Chapter 4. Will Solar Energy Become a "New Curse", or Bring Development for Africa?

4.1 Solar Energy: Potential to Become a New Curse & Potential to Reduce the Resource Curse Effects

The demand for energy has been constantly growing and, therefore, the search for new energy sources has been extensively focused globally. As mentioned in chapter 3, fossil-fuels still dominates global energy consumption. However, due to a number of factors, such as peak oil and policies for reduction in GHG emissions, the world has begun to look for alternative solutions, as such renewable energy, and the use/development of renewable energy has been growing rapidly. The use of renewable energy is environmental friendly, and the growth of its use is likely inevitable. Despite the difference between fossil-fuels, or other natural resources, and renewable energy, one definite fact still remains; renewable energy is energy.

As mentioned before, the aim of this thesis is to analyze whether renewable energy has the potential to become a new curse in Africa. However, it is not an easy task to see whether renewable energy will become a new resource curse as most of renewable energy sources are still at their beginning stage and, therefore, there is limited data and literature which can be used to project its future. Moreover, identifying a renewable energy curse by generalizing all renewable energy sources as one subject is unlikely to provide an accurate result as they have different characters and capacity. In other words, in order to achieve the main target of the thesis, it is necessary to narrow down the subject, selecting a specific renewable energy source. Therefore, solar energy is selected because, as discussed in chapter 3, it is the renewable energy which has been receiving significant focus, especially, in Europe and the MENA region.

As mentioned earlier, solar energy has been perceived as one of energy sources which will contribute in meeting the future energy demand for Europe and MENA. In the case of North Africa, it has been receiving focus due to the possession of the Sahara desert, and there are already few solar power stations erected or underway. In other words, the exploration and exploitation of solar energy has been ongoing in the North African region. This is, to a certain degree, similar to the exploration and exploitation of oil in Africa in order to meet the world energy demand. Of course, one can not simply argue that the exploration/exploitation of oil in Africa to help satisfying the world's energy demand has been the main factor that brought the oil curse in the oil-producing African countries. However, the combination of the discovery of oil in the continent and demand, whether directly or indirectly, led them to a heavy reliance on oil exports, and the oil curse occurred in many of these

countries. In other words, one should pay great attention to the current solar energy development in the North African region, and the possibility of solar energy becoming a new curse. Fortunately, although not yet proven, one may foresee certain possibilities in reducing the current resource curse effects due to the nature of solar energy. For example, the most obvious difference between oil and solar energy is that one is a non-renewable energy, and the other is a renewable energy. Despite the fact that the difference is rather obvious, one should not overlook this point as it may be a great factor that helps prevent some of the current resource curse effects. Furthermore, if the DESERTEC's long-term aim, meeting around 15 percent of Europe's electricity demand via renewable energy from MENA, is to be combined with the nature of solar energy, the possibility in preventing the current resource curse effects in the field of solar energy could increase even more. Accordingly, this chapter will illustrate the possible impact of the DESERTEC's long-term aim on the current resource curse effects in combination with the nature of solar energy.

Conflict

As mentioned earlier, many resource-rich countries in Africa, especially oil-producing countries, suffer from conflicts/violence. If a country is to become a solar energy electricity exporter -under the circumstance that the nature of solar energy is the same as oil- conflict/violence may also occur. Fortunately, however, the nature of solar energy is different from oil and other natural resource and has the potential to reduce certain amounts of conflict/violence. The major difference between oil and solar energy which has the potential to reduce conflict/violence is that oil can be stored for long periods of time whereas solar energy can not. This simple difference can, for instance, help facilitate to a certain degree-the reduction of conflict/violence in Nigeria especially regarding oil bunkering. As mentioned earlier in chapter 2, oil bunkering harms Nigeria's oil production as oil bunkerers steal around 10 percent of nation's daily oil production. More importantly, this fuels conflict/violence between armed groups which is motivated by the struggles to control territory and oil bunkering routes. If Nigeria were to become a solar electricity exporter, however, the chance of conflict/violence occurring may decline. Oil can be bunkered due to its liquid form and the fact that it can be stored for a long time. In the case of electricity, on the other hand, the amount of time that it can be stored is extremely short. Also, electricity can not be tapped and stored in a drum. Furthermore, it is unlikely that the bunkerers will develop high level technology to steal electricity. Therefore, in the case of solar energy, bunkering is less likely to occur.

In chapter 2, four types of conflict/violence mechanisms are illustrated, and oil bunkering in Nigeria is in the category of looting mechanism. Due to the nature of solar electricity, however, it appears that solar energy may have less chance in providing such conflict/violence, under the looting

mechanism, as the bunkerers have much less chance to profit, or even to extract, from selling electricity. Therefore, if Nigeria were to become a solar electricity exporter, the decline in conflict/violence between rebels could be expected.

