of economic freedom and should, therefore, be a useful proxy for institutional quality (Fraser Institute, 2019). The variable is only available for every five years from 1984 onwards and values for Vietnam are missing until 2000 (Fraser Institute, 2019). The missing values in between two observations have been filled with the prediction of a linear trend in order to reduce this limitation.

The conflict variable is a dummy variable retrieved from the Uppsala Armed Conflict dataset provided by the Department of Peace and Conflict Research (Gleditsch, Wallensteen, Eriksson, Sollenberg, & Strand, 2002; Pettersson & Eck, 2018). The year is marked with a 1 if a political conflict with 25 deaths or more is prevalent in the country in one year and takes the value of 0 otherwise. The variable is available for all countries from 1984 until today and is added to account for the fact that an existing conflict might affect education expenditure negatively due to high costs and inefficiencies (Gleditsch, Wallensteen, Eriksson, Sollenberg, & Strand, 2002; Pettersson & Eck, 2018).

4 Methodology

4.1 Province-Level Analysis

Based on the results of a stationarity test, which is further explained and discussed in the fifth section of the thesis, a static panel estimator is chosen as the baseline model:

(1) $$Enrolment_{it} = \alpha + \beta\, NR_{it} + \gamma\, X_{it} + \varepsilon_{it}$$

with i= 1, 2, …, N being the different countries and t = 1, 2, …, T being the number of years. α is the intercept, $Enrolment_{it}$ is the human capital variable, NR_{it} indicates the natural resource dependence measures and X_{it} illustrates a set of control variables. The set is defined as:

(2) $$X_{it} = \gamma_1\, PopDen_{it} + \gamma_2\, GDP_{it}$$

with PopDen being the variable that illustrates the population density in every province and over time and GDP being the natural logarithm of GDP per capita.

Due to the structure of the data the fixed effects assumption of a possible correlation between μ_i and the observed characteristics appears more reasonable than the strong restriction of the random effects of no correlation between the unobserved heterogeneity and the measured predictors (Bell, Fairbrother & Jones, 2019). This assumption could, for example, be violated by unobserved and time-invariant factors such as institutions or cultural aspects and hence, the random effects measures are likely to be biased (Bell, Fairbrother & Jones, 2019). The Hausman test, where the null hypothesis assumes random effects as optimal while the alternative hypothesis states fixed effects is preferred, is performed in order to find out whether the random and fixed effects estimations differ from each other (Hausman & Taylor, 1981). In other words, the test analyses whether the unique errors are correlated with the explanatory variables. The results of this leads to the conclusion that a fixed effects estimation is preferred, as further explained in the next section. Hence, the model analyses the changes for each individual, provinces in this case, within rather than developments between individuals over time, which is called within variation (Mummolo & Peterson, 2018). Combining equations (1) and (2) with this result and an additional factor controlling for a time trend leads to a panel estimation which is described by the following equation:

(3) $$Enrolment_{it} = \alpha + \beta\, NR_{it} + \gamma_1\, PopDen_{it} + \gamma_2\, GDP_{it} + \mu_i + \nu_t + \varepsilon_{it}$$

with α presenting the intercept, $Enrolment_{it}$ illustrates the human capital variable, NR_{it} proxies the natural resource dependence, $PopDen_{it}$ and GDP_{it} are the controls while μ_i is the fixed effect for each province in order to control for unobserved and time-invariant factors. ν_t is the time trend and ε_{it} shows the error term.

Another test is performed in order to control for cross-sectional dependence. Since the Pesaran (2004) test confirms the prevalence of cross-sectional dependence for variables in this sample, the estimations are adjusted for it using the Driscoll-Kraay (1998) standard errors. The motivation behind this lies in the fact that these produce heteroscedasticity consistent standard errors that are robust to cross-sectional dependence which should deliver consistent results for this dataset (Hoechle, 2007).

4.2 Cross-Country Analysis

The dataset structure, for example characterised by nonstationary variables, suggests that a standard static panel approach in the form of a random or fixed effects estimation would lead to unreliable and spurious estimations of the long-run relationship between education and natural resource dependence (Beck & Katz, 2011). Furthermore, the model choice here is motivated by possible issues that need to be accounted for. Firstly, a bias caused by endogeneity is a possible issue due to an omitted variable bias and reverse causality. Natural resource endowments can affect education decisions through many different channels. Thus, it is difficult to identify all important variables, find data and include them into the regression. Reverse causality, which describes in this case that high or low levels of human capital have an effect on the resource dependency, could bias the estimations further (Kim & Lin, 2017). Secondly, occurring shocks, which are a significant factor when a country is dependent on natural resources, pose a possible threat to the causal interpretations of the estimations in a standard cross-country model (Kim & Lin, 2017). Heterogenous human capital accumulation processes across countries pose, at least in the short-run, might be a possible issue in this setting as well.

Hence, based on the test results and the reasoning explained in the previous paragraph, a dynamic heterogeneous estimator is chosen to identify the magnitude and the sign of the short and long-run relationship. The estimator is based on Pesaran, Shin & Smith (1999) who developed different possibilities, a mean group (MG) model and a pooled mean group (PMG) model, to calculate the long-term relationship between the variables. The MG estimator uses the assumption of a fully heterogeneous coefficient model, calculating the unweighted mean of the short and long-run estimates across countries (Pesaran, Shin & Smith, 1999). The PMG assumes heterogenous short-run coefficients while the long-run relationship is characterised by homogenous slopes. This strict assumption is likely to hold in this setting since the chosen country sample is characterised by a relative homogeneity in the long-run (Booth, 1999). At the same time, the short-term development might differ significantly. This could be, for example, due to specific settings that impact the countries differently such as shock vulnerability (Loayza and Rancière, 2006). Based on this, the PMG estimator appears to be the preferred estimation. A Hausman test is performed, where the null hypothesis assumes that the PMG estimator is preferred and the alternative hypothesis accepts the MG estimations as optimal, to confirm the assumption of significant differences and strengthen the results (Hausman & Taylor, 1981). The model is calculated through maximum likelihood and a major advantage lies in the fact that variables without the same order of integration can be estimated in this model (Pesaran, Shin & Smith, 1999). Since the unit root tests for the sample present a mixed set of variables that are stationary at I(0) and I(1), this specification minimises possible issues resulting from this. A second advantage is that the model, despite including the lag of the dependent variable which can cause endogeneity issues, is able to deliver consistent estimations (Pesaran, Shin & Smith, 1999).

Pesaran, Shin & Smith (1999) begin the estimation of the pooled mean group estimator with the autoregressive distributive lag, ARDL, (p, q1, . . . , qk). P are the lags for the dependent variable while q presents the lags for the independent variable. The dynamic panel specification is based on the following equation:

(4) $$y_{it} = \sum_{j=1}^{p} \lambda_{ij}\, y_{i,t-j} + \sum_{j=0}^{q} \delta_{ij}\, X_{i,t-j} + \mu_i + \varepsilon_{it}$$

with i = 1, 2, …, N being the number of countries, t = 1, 2, …, T the years and j the number of time lags. X_{it} is a set of control variables, λ_{ij} presents the scalars, δ_{ij} the coefficient vectors and μ_i is the country-specific effect.

The error correction term is defined as:

(5) $$\Delta y_{it} = \phi_i y_{i,t-1} + \beta_i X_{it} \sum_{j=1}^{p-1} \lambda_{ij}\, y_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij}\, \Delta X_{i,t-j} + \mu_i + \varepsilon_{it}$$

where $$\phi_i = -\left(1 - \sum_{j=1}^{p} \lambda_{ij}\right) \qquad \beta_i = \sum_{j=0}^{q} \delta_{ij}$$

Using the specified variables of the sample and inserting them into (4), the long-run relationship of the variables in the sample is defined by:

(6) $$EduEx_{it} = \lambda_i EduEx_{i,t-j} + \alpha_{1i} NR_{it} + \alpha_{2i} PopDen_{it} + \alpha_{3i} GDP_{it} + \alpha_{4i} Conflict_{it} + \alpha_{5i} Corruption_{it} + \alpha_{6i} Institutions_{it} + \varepsilon_{it}$$

with $EduEx_{it}$ being the education expenditure measure. NR_{it} is the natural resource dependence measure, $PopDen_{it}$ illustrates population density, GDP_{it} is the GDP per capita measure, $Conflict_{it}$ is the Dummy variable for conflicts, $Corruption_{it}$ and $Institutions_{it}$ are the institutional quality measures.

