Chapter 6. Measuring the Resource curse and a Solar Energy Curse via the Institutional Quality Comparison Method

In chapter 5, two methods, the GDP growth comparison and the institutional comparison, are tested in order to see whether they are suitable to be the boundary-lines to identify the resource curse. Unfortunately, the GDP growth comparison method was found to be problematic in identifying the resource curse. As mentioned in section 4.3, resource rents should be considered as one of the boundary-lines to identify the resource curse. Perhaps, the problem with the GDP growth comparison method is that it does not directly deal with the actual resource rents. This issue will be dealt later in Chapter 7. On the other hand, the institutional quality comparison method, especially after adding the 'development status filter', appears to function sufficiently in measuring the resource curse. Therefore, this chapter will first use the institutional quality comparison method to identify the resource curse in the five North African countries, and their potentials to suffer from a solar energy curse.

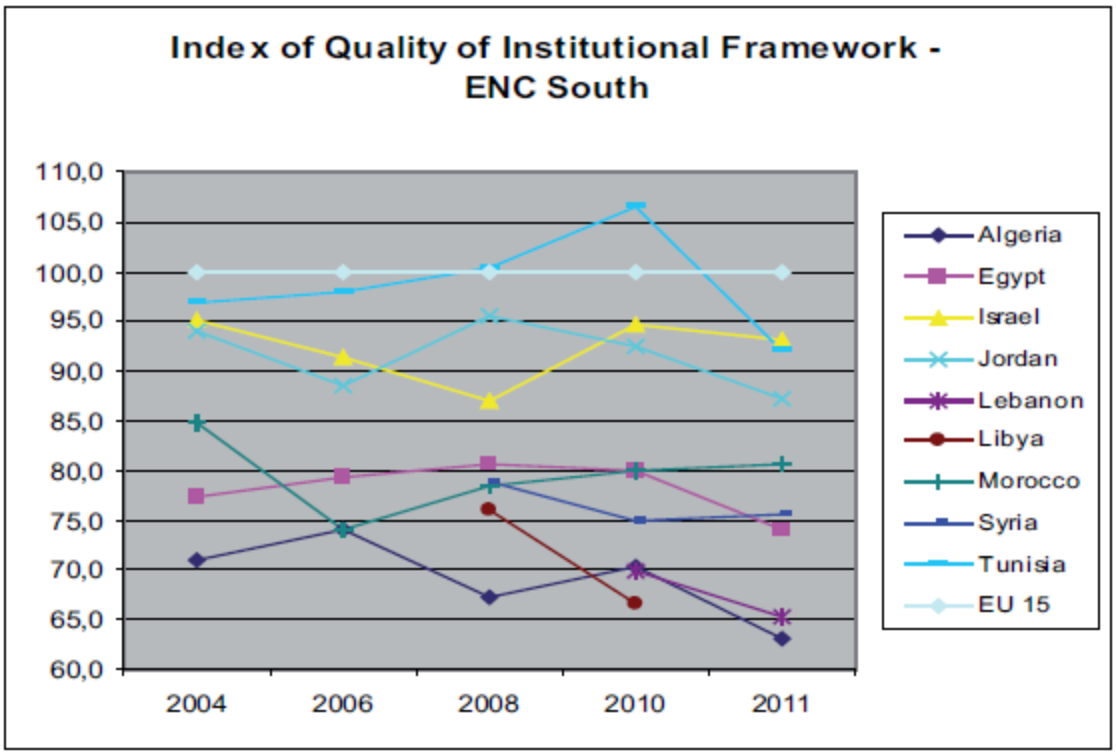
Before proceeding the comparison, one should be aware of the recent events in the region and its possible impact on the institutional quality of the five North African countries.

The Northern African region and other Arab Worlds have been going through a significant revolutionary wave, or reform, in recent years which is called the Arab Spring. The Arab Spring began in Tunisia, December 18, 2010, which eventually led to the ousting of President Zine El Abidine Ben Ali in January, 2011. Among the other North African countries, the rulers of Egypt (Hosni Mubarak) and Libya (Colonel Muammar Gaddafi) also have been forced from power. Furthermore, major protests have broken out in Algeria and Morocco. Consequently, the period 2010-2011 is perceived as a crucial turning point for the five North African countries and many other MENA countries. Accordingly, it can be argued that the recent events in these countries have impacted greatly on their institutional qualities. Hlepas (2013) presents the index of institutional quality and its changes in the recent years in the five North African countries, Israel, Jordan, Lebanon, Syria, and EU 15[51], this can be seen in figure 9.[52] As can be seen from figure 9, the institutional quality of the five North African countries, except for Morocco, have fallen since 2010. Hlepas (2013, p.12) suggests that this is probably because of their involvement in the Arab Spring.

[51] Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom.

[52] It must be mentioned Hlepas's (2013) institutional quality index is based on the concept that the Index of national institutional quality is dependent on "Government Effectiveness", "Regulatory Quality", "Rule of Law" and "Control of Corruption"(Hlepas 2013, p. 6).

Figure 9: Index of Institutional Quality Changes in Recent Years in the of the Southern European Neighborhood Countries



Source: Hlepas (2013, p.13)

Despite the decline in the institutional quality since 2010 as presented in figure 9, there are studies that project positive outcome, perceiving the Arab Spring as the positive indication, from the Arab Spring. For example, Weill (2012, p. 4) argues that the Arab Spring, or the recent political changes, can contribute to the enhancement of weak institutional quality in the MENA countries. According to Weill (2012, p.4), these changes have been motivated by the willingness to obtain greater transparency and lower corruption. Furthermore, he views Tunisia's recent free elections in October 2011 as the portrait of these positive changes.

It is true that the Arab Spring brought political changes and regime changes in Egypt and Tunisia. However, one should not overlook the current visible consequences of the recent events, such as regime changes, in the five North African countries because it is uncertain what kind of role they will play in the future within this region. Also, according to Dodge (2012, p. 64), it is hard to say that, though there has been regime changes in countries such as Egypt and Tunisia, the ruling elites, state structures, the powerful secret services and crony capitalist that Mubarak, Gaddafi and Ben Ali created have not been completely eradicated. Furthermore, though there is no doubt that the Arab Spring is a historic moment in the politics of the Arab Worlds, Dodge (2012, p. 64) finds that its long-term impact is still to reveal itself and is unpredictable. In other words, changes in the five North

African countries' institutional qualities are also unpredictable.

It is important to be aware of the Arab Spring and its possible impact because it plays, or is to play, a great role in shaping the future institutional quality of the five North African countries. The projection of the institutional quality in the future itself, despite the Arab Spring, is already a difficult task. Here, the ongoing political changes and the Arab Spring in the region add more uncertainty in their future, and it makes it even more difficult to project the institutional quality of the region in the future. Perhaps, institutional quality is a subject that is not possible to be projected especially in countries or regions that are going through significant transformation. In this case, therefore, the best way to 'project' the changes in the institutional quality is to look at the changes in their institutional quality in the past or the most recent institutional quality available. As it will be discussed later, the combination of the poor institutional quality and the enormous rent size is the main driving factor that leads countries into the resource curse. Therefore, if a country's institutional quality is poor and continues to remain poor in the future, this can be the cause of a solar energy curse in North Africa in the future.

6.1 Choosing the "Boundary-Countries" for the Institutional Quality Comparison Method

When using the institutional quality comparison method to identify the resource curse in the five North African countries, one should compare their institutional quality to some other countries' intuitional quality. However, the five North African countries' institutional quality can not be compared to just a number of randomly selected countries as this thesis has a specific purpose which is to identify the resource curse and project a solar energy curse. In other words, their institutional quality must be compared to the institutional quality of the resource cursed countries and resource curse avoided/escaped countries. In this way, it is possible to identify where the five North African countries stand; closer to the resource curse or closer to avoiding/escaping the resource curse. Of course, the current resource curse can be only found in energy exporting countries. However, the North African energy importers will be included in the process in identifying the current resource curse because, as mentioned earlier, their institutional quality can show where they stand from a possible solar energy curse in the future.

The first step in this analysis is to select countries which have been affected by the resource curse and the countries that have avoided/escaped the resource curse. The final chosen countries will be referred to as the 'boundary-countries'. The candidates for the boundary-countries will be selected from various articles and literature regarding the resource curse.

Table 19: Candidates for being the Boundary-Countries for the Resource Cursed and Resource Curse Avoided/Escaped Countries

Resource cursed	Algeria, Angola, Ecuador, Equatorial Guinea, Liberia, Democratic Republic of the Congo, Mexico, Nigeria, Saudi Arabia, Sierra Leone, Sudan, Trinidad & Tobago Venezuela, Zambia,
Escaped/avoided	Australia, Botswana, Brazil, Canada, Chile, Indonesia, Malaysia, The Netherlands, Norway, Oman, Peru, Thailand

Source: Abidin (2001), Alicante & Misol (2009), Humphreys et al (2007), Ilim (2006), Mieksell (1997), Mehlum et al. (2006 a,b), Sarraf & Jiwanji (2001)

Table 19 presents countries from various studies on the resource curse, which are considered to be either affected by the resource curse or have avoided/escaped the resource curse. What one can notice from table 19 is that many candidates from African region are affected by the resource curse including Algeria. It must be mentioned that some countries are considered to be suffering from the resource curse but also considered to have avoided/escaped the resource curse. For example, Peru is considered to be affected by the resource curse by Mikesell (1997), whereas Mehlum et al. (2006b) considers Peru as a country which avoided the resource curse. Different findings from these authors may be due to the different ways in approaching the resource curse and also the different period of time the literature was written. For example, Mikesell's (1997) approach identifies more with the Dutch disease explanation whereas Mehlum et al. (2006a) identifies with the institutional quality explanation regarding the resource curse in Peru.

Many candidates of the boundary-countries regarding the resource curse can be found from several articles and literature, as can be seen from table 19. However, though a number of candidates exist, it is unwise to compare the institutional quality of the five North African countries to all of the candidates found above because the process will be unnecessarily complicated. Accordingly, the result may not be tangible and sufficient. Instead, one should choose the most suitable candidates to be used as the boundary-countries. As can be seen in Chapter 5, when testing the average GDP growth comparison method and the institutional quality comparison method, the application of the development status contributed to the improvement of both methods. Here, the development status can be used to divide the candidates into separate groups. This process may help provide a clearer distinction among the candidates which may be useful in selecting the most suitable boundary-countries.