Dutch Disease

Dutch disease is probably one of the most famous resource curse effects. Many resource curse effects often occur in economies that heavily rely on their point source and its revenue. However, if the combination of the nature of solar energy and the DESERTEC's long-term aim come in to reality, the chances that solar energy exporters are likely to suffer from the Dutch disease can be reduced as they are less likely to be as heavily dependent on electricity exports compared to other point source exports. DESERTEC Foundation's main focus is not to make the MENA countries as big electricity exporters but enable them to satisfy their own energy demand with their renewable energy. Also, although still unsure, their long-term aim, meeting 15 percent of Europe's energy demand by importing electricity via solar and other renewable energy from the MENA region, suggests that the share of the electricity export may not be as high as the export dependency created by the oil export. In this scenario, the combination of the successful establishment of solar energy with the DESERTEC Concept and much lower electricity export revenue compared to other point source may play a role in reducing the chances of suffering from the Dutch disease.

As explained in chapter 2, there are two types of Dutch disease, de-industrialization; direct de-industrialization, also called factor movement effect, and indirect de-industrialization, also called spending effect. If the given scenario is to occur, it will be especially effective in preventing the spending effect. More specifically, if electricity exports from the MENA or North African countries do not provide them with such enormous revenue, such as from oil, it is less likely that there would be huge additional spending caused by the revenues from electricity exports, or appreciation of the real exchange rate. Furthermore, under the given scenario, there is, compared to other point sources, less chance that the electricity-exporting countries will suffer from 'solar energy boom' because most of the solar electricity would be used to satisfy the MENA region's electricity demand rather than for export. In this case, unlike what Krugman (1987) argues in the case of the natural resources, one may have less chance in witnessing the worsening competitiveness of the manufacturing sector, diminishing of the learning-by-doing benefits, and decline in market share and relative wages.

Volatility

The nature of solar electricity may prevent the extreme volatility that often occurs with point sources such as oil. There are few reasons why oil suffers from volatility. Oil needs to be scouted with

difficult procedures and even more difficult forms of extraction have to be researched and applied. Also, only relatively few countries in the world have large oil fields. These factors have contributed to the establishment of such institutes as the OPEC, which continue to have considerable influence on the price of oil through their member nation quota system.

Unlike oil however, due to the nature of solar electricity there may be less chance that it will suffer from extreme volatility. This is due to the fact that solar irradiation with the intensity like that found in the MENA countries is also available in a large number of other countries. Also, as mentioned before, electricity can not be stored like oil. In other words, a cartel of solar electricity suppliers is hardly possible. For the North African countries, solar irradiation is easily detected. Especially in the desert, there is very little variation of the solar radiation throughout the year. This is what makes deserts the ideal place for solar energy. Combined with the CSP plants which can deliver electricity from solar power on demand and even 24/7, the electricity output from solar energy would be stable. Therefore, the volatility is expected to be low which makes North Africa an attractive region for implementing solar energy.

Here, it must be noted that the potential improvements above concerns volatility only on the supply side. As will be mentioned in section 7.2.1, due to the population growth and economic growth, the demand for energy will continue to increase. In other words, it is uncertain exactly how the volatility on demand side will look like in the future. Therefore, it is still uncertain whether the volatility matter will be solved because one does not know the size of the solar power capacity from North Africa in the future. Nevertheless, as can be seen above, it is still likely that solar energy will have less volatility issue with supply side due to its nature and CSP technology in North Africa.

Debt

Resource-rich countries tend to build up debt even when they receive vast amounts of resource revenues since governments expect more income in the future. This situation occurs when there is an increase in the real-exchange rate which often makes interest payment on the debt cheaper. However, if the prices of natural resources, especially oil, and the real exchange rate fall, governments have less money and more expensive debt to repay. In other words, debts issue occurs due to the combination of resource curse effects such as Dutch disease, volatility and heavy dependence. In the case of solar energy, as mentioned earlier, there would be less chance for mentioned resource curse effects to occur due to the nature of solar energy and the DESERTEC Concept. Therefore, there might be less chance for the electricity exporters to suffer from debt, or debt overhang problems.

As can be seen above, one may project that North Africa may suffer less from a solar energy curse due to the nature of solar energy and the DESERTEC Concept and its long-term aim. However, this prediction is rather inaccurate as it relies on an uncertain assumption that the DESERTEC Concept will materialize. Furthermore, the projections presented above still do not show the best way to find out if solar energy will become a curse. Therefore, one needs to concentrate on finding a concrete way to predict whether solar energy will become a new curse.