Following this and adjusting the model to the baseline sample specifications with education expenditure and natural resource rents as the main variables leads to this ARDL (1, 1, 1, 1, 1, 1, 1) estimation:

(7) $$EduEx_{it} = \lambda_i EduEx_{i,t-j} + \delta_{10i}NR_{it} + \delta_{11i}NR_{i,t-1} + \delta_{20i}PopDen_{it} + \delta_{21i}PopDen_{i,t-1} + \delta_{30i}GDP_{it} + \delta_{31i}GDP_{i,t-1} + \delta_{40i}Conflict_{it} + \delta_{41i}Conflict_{i,t-1} + \delta_{50i}Corruption_{it} + \delta_{51i}Corruption_{i,t-1} + \delta_{60i}Institutions_{it} + \delta_{61i}Institutions_{i,t-1} + \mu_i + \varepsilon_{it}$$

With the error correction term being defined as:

(8) $$\Delta EduEx_{it} = \phi_i(EduEx_{i,t-1} - \theta_{0i} - \theta_{1i}NR_{it} - \theta_{2i}PopDen_{it} - \theta_{3i}GDP_{it} - \theta_{4i}Conflict_{it} - \theta_{5i}Corruption_{it} - \theta_{6i}Institutions_{it}) - \delta_{11i}\Delta NR_{it} - \delta_{21i}\Delta PopDen_{it} - \delta_{31i}\Delta GDP_{it} - \delta_{41i}\Delta Conflict_{it} - \delta_{51i}\Delta Corruption_{it} - \delta_{61i}\Delta Institutions_{it} + \varepsilon_{it}$$

with Δ which is the first-order difference, $\phi_i = -(1 - \lambda_i)$ being the adjustment coefficient and the long-run coefficients are:

$$\theta_{0i} = \frac{\mu_i}{1-\lambda_i},\ \theta_{1i} = \frac{\delta_{10i} + \delta_{11i}}{1-\lambda_i},\ \theta_{2i} = \frac{\delta_{20i} + \delta_{21i}}{1-\lambda_i},\ \theta_{3i} = \frac{\delta_{30i} + \delta_{31i}}{1-\lambda_i},\ \theta_{4i} = \frac{\delta_{40i} + \delta_{41i}}{1-\lambda_i},\ \theta_{5i} = \frac{\delta_{50i} + \delta_{51i}}{1-\lambda_i},\ \theta_{6i} = \frac{\delta_{60i} + \delta_{61i}}{1-\lambda_i}$$

The lag structure was estimated based on the restricted data. For example, a small sample size, which is the case in this setting, can limit the optimal lag selection (Loayza and Rancière, 2006). Resulting from this, the maximum lag structure is restricted to a common structure for all countries and based on the estimation criteria an optimal lag of 1 for all variables and models is chosen. This is in order to not lose too many degrees of freedom while also estimating a fairly rich set of dynamics (Loayza and Rancière, 2006).

4.3 Sensitivity Analysis

To test the robustness of the results, a sensitivity analysis is performed. This includes using the Levin-Lin-Chu (2002) unit root test for both samples. Including this test aims at the confirmation of the initial results and hence, strengthening the obtained estimates to define consistent and reliable specifications.

Table 1: Different Model Specifications

	(1)	(2)
Variable	**Province-Level Analysis**	**Cross-Country Analysis**
Enrolment	Baseline Model	
Mining	Baseline Model	
Agriculture	Robustness Check	
Education Expenditure		Baseline Model
Natural Resource Rents		Baseline Model
Natural Resource Depletion		Robustness Check

A further robustness check is conducted through the use of different variables. The specification that is used for each of the two analyses is specified in Table 1. From this, it can be noted that both analyses utilise a second explanatory variable for the resource dependence as a robustness measure. The last robustness check is applied using an interaction term for the natural resource rents and resource depletion variables with the institutional measure. This is brought out for the cross-country analysis only because the province-level examination offers no available long-term measure. This sensitivity analysis is conducted to analyse the robustness of the results but also to test for whether the second proposed hypothesis on the mitigating effect of a good institutional framework can be confirmed.

5 Empirical Analysis

5.1 Descriptive Statistics

5.1.1 Province-Level Analysis

Table 2: Descriptive Statistics for the Province-Level Analysis

		(1)	(2)	(3)	(4)	(5)	
Variable		**Mean**	**Std. Dev.**	**Min**	**Max**	**Observations**	
Enrolment	overall	62.484	9.492	30.44	84.61	N =	442
	between		7.922	42.385	75.141	n =	26
	within		5.443	45.910	77.34	T =	17
Mining	overall	12.582	1.728	9.805	16.433	N =	442
	between		1.71	10.335	16.277	n =	26
	within		0.411	10.524	14.818	T =	17
Agriculture	overall	14.034	0.772	10.353	14.926	N =	442
	between		0.776	10.528	14.805	n =	26
	within		0.127	13.7	14.51	T =	17
Population Density	overall	4.803	1.6389	1.609	9.606	N =	442
	between		1.665	1.864	9.48	n =	26
	within		0.114	4.282	5.207	T =	17
GDP	overall	15.673	0.642	14.487	17.636	N =	442
	between		0.629	14.648	17.328	n =	26
	within		0.175	15.271	16.279	T =	17

Table 2 shows the descriptive statistics summary for the province-level sample. It shows a consistent data availability for all measures and time periods. Moreover, the within variation for the dependent and explanatory variable are relatively large. This could be beneficial for the fixed effects estimation since it calculates the variation within provinces rather than between provinces (Mummolo & Peterson, 2018). A lower variation, however, can be found for the robustness check measure for resource dependency. A closer look at the main dependent and explanatory variables reveal some further insights into the data structure.

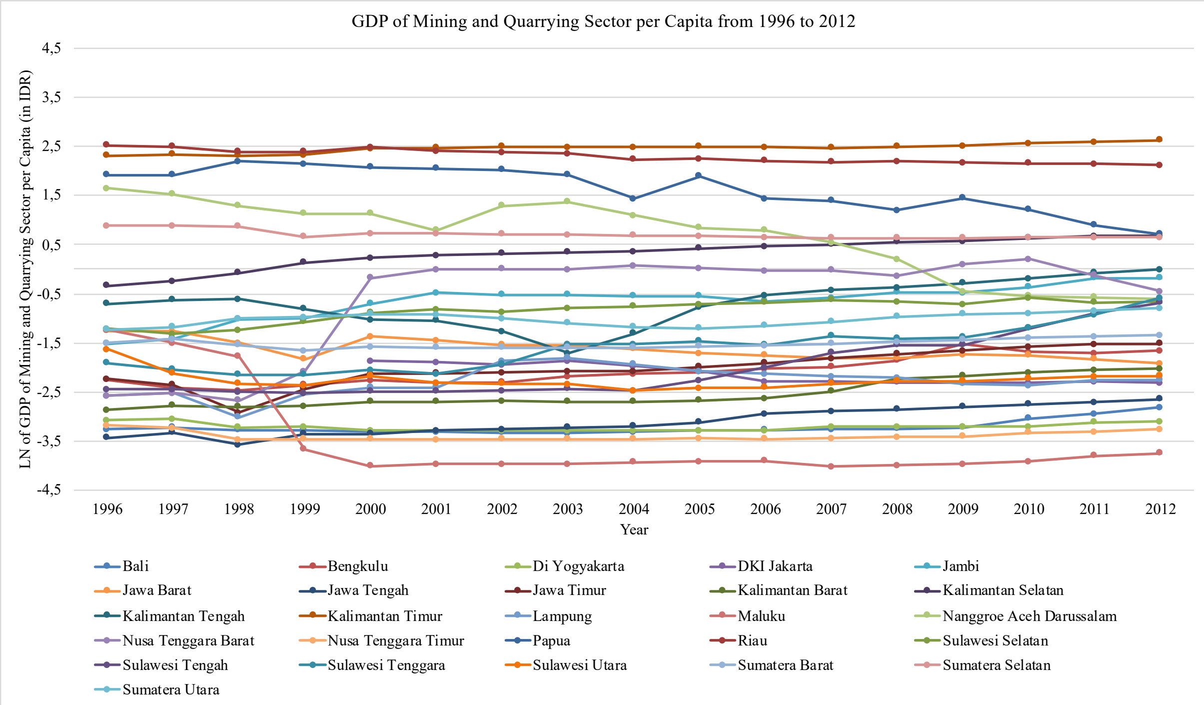

Figure 4: Own calculations, based on GDP of Mining and Quarrying Sector (World Bank, 2019e) and Population (Badan Pusat Statistik, 2019b)

Figure 4 illustrates the natural logarithm of the mining and quarrying sector GDP in per capita terms from 1996 and 2012. The trend overall appears to be stable with little volatility for most provinces. The long-term development on average seems to be slightly positive with some outliers in the data. The provinces Maluku, Nanggroe Aceh Darussalam and Papua, for example, show a relatively strong decline compared to the overall trend. Similarly, Kalimantan Tengah had a strongly decreasing rate but moved on towards a more stable path since 2000. Additionally, Nusa Tenggara Barat experienced a strong increase in the late 1990s with more stable rates since 2000.