Table 20: The Division of the Candidates by the Development Status

	Least Developed	Developing	Developed/emerging
Resource cursed	Angola, Equatorial Guinea, Liberia, Sierra Leone, Sudan, Zambia	Algeria, Brazil, Ecuador, Mexico, Nigeria, Venezuela,	Saudi Arabia, Trinidad and Tobago
Escaped/avoided		Botswana, Chile, Indonesia, Malaysia, Peru, Thailand	Australia, The Netherlands, Norway, Oman

Source: The World Bank Data Countries and Economies
http://data.worldbank.org/country (accessed: 08.03.2012)
UNCTAD (2011, Contents xi),

Table 20 presents the separation of the candidates from table 19 according to their development statuses. As mentioned earlier, the five North African countries are considered as developing countries. Therefore, as this thesis has been emphasizing the importance of the development status in measuring the resource curse, the boundary-countries shall be selected from the developing countries group in table 20. Here, it should be noted that above candidates' experiences with the resource curse have not, or are not, taken at the same period of time. This means that the priority requirement for becoming a boundary-country is that the country is still heavily reliant on its resource rents. In other words, countries will be selected if their resource rents is more than 10 percent of their GDP during the period of 1993-2009 as seen in table 6.[53] Furthermore, if a country's resource rents is not more than 10 percent of its GDP but still can be perceived as an important country regarding the resource curse, it may be considered as an additional boundary-country. More explanation will be followed later in this section.

When choosing developing resource cursed boundary-countries, one can see that Algeria is in the developing resource cursed countries group. As the purpose of this thesis is to find the resource curse and the possible solar curse in the five North Africa countries, Algeria can not be selected as a boundary-country. From the remaining candidates, Nigeria is the only country from Africa. Nigeria is a good candidate as a boundary-country because it is frequently mentioned in the literature on the resource curse, as seen in chapter 2, and is in Africa. Also, as mentioned in section 3.2, Nigeria is also considered to have a great potential in becoming a solar electricity exporter. Also, Nigeria's oil rents alone takes average of 32.5 percent during the period of 1993-2009 (World Development Indicators) making it suitable to be one of the boundary-counties.

[53] Of course, Mehlum et al. (2006b, p.1) considers that '10 percent of resource export share in the GDP' as a high rate. Here, it must be noted that resource rents are mostly obtained from exporting resources. This is the reason why countries will be selected as boundary-countries i.e their resource rents is more than 10 percent of their GDP.

Venezuela is an OPEC member which is frequently mentioned in the literature regarding the resource curse. It is known to have suffered from the Dutch disease and considered to be a rent-seeking society (Rossi 2011, p.14), which in turn has led their slow economic growth. More importantly, Venezuela is seen as a resource cursed country because of its poor institutional quality (Mehlum et al., 2006 a, b). Furthermore, its oil rent size takes 32.5 percent of its GDP during the period of 1993-2009 (WDI) making it also a suitable candidate for the boundary-country.

For the developing resource curse avoided/escaped boundary-countries, one can see Botswana is the only candidate from Africa. Though the main focus of this thesis 'energy', it does not mean Botswana is not a good candidate for being a boundary-country. Though Botswana is not an energy exporter like Nigeria and Venezuela, it exports diamonds which is considered as a point source. As seen in chapter 2, Botswana is a country that is considered to have avoided/escaped the resource curse due to its good institutional quality. Unfortunately, the WDI does not provide Botswana's diamond rent size as the percentage of GDP during the period of 1993-2009. However, diamond sector still plays an important role in Botswana's economy as it is estimated to account for more than one-third of GDP, 70-80 percent of export earnings, and about one-third of the government's revenues (Central Intelligence Agency[54]). Therefore, Botswana will be chosen as one of the resource curse avoided/escaped boundary-country.

In the case of Chile, a large exporter of copper, presents a classic case of a country which is avoiding/escaping the resource curse. Chile experienced its first export boom between 1973 and 1974 during the period of severe economic and political instability, which also led to the overthrow of the Allende government in 1973 (Mikesell 1997, p. 197). During the Allende's regime, though there was increase in copper prices, Chile's GDP declined and it experienced high inflation and disruption in copper production because of the nationalization of the banks and industries. The military government started an anti-inflation program and devaluated the real exchange rate which had appreciated due to the 100 percent inflation rate during the Allende regime. During the 1970s, the periodic real exchange rate appreciation occurred as a result of the nominal exchange rate depreciation lagging behind inflation. Despite this, trade liberalization and reduced domestic demand led to an increase in non-copper exports during the period of 1976-1978. It was followed by the country's second export boom during the period of 1979-1980, which was coupled with a rise in copper prices and rapid growth in real GDP. Although Chile experienced an increase in its current account deficit financed by foreign debt following a decline in copper exports in 1981, Chile still managed to maintain a 5 percent annual GDP growth during the 1980s. The Chilean government

[54] https://www.cia.gov/library/publications/the-world-factbook/geos/bc.html (accessed: 17.05.2013)

dealt with the windfalls from copper export by retaining it in a stabilization fund and prevented the non-mining tradable sector to be damaged by the Dutch disease (Mikesell 1997,p. 197). As can be seen from Chile's experience, Chile appears to have prevented the Dutch disease and escaped from the resource curse. Chile's mineral rent size accounted for 9.8 percent of GDP during the period of 1993-2009 (WDI). Although mineral rent alone did not account for 10 percent of GDP during the period of 1993-2009, it increased more than 10 percent when adding oil and natural gas rents (0.05 percent and 0.2 percent accordingly) during the period of 1993-2009. Therefore, Chile will be selected as one of the boundary-countries that avoided/escaped the resource curse.

The chosen developing resource curse boundary-countries represent rather famous cases which are often mentioned in articles and literature regarding the resource curse. However, in order to provide broader range, additional developing boundary-countries shall be added.

For the additional resource cursed developing boundary-country, Ecuador appears to be a suitable candidate. Ecuador is also an OPEC member with vast amounts of oil. It is one of the largest oil exporters in Latin America and its oil sector accounts for about 50 percent of export earnings and about one-third of all tax revenues (EIA Country Analysis Ecuador). It is often considered as the 'Growth Loser" in articles and literature regarding the resource curse. For example, Mehlum et al. (2006 a,b) and Robinson et al. (2006) argue that Ecuador's poor institutional quality is the main reason why they are affected by the resource curse. Also, it might be worth mentioning that Ecuador is an interesting country to be selected as a boundary-country because its experience with oil can be compared to Norway's experience. More specifically, their oil discoveries occurred in the similar period but their experiences are quite the opposite. Furthermore, Ecuador's oil rent size accounts for 16.1 percent of GDP during the period of 1993-2009 (WDI). Therefore, Ecuador will be added as a developing resource cursed boundary-country.

For the additional resource curse avoided/escaped developing boundary-country, Malaysia can be considered as a suitable candidate. Malaysia is an oil-producing country which is frequently considered to have avoided/escaped the resource curse. For example, Malaysia is the only country, along with Mauritius, which sustained 2 percent per annum growth during the period of 1970-80 whereas economies with high share of resource exports in GDP tended to grow slowly during the period of 1970-90 (Sachs & Warner 1997, p. 27).

The explanation of how Malaysia avoided/escaped the resource curse is often related to the institutional quality which makes it even more suitable to be a boundary-country for the institutional quality comparison analysis. For example, Ross (2001, p.18) emphasizes the importance of the democracy (transparency) in oil and mineral export dependent countries, and that a democratic government is essential in avoiding certain resource curse effects such as corruption. He argues that

countries which use their resource revenues effectively, thus avoiding/escaping the resource curse, such as Malaysia are at least partly democratic. Similarly, Auty (2000, p. 349) mentions that resource-abundant countries which experience sustainable and rapid economic growth are consensual democracies such as Malaysia. Furthermore, Mehlum et al. (2006a,b) point out that the main reason that Malaysia, resource-abundant growth winner, has been able to avoid/escape the resource curse, when compared to the growth loser, is their good institutional quality.

In recent years, the Malaysian government has been putting effort into enhancing output from existing oil and natural gas fields and to advance exploration in deepwater areas. Malaysia's new tax and investment incentives which were introduced in 2010 aim to promote both oil and natural gas exploration and development. Furthermore, they aim to increase aggregate production capacity by 5 percent per year up to 2020 in order to meet domestic demand and to sustain both crude oil and Liquefied Natural Gas (LNG) exports to overseas markets (EIA Country Analysis Malaysia). Though Malaysia's oil rent size is not more than 10 percent, its oil rent size (5.7 percent) and natural gas rent size (4.9 percent) together is 10.6 percent of GDP during the period of 1993-2009 (WDI). As good institutional quality and governance are pointed out as the main reason that Malaysia was able to avoid/escape the resource curse, and its oil and natural gas rent in recent years is still relatively high, Botswana will be chosen as an additional boundary-country.

So far, three resourced cursed boundary-countries and three resource curse avoided/escaped boundary-countries, which are all developing countries, have been identified. As the five North African countries are considered as developing countries, the selection of the boundary-countries from the developing countries has been perceived necessary in obtaining a fair and accurate outcome. However, though the comparison among the countries with similar development status is important, the institutional quality comparison among only developing countries may provide a complication because their institutional quality scores may often overlap, thus unable to make comparisons. Therefore, additional boundary-countries will also be selected from the countries with different development status which enables one to have a broader range in making the institutional quality comparison. Also, including boundary-countries with different development statuses in the institutional quality comparison gives an opportunity for one to reassess whether the development status plays a crucial role in finding the resource curse as it has been argued throughout this thesis. The additional boundary-countries will be selected from the developed resource curse avoided/escaped countries and the least developed resource cursed countries.