Unlike the existing resource curse theories, the renewable energy curse idea is quite new. There is lack of literature or other types of data regarding the possible renewable energy curse in comparison to the current resource curse. Also, at the 2nd and 3rd DII Desert Energy Conferences, where many solar energy experts attended, the term resource curse was not familiar to many of them. Of course, the focus of these conferences was not on the resource curse.

Fortunately, however, in recent years, it has been possible to find a number of publications, whether directly or indirectly, regarding renewable energy curse. For example, Gennaioli & Tavoni (2011) argue that there is 'curse', the diffusion of corruption practices, in the case of wind energy sector in Italy. They find higher criminal association activity level in high-wind provinces and especially after the introduction of a more favorable public policy regime, and argue that the expansion of the wind energy sector has been driven by the level of the wind and the quality of political institutions, through their effect on criminal association (Gennaioli & Tavoni 2011, p. 1).

There is also some literature regarding solar energy. For instance, the article by Massetti & Ricci (2011), although it is not directly related to the idea of the resource curse, focuses on solar energy in the MENA countries. Massetti & Ricci (2011, p.39) argue that the MENA countries may form a cartel to sell electricity to Europe at a price higher than the marginal cost.[9] This article shows that there is a possible curse symptom that the MENA countries may suffer from as there is a possibility that they can rely heavily on exporting electricity in the future.

Furthermore, via an email interview, Paul van Son, the CEO of DII, agrees that there are, similar to any energy asset, risks related to renewable energy such as various investment risks, operational risks of the installation, security risks, integrity and compliance risks, financial risks, such as off-take volume/prices, grid failure risk, and credit risk of off-takers, social acceptance risks and political risk. In the case of solar installations one faces of course volatility of sunshine and in the case of wind, volatility in wind. Also, he considers compliance issues such as manipulation, corruption and criminality as major threat against sustainable development and suggests that, along with the

[9] This is different from the DESERTEC's point of view. However, at the 2nd DII DESERTEC ENERGY CONFERENCE CAIRO 2011, ironically, the best European thesis award was given to Lilliestam & Ellenbeck (2011) whose topic was whether the DESERTEC would make Europe vulnerable to the "energy weapon", and they found that it is, though not by high chance, possible.

development of renewable energy, these subjects must be addressed and all measures must be taken to eliminate such effects. By analyzing the existing literature and the aforementioned interview it can be argued that the risks related with renewable energy may not be fundamentally different from risks related with fossil-fuels, although the latter is also exposed to fuel price risks and emission issues. Therefore, according to Van Son, the risk/return patterns may, thus, strongly determine the renewable energy in the future.

Although there is a body of literature regarding the renewable energy curse, in order to achieve the main goal of this thesis, one still faces a greater task ahead: *How does one find out whether solar energy will turn into a new curse?* Anyone can make assumptions, whether the solar energy in North Africa may turn into a new curse or not by comparing the nature of oil and solar energy or applying the current resource curse effects presented in chapter 2 on solar energy as presented above. However, as mentioned earlier, this method is unlikely to bring an accurate projection.

Unlike the resource curse, the solar energy curse in North Africa is a young topic, and there is limited literature and data available. How then would it be possible to achieve the main target of this thesis when its subject matter is still in its infancy and there are limited resources available? Obviously, although helpful, the literature relating to renewable energy curse and interview with Paul van Son is not sufficient enough to grasp the entire picture of the path that one needs to take to find how to project whether solar energy in North Africa will turn into a new curse.

So far, the question has moved from "would solar energy turn into a new curse?" to "how does one find out whether solar energy will turn into a new curse?". The latter question should be properly dealt in order to achieve the goal of this thesis. However, it has been difficult to come up with a concrete plan. It means that there should be another step to take in order to answer the "how" question and, eventually, the main question. This 'other step' is to answer the question "what will be the *cause* of a solar energy curse?" In any kind of questions, directly or indirectly, when the cause is found, it is one step closer to finding the answer. However, yet again, it is problematic to find the cause of the possible solar energy curse in North Africa as it has not been fully established in the region yet, therefore, one can not argue against/for the existence of a solar energy curse. This situation leaves only one path which is to go back to the backbone of this thesis: the resource curse. More specifically, as solar energy is, although renewable, a type of resource, one needs to build up the plan with the basis of the resource curse.