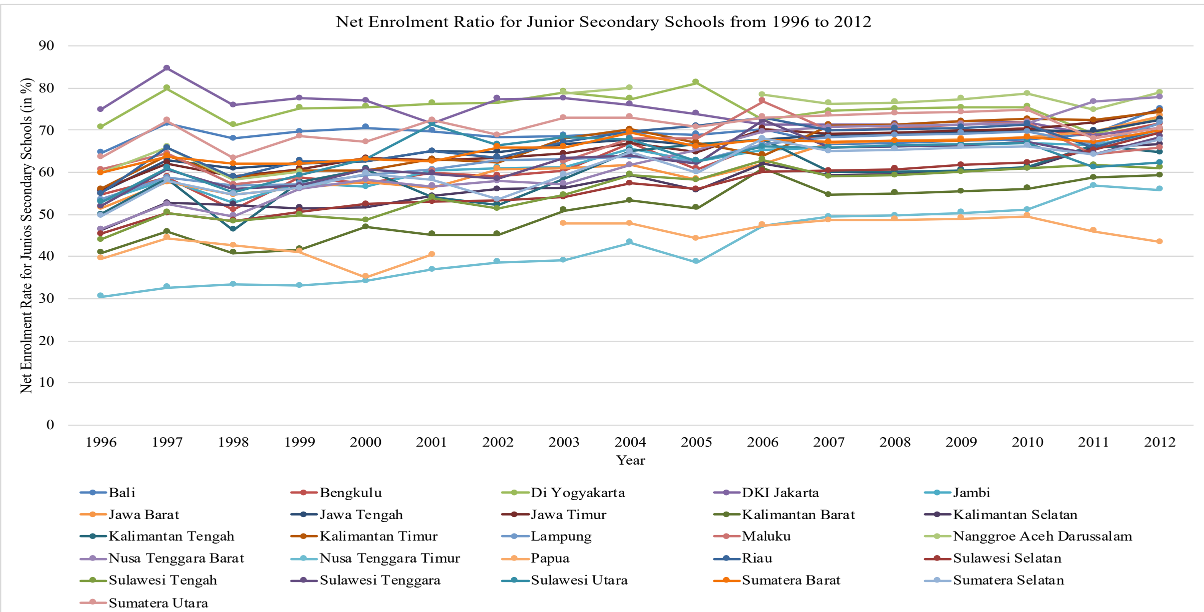

Figure 5: Net Enrolment Ratio for Junior Secondary Schools (World Bank, 2019f)

In Figure 5, that shows the net enrolment ratio for junior secondary schools, illustrates that over time a slight increase of the average rate has been observable. During the late 1990s and early 2000s the values appear as more volatile, while a stabilisation from 2007 onwards can be detected in the graph. A drop of the enrolment ratio for many provinces appears to have taken place in 1998 which might be due to negative effects of the Asian financial crisis of 1997 on the education sector (Suryadarma, Suryahadi, & Sumarto, 2006). Looking at some provinces in more detail, it is observable that Papua has declining rates since 2011 and appears to lose ground compared to other provinces. Furthermore, Nusa Tenggara Timur appears to have been able to catch up significantly with what appears as the strongest increase in the enrolment ratio out of all provinces.

5.1.2 Cross-Country Analysis

Table 3: Descriptive Statistics for the Cross-Country Analysis

		(1)	(2)	(3)	(4)	(5)
Variable		**Mean**	**Std. Dev.**	**Min**	**Max**	**Observations**
Education Expenditure	overall	3.101	1.332	0.485	6.4	N = 170
	between		1.191	1.769	4.710	n = 5
	within		0.795	1.671	5.171	T = 34
Natural Resource Rents	overall	6.534	5.725	0.414	27.510	N = 169
	between		5.144	1.700	14.127	n = 5
	within		3.371	-2.083	19.917	T = 33.8
Natural Resource Depletion	overall	3.387	2.28	0.303	9.303	N = 165
	between		1.934	1.178	5.240	n = 5
	within		1.459	-0.237	7.45	T = 33
Population Density	overall	4.973	0.528	3.834	5.863	N = 170
	between		0.558	4.241	5.556	n = 5
	within		0.169	4.566	5.299	T = 34
GDP	overall	8.762	0.680	7.171	10.109	N = 170
	between		0.636	7.906	9.576	n = 5
	within		0.37	7.964	9.615	T = 34
Conflict	overall	0.418	0.495	0	1	N = 170
	between		0.383	0.0294	1	n = 5
	within		0.356	-0.082	1.388	T = 34
Corruption	overall	51.155	8.698	34.608	64.360	N = 170
	between		9.472	36.463	61.014	n = 5
	within		1.862	42.865	56.192	T = 34
Institutions	overall	4.828	1.159	2.188	6.625	N = 154
	between		1.059	3.649	5.734	n = 5
	within		0.635	3.176	6.426	T = 30.8

The descriptive statistics summary for the cross-country analysis in Table 3 presents overall some missing values for some periods and countries. For instance, the institutional measure only offers 154 observations while 170 would be the value for consistently available variables. All measures show a comparatively high level of variation and standard deviations. Natural resource rents, for example, reach from a value of 0.414 to 27.510. A closer look at the data structure of the dependent and explanatory variable is used to illustrate further insights:

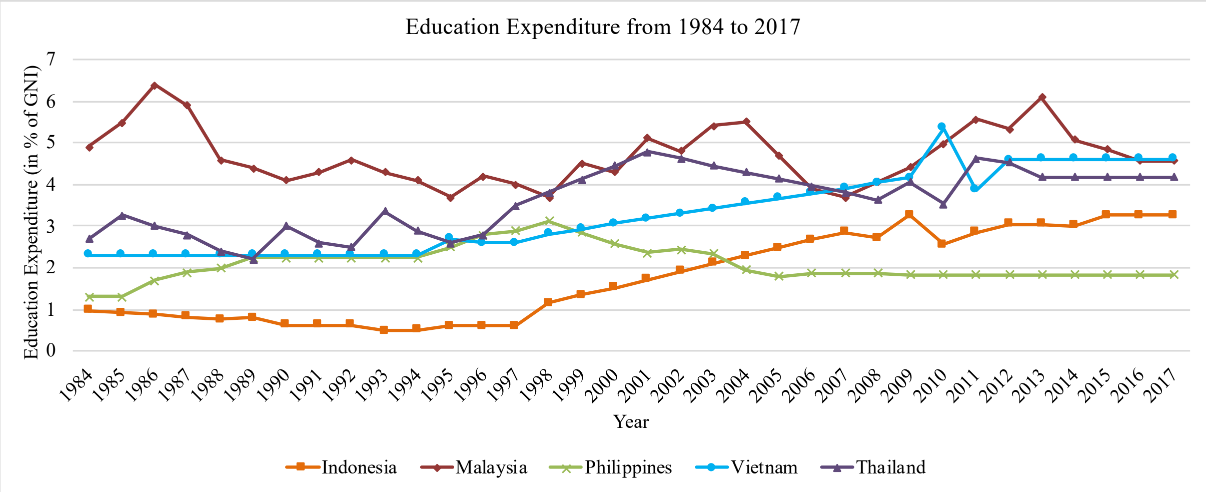

Figure 6: Education Expenditure (World Bank, 2019a)