From the developed resource curse avoided/escaped countries, Norway will be selected as an additional boundary-country because their experiences present classic case regarding avoiding/escaping the resource curse. Norway's successful escape from the resource curse is already

presented in section 2.5.1. Its oil rent size accounts for 11 percent of GDP during the period of 1993-2009 (WDI). Furthermore, as mentioned earlier, its experience with oil can be compared to Ecuador which has the opposite experience. As choosing just one country from developed countries may provide inaccurate results, in case of Norway being just an exceptional case among the developed resource curse avoided/escaped country, it is necessary to select another additional country. The Netherlands' natural gas rent size is not near 10 percent of GDP. However, their experience, with the Dutch disease, is considered as one of the most important explanations of the resource curse as can be seen throughout this thesis. Therefore, the Netherlands will be selected as an additional developed resource curse avoided/escaped boundary-country.

Angola is an OPEC member and one of the largest oil-producing countries in Africa. For a short period of 2009 it became the largest oil producer in Africa. Angola's oil sector accounts for over 95 percent of export revenues and over 75 percent of government revenues (EIA Country Analysis Angola). Furthermore, Angola's oil rent size takes 81.7 percent of GDP during the period of 1993-2009 (WDI).

Oil production in Angola is known to have been the driver of economic growth. For example, the cumulative economic growth reached 67.5 percent between 2003 and 2006 mainly due to oil production. However, though oil wealth drove per capita GDP up to US$2,335, at purchasing power parity, in 2005, most of the population did not receive any benefits. The recent poverty rate is estimated at 68 percent (Hammond 2011, p.358). Furthermore, Angola appears to suffer from massive corruption and poor accountability. For instance, in 2006, the Transparency International gave Angola a rank of 142 out of 163 (Hammond 2011, p. 360). Overall, Angola's possession of oil, and other resources such as diamonds, has not helped its economy but rather formed corruption, rent-seeking behavior, debt and conflict. Therefore, Angola will be selected as one of the additional least developed resource cursed boundary-country.

The comparison between Sierra Leone and Botswana is often made when discussing the resource curse because their experiences with diamond wealth are quite the opposite. In Sierra Leone, diamonds were discovered in the 1930s and its exports played a crucial role in their economy between the 1930s and the 1970s, accounting for two-thirds of the country's export earnings and one quarter of its GDP (Maconachie & Binns 2007, p. 104).

In 1968, president Siaka Stevens and the All People's Congress party came to power. The diamond wealth was often used to rewards Stevens' supporters and, moreover, its industry became a parastatal which was closely related to corruption. During the period that Stevens was retaining the power, Sierra Leone's official diamond exports fell from 1.7 million carats in the 1960s to 50,000 carats by 1985. The Stevens' regime was closely linked to corruption and rent-seeking and created a

socially excluded underclass which provided the basis for the pre-conditions for war in the 1990s (Macronachie & Binns 2007, p. 105).

The famous 'blood diamonds' is an extensively highlighted topic which is often linked to the conflict in Sierra Leone. More importantly, Sierra Leone's conflicts are often linked to the resource curse especially regarding the greed and grievance mechanisms which are mentioned in section 2.2. The history of Sierra Leone with their diamond wealth demonstrates that it has suffered massively from the resource curse and makes it suitable as a boundary-country. Unfortunately, Sierra Leone's diamond rent size as percentage of GDP is not available from the WDI, and it appears that the mining industry, which include the diamond sector, only accounted for 4.5 percent in the nation's GDP in 2007 (African Development Bank 2009, p. 563). However, as Sierra Leone is a suitable candidate in presenting the opposite experience to Botswana with diamond wealth, it will still be selected as the least developed resource cursed boundary-country.

6.2 Identifying the Resource Curse & Solar Energy Curse Potential in the Five North African Countries by the Institutional Quality Comparison Method

6.2.1 Methodology

The specific aim of this section is to find out whether the North African energy exporters are affected by the resource curse, and if the five North African countries have the potentials to suffer from a solar energy curse, by using the institutional quality comparison method. Here, the institutional quality of ten boundary-countries will be compared to the five North African countries, and all of WGI's six institutional quality aspects will be compared separately. However, in this section, the average institutional quality during the period of 1996-2011 and 2007-2011 will not be applied. As mentioned earlier, the purpose of applying the average institutional quality of these two periods was not to identify the resource curse but to test the correlation between institutional quality and development status. Therefore, in order to obtain the most accurate result, the most recent institutional quality scores (2011), provided by WGI will be applied in this section. This analysis will also include the standard error with the 95 percent confidence level.

Here, a specific explanation of the use of standard error and its relations to confidence level should be examined. Standard errors, which are known as standard deviation, are considered essential features in the WGI because they capture the inherent uncertainty in measuring governance. The standard error is smaller when more data sources are available for a country. This can be seen in table 21. In other words, lower values indicate more precision.

Table 21: Governance Scores, Number of Data Sources, and Standard Errors based on Government Effectiveness Dimension

	Sources	Governance Score	Standard Errors
Botswana	11	+0.53	0.18
Morocco	9	-0.22	0.19
Sierra Leone	8	-1.16	0.20

Standard errors are closely related to confidence intervals which are also referred to as confidence level. The confidence level displays statistically-likely range of values for each indicator. For instance, when the 95 percent confidence level is chosen, it is likely that governance falls within the indicated range. On the other hand, if one chooses a lower confidence level, such as 50 percent, 75 percent, or 90 percent, the confidence interval is more likely to result in narrower ranges but governance is less likely to fall in the indicated range (WGI).

According to Kaufmann et al. (2010, p. 11), WGI always report the 90 percent confidence interval associated with both estimates of governance, i.e the estimate of governance +/-1.64 times its standard deviation (Kaufmann et al. 2010, p. 11). For example, Angola's institutional quality score based on Voice and Accountability in 2011 is -1.17 and the standard error is 0.11 (see table 23). If the confidence level of 90 percent is applied, the standard error then becomes +/-0.1804. WGI refers this range as the "margin of error", which was mentioned in the previous chapter, for the governance score. In other words, this range means that, based on the observed data, WGI is 90 percent confident that the true, but unobserved, level of governance for the countries lies in this range. More specific example is illustrated below.

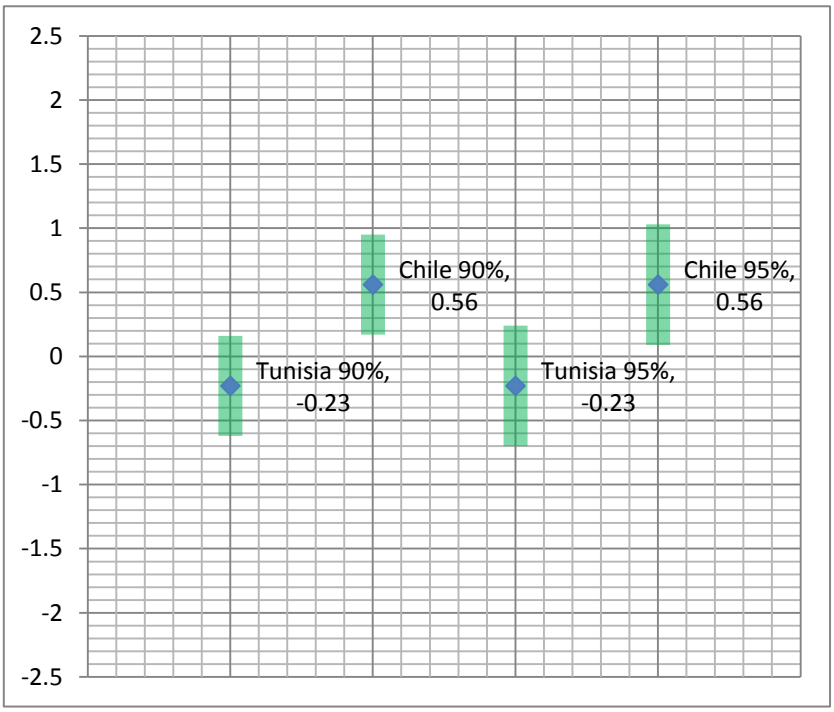
Table 22: Governance Score of Tunisia and Chile based on Political Stability & Absence of Violence and Standard Error based on Different Confidence Levels

	Governance Score	Standard Error	Standard Error (90% Confidence Level)	Standard Error (95% Confidence Level)
Tunisia	-0.23	0.24	+/-0.39[55]	+/-0.47[56]
Chile	0.56	0.24	+/-0.39	+/-0.47

Source: Worldwide Governance Indicators (WGI)

Table 22 presents the governance score based on Political Stability & Absence of Violence and their standard error based on different confidence levels. Each confidence level applies different standard deviation. For example, applying the 95 percent confidence level means +/-1.96 times the given standard deviation (Wolfram MathWorld: Confidence Interval).

Figure 10: Figure form of Table 22[57]



[55] Exact value is 0.3936 but rounded up to 0.39.
[56] Exact value is 0.4704 but rounded up to 0.47.
[57] Vertical-Axis present the governance score range from -2.5 to + 2.5. This vertical-Axis form will be applied to all figures in section 6.2.2.

As can be seen from figure 10, which presents the figure form of table 22, it is possible to see overlaps of two confidence intervals between Tunisia and Chile when 95 percent confidence level is taken whereas there are no overlaps of two confidence intervals when 95 percent confidence level is taken.[58] As mentioned earlier, when comparing two countries or one country at two points in time, the application of the margins of error should be taken into account. An overlap of two confidence intervals means the difference between them in time is not statistically significant. In other words, when the aggregate governance scores' changes are small relative to the reported margins of error, they should not be over-interpreted (WGI).[59] In this thesis, as the institutional quality (governance score) will be presented in figure form, the standard error with the 95 percent confidence level will be applied to make sure that statistically significant interpretations will be made. Furthermore, it must be noted that when the 95 percent confidence level is applied, +/-1.96 times the standard deviation, the outcome will be rounded to 2 decimal places as shown in table 22.

Before proceeding with the institutional quality comparisons, there are a number of aspects that should be explained. In this section, Egypt will be considered as an energy exporter. This is because this analysis does not only search for the possibilities of the five North African countries to suffer from a solar energy curse, but also identify the resource curse in the North African energy exporters. When dealing with the current resource curse in this section, there is no reason to consider Egypt as an energy importer. Also, when identifying the solar energy curse, one does not have to test Egypt as both exporter and importer because all five North African countries are projected to become solar electricity exporters in the future.

As mentioned earlier, it is not possible to project the future institutional quality of the five North African countries. Therefore, when projecting which countries would suffer from a solar energy curse in the future, it will be based on the assumption the most recent institutional quality will remain at similar levels in the future.