As mentioned before, the term resource curse has been studied for decades. There are numerous works and different perspectives on the resource curse. Also, during that time there have been various causes and solutions found regarding the resource curse. In chapter 2, for instance, the concept of the resource curse, resource curse effects and cases studies are illustrated. However, it is

hard to find the elements or factors that lead to the resource curse by just looking at the concept of the resource curse and its effects. Of course, by looking at the case study in Nigeria, for example, it was possible to see that the resource curse exists in resource-abundant countries. However, the experiences of Botswana and Norway show that not all resource-abundant countries suffer from the resource curse. Therefore, although the resource curse does exist in many resource-abundant countries, it is proven that the abundance of resource and heavy dependence on resources can not be considered as the main reason for the existence of the resource curse. In other words, abundance of solar irradiation will not be considered as the main factor that would create a solar energy curse in North Africa. Then what is the factor that makes the resource-abundant countries to suffer from the resource curse? And what is/are the main difference between countries which suffer from the resource curse and countries which avoided/escaped from the resource curse? These questions seem rather simple, but they are very essential questions that one should focus on as it begs the question as to what elements and factors put countries into the resource curse or not, furthermore, in other words, ask what causes the resource curse. If these questions are dealt properly, it would be possible to find the main factor(s) that 'determines' whether a country is under the danger of being resource cursed or not. In other words, the boundary-line(s) can be obtained. When the boundary-line(s) is obtained, one can find which countries are in the resource curse and, furthermore, may be used to project which countries have the potential to suffer from a solar energy curse. Therefore, the next section will search for the most convincing and concrete boundary-line(s) for filtering which countries are suffering from the resource curse, and also which countries have the potential to suffer from a solar energy curse.

4.2 Search for the Boundary-line(s) via Literature

Although this thesis is focusing on the resource curse and the possible solar energy curse, it must be noted that the abundance of natural resource and dependence on natural resource have not always been perceived as the negative factors or as the curse. Until the end of the 1980s, many economic theories took a similar path which considered the abundance of resources, or dependence on natural resources such as oil and natural gas, as an advantage in achieving economic growth and development.

For instance, Ginsburg (1957, p.211), a geographer, argues that having a sizable and diversified natural resource endowment is an advantage to any country embarking upon a period of rapid economic growth. Similarly, Walter Rostow, a development theorist, argues that natural resource abundance can help developing countries to move forward from underdevelopment to industrial

take-off as the United States and Britain have experienced (Rosser 2006, p.5). Similar views continued to occur until the late 1980s. For example, Bela Balassa, a neoliberal economist, argues that the abundance of natural resources is able to facilitate a nation's industrial development as it can provide domestic markets and investible funds (Rosser 2006, p.5). However, since the late 1980s, the view towards the abundance of natural resources and dependence on natural resources have started to be perceived differently as it has often been observed that many resource-rich countries have not achieved expected sustainable growth and development and, as mentioned in chapter 2, are often outperformed by resource-poor countries. Rather than being considered as a blessing, resource abundance had begun to be viewed as a factor that causes countries to experience negative economic, political and social outcomes which include decline in economic performance, low level of democracy, and civil war (Rosser, 2006, p. 7). This phenomenon of natural resources and negative economic development, as mentioned in chapter 2, was coined the resource curse by Auty (1993), Sachs & Warner (1995), and later by other scholars. Sachs & Warner (1995) examined the experiences of natural resource economies during the period of 1970-1989, and discovered that the natural resource abundance had been negatively correlated with economic growth.

Although it was Auty (1993) that is known to have created the term resource curse, it was the work of Sachs & Warner (1995) that inspired many economists and scholars to consider the cause of the resource curse (Brunnschweiler & Bulte, 2008, p.248). Of course, there have been different explanations for the resource curse. The main, or most popular, explanations for the resource curse are based on Dutch disease, rent-seeking and, more recently, institutional quality. The following section will examine the other main explanations for the resource curse from literature in order to test whether they can be the boundary-line(s) for identifying the resource curse and a solar energy curse.

4.2.1 Dutch Disease

Dutch disease is one of the more famous explanations for the resource curse. Since the early 1980s, several publications supporting the idea of the Dutch disease have been written by scholars and commentators such as Bruno & Sachs (1982), Corden & Neary (1982) and Matsuyama (1992).

Matsuyama's (1992) model, for example, includes an agriculture sector and a manufacturing sector. He argues that any forces that push the economy away from manufacturing and towards agriculture can lower the growth rate by reducing the learning-induced growth of manufacturing. Also, he shows that in a land-intensive economy, trade liberalization can slow economic growth by inducing the economy to pull resources away from manufacturing and towards agriculture. In his

model, the adverse effects of agricultural production occurs when the factors of production, that would otherwise be directed towards manufacturing, are diverted towards the agricultural sector (Sachs & Warner 1997, pp.5-6). It is, however, important to note that such a theory may be useful when it comes to studying labour intensive production of natural resources, such as in agriculture, but it is not so relevant for a natural resource sector which uses very little labour such as oil, and therefore does not directly draw employment from manufacturing.