In Figure 6, the education expenditure in percentages of GNI from 1984 to 2017 is presented for the cross-country sample. A fairly stable but low rate for Indonesia from 1984 until 1997 is observable, followed by a substantial rise from around 0,6% to 3,3% of GNI since then. Hence, the expenditure has grown continuously since the Asian financial crisis in 1997 with the exception of the year 2010. Malaysia started off with a relatively high expenditure rate of 5% compared to the other countries that were located below 3%. For Malaysia a general trend over time is difficult to identify and the rates are characterized by a high volatility. This is also true for Thailand, however, overall a positive trend is observable. Indeed, the values have increased from around 2,7% in 1984 to a stable value of 4,2% in 2017. A positive path is also observable for Vietnam with stable rates of around 4,6% now. One striking observation is the stagnating rate of expenditure of 2,3% until 1994 which raises questions about the data quality for this case. For the Philippines a stable rate of around 1,9% for the last ten years is presented. Before that, the development was more volatile, particularly in the 1980s, and showed increasing rates during the 1990s. Overall, most countries, with the exception of the Philippines have been able to catch up to the high expenditure rates of Malaysia and have increased the rates over time.

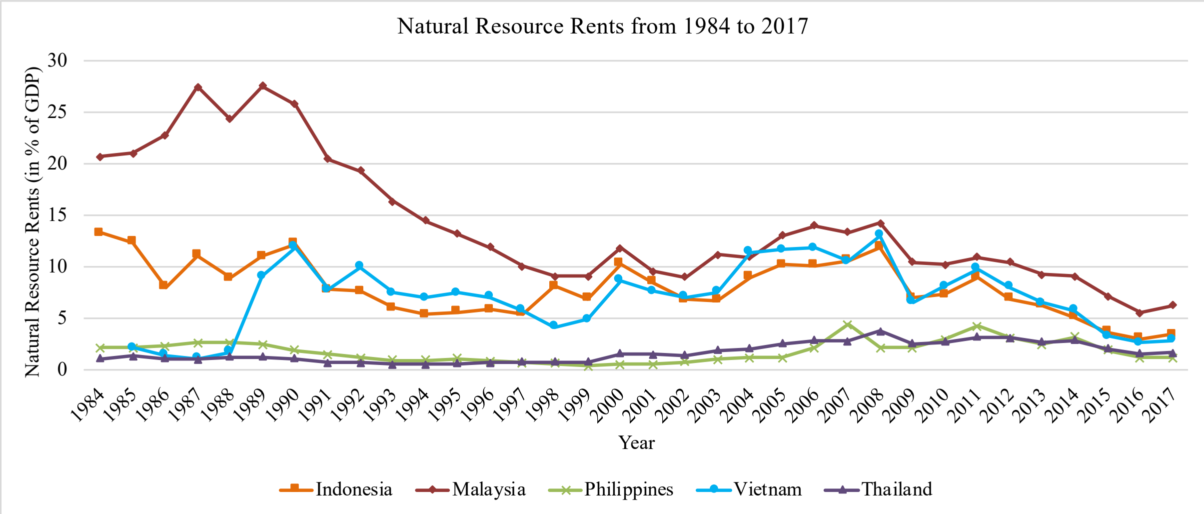

Figure 7: Natural Resource Rents (World Bank, 2019j)

Looking at the explanatory variable natural resource rents in percentages of GDP from 1984 to 2017 in Figure 7, it can be seen that Malaysia has been having the highest share since 1984. During the 1980s the values were particularly high with rates above 25%. Until today the importance of natural resources has decreased significantly with shares now at around 5%. A very similar development is observable for Indonesia. The continuation of the 1970s oil boom was characterised by high shares with the peak at around 14% in 1984. After that, the natural resource rents decreased slowly. Since then the rents have varied between 5% and 10% and appear fairly volatile over time. It can be stated that the importance has decreased substantially over time and that the shares today are relatively low with values around 5%. Thailand and the Philippines are defined by significantly lower resource shares compared to the other countries in the sample. The shares have never exceeded the 5% line, except for the Philippines in 1973, and the development over time appears as stable. The rates for Vietnam are not available before 1985 and the path since then has followed a similar development to Indonesia. The rate increased substantially after 1988 with then almost identical rates to Indonesia's share of natural resources.

5.2 Results

The analysis of the panel data for both, the province and cross-country level, follows a similar procedure: Firstly, the stationarity of the variables in each dataset is analysed using the Im-Pesaran-Shin (2003, IPS) unit root test which is used as the main indicator. As a robustness check for the results the Levin-Lin-Chu (2002, LLC) test is taken into account. Based on the results, a fitting model specification is chosen for each dataset and robustness checks are performed to analyse the sensitivity of the results. The significance levels used for all analyses are the 90%, 95% and 99% confidence level values. The estimates reject the null hypothesis when the p-value is smaller than 0.05, which equals significance at the .05 level. A description of the obtained results is presented in the next section, first for the Indonesian provinces and then for the cross-country case.

5.2.1 Province-Level Analysis

Table 4: Results from IPS (2003) Unit Root Test (Level Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Enrolment	0.0268**	0.0268**	0.0268**	0.000***	0.000***	0.000***
Mining	0.1550	0.1436	0.1550	0.000***	0.004***	0.011**
Agriculture	0.4865	0.2803	0.4865	0.000***	0.000***	0.000***
GDP	0.7924	0.7929	0.7924	0.000***	0.000***	0.000***
Population Density	0.1150	0.0387**	0.1150	0.000***	0.000***	0.000***

Note: H_0: All panels contain unit roots and H_1: Some panels are stationary. P-Values are presented. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

The test results for the panel IPS (2003) unit root test at level is presented in Table 4. The null hypothesis states that all panels contain a unit root while the alternative hypothesis is the stationarity of at least some panels (Im, Pesaran, & Shin, 2003). The number of lags is chosen according to the different criteria, namely the Akaike Information Criterion (AIC), the Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). The results show that all the variables in the columns (4) to (6) reject the null hypothesis that all panels contain a unit root and accept the alternative hypothesis that at least some panels are stationary at the significance levels of .01 and .05. This specification includes a control for a possible deterministic linear time trend. In contrast, without the time trend, most variables appear to contain a unit root as displayed in the columns (1) to (3). The exception in this case is the variable for the enrolment ratio that reject the null hypothesis at the .05 significance level and population density that offers the same result but only the BIC specification. This indicates that the variables are trend stationary at I(0). Taking the LLC (2002) unit root test into account in order to confirm the findings, the results strongly indicate the trend stationarity at I(0). The results are presented in Table 11 in Appendix A. The exception is the enrolment ratio measure which is stationary without a time trend. Based on this, the conclusion is that all variables are stationary at I(0). However, IPS and LLC unit root test results show that a clear deterministic time trend can be assumed. This will be accounted for in the analysis by including a time trend into the regressions.