The institutional quality comparisons will be separated into six sections as these comparisons will be based on six dimensions. Firstly, the institutional quality comparison in six dimensions will be made separately, then all results will be gathered at the end of this section. The reason behind this is that, a low score in one institutional quality dimension does not mean that country is affected by the curse.

Lastly, graphs will present the institutional quality of the five North Africans countries and the boundary-countries with the confidence intervals. Tables will be followed to illustrate details of each

[58] It must be mentioned that the horizontal width of each bar does not represent any meaning. The horizontal width is purely used to make it easier to view the figure forms which will be applied in all figures in the next section.

[59] http://info.worldbank.org/governance/wgi/faq.htm#10 (accessed: 07.12.2012)

graph. Tables will demonstrate the overlaps of confidence intervals in 6 dimensions. Description of each dimension is illustrated below.

Affected by Curse: Confidence intervals do not overlap and institutional quality score is lower than the resource cursed boundary-countries

Overlap Curse: Confidence intervals overlap with the resource cursed boundary-countries

Over Cursed: Confidence intervals do not overlap and institutional quality score is higher than the resource cursed boundary-countries

Both: Confidence intervals overlap with both the resource cursed boundary-countries and the resource curse avoided/escaped boundary-countries

Overlap Avoided/Escaped: Confidence intervals overlap with the resource curse avoided/escaped boundary-countries

Under Avoided/Escaped: Confidence intervals do not overlap and institutional quality score is lower than the resource curse avoided/escaped boundary-countries

The graphs and tables will be based on governance scores and margin of errors provided by WGI for the year 2011 which is illustrated in table 23.

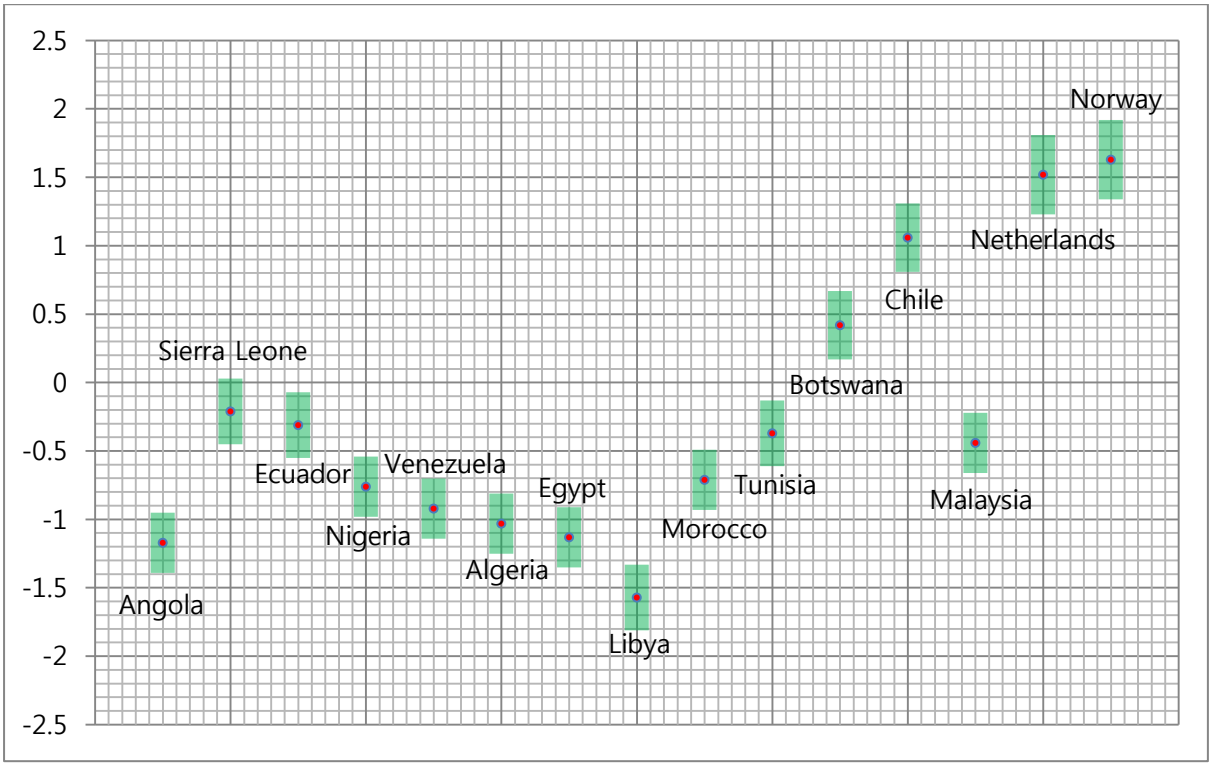
Table 23: Governance Scores and Margin of Errors of the Five North African Countries and Boundary-Countries in 2011

	V·A		P·S & A·V		G·E		R·Q		R·L		C·C	
	G.S	S.E	G.S	S.E	G.S	S.E	G.S	S.E	G.S	S.E	G.S	S.E
Angola	-1.17	0.11	-0.33	0.24	-1.15	0.18	-1.10	0.16	-1.23	0.13	-1.36	0.16
Sierra Leone	-0.21	0.12	-0.19	0.27	-1.16	0.20	-0.70	0.17	-0.86	0.14	-0.69	0.18
Ecuador	-0.31	0.12	-0.73	0.24	-0.55	0.19	-1.02	0.17	-1.14	0.13	-0.82	0.17
Nigeria	-0.76	0.11	-1.94	0.24	-1.12	0.18	-0.69	0.16	-1.25	0.13	-1.14	0.15
Venezuela	-0.92	0.11	-1.30	0.24	-1.10	0.18	-1.49	0.17	-1.63	0.13	-1.22	0.16
Algeria	-1.03	0.11	-1.35	0.24	-0.66	0.18	-1.16	0.17	-0.82	0.13	-0.57	0.17
Egypt	-1.13	0.11	-1.29	0.24	-0.60	0.18	-0.33	0.16	-0.42	0.13	-0.68	0.16
Libya	-1.57	0.12	-1.01	0.25	-1.47	0.21	-1.52	0.19	-1.16	0.15	-1.31	0.19
Morocco	-0.71	0.11	-0.47	0.25	-0.22	0.19	-0.09	0.16	-0.21	0.13	-0.26	0.17
Tunisia	-0.37	0.12	-0.23	0.24	+0.02	0.18	-0.18	0.16	-0.10	0.13	-0.21	0.17
Botswana	+0.42	0.13	+1.04	0.24	+0.53	0.18	+0.50	0.16	+0.66	0.13	+0.97	0.16
Chile	+1.06	0.13	+0.56	0.24	+1.17	0.19	+1.54	0.17	+1.37	0.13	+1.57	0.16
Malaysia	-0.44	0.11	+0.16	0.24	+1.00	0.19	+0.66	0.17	+0.52	0.13	+0.00	0.15
Netherlands	+1.52	0.15	+1.12	0.24	+1.79	0.21	+1.84	0.23	+1.82	0.15	+2.17	0.18
Norway	+1.63	0.15	+1.35	0.24	+1.76	0.21	+1.41	0.23	+1.89	0.15	+2.17	0.18

Source: The Worldwide Governance indicators (WGI) (accessed: 13.05.2013)

6.2.2 The Institutional Quality Comparisons with Six Different Dimensions

Figure 11: Institutional Quality based on Voice and Accountability 2011 (-2.5 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 24: Details of Figure 11

V & A	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse	Sierra Leone, Ecuador	Sierra Leone, Ecuador	Sierra Leone, Ecuador, Nigeria, Venezuela	Sierra Leone	-
Overlap curse	Angola, Nigeria, Venezuela	Angola, Nigeria, Venezuela	Angola	Ecuador, Nigeria, Venezuela	Sierra Leone, Ecuador, Nigeria
Over curse				Angola	Angola, Venezuela
Both	No	No	No	Yes	Yes
Overlap avoided/escaped				Malaysia	Malaysia
Under avoided/escaped	All	All	All	Botswana, Chile, the Netherlands, Norway	Botswana, Chile, the Netherlands, Norway

Figure 11 presents the institutional quality comparison based on Voice and Accountability dimension of the five North African countries and the boundary-countries, and table 24 presents the details of figure 11.

When one compares the institutional quality among the five North African countries, Tunisia appears to have the highest institutional quality. Though Tunisia's confidence interval overlaps with Morocco, Tunisia's institutional quality is better than the North African energy exporters. On the other hand, Libya, though their confidence interval overlaps with Egypt, appears to have the lowest institutional quality within the five North African countries.