Perhaps, it is Sachs & Warner (1995, 1997) whose work is more closely linked to the Dutch disease and the resource curse. Their Dutch disease model is similar to the de-industrialization model which is presented in chapter 2. In their model, there are also three sectors which are tradeable natural resource sector a tradeable (non-resource) manufacturing sector, and a non-traded sector. Capital and labour are only used in the manufacturing sector and non-trade sectors. They argue that there is higher demand for non-tradeable goods when the natural resource endowment is greater. When natural resources are abundant, capital and labour which are supposed to be employed in manufacturing sector will often shift into the non-trade goods sector. Consequently, when there is a resource boom, the manufacturing sector is likely to shrink and the non-traded goods sector is to be expanded. The shrinking in manufacturing sector is dubbed the “disease” in their work (Sachs & Warner 1997, p.6)

In Sachs & Warner’s (1995,1997) work, they measure the impact of mineral and other resource exports on GDP growth, 97 countries over a 19 year period, by using regression analysis. They find that economies with a high ratio of natural resource exports to GDP in 1971 grew slowly between 1971 and 1989. Based on their research, they argue that, when compared to resource-poor economies, resource-rich economies tend to have larger service sectors and smaller manufacturing sector. Also, they show that resource-rich economies tend to have slower growth in exports of manufactures than resource-poor economies. Furthermore, they argue that the correlation remains even after they controlled for growth-related variables such as trade policy, bureaucratic efficiency, initial per capita income, region, and terms of trade volatility.

It must be mentioned that, though the Dutch disease theory appears as a promising explanation for the poor economic development of resource exporters in the early 1980s, there are a number of studies which argue against it, or are less convinced by, the Dutch disease theory. Ross (1999, p.305) argues that the Dutch disease model does not fit many developing economies. This is due to the fact that the Dutch disease model assumes that an economy’s capital and labour supplies are fixed and is fully employed before a boom occurs. It might be the case that a booming sector draws capital and labour away from agriculture and manufacturing under the mentioned circumstances. However, according to Ross (1999, p.306), this is often not true as many developing countries have labour

surpluses, and their resource booms draw in foreign capital and labour, offsetting any scarcities. There are other scholars who argue against the Dutch disease theory such as Sala-i-Martin & Subramanian (2004). They present the experience of Nigeria and argue that it is rather the corruption and waste from oil that has been responsible for its poor long-run economic performance than the Dutch disease and, furthermore, argue that the assumption of superior learning effects in manufacturing are unproven (Sala-i-Martin & Subramanian 2004, p.3 , 5). Also, Kostad and Wiig (2009, p.5318) argue that the Dutch disease does not fully explain the negative growth effect of resources once other mechanisms are controlled for. These argument will be tested in Chapter 7 where the resource curse is measured based on Sachs & Warner's (1995, 1997) studies.

4.2.2 Centralized (Patronage Politics) & Decentralized (Rent-Seeking) Political Models

As regards to the negative effects of resources on growth, there are two popular political economy models regarding the resource curse which are known as the Centralized Political model and the Decentralized Political models.

The centralized political model is often referred to as Patronage politics[10]. This model accentuates the decision making of the politicians in controlling/governing resource-abundant countries. It is argued that an increase of natural resource rents can increase the value of staying in power as it would mean control over greater rent and, consequently, increases the chances for other to challenge the government for power (Kolstad & Wiig, 2009, p. 5318).

When the value of staying in power increases, those with the power can spend more resources in order to secure their position in government; increasing their chances of being re-elected. This can be done in various ways. For example, Isham et al. (2005, p.147) argue that politicians can buy off critics, provide the population with benefits, infrastructure projects, patronage, or outright graft. Similarly, Kolstad & Wiig (2009, p. 5318) further argue that it can be done through patronage, political supporters to supporters to get government jobs, or investing public funds in politically important but economically unproductive projects which are often referred to as 'white elephants projects'. When there is a chance for others to challenge the government for power, as Kolstad & Wiig (2009, p. 5318) argue, it can further lead governments to spend resources unproductively such as repression or bribing/buying off potential opponents. Accordingly, it can be argued that the bias allocation of labour and investment can potentially damage economic growth.

The decentralized political model emphasizes the decisions/actions of individuals outside the

[10] According to Weingrod (1968, p.379), "patronage refers to the way in which party politicians distribute public jobs or special favours in exchange for electoral support.".

power elite. This model is often referred to as the rent-seeking model, where individuals choose between using their effort on rent extracting activities, or on productive activities. Though increases in resource rents leads to increase of income, this model sees that there can be a displacement effect in productive sectors as more entrepreneurs may choose to become rent-seekers (Kolstad & Wiig, 2009, 5319-5320). More details on the decentralized political model can be found in the following section, Institutional Quality, which accentuates the importance of the institutional quality base on the rent-seeking behavior.