Table 5: Results from the Fixed and Random Effects Estimations

	(1)	(2)	(3)	(4)
Model	**Fixed Effects**	**Fixed Effects**	**Random Effects**	**Random Effects**
VARIABLES	Enrolment	Enrolment	Enrolment	Enrolment
Constant	-1,746***	-1,582***	-1,550***	-1,391***
	(205.3)	(202.4)	(188.5)	(246.6)
Mining	3.375**		2.495**	
	(1.308)		(1.171)	
Agriculture		10.96		4.782*
		(6.741)		(2.774)
Population Density	-0.0861	-0.978	3.627***	3.828**
	(2.910)	(2.496)	(1.296)	(1.844)
GDP	-7.311*	-4.923	-3.911	0.178
	(3.843)	(4.021)	(3.229)	(1.758)
Year	0.939***	0.785***	0.811***	0.681***
	(0.107)	(0.117)	(0.0950)	(0.138)
Observations	442	442	442	442
R-squared (within)	0.583	0.581	0.579	0.569
Number of Provinces	26	26	26	26

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The regressions for the fixed and random effects estimations are presented in Table 5 with robust standard errors in order to control for heteroscedasticity. The random effects estimations are presented in column (3) and (4) for comparison, however, the assumption of the fixed effects model to be the preferred specification is confirmed by the Hausman test results. The findings are available in Table 12 in Appendix A. Therefore, the analysis focuses on the fixed effects models. The first column presents a model with a time trend and with the GDP of the mining and quarrying sector as the explanatory variable (in natural logarithm). The coefficient has a magnitude of 3.375 and is significant at the .05 level. As a result, the presented linear-log model shows that a 1% increase in the GDP of the mining and quarrying sector would lead to an increase the enrolment ratio by 0.0375 within a province, holding all other variables constant. Moreover, the GDP per capita variable in natural logarithm form is significant at the 0.10 level, while the population density measure has the expected negative impact but is insignificant in this model. The obtained results are unexpected since one would expect that a higher GDP per capita is associated with an increase in enrolment ratios within provinces as described in the section about the Indonesian case. The year coefficient depicts a statistically significant impact on the results which confirms the inclusion in the regression is justified. According to the first hypothesis, the natural resource dependence variable is expected to impact human capital accumulation negatively, in this setting within a province over time. This indicates a rejection of the first hypothesis for this sample. The obtained result for the mining and quarrying sector implies supportive evidence for the avoidance of the resource curse or at least the impact on educational measures in Indonesia.

The model that includes the GDP of the agriculture sector, as a robustness check and in the natural logarithm form, is presented in column (2) of Table 5. The results appear similar to the first estimation. Agriculture has a strongly positive impact on the enrolment ratio with a coefficient of 10.96. However, the coefficient is insignificant due to a large estimate for the robust standard errors of 6.741. Thus, no significant relationship between the agricultural sector and the human capital accumulation can be detected in this model specification.

Table 6: Results from Fixed Effects Estimations with Driscoll-Kraay (1998) Standard Errors

	(1)	(2)
Model	**Fixed Effects**	**Fixed Effects**
VARIABLES	Enrolment	Enrolment
Constant	-1,746***	-1,582***
	(190.6)	(194.4)
Agriculture		10.96***
		(1.404)
Mining	3.375***	
	(0.597)	
Population Density	-0.0861	-0.978
	(2.985)	(2.719)
GDP	-7.311***	-4.923**
	(2.308)	(1.844)
Year	0.939***	0.785***
	(0.111)	(0.107)
Observations	442	442
R-squared (within)	0.583	0.582
Number of Provinces	26	26

Driscoll-Kraay (1998) standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Testing the fixed effects estimations for cross-sectional dependence with the Pesaran (2004) test shows that correlation indeed is an issue in in this model. The null hypothesis suggests independence while the alternative hypothesis states that the data are correlated across panels. Table 13 in Appendix A illustrates the results. The cross-sectional dependence of the errors of some variables in the panel dataset can be expected. This can, for example, be explained by the rise in economic integration of the different provinces which is likely to have led to increasing interdependence between cross sectional entities (De Hoyos & Sarafidis, 2006). Resulting from this, it needs to be taken into account when interpreting the results (Phillips & Sul, 2003) and to account for the biased standard errors, the Driscoll-Kraay (1998) standard errors are introduced. Table 6 displays the improved fixed effects estimations only since the random effects option is not available for this specification.

This causes changes in the statistical significance of some coefficients. While the mining and quarrying sector coefficient is now significant at the .01 level, the GDP coefficients for both models are significant at least at the .05 level. Hence, it can be stated that the Driscoll-Kraay specification reduces the size of the standard errors for some variables substantially. The exception for this is the population density coefficient that remains insignificant. The opposite result is true for the model with the agriculture variable as the explanatory measure. The coefficient is now significant at the .01 level which suggests the issue of cross-sectional dependence to be particularly strong for this measure in this model. In the linear-log model this means that a 1% increase in the GDP of the agricultural sector would lead to an increase the enrolment ratio by 0.1096 within a province, holding all other variables constant. Resulting from this, it can be concluded that the dependence on the agriculture sector in this model has substantial positive impact on the enrolment ratio in this sample within a province. Since the agricultural sector illustrates diffuse-source resources, this result can be expected. As mentioned in the data section, the possible negative impact of natural resources depends on the type of resource (Boschini, Pettersson & Roine, 2013).

5.2.2 Cross-Country Analysis

Table 7 presents the results for the IPS (2003) unit root test for the cross-country analysis to determine the order of integration. The null hypothesis defines that all panels contain unit roots while the alternative hypothesis states that at least some panels are stationary. Testing for a unit root in the panel dataset is particularly important due to the relatively large time frame (Im, Pesaran, & Shin, 2003). Additionally, the estimation with the PMG and MG estimator can only be applied with variables that are of order I(0) or I(1). Therefore, one has to make sure that none of the variables are of the integration order I(2). Estimations without a time trend lead to the result that the measures for education expenditure, natural resource rents, institutions, GDP per capita and population density fail to reject the null hypothesis for the different criteria as shown in columns (1) to (3). Including a time trend in columns (4) to (6) in Table 7 changes the results only partly. Most variables, that fail to reject the null hypothesis at level, still fail to do so, except for GDP per capita that now rejects at least at the .05 level.

Table 7: Results from IPS (2003) Unit Root Test (Level Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Education Expenditure	0.5195	0.5235	0.5195	0.0296**	0.0011***	0.0296**
Natural Resource Rents	0.1272	0.1272	0.1272	0.1853	0.1868	0.1853
Natural Resource Depletion	0.0321**	0.0321**	0.0321**	0.0067***	0.0067***	0.0067***
Population Density	0.9622	0.9622	0.9622	0.8564	0.8829	0.8564
GDP per Capita	0.7315	0.7807	0.7315	0.6585	0.5765	0.6585
Conflict	0.0000***	0.0000***	0.0000***	0.0002***	0.0000***	0.0000***
Corruption	0.0218**	0.0218**	0.0218**	0.0304**	0.0304**	0.0304**
Institutions	0.3647	0.3647	0.3647	0.5940	0.5940	0.5940

Note: H_0: All panels contain unit roots and H_1: Some panels are stationary. P-Values are presented. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

Testing the stationarity of the variables in the first difference, presented in Table 8, results in the observation that now all variables reject the null hypothesis already at the .01 significance level. This observation is confirmed by the LLC (2002) unit root tests which are presented in Tables 14 and 15 in Appendix B. This leads to the conclusion that the natural resource rent measure as well as population density are trend stationary at level. The conflict, corruption, education expenditure and natural resource depletion variables are stationary at level with a time trend and the remaining variables are stationary at the first difference. The results are robust to the application of another unit root test as well as to different information criteria – the AIC, BIC and HQIC. As a result, the variables are a mix of I(0) and I(1). This impacts the choice of model since not all models can employ panel data that is characterised by this feature. As mentioned before, the panel ARDL approach is applied as a result of these results.

Table 8: Results from IPS (2003) Unit Root Test (First Difference Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Education Expenditure	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Natural Resource Rents	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Natural Resource Depletion	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Population Density	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
GDP	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Conflict	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Corruption	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Institutions	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***

Note: H_0: All panels contain unit roots and H_1: Some panels are stationary. P-Values are presented. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

The estimations of the PMG model are illustrated in Table 9. According to the Hausman test (Hausman & Taylor, 1981), the PMG specification for both explanatory variables is preferred since the null hypothesis of the homogeneity assumption cannot be rejected as illustrated in Table 16 in Appendix B. Since the MG estimator reacts comparatively sensitive to outliers when the sample size N is small, this could explain the significant difference of the results for the two estimations (Favara, 2003). Here lies the advantage of the PMG estimator that "produces estimates that are similar to weighted averages of the respective country-specific estimates, where the weights are given according to their precision" (Loayza and Rancière, 2006, p. 1057). In other words, the focus in the analysis lies on the PMG estimator which is interpreted. Nevertheless, the MG results are reported in Table 17 in Appendix B for comparison. For both dependent variables in Table 9 it can be noted that the error correction coefficient is negative and smaller than -2 which suggests the existence of a long-run relationship, also called dynamic stability (Loayza and Rancière, 2006).