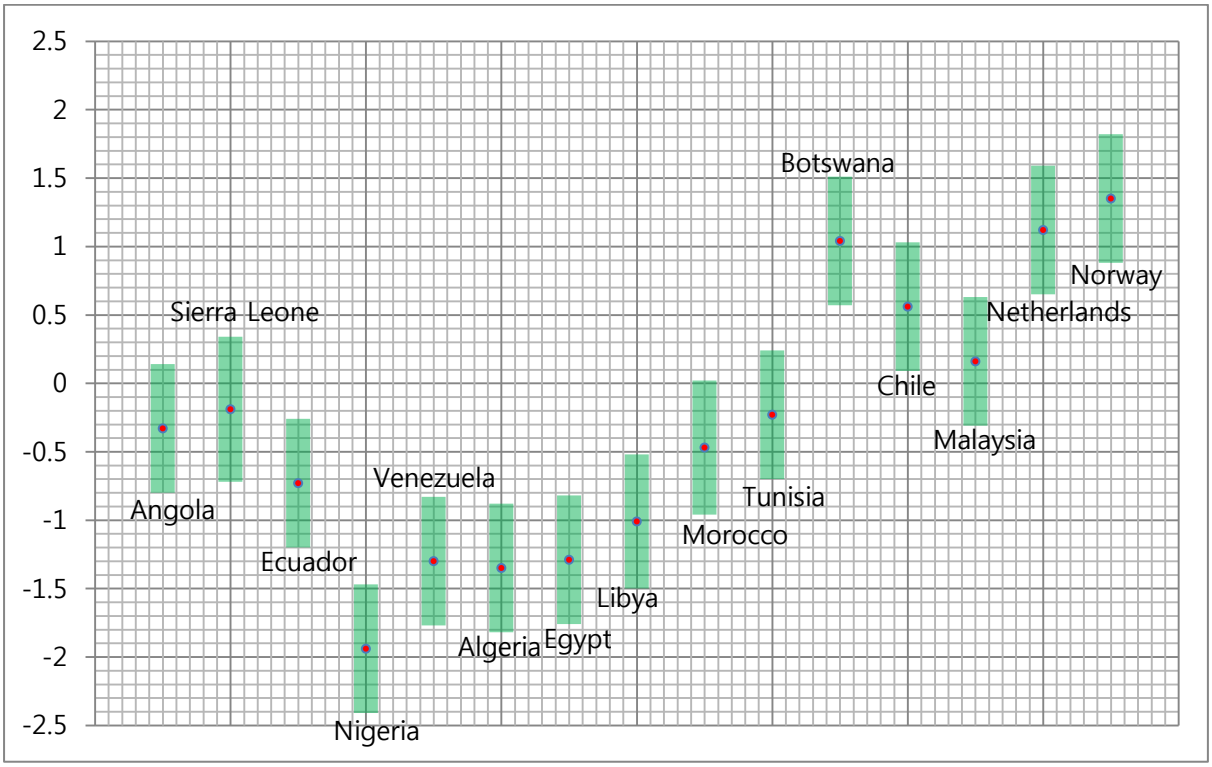
When one compares the institutional quality of the five North African countries to the resource curse avoided/escaped boundary-countries, the resource curse avoided/escaped boundary-countries, especially the developed countries, have significantly higher institutional quality except for Malaysia. Malaysia's confidence interval overlaps with Morocco and Tunisia which means these three countries do not have significant difference in their institutional quality. Nevertheless, in general, the institutional quality of the five North African countries is relatively lower than the resource curse avoided/escaped boundary-countries.

The institutional quality of the five North African countries appears to be closer to the resource cursed boundary-countries rather than the avoided/escaped boundary-countries in figure 11. The institutional quality of the five North African countries are either lower than some of the resource cursed boundary-countries, or their confidence intervals overlap with the resource cursed boundary-countries.

When one compares the institutional qualities of the three North African energy exporters to the resource cursed boundary-countries, they appear to have low institutional quality as their institutional qualities are lower than the resource cursed boundary-countries or their confidence intervals overlap with the resource cursed boundary-countries. Libya appears to have the lowest institutional quality among the North African energy exporters because Libya's institutional quality is lower than most of the resource cursed boundary-countries except for Angola. Nevertheless, it is possible to see that the North African energy exporters seem to be affected by the resource curse, or at least closer to suffering from the resource curse than avoiding/escaping it. Thus, they have the potentials to suffer from a solar energy curse.

When one compares the institutional quality of the North African energy importers to the resource cursed boundary-countries, they appear to have the potentials to suffer from a solar energy curse as their institutional qualities are either worse than the resource cursed boundary-countries, or their confidence intervals overlap with the other cursed boundary-countries. However, when looking at table 24, it is possible to see that their institutional quality is higher than some of the resource cursed boundary-countries such as Angola and Venezuela. In other words, the North African energy importers may have less chance to suffer from a solar energy curse than the North African energy exporters.

Figure 12: Institutional Quality based on Political Stability and Absence of Violence 2011 (-0.25 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 25: Details of Figure 12

P·S & A·V	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse	Angola, Sierra Leone	Angola, Sierra Leone			
Overlap curse	Ecuador, Nigeria, Venezuela	Ecuador, Venezuela, Nigeria	All	Angola, Sierra Leone, Ecuador, Venezuela	Angola, Sierra Leone, Ecuador
Over curse				Nigeria	Venezuela, Nigeria
Both				Yes	Yes
Overlap avoided/escaped				Malaysia	Chile, Malaysia,
Under avoided/escaped	All	All	All	Chile, the Netherlands, Norway	Botswana, The Netherlands, Norway

Figure 12 presents the institutional quality comparison based on Political Stability and Absence of Violence dimension of the five North African countries and the boundary-countries, and table 25 presents the details of figure 12.

When one compares the institutional quality among the five North African countries, it is difficult see which countries have better institutional quality because their confidence intervals often overlap.

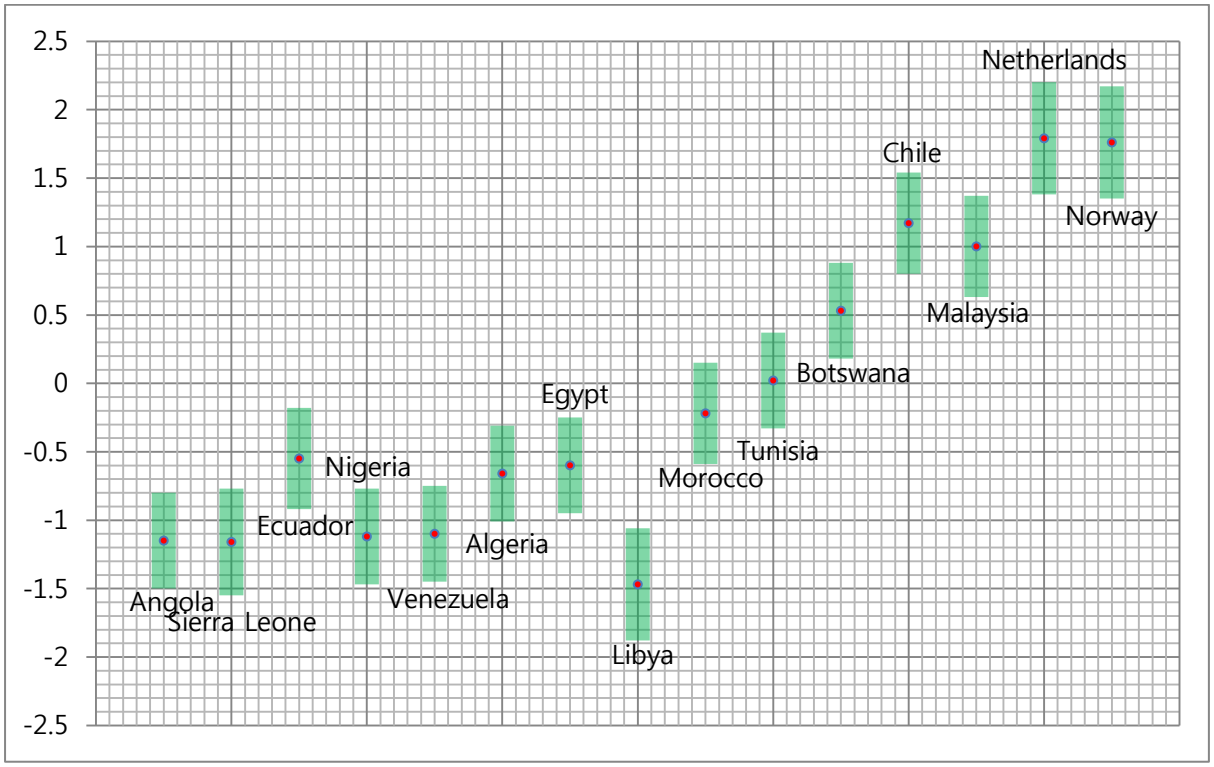
However, when carefully observed, it is possible to see that Tunisia has better institutional quality than Algeria and Egypt. Apart from Tunisia, it is not possible to make comparisons among the five North African countries because their confidence intervals overlap.

When the institutional quality of the five North African countries is compared to the resource curse avoided/escaped boundary-countries, few confidence intervals overlaps between two groups are detected. For example, the confidence interval of Morocco overlaps with Malaysia, and Tunisia overlaps with Chile and Malaysia. However, as can be seen in figure 12 and table 25, the rest of the North African countries have relatively worse institutional quality compared to the resource curse avoided/escaped boundary-countries. The institutional quality of the five North African countries appears closer to the resource cursed boundary-countries rather than the resource curse avoided/escaped boundary-countries in figure 12. The institutional quality of the five North African countries are either lower than some of the resource cursed boundary-countries, or at least their confidence intervals overlap with the resource cursed boundary-countries.

When one compares the institutional quality of the North African energy exporters to the resource cursed boundary-countries, they all appear to have low institutional quality because their institutional qualities are lower than the resource cursed boundary-countries or their confidence intervals overlap with the resource cursed boundary-countries. However, Algeria and Egypt, though their confidence intervals overlap with Libya, may be in a deeper resource curse than Libya because their institutional qualities are worse than some of the resource cursed boundary-countries such as Angola and Sierra Leone, whereas Libya's confidence interval only overlaps with the resource cursed boundary-countries' confidence intervals. Nevertheless, one can see that the North African energy exporters may be already suffering from the resource curse, or at least closer to the resource curse than avoiding/escaping it. Thus, their potentials to suffer from a solar energy curse is high.

When one compares the institutional quality of the energy importers to the resource cursed boundary-countries, despite their confidence intervals overlapping with the resource curse avoided/escaped boundary-countries, one can see that their confidence intervals often overlap with the resource cursed boundary-countries. In other words, they have the potential to suffer from a solar energy curse rather than avoiding it because their institutional qualities are closer to the resource cursed-boundary countries. However, when looking at table 25, their institutional qualities are never lower than the resource cursed boundary-countries. In other words, the North African energy importers may have less chance to suffer from a solar energy curse than the North African energy exporters.

Figure 13: Institutional Quality based on Government Effectiveness 2011 (-2.5 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 26: Details of Figure 13

G · E	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse			Ecuador		
Overlap curse	All	All	Angola, Sierra Leone, Nigeria, Venezuela	Ecuador	Ecuador
Over curse				Angola, Sierra Leone, Nigeria, Venezuela	Angola, Sierra Leone, Nigeria, Venezuela
Both				No	Yes
Overlap escaped/avoided					Botswana
Under avoided/escaped	All	All	All	Chile, the Netherlands, Norway	Chile, The Netherlands, Norway

Figure 13 presents the institutional quality comparison based on Government Effectiveness dimension of the five North African countries and the boundary-countries, and table 26 presents the details of figure 13.