4.2.3 Institutional Quality

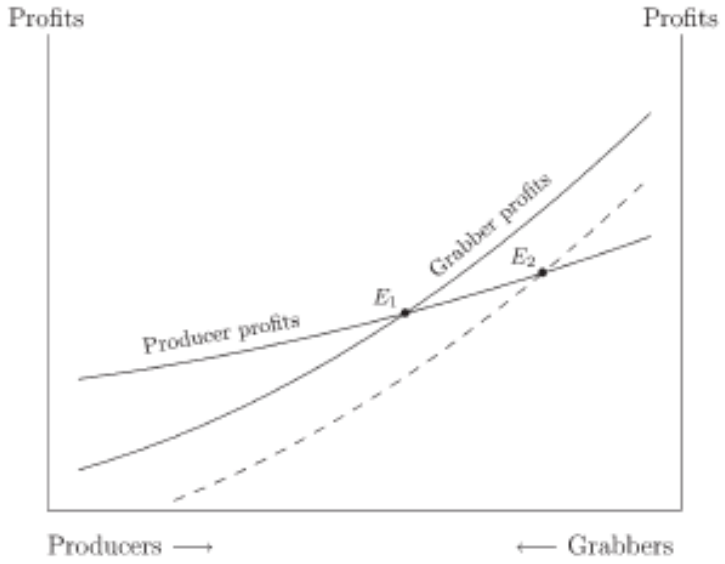
Sachs & Warner (1995) do not believe that institutional quality plays an important role in explaining the resource curse. However, this argument has been challenged by many scholars such as Robinson et al. (2006), Kolstad & Wiig (2009), and Mehlum et al. (2006a,b).

Robinson et al. (2006, p. 5317) argue that countries with institutions which promote accountability and state competence will likely benefit from resource booms because these institutions can help prevent rent-seeking or patronage behavior that may occur as a result of a resource boom. If countries do not have such institutions, they are likely to suffer from a resource curse. Similarly, Kolstad & Wiig (2009, p.5324), though they find resource rents as the main source of the resource curse, argue that resource rents induce dysfunctional and costly behavior in terms of patronage and rent-seeking when countries have weak institutions of democratic accountability and rule of law.

Mehlum et al. (2006a,b) present a more specific study on the relationship/correlation between the resource curse and the institutional quality. They reject the idea that the resource abundance is the cause of the resource curse as there are countries that still achieved growth despite the abundance of resources.

More specifically, they make a distinction between producer-friendly institutions, where rent-seeking and production are complementary activities, and grabber-friendly institutions, where rent-seeking and production are competing activities. According to Mehlum et al. (2006a, p.1121), rich resources attract entrepreneurs into production, implying higher growth with the producer-friendly institutions, whereas the entrepreneurs are diverted away from production and go into unproductive rent activities with grabber-friendly institutions.

Figure 6: The Allocation of Entrepreneurs

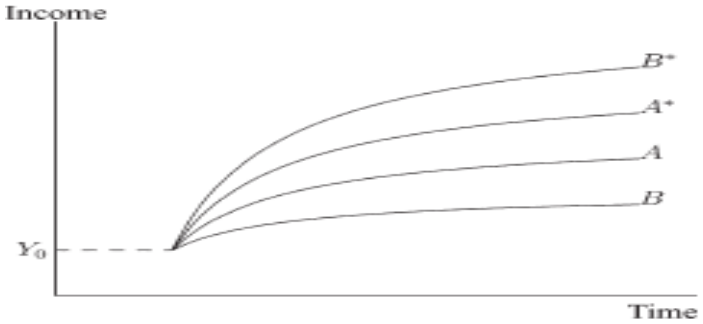


Source: Mehlum et al. (2006a, 1123)

Figure 6 helps in explaining Mehlum et al.'s (2006a) idea of the producer-friendly institution and grabber-friendly institutions. The Horizontal axis represents the total number of entrepreneurs. The number of entrepreneurs that enter into production is measured from left to right, and the number of entrepreneurs that enter in to grabbing is measured from right to left. The equilibrium E1 represents the situation where there is individual entrepreneur has no incentives to move from grabbing to production, and vice versa.

As can be seen from figure 6, the profit curve for producers increases when the number of producers increases. One the other hand, the profit curve for grabbers decreases when there is an increase in the number of grabbers, and decrease in the number of producers. This is because when there are more grabbers, there would be fewer producers to extort and, consequently, grabbers have to compete relative to targets. When there are less grabbers, they do not have to compete as much because there are more targets to extort, thus, more profit for the remaining grabbers. The dashed line in figure 6 represents a move towards the producer-friendly institutions. In the new equilibrium E2, there are more producers and less grabbers. One can see that the production in grabbing has also increased. The reason for this is that the good institutions induce entrepreneurs to shift from grabbing to production. According to Mehlum et al. (2006a, p.1123), it leads to the increase in production and income in society and the profit to be higher for both producers and the remaining grabbers.