The first model in Table 9 specifies natural resource rents as the explanatory variable. Most importantly and in accordance with the fist hypothesis, the natural resource measure has a negative impact on education expenditure with a magnitude of 0.220. The parameter estimate is significant at the 99% confidence level and would lead to a decrease of 0.22 in education expenditure for a one unit increase in the natural resource rents, holding all other variables constant. In addition, the variables population density, corruption and GDP have highly significant coefficients. Population density and GDP present coefficients with a sign in accordance with the expected results from the literature review, namely a negative one for the former and positive one for the latter. In contrast to this, the corruption parameter estimate states a positive impact on education expenditure which is a surprising result. One would expect corruption to impact education expenditure negatively based on the literature review. At the same time, the institutions variable is presented with the expected positive impact, yet, the coefficient is insignificant. This picture changes when the short run coefficients are summarised. Most parameter estimates are not statistically significant, however, institutions impact education expenditure positively with a magnitude 0.147. Furthermore, population density also has a strongly negative effect in the short run. For GDP per capita the coefficient turns negative, again a rather surprising result. The natural resource rents coefficient is positive but insignificant. This could indicate that, when the long and short run estimates are compared, the linkage between natural resource dependence and education expenditure for this sample depends on the time frame. A significant relationship is found for the long-run but not for the short run.

Table 9: Results from Pooled Mean Group Estimations

	(1)	(2)
Model	**PMG**	**PMG**
VARIABLES	Education Expenditure	Education Expenditure
Long Run Coefficients		
Constant	58.25	17.67
	(51.35)	(14.45)
Natural Resource Rents	-0.220***	
	(0.0386)	
Natural Resource Depletion		-0.203***
		(0.0535)
Population Density	-52.65***	-20.53***
	(12.87)	(6.408)
GDP per Capita	12.42***	6.335***
	(2.318)	(1.185)
Conflict	-1.940	-0.853
	(3.488)	(1.578)
Corruption	0.568***	0.413***
	(0.114)	(0.0870)
Institutions	0.174	0.319***
	(0.107)	(0.104)
Short Run Coefficients		
Error Correction Coefficient	-0.355	-0.435
	(0.302)	(0.326)
ΔNatural Resource Rents	0.0547	
	(0.0431)	
ΔNatural Resource Depletion		0.0739
		(0.0593)
ΔPopulation Density	-91.60**	-64.16*
	(45.52)	(33.87)
ΔGDP	-2.279**	1.862
	(1.017)	(4.381)
ΔConflict	0.226	0.222
	(0.188)	(0.174)
ΔCorruption	-0.0456	-0.0859
	(0.0796)	(0.102)
ΔInstitutions	0.147**	0.140
	(0.0731)	(0.130)
Observations	149	149

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The robustness check with the natural resource depletion measure in the second column presents a similar result. The variable has a negative effect on education expenditure, however, with a somewhat smaller magnitude. The coefficient, with a value of -0.203, is significant at the .01 significance level and would mean a drop in education expenditure of 0.203 for a one unit increase in the depletion rate, holding all other variables constant. This suggests a substantial negative impact of resource depletion on investments into education in the long-run for the sample and indicates a confirmation of the first hypothesis. The population density, GDP and corruption variables show a similar pattern as in the first column. Although the coefficients are presented with smaller magnitudes, they remain with their sign of impact and are significant. Moreover, the institutions variable has a significantly positive impact at the .01 significance level on education expenditure with the resource depletion rate as the explanatory variable. This is in accordance with the second hypothesis and indicates that institutions could have a positive impact on education expenditures in the long-run. However, this needs further examination in order to be able to draw conclusions about the effect. In this specification the short run coefficients, with the exception of population density, are insignificant suggesting that the negative relationship between resource dependence and human capital investments focuses on the long-run. This is in accordance with the model that applies the resource rents and illustrates the robustness of the results to different resource dependence measures.

Based on this, a sensitivity analysis that applies an interaction term between the natural resource measures and the institutions variables is introduced and presented in Table 10. This is due to the fact that from the literature review it can be expected that the impact of resource dependence diminishes with a good institutional framework. The sensitivity analysis is performed on the education expenditure measure with the two different natural resource dependence variables with the PMG estimator since it is the preferred model specification. Including the interaction term impacts the results. Population density here, being significant at the .10 level, has a negative parameter estimate with a magnitude of -8.8. The corruption measure is highly significant with a positive coefficient of 0.155 which is, again, a surprising result since one would expect the variable to reduce investments into human capital. An expectation that is derived from the literature review section. Furthermore, the interaction term between institutions and resource rents is significant at the 99% confidence level and has a negative sign. This can be interpreted that the effect of resource dependence depends on the institutional framework in a country. More precisely, in this setting it depends on the legal and property rights system which is a result in accordance with the second hypothesis. The impact of resource dependence decreases by -0.325 when the measure for institutions increases by one unit. For example, if the institutions variable equals one, then the slope between natural resource rents and education expenditure is 1.894 – 0.325 = 1.569.

Table 10: Results from Pooled Mean Group Estimations with Interaction Terms

	(1)	(2)
Model	**PMG**	**PMG**
VARIABLES	Education Expenditure	Education Expenditure
Long Run Coefficients		
Constant	6.224**	9.366**
	(2.904)	(4.745)
Natural Resource Rents	1.894***	
	(0.546)	
Natural Resource Depletion		5.986***
		(1.746)
Population Density	-8.800*	-3.885
	(4.532)	(4.226)
GDP per Capita	1.204	-2.690
	(2.303)	(2.300)
Conflict	0.0774	-0.166
	(0.510)	(0.532)
Corruption	0.155**	0.0331
	(0.0674)	(0.0717)
Institutions	1.474***	2.056***
	(0.519)	(0.737)
Institutions*Natural Resource Rents	-0.325***	
	(0.0934)	
Institutions*Natural Resource Depletion		-1.016***
		(0.297)
Short Run Coefficients		
Error Correction Coefficient	-0.262**	-0.233**
	(0.125)	(0.116)
ΔNatural Resource Rents	0.0943	
	(0.632)	
ΔNatural Resource Depletion		-0.500
		(1.289)
ΔPopulation Density	-84.40*	-95.81**
	(46.65)	(47.22)
ΔGDP per Capita	-1.199	-1.066
	(1.492)	(1.792)
ΔConflict	0.322	0.387
	(0.211)	(0.246)
ΔCorruption	-0.0751	-0.0880
	(0.0938)	(0.108)
ΔInstitutions	-0.116	-0.398
	(0.727)	(1.046)
ΔInstitutions*Natural Resource Rents	-0.0231	
	(0.111)	
ΔInstitutions*Natural Resource Depletion		0.0755
		(0.224)
Observations	132	132

Standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

A similar conclusion can be drawn for the second model in column (2) of Table 10 that explores resource depletion as the explanatory variable. The coefficient of the interaction term is significant at the .01 level which means that also in this specification the long-run relationship between education and resource dependence is impacted by the institutional framework. A one unit increase in institutions results in a reduced impact of natural resource depletion by -1.106. Again, the interaction coefficient supports the second hypothesis which states that an improved legal and property rights framework mitigates the effect of resource dependence. Furthermore, it needs to be noted that the interaction coefficient in column (2) is substantially larger than in column (1). This suggests a higher mitigating effect of institutions when resource depletion is used as the explanatory variable. The short run estimates are insignificant for all coefficients, except for population density. This suggests that the impact the interaction between institutions and natural resource dependence depend on the long-term dynamics rather than the short run. One could argue that this is the expected result since the results presented earlier show an impact of natural resource dependence as well as institutions mainly in the long-run.

Overall, this suggests that the results are sensitive to some extent to different model specifications. Particularly the long-run parameter estimates change significantly when, for example, an interaction term is introduced. The sensitivity of the results could be due to different reasons. To give an instance, the sample size and the applied model specifications could be responsible for this. However, the estimates appear robust to different explanatory variables. The coefficients for natural resource rents and resource depletion are comparable. Resulting from this, the next section deals with a more in-depth discussion and the limitations of the presented findings in the context of the expectations that were raised in the literature review.

5.3 Discussion and Limitations

The findings are considered in light of the two hypotheses. In addition to this, some of the most important limitations of this study are included in the discussion to deliver a full picture on the explanatory power of the results.