When one compares the institutional quality within the five North African countries, Libya has the lowest institutional quality because their institutional quality is clearly lower than the rest of the North African countries. The distinction among the rest is not possible as their confidence intervals

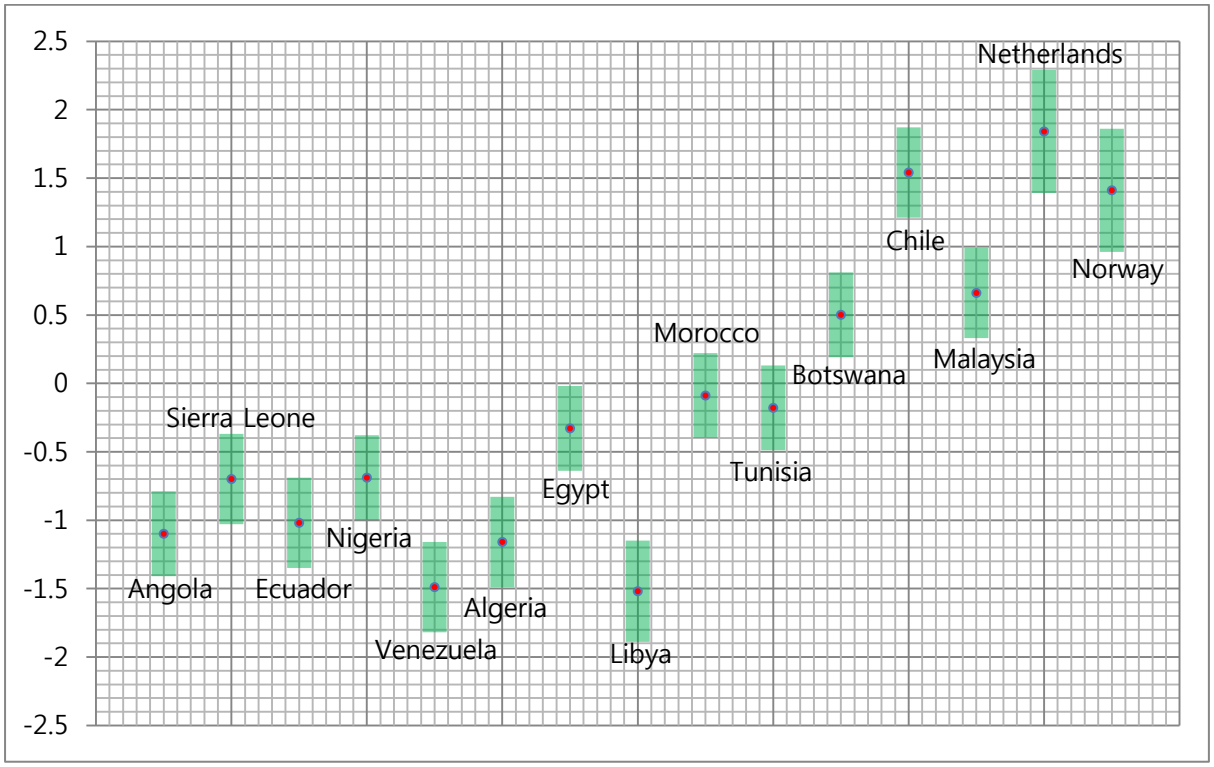
all overlap.

When the institutional quality of the five North African countries are compared to the resource curse avoided/escaped boundary-countries, it is possible to see that only Tunisia's confidence interval overlaps with Botswana's confidence interval. The rest of the North African countries have worse institutional qualities compared to all the resource curse avoided/escaped boundary-countries. The institutional quality of the five North African countries appears to be closer to the resource cursed boundary-countries rather than the resource curse avoided/escaped boundary-countries as can be seen in figure 13. All of the North African countries' confidence intervals overlap with at least one resource cursed boundary-country. Libya, however, is the only country whose institutional quality is lower than one of the resource cursed boundary-countries (Ecuador).

When one compares the institutional quality of the North African energy exporters to the resource cursed boundary-countries, they all appear to have low institutional quality because their institutional qualities are lower than the resource cursed boundary-countries or their confidence intervals overlap with the resource cursed boundary-countries. Libya, however, has the lowest institutional quality among the North African exporters and, as mentioned earlier, is the only country that whose institutional quality is worse than Ecuador whereas the confidence intervals of Algeria and Egypt only overlap with the resource cursed boundary-countries. Nevertheless, though Libya may be considered to suffer more seriously from the resource curse, the North African energy exporters can be considered to be suffering from the resource curse and have the potentials to suffer from a solar energy curse.

When one compares the institutional quality of the North African energy importers to the resource cursed boundary-countries, one can see that their confidence intervals more often overlap with the resource cursed boundary-countries than with the resource curse avoided/escaped boundary-countries. In other words, they are more likely to suffer from a solar energy curse rather than avoiding it. However, when looking at figure 13, Morocco and Tunisia have significantly higher institutional qualities compared to Libya. Also, unlike the North African energy exporters, their institutional qualities are often higher than the resource cursed boundary-countries as can be seen from table 26. Therefore, in other words, the North African energy importers may have less chance to suffer from a solar energy curse than the North African energy exporters in the future.

Figure 14: Institutional Quality based on Regulatory Quality 2011 (-2.5 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 27: Details of Figure 14

R · Q	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse			Sierra Leone, Nigeria		
Overlap curse	All	Sierra Leone, Nigeria	Angola, Ecuador, Venezuela	Sierra Leone, Nigeria	Sierra Leone, Nigeria
Over curse		Angola, Ecuador, Venezuela		Angola, Ecuador, Venezuela	Angola, Ecuador, Venezuela
Both	No	No	No	Yes	No
Overlap escaped/avoided				Botswana	
Under avoided/escaped	All	All	All	Chile, Malaysia, the Netherlands, Norway	All

Figure 14 presents the institutional quality comparison based on Regulatory Quality dimension of the five North African countries and the boundary countries, and table 27 presents the details of figure 14.

When one compares the institutional quality within the five North African countries, Algeria and Libya appear to have the lowest institutional qualities. As the confidence intervals of Egypt, Morocco

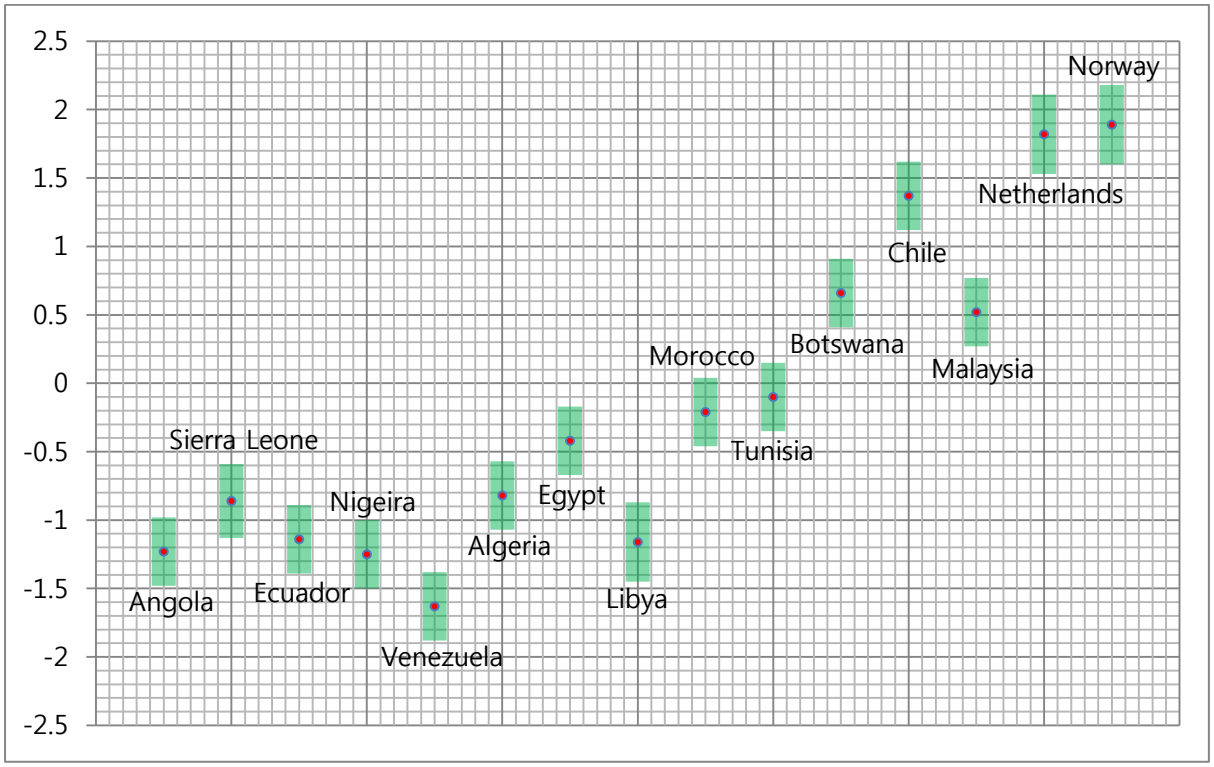
and Tunisia overlap, it is not possible to see which countries have better or worse institutional quality.

When the institutional quality of the five North African countries is compared to the resource curse avoided/escaped boundary-countries, it is possible to see that the resource curse avoided/escaped boundary-countries generally have higher institutional quality. Only Morocco has confidence interval which overlaps with a resource curse avoided/escaped boundary-country (Botswana). Again, the institutional quality of the five North African countries appears to be closer to the resource cursed boundary-countries rather than the resource curse avoided/escaped boundary-countries in figure 14. All of the North African countries' confidence intervals overlap with a number of resource cursed boundary-countries. Libya, however, is the only country that has institutional quality lower than some of the resource cursed boundary-countries (Sierra Leone and Nigeria), whereas the rest have either better institutional quality or their confidence intervals only overlap with the resource cursed boundary-countries.

When one compares the institutional qualities of the North African energy exporters to the resource cursed boundary-countries, they all appear to have low institutional quality because their institutional qualities are lower than the resource cursed boundary-countries or confidence intervals overlap with the resource cursed boundary-countries. Libya appears to have the lowest institutional quality among the North African exporters because Libya's institutional quality is worse than some of the resource cursed boundary-countries. Algeria's institutional quality is also very low. On the other hand, Egypt appears to have a much higher institutional quality, at least compared to Algeria and Libya, which might mean that it is suffering less from the current resource curse. Nevertheless, the North African energy exporters, in general, seem affected by the resource curse and have the potentials to suffer from a solar energy curse.