Figure 7: Growth Paths of Four Hypothetical Countries



Source: Mehlum et al. (2006a, p. 1126)

Mehlum et al. (2006a) accentuate the importance of the institutional quality by comparing four hypothetical countries (resource poor with grabber-friendly institution (A), resource poor with producer-friendly institution (A*), resource-abundant with grabber-friendly institution (B), and resource-abundant with producer-friendly institution (B*)) which are presented in figure 7. As expected, economies with producer-friendly institutions outperformed economies with grabber-friendly institutions. However, what one should also focus on is the comparison between economies with grabber-friendly institutions where the resource poor economies outperform the resource-abundant economies. Mehlum et al. (2006a, p.1126) argue that economies with bad institutions with more resources are considered to be suffering from the resource curse, more natural resources push income down. Thus, when assuming that they start out at the same income level, resource-poor economy with grabber-friendly institutions outperforms resource-rich economy with grabber-friendly institutions.

Mehlum et al. (2006a, b) contradict to the arguments that resource abundance is the cause of the resource curse, but rather, it could be a blessing to an economy if it has a producer-friendly institution. Thus, the institutional quality is the key that can bring economies in/out of the resource curse.

4.2.4 Saving of Resource Income

Despite being a resource cursed country or not, resource-abundant countries have the resource income which they spend. It means that there must be a difference in the way the resource-abundant countries spend and save their resource revenue which may contribute in making them resource cursed or not. In other words, spending behavior may play an important role, or can act as the boundary-line, in finding whether an economy is affected by the resource curse or not. According to Torvik (2009, p.245), however, the comparison of the saving behavior between the 'resource-

abundant winner economy' and the 'resource-abundant loser economy' is problematic as the income from non-renewable resource in the national account is misleadingly classified as income. For instance, based on Torvik's (2009, pp.245-246) explanation, if an economy has US$1000 worth of oil and they export all that oil and receive US$1000, this would mean that the economy exchanges the US$1000 worth of oil with US$1000 in cash, thus the US$1000 the economy received from the oil export must be considered as zero profit. When put differently, if a county exports its oil and puts the proceeds in the financial market, the country's natural capital is reduced while it increases the financial capital. Thus, there is no change in wealth of the country. Furthermore, if this economy consumes all the proceeds from the oil export, this can not be considered as saving but rather its saving rate should be perceived as negative. This is where the problem occurs, because the savings rate in the national accounts would be calculated as zero. In other words, the fundamental problem with sales of non-renewable resource such as oil in national account is that it is considered as income which actually overestimates the true saving rate (Torvik, 2009, p. 246). Torvik (2009), therefore, argues that if one is to study the saving rates and its behaviour, it is necessary to see the savings rates that take changes in countries' resource wealth into account. Torvik (2009) selects the traditional savings rates from national accounts as a starting point, and then subtracts net extraction of resources, such as oil, gas, mineral, and timber. Torvik (2009, p. 246) terms these saving rates as 'resource-adjusted savings rates'. In his finding, one can see that the countries which are considered to have avoided/escaped the resource curse tend to have higher resource-adjusted savings rates than the resource cursed countries.

In the case of solar energy, one may not even have to take Torvik's (2009) resource-adjusted savings rates to see the difference of the saving/spending behavior between the resource cursed countries and resource curse avoided/escaped countries. For instance, as solar energy is a renewable energy, if a country exports electricity via solar energy and puts the proceeds in the financial market, there would be an increase in the financial capital while the country's natural capital does not decline. This would mean that if an economy is to consume all the proceeds from electricity export, this can be still considered as saving because the exports of electricity will be still possible due to its solar energy's nature; renewable. Unfortunately, the establishment of solar energy in North Africa is still a long way off, thus, one can not use this saving rate as the boundary-line. Also, though Torvik 's(2009) 'resource-adjusted saving rates' may appear a convincing tool to see the difference between the resource cursed countries and resource curse avoided/escaped countries, but it does not prove that overspending of resource income leads to bad economic development, or vise-versa. Therefore, the spending behavior/saving rate may not be suitable to be the boundary-line that decides whether a country is affected by the resource curse or not.