The first hypothesis in the study states that natural resource dependency has a negative effect on investments into education and the enrolment ratio. This hypothesis is based on the general literature review where a majority of studies finds that a higher level of resource dependence decreases investments into education and school enrolment rates (see for instance Gylfason & Zoega, 2001). The results from the province-level and cross-country analysis delivered contrary results on this issue. While the province-level approach overall displays a positive effect of both natural dependency measures on enrolment ratios, the cross-country study estimates suggest a negative effect of both resource measures on education expenditure. Based on this, the study finds supportive evidence against the first hypothesis for Indonesia. Thus, as some authors argue, it is suggested that Indonesia on the province-level has successfully avoided the negative transmission channel of resource dependency on human capital measures (World Bank, 1993, p. 26). However, no consensus on this issue has been reached and as forwarded in the background section of Indonesia, the development is not without doubt. While Bevan, Collier & Gunning (1999, pp. 250-251) Indonesia has used its resource revenues to invest in social expenditures, other authors (for instance proposed by Resosudarmo (2005, p. 4) and Seda (2005, p. 189) state that revenues have been wasted to some extent and led to an unequal distribution of investments. Furthermore, one could argue that the junior secondary enrolment rates would have improved despite a less than optimal management of the resource revenues and the educational sector (Suryadarma, Suryahadi, & Sumarto, 2006). As forwarded by Suryadarma, Suryahadi, & Sumarto (2006) the quality of the schooling system remains an issue. The improvement in enrolment rates, hence, not necessarily means that the quality of teaching or the high attrition rates have improved significantly over time. Moreover, it cannot be explained whether the country has avoided the resource curse or only the impact on the educational sector. Here, the obtained results suggest supportive evidence for the avoidance of a negative impact on educational measures in Indonesia. Nevertheless, the discussion surrounding this issue continues. In contrast, the cross-country sample implies that the first hypothesis indeed holds in this setting in the long-run. Resulting from this, it could be argued that some countries in the sample drive the negative effect in the cross-country sample, which is supported, for instance, through the argument proposed by Douangngeune, Hayami & Godo (2005). According to their study, Thailand fails to effectively utilise the resource revenues for investments in a sustainable development path. Due to this, the slower educational development, in return, impacts the economic development process in the country (Douangngeune, Hayami & Godo, 2005). Therefore, the findings might be interpretable as complementary rather than contradicting. Overall, the evidence implies different impacts of resource dependence on educational measures in Indonesia compared to the overall effect of the selected countries in Southeast Asia.

A closely connected point to this discussion is that the two analyses were conducted to complement each other but the interpretation of the results is challenging. It appears reasonable that the development in Indonesia differs from the other countries in the study, namely Malaysia, Thailand, Vietnam and the Philippines. Although the countries are characterised by many similarities, issues that are highly context-specific, such as the quality of the educational system, are likely to play a role here (Booth, 1999). For instance, the descriptive statistics have shown that the development and the initial conditions differed across the countries in the sample. Besides that, the examinations use different variables to proxy the long-run relationship and a lack of control variables is prevalent, particularly in the province-level setting. This is illustrated by the fact that the analyses applied public education expenditures and enrolment rates as dependent variables. This could be an issue because the variables capture the investments on the one hand and the educational outcomes on the other hand (World Bank, 2019a; World Bank, 2019f). Thus, this might drive the results to some extent and the question occurs whether the results can be compared without a doubt. This calls for improved human capital measures and a more in-depth examination of the long-run dynamics in the region as well as the relationship between resource dependency and educational measures in Indonesia.

The second hypothesis states that good institutions in the sense of the legal and property rights system can mitigate the impact of resource dependency on education measures. Unfortunately, the Indonesian province dataset lacks measures on institutional quality. Hence, this part of the analysis is not able to test the hypothesis. The second, the cross-country estimation, has revealed the expected results regarding the role of institutions. This confirms the hypothesis and leads to the overall conclusion that the institutions significantly impact the effect of resource dependency. Mehlum, Moene & Torvik (2006), Robinson, Torvik & Verdier (2006) and Collier & Goeris (2007), among others, have found supportive evidence for a significant impact of the quality of institutions on the relationship between resource dependency and investments into education. This study shows results that strengthen this hypothesis. However, the question of whether institutions are a mechanism in the resource curse or more a regulating characteristic in connection with other transmission channels persists. It is beyond the scope of this study to settle this debate and only suggestive evidence on the hypothesis can be presented. Hence, a further examination using an advanced statistical framework could be beneficial. An interesting analysis would, for example, be the estimation of the interaction on the province-level in Indonesia to be able to compare the local to the international development, as done for the first hypothesis. Nevertheless, aiming to improve the institutional quality appears to offer an opportunity to diminish the long-run effect of resource dependence on public education expenditure.

In this context, it is also important to discuss some of the most important limitations of the empirical analysis. According to Stijns (2006), study results in this field are often sensitive to econometric specifications. The estimations here are likely to contain some shortcomings that could not be accounted for and might have caused an estimation bias or led to a lower explanatory power of the obtained results. And illustrating example is that the PMG and MG models are designed to analyse panel sets with large T and large N to estimate consistent and efficient coefficients (Pesaran, Shin & Smith, 1999). The used cross-country data is, however, characterised by a relatively small number of individuals which could bias the results or impact the power of the test statistics (Pesaran, Shin & Smith, 1999). Closely connected to this is the restriction imposed on the lag structure. The small sample size can limit the optimal lag selection due to the need to balance the degrees of freedom as well as estimating a relatively rich set of dynamics (Loayza and Rancière, 2006). Additionally, data availability is an issue, for instance in the case of the province-level analysis, that could not be accounted for. The issue can lead to an omitted variable bias (OVB). This could, for instance, be one possible explanation for the unexpected results in some of the regressions for the GDP and the corruption variables. Moreover, the data is restricted to a rather short time frame. Particularly the dynamics in Indonesia during the 1970s would have been interesting to analyse quantitively since the resource dependency was substantial and the economic growth process remarkable as seen in the country case section (Rosser, 2007). Furthermore, some of the variables need to be discussed and the question occurs whether those are a fitting proxy. The chosen human capital variables, for instance, tell little about the quality of the educational system (see for example World Bank, 2019a). Although the education expenditure measure should be able to capture the investments transmission channel the educational system the money flows into might not be able to lead to a significantly higher human capital accumulation in the long-run. Supporting evidence for this is provided by Suryadarma, Suryahadi, & Sumarto (2006). They conclude that the quality of the schools and the teachers is as important (Suryadarma, Suryahadi, & Sumarto, 2006). At the same time, the availability of measures that estimate the quality of a schooling system limits the choice of variable significantly. As a result, the use of the applied proxies in this study can be justified because of this.

6 Conclusion

6.1 Research Aim and Objective

The purpose of this study was to identify the long-term relationship between natural resource dependence and human capital accumulation. The research aim was motivated by the lack of consistent results and the research gap concerning the analysis on a regional level. As a result, the study attempted to fill this research gap and offer informative new insights on the linkages for the county case Indonesia and the regional comparison. To answer the research question that asked what the effect of natural resource dependency on human capital measures is, a province-level fixed effects estimation and a small cross-country PMG estimator regression were applied.

The presented analysis demonstrates mixed evidence on the discussed issues. In the applied sample of Indonesia, resource dependency fails to affect education measures negatively. In comparison to this, the effect in the region shows the opposite result, as illustrated in the cross-country regressions. The province-level case shows a positive effect of the mining and the agricultural sector. According to the first hypothesis a negative effect of the main measure, the mining variable, was expected. For the cross-country analysis, the evidence presents a different picture. In the setting with education expenditure as the dependent variable, the relationship is characterised by a statistically significant negative impact. This finding confirms the first hypothesis. Overall, it implies that the province-level case is a positive example of a country escaping the negative impact of resource dependence while the effect for the Southeast Asian cross-country sample indeed performs as expected from the literature review. This conclusion can also be confirmed by authors such as Temple (2001) who analyses Indonesia as a country where the resource rents have been used to invest in the social sector including education. Looking at the second hypothesis, that suggests a mitigating effect of the institutional framework on the negative resource dependency effect, the evidence appears as supportive. Indeed, in the baseline model specifications, the institutional measure impacts the education variables positively. The introduction of an interaction term, moreover, illustrates that the higher the value of the institutional index, the smaller is the effect of resource dependency on human capital variables. This is in accordance with the expectations derived from the literature review.