When one compares the institutional quality of the North African energy importers to the resource cursed boundary-countries, one can see that their confidence intervals overlap with the resource cursed boundary-countries more often than with the resource curse avoided/escaped boundary-countries. In other words, it is more likely that they will suffer from a solar energy curse rather than avoiding it. Unlike the North African energy exporters, their institutional qualities are often higher than the resource cursed boundary-countries, such as Angola, Ecuador, and Venezuela, as can be seen from figure 14 and table 27. Therefore, the North African energy importers may have less chance of suffering from a solar energy curse than the North African energy exporters.

Figure 15: Institutional Quality based on Rule of Law 2011 (-2.5 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 28: Details of Figure 15

R · L	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse					
Overlap curse	Angola, Sierra Leone, Ecuador, Nigeria	Sierra Leone	All		
Over Curse	Venezuela	Angola, Ecuador, Nigeria, Venezuela		All	All
Both	No	No	No	No	No
Overlap escaped/avoided	No	No	No	No	No
Under avoided/escaped	All	All	All	All	All

Figure 15 presents the institutional quality comparison based on Rule of Law dimension of the five North African countries and the boundary countries, and table 28 presents the details of figure 15.

When one compares the institutional quality within the five North African countries, one can not clearly see which countries have higher or lower institutional quality because their confidence intervals often overlap. However, what is clear is that Morocco and Tunisia have better institutional qualities compared to Algeria and Libya.

When the institutional quality of the five North African countries is compared to the resource

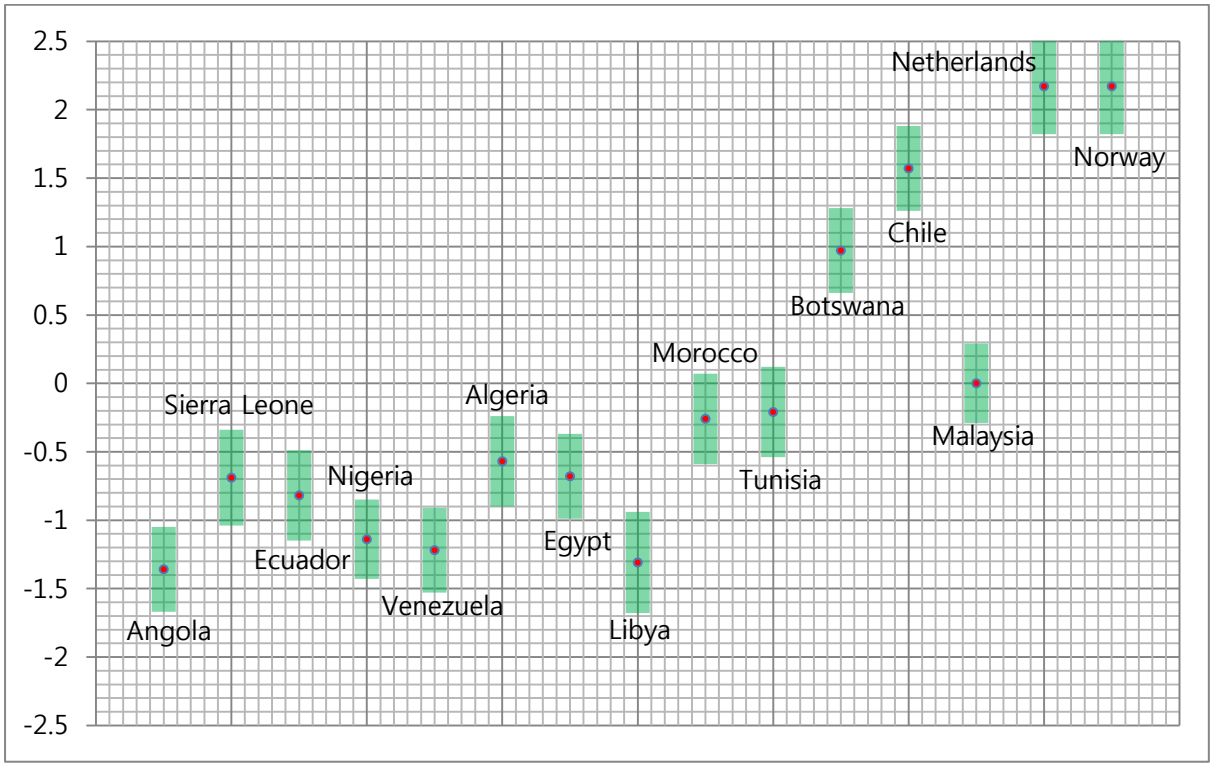
curse avoided/escaped boundary-countries, it is possible to see that the resource curse avoided/escaped boundary-countries have higher institutional qualities compared to all the five North African countries. This might suggest that the North African energy exporters are not close to escaping the current resource curse, and all North African countries have the potentials to suffer from a solar energy curse.

When the five North African countries' institutional qualities are compared to the resource cursed boundary-countries, mixed results are attained. In the case of the North African energy exporters, they are likely to be affected by the resource curse because their confidence intervals all overlap with the resource cursed boundary-countries' confidence intervals. Egypt may be in a slightly better position as their institutional quality is higher than many resource cursed boundary-countries. Nevertheless, all the North African energy exporters have the potential to suffer from a solar energy curse because their institutional qualities are closer to the resource cursed boundary-countries.

In the case of the North African energy importers, they are in a peculiar position as their confidence intervals do not overlap with either side of the boundary-countries. Of course, this does not mean they are not in danger of suffering from a solar energy curse. For example, as can be seen in figure 15, their institutional quality scores are below 0[60], and their confidence intervals overlap with Egypt's confidence intervals which overlaps with many resource cursed boundary-countries. Therefore, the fact that their institutional quality score is rather low, and are closer to the resource cursed boundary-countries, suggests that they have the potentials to suffer from a solar energy curse rather than avoiding it. However, as mentioned before, their chances of suffering from a solar energy curse are likely to be less than Algeria and Libya because their institutional qualities are relatively higher than Algeria and Libya.

[60] The average score for the world as a whole is zero in every period in WGI.

Figure 16: Institutional Quality based on Control of Corruption 2011 (-2.5 to +2.5)



Source: Worldwide Governance Indicator (WGI)

Table 29: Details of Figure 16

C · C	Algeria	Egypt	Libya	Morocco	Tunisia
Under curse					
Overlap curse	Sierra Leone, Ecuador, Nigeria	Sierra Leone, Ecuador, Nigeria, Venezuela	All	Sierra Leone, Ecuador	Sierra Leone, Ecuador
Over curse	Angola, Venezuela	Angola		Angola, Nigeria, Venezuela	Angola, Nigeria, Venezuela
Both	Yes	No	No	Yes	Yes
Overlap escaped/avoided	Malaysia			Malaysia	Malaysia
Under avoided/escaped	Botswana, Chile, the Netherlands, Norway	All	All	Botswana, Chile, the Netherlands, Norway	Botswana, Chile, the Netherlands, Norway

Figure 16 presents the institutional quality comparison based on Control of Corruption dimension of the five North African countries and the boundary countries, and table 29 presents the details of figure 16.

When one compares the institutional quality among the five North African countries, though

Libya's confidence interval overlaps with Egypt, Libya appears to have the lowest institutional quality as their institutional quality is lower than Algeria, Morocco and Tunisia. As the rest of the North African countries' confidence intervals all overlap, it is hard to make the institutional quality comparisons.

When one compares the institutional quality of the five North African countries to the resource curse avoided/escaped boundary-countries, it can be observed that the institutional quality of the resource curse avoided/escaped boundary-countries, especially the developed countries, is significantly higher except for Malaysia. Malaysia's confidence interval overlaps with Algeria, Morocco and Tunisia. Here, one should not argue that their institutional qualities are high just because their confidence intervals overlap with Malaysia. As can be seen from figure 16, Malaysia's institutional quality is exceptionally low compared to the other resource curse avoided/escaped boundary-countries. Nevertheless, the institutional quality of the five North African countries appears to be closer to the resource cursed boundary-countries rather than the resource curse avoided/escaped boundary-countries. For example, the confidence intervals of the five North African countries all overlap with some of the resource cursed boundary-countries.

When one compares the institutional qualities of the North African energy exporters to the resource cursed boundary-countries, they all appear to have low institutional quality as their confidence intervals all overlap with a number of resource cursed boundary-countries. Libya, however, may be considered to have the lowest institutional quality among the North African energy exporters because it is the only country that its institutional quality is not higher than any resource cursed boundary-countries. Nevertheless, the fact that the North African energy exporters' institutional qualities are quite close to the resource cursed boundary-countries shows that they are more likely to be suffering from the resource curse than avoiding/escaping from it. In other words, they have the potentials to suffer from a solar energy curse.

When one compares the institutional quality of the North African energy importers to the resource cursed boundary-countries, they appear to have the potentials to suffer from a solar energy curse because their confidence intervals overlap with a number of resource cursed boundary-countries. It is hard to say that their institutional quality is better than the North African energy exporters, or have less chance to suffer from a solar energy curse, because their confidence intervals often overlap except for Libya.

6.3 Results

6.3.1 Gathering the obtained Results from the Institutional Quality Comparisons based on Six Dimensions

The previous section illustrated the institutional quality comparisons between the five North African countries and ten boundary-countries in six different dimensions. The aim of this section is to gather the results from the comparisons made in section 6.2.2, and present which North African energy exporters are already suffering from the resource curse, and which of the five North African countries have the potentials to suffer from a solar energy curse.

The likelihood of the North African energy exporters to be affected by the current resource curse and the five North African countries to suffer from a solar energy curse will be measured in four categories which are illustrated below.

- Completely avoided/escaped the resource curse and will not suffer from a solar energy curse: Institutional quality is as high as the resource curse avoided/escaped boundary-countries with the highest institutional quality (O)

- Not suffering from the resource curse and have less chance to suffer from a solar energy curse: Better institutional quality than all the cursed boundary-countries and the confidence interval overlaps with the resource curse avoided/escaped boundary-countries (O)

- Suffering from the current resource curse and have the potential to suffer from a solar energy curse: Confidence intervals overlap with the resource cursed boundary-countries (O)

- Suffering seriously from the current resource curse and have the high potential to suffer from a solar energy curse: Have lower institutional quality than the resource cursed boundary- countries. (O)

Accordingly, there are few issues that should be addressed and clarified. Firstly, if a country is considered to be suffering from the resource curse, it will be considered to have the potential to suffer from a solar energy curse because it proves that they have poor institutional quality.

Secondly, there are some cases that the confidence intervals of the five North African countries overlap both with the resource cursed boundary-countries and the resource curse avoided/escaped boundary-countries. For instance, the confidence interval of Tunisia, regarding the Voice and

Accountability dimension, overlaps with both the resource cursed boundary-countries (Angola and Venezuela) and the resource curse avoided/escaped boundary-country (Malaysia). If a country's confidence interval overlaps with both sides of boundary-countries, it will still be considered to be affected by the resource curse or has the potentials to suffer from a solar energy curse. The reason behind this is because, when a country's confidence interval overlaps with both sides, it is often the case that the overlapped resource curse avoided/escaped boundary-countries, such as Malaysia, have relatively low institutional quality compared to the other resource curse avoided/escaped boundary-countries. Therefore, a country's confidence interval overlaps with relatively low institutional quality of the resource curse avoided/escaped boundary-countries should not guarantee that they are not to suffer from a solar energy curse. Another reason is that if a country's confidence interval overlaps with the resource cursed boundary-countries, whether it also overlaps with the resource curse avoided/escaped boundary-countries, it still means that the country has the potential to suffer from the solar energy curse whether their chance is high or not. In other words, when overlaps with both sides, it is better to perceive their position closer to the resource curse and a solar energy curse because a careful consideration of the slight possibility in advance will help in preventing a solar energy curse.

Table 30 below presents where the five North African countries stand regarding the current resource curse and a solar energy curse in the future.

Table 30: Results of the Institutional Quality Comparison in Six Dimensions

	Voice and Accountability	Political Stability & Absence of Violence	Government Effectiveness	Regulatory Quality	Rule of Law	Control of Corruption
Algeria	O	O*	O	O	O	O
Egypt	O	O*	O	O	O	O
Libya	O*	O	O*	O*	O*	O*
Morocco	O	O	O	O	O	O
Tunisia	O	O	O	O	O	O

*: indicates the countries that are in the more serious resource curse, or the highest potential to suffer from the solar energy curse

Regarding the Voice and Accountability dimension, the result shows that the North African energy exporters are already suffering seriously from the current resource curse, and the five North African countries have the potentials to suffer from a solar energy curse because their institutional qualities are lower than a number of the resource cursed boundary-countries except for Tunisia. As

mentioned in the previous section, Libya appears to be affected most seriously by the resource curse and has the highest potential to suffer from the solar energy curse because their institutional quality is one of the lowest among the five North African countries and often lower than the resource cursed boundary-countries. Tunisia appears to have less chance of suffering from a solar energy curse compared to the rest of the North African countries. However, it is still in the danger of suffering from a solar energy curse as its institutional quality, based on the Voice and Accountability, is still low as it is similar to many of the resource cursed boundary-countries.

Regarding the Political Stability and Absence of Violence dimension, the result shows that the North African energy exporters are already suffering from the current resource curse, and the five North African countries are likely to suffer from a solar energy curse because their institutional qualities are either similar to the resource cursed boundary-countries or lower than them. In particular, Algeria and Egypt seem to be more seriously affected by the resource curse than Libya, and have a higher potential to suffer from a solar energy curse, as their institutional qualities are lower than a number of resource cursed boundary-countries. Though the institutional qualities of Morocco and Tunisia appear higher than a number of the resource cursed boundary-countries, their institutional qualities are still far from reaching high levels. Overall, the confidence intervals of the five North African countries often overlap with the resource cursed boundary-countries, and they all have the potentials to suffer from a solar energy curse.

Regarding the Government Effectiveness dimension, the result shows that the North African energy exporters, especially Libya, are suffering from the current resource curse, and five North African countries have the potentials to suffer from a solar energy curse because their institutional qualities are as low as the resource cursed boundary-countries. Here, as mentioned earlier, Libya appears to be in a more serious situation as its institutional quality is lower than Ecuador's institutional quality which is considered to be affected by the resource curse. Although the institutional quality of Morocco and Tunisia are higher than many resource cursed boundary-countries, and may appear higher than Libya's institutional quality, their institutional quality can not be considered high enough and are considered to have the potentials to suffer from a solar energy curse regarding the Government Effectiveness dimension.

Regarding the Regulatory Quality dimension, the result shows that the North African energy exporters, especially Libya, are already suffering from the resource curse, and the five North African countries have the potentials to suffer from a solar energy curse because their institution qualities are similar to the resource cursed boundary-countries. Again, Libya appears to be affected by a deeper resource curse because its institutional quality is worse than a number of the resource cursed boundary-countries. Though the energy North African importers and Egypt have higher institutional

qualities compared to the North African energy exporters in figure 14, their institutional qualities are still closer to the resource cursed boundary-countries which indicate that they are in the danger of suffering from a solar energy curse in the future.

Regarding the rule of Law dimension, the result shows that the North African energy exporters are already suffering from the resource curse. Regarding the solar energy curse, however, the institutional qualities of Morocco and Tunisia are higher than all the resource cursed boundary-countries which suggests that they have less chance to suffer from a solar energy curse because their institutional qualities are 'relatively' high. However, as mentioned earlier, one should not conclude that the energy importers will not suffer from a solar energy curse because their institutional qualities can not be considered high as their institutional qualities are below the average (0), and their institutional qualities are still closer to the resource cursed boundary-countries rather than to the resource curse avoided/escaped boundary-countries. In other words, they still need to improve their institutional quality, regarding the Rule of Law dimension, in order to properly avoid a solar energy curse.

Regarding the Control of Corruption dimension, the result shows that the North African energy exporters are already suffering from the resource curse, and the five North African countries have the potentials to suffer from a solar energy curse. Though it appears that the five North African countries' chances of suffering from a solar energy curse may be the same according to table 30, Libya clearly has a higher chance of suffering from a solar energy curse as seen in figure 16. Nevertheless, the need for institutional quality improvement, regarding the Regulatory Quality dimension, is applicable to all five North African countries.

Overall, it could be argued that there is not a single country, among the five North African countries, which has a comparable institutional quality, in all dimension, to the resource curse avoided/escaped boundary countries with higher institutional quality. In other words, the North African energy exporters have not avoided/escaped from the resource curse, and the five North African countries are all projected to suffer from a solar energy curse if their current poor institutional qualities are to remain in the future.

As can be seen from the institutional quality comparison in all dimensions, the North African energy exporters are all suffering from the resource curse in certain degrees, thus having a greater potential to suffer from a solar energy curse. Here, especially, Libya appears to be suffering from the resource curse the most and also has the highest possibility to suffer from a solar energy curse in the future. On the other hand, according to table 30, Tunisia appears to have the least chances of suffering from a solar energy curse among the five North African countries. However, Tunisia's institutional quality is only slightly higher than the rest of the North African countries but their

institutional quality still remains quite low. As seen in section 6.2.2, Tunisia's institutional quality is closer to the resource cursed boundary-countries than the resource curse avoided/escaped boundary-countries.

What one can see in general from the above institutional quality comparison is that the North African energy importers often have higher institutional quality compared to the North Africa energy exporters. For example, the institutional qualities of Morocco and Tunisia are better than Libya in all dimensions except for the Political Stability and Absence of Violence dimensions, and their institutional qualities are higher than Algeria regarding the Regulatory Quality and Rule of Law. Nevertheless, their institutional qualities are still closer to the resource cursed boundary-countries than the resource curse avoided/escaped boundary-countries.

Overall, though some countries have higher institutional quality than other within the five North African countries, their institutional qualities are quite poor. In other words, the North African energy exporters may already be suffering from the resource curse, and, more importantly, the five North African countries have the potentials to suffer from a solar energy curse if their institutional qualities remain poor in the future.

6.3.2. Limitations and Additional Findings

By looking at all the institutional quality comparisons made in section 6.2.2, it is possible see that the institutional quality is not always paralleled with the development status. Throughout the analysis, one can see that, such as in the case of the Voice and Accountability dimension, there are cases that the institutional quality of the least developed resource cursed boundary-countries is higher than the developing resource cursed boundary-countries or even similar to the resource curse avoided/escaped boundary-countries. Similarly, there are cases that the institutional quality of the resource curse avoided/escaped developing boundary-country, such as Malaysia, appears to be similar to the resource cursed least developed boundary-countries. Of course, a part of this outcome may be from the use of the 95 percent confidence level (double standard error). However, the application of the 95 percent confidence level, overlaps of the confidence intervals of the resource cursed least developed boundary-countries and the resource curse avoided/escaped developing boundary-countries, can not be the entire explanation as there are cases that their institutional qualities are quite similar such as Sierra Leone and Malaysia regarding the Voice and Accountability dimension. Therefore, it would be incorrect to argue that institutional quality is always paralleled to the development status. Despite this outcome, what is still proven is that the resource curse avoided/escaped boundary-countries do tend to have better institutional quality than the resource

cursed boundary-countries, and they tend to have higher development statuses. Particularly, the developed resource curse avoided/escaped boundary-countries, the Netherlands and Norway, always have better institutional quality than the resource cursed boundary-countries. Therefore, institutional quality still plays a crucial role in determining whether a country is to suffer from the resource curse or to avoid/escape from the resource curse. In other words, the improvement of the institutional quality can play a crucial role for the five North African countries to avoid a potential solar energy curse in the future.

Lastly, as illustrated earlier, selecting Sierra Leone and the Netherlands as additional boundary-countries did not fulfill the main requirement for being boundary-countries where resource rent size is to consist of more than 10 percent of their GDP. One may argue that this may have affected the outcome of this section. However, as seen throughout this section, the Netherlands (resource curse avoided/escaped boundary-country) has higher institutional quality than Sierra Leone (resource cursed boundary-country) in all dimensions