4.3 The Need of Simplicity in Searching for the Boundary-line(s)

There are various resource curse effects, and what are claimed to be the causes of the resource curse as seen in section 4.2. Therefore, it can be argued that it is not an easy task to select the 'perfect boundary-line' as the resource curse is a broad subject which can be viewed from various angles. In other words, one may arrive at different outcomes as regards to the decision as to which countries are suffering from the resource curse, as this may be heavily dependent on the selected cause, or boundary-line. Also, the fact that the purpose of this thesis is to analyze whether solar energy has the potential to become a new curse makes it harder to find the boundary-line(s). Perhaps, the question is not to find the 'perfect boundary-line', but it is to find the 'most suitable boundary-line'. Nevertheless, this task remains difficult. The chosen boundary-line(s) should be the backbone of both the resource curse and the solar energy curse. In other words, one should specify what kind of elements that the boundary-line should require in order to obtain the most suitable boundary-line. The requirements that the boundary-line should contain are illustrated below.

First, the most obvious necessity is that, the boundary-line should be applicable for both the resource cursed countries and the resource curse avoided/escaped countries. It means the boundary-line should be a factor that both the resource cursed countries and the resource curse avoided/escaped possess, and it also should be the factor that can 'determine' whether a country is/will be in the resource curse or not.

Second, the boundary-line should be applicable for both the resource curse and the solar energy curse. As mentioned earlier, the purpose of this thesis is to project whether solar energy will become a curse or not. If the boundary-line is only applicable for the resource curse, it will not be possible to tackle the purpose of this thesis.

Third, the chosen boundary-line should have influence on, whether directly or indirectly, all the resource curse effects. Of course, the resource curse may not be caused by just one factor. However, finding the most influential factor which is related to the resource curse effects, and what are considered as the causes of the resource curse, may be the best boundary-line as the difference of this factor can influence on many resource curse effects.

These necessities, or requirements, will act as the three filters to select the most suitable boundary-line. Figure 8 presents the resource curse effects and causes of the resource curse mentioned throughout this thesis which will go through the three filters mentioned above.

Figure 8: The Resource Curse Effects and Causes

The first filter requires that the boundary-line should be applicable for both the resource cursed countries and resource curse avoided/escaped countries. Therefore, after the first filter, one will have government/governance, institutions, resource rent, saving/spending behavior, taxation, and volatility remained. Some of the eliminated ones are rather the resource curse effects, such as the Dutch disease, and others can be considered as parts of the chosen candidates. For example, the centralized political model and decentralized political model can go under the government/governance and institutions. Of course, some of the chosen candidates are also parts of the resource curse effects. The reason why they are chosen is that, as the purpose of the first filter, they are elements that, whether resource cursed or not and whether resource-abundant or not, they are the elements that all countries have in general.

When one applies the second filer to the remained candidates, the outcome may vary. As mentioned earlier, the boundary-line should be applicable for both the resource curse and the solar energy curse, and the remained candidates may appear as they are all applicable. What are definitely applicable are government/governance, institutions and resource rent. The saving/spending behavior should be eliminated as explained earlier in section 4.2.4. When it comes to the volatility, it is true that it will also occur for solar energy. However, as mentioned in section 4.1, solar energy is a renewable energy which means that its volatility is expected to be much lower than other resources such as oil. Therefore, volatility will be eliminated. In the case of taxation, when perceived as the resource curse effect, one can not be sure whether it will become a problem for the solar energy as it is uncertain whether solar energy will provide enough revenues for the government not to rely on taxes from their citizens. It is true that taxation is connected to accountability, however, taxation

itself is not an element that can cause the resource curse as it becomes a problem due to other factors such as resource rents and government/governance. Therefore, taxation is eliminated.

The remaining candidates are government/governance, institutions, and resource rents. If these candidates have direct/indirect influences on all the resource curse effects, satisfying the third requirement, they can be considered as the boundary-line(s). Here, it must be mentioned that the term governance and institutions are often used interchangeably. According to Stevens & Dietsche (2008, p.59), for example, when measuring institutional quality, governance indicators are often used as proxies. Therefore, throughout this thesis, governance and institutions will be viewed as one factor. Thus, this candidate will be referred to as 'institutional quality'.

In the case of the resource rents, whether in the current resource curse or in the solar energy curse, it has to be qualified as being the boundary-line as the resource curse itself would not have become an issue if there has been no rents from resources. However, it is questionable whether resource rents alone can create all the resource curse effects as it is also highly dependent on how the resource rent is being utilized. This is where the institutions, or institutional quality, come in. Institutional quality is probably even more of a suitable boundary-line as institutions exists in every country whether resource cursed or not, or even resource-rich or not. In other words, all the resource curse effects are connected to the resource rent and institutions. Therefore, resource rent and institutional quality will be chosen as the final candidates which will be used as the boundary-lines to find the resource curse.