However, the explanatory power of the findings might be limited because of statistical and conceptional shortcomings as described in previous sections. Due to these arguments, the obtained results should be interpreted as a correlation rather than the long-term causal effect between the variables. Nevertheless, it can be stated that natural resource dependence matters for human capital accumulation. Indonesia on the province-level appears to be a positive example.

6.2 Practical Implications and Future Research

Resulting from the obtained results, the practical implications are limited. One could take Indonesia as a positive example and argue that the way the generated resource revenues have been handled and invested beneficially. On the other hand, as some authors state that the natural resource sector in Indonesia contains certain aspects of the resource curse (see for example Seda, 2005, p. 189). This can be illustrated by the continuously high levels of corruption in the country. It can certainly be argued that natural resource dependency matters for educational measures due to significant effects revealed in this study. A possible recommendation could be that a high level of transparency of natural resource management is important for resource dependency to contribute positively to a sustainable development process with increasing human capital accumulation. Accountability could be implemented and improved through initiatives, such as the Extractive Industries Transparencies Initiative (World Bank, 2015). Furthermore, derived from the empirical analysis and the section about the Indonesian case, further progress in the access and outcomes of education is needed in Indonesia. This includes higher investments in education to provide an enhanced system for the large and young population of Indonesia (OECD, 2015, p. 11). In general, to draw direct practical implications from the study appears as challenging. A more in-depth analysis of the specific settings in Indonesia is needed to be able to derive more concrete recommendations. As a result, the findings and in particular the raised issues clearly illustrate that further research is needed.

Regarding future research, firstly, approaches emphasising the regional level appear to be a key factor in future studies. As seen in the literature review, research so far has mainly relied on cross-country models which can be explained through statistical issues such as small sample sizes and a lack of available data on the local level. However, this could lead to inaccurate findings since the effect of resource dependency on human capital accumulation appears to significantly depend on local settings. Examples can be the institutional framework but also the educational system. Resulting from this, it might be advisable to conduct local analyses to obtain useful evidence. Secondly, the institutional framework of countries should be studied in detail. This is a point that is closely connected to the aforehand mentioned research recommendations. From this study, it can be concluded that institutions, for instance in the sense of the law and property rights system, matter for the long-term impact. Due to the complexity and the multidimensional characteristics of the variable, the analysis is likely to require a framework that can account for this. Thus, future research should aim to identify the mechanisms through which the institutional framework impacts the long-term effect of resource dependency on education.

In conclusion, it can be stated that the topic remains highly relevant and future research could reveal interesting new findings of the relationship. Therefore, further investigations into the issue, particularly on the local level, could be beneficial. More robust evidence could significantly impact the policy design in natural resource-rich countries and contribute to the wider discussion on the importance of natural resources for the economic development process of a country.

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Appendix A

Table 11: Results from LLC (2002) Unit Root Test (Level Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Enrolment	0.0004***	0.0004***	0.0004***	0.000***	0.000***	0.000***
Mining	0.0001***	0.0001***	0.0001***	0.000***	0.000***	0.000***
Agriculture	0.0000***	0.0000***	0.0000***	0.000***	0.000***	0.000***
GDP	0.0218**	0.0219**	0.0218**	0.000***	0.000***	0.000***
Population Density	0.0006***	0.0001***	0.0006***	0.000***	0.000***	0.000***

Note: H_0: Panels contain unit roots and H_1: Panels are stationary. P-Values are presented. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

Table 12: Results from Hausman Test for Fixed and Random Effects

	(1)	(2)	(3)
Explanatory Variable	**χ^2 Test Statistics**	**Prob > χ^2**	**Result**
Mining	10.7	0.030	Reject H_0
Agriculture	19.23	0.001	Reject H_0

Notes: H_0: Difference is not systematic; H_1: Difference is systematic

Table 13: Results from Pesaran (2004) Cross-Sectional Dependence Test

	(1)	(2)	(3)
Explanatory Variable	**Test Statistics**	**p-value**	**Result**
Mining	18.293	0.000	Reject H0
Agriculture	17.737	0.000	Reject H0

Notes: H0: cross-sectional independence; H1: Units are cross-sectional dependence

Appendix B

Table 14: Results from LLC (2002) Unit Root Test (Level Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Education Expenditure	0.5195	0.5235	0.5195	0.0296**	0.0011***	0.0296**
Natural Resource Rents	0.3094	0.0717*	0.2127	0.2288	0.0435***	0.2288
Natural Resource Depletion	0.0232**	0.0232**	0.0232**	0.0007***	0.0007***	0.0007***
Population Density	0.4690	0.4690	0.4690	0.5648	0.5507	0.5648
GDP per Capita	0.4822	0.5151	0.4822	0.1610	0.1610	0.1610
Conflict	0.0041***	0.0003***	0.0003***	0.0000***	0.0000***	0.0000***
Corruption	0.0307**	0.0307**	0.0307**	0.0001***	0.0001***	0.0001***
Institutions	0.1823	0.1192	0.1823	0.0068***	0.0068***	0.0068***

Notes: H_0: Panels contain unit roots and H_1: Panels are stationary. P-Values are presented. Reduced time frame is used due to the requirement of a strongly balanced panel and missing values for the variables Institutions, Natural Resource Depletion and Natural Resource Rents. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

Table 16: Results from LLC (2002) Unit Root Test (First Difference Estimations)

	(1)	(2)	(3)	(4)	(5)	(6)
Variable	**AIC**	**BIC**	**HQIC**	**AIC, Trend**	**BIC, Trend**	**HQIC, Trend**
Education Expenditure	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Natural Resource Rents	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Natural Resource Depletion	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Population Density	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
GDP	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Conflict	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Corruption	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***
Institutions	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***	0.0000***

Notes: H_0: Panels contain unit roots and H_1: Panels are stationary. P-Values are presented. Reduced time frame is used due to the requirement of a strongly balanced panel and missing values for the variables Institutions, Natural Resource Depletion and Natural Resource Rents. Columns (4) to (6) include a time trend while columns (1) to (3) were estimated without a time trend. The number of lags was determined by the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC) and the Hannan-Quinn Information Criterion (HQIC). Demeaned data are used. ***, ** and * denote significance at 1%, 5%, and 10% level, respectively.

Table 15: Results from Hausman Test for MG and PMG Estimators

	(1)	(2)	(3)
Explanatory Variable	**χ^2 Test Statistics**	**Prob > χ^2**	**Result**
Natural Resource Rents	2.12	0.9082	Fail to reject H_0
Natural Resource Depletion	2.03	0.9203	Fail to reject H_0

Notes: H_0: Difference is not systematic; H_1: Difference is systematic

Table 17: Results from MG Estimations

	(1)	(2)
Model	**MG**	**MG**
VARIABLES	Education Expenditure	Education Expenditure
Long-Run Coefficients		
Constant	56.70	-22.97
	(83.32)	(17.18)
Natural Resource Rents	0.0785	
	(0.120)	
Natural Resource Dependency		0.125
		(0.173)
Population Density	-4.631	6.512
	(17.40)	(8.168)
GDP per Capita	1.664	0.0716
	(4.483)	(2.980)
Conflict	0.116	0.0499
	(0.374)	(0.263)
Corruption	0.161	0.177
	(0.127)	(0.132)
Institutions	-0.190	-0.335
	(0.461)	(0.618)
Natural Resource Dependency		0.125
		(0.173)
Short Run Coefficients		
Error Correction Term	-0.830***	-0.845***
	(0.230)	(0.256)
ΔNatural Resource Rents	0.0198	
	(0.0551)	
ΔNatural Resource Dependency		0.0347
		(0.0828)
ΔPopulation Density	-2.884	-33.05
	(123.3)	(139.6)
ΔGDP	-1.276	4.810
	(1.111)	(5.234)
ΔConflict	0.300	0.325
	(0.242)	(0.229)
ΔCorruption	-0.0689	-0.102
	(0.0940)	(0.131)
ΔInstitutions	0.441*	0.382
	(0.247)	(0.291)
Observations	149	149

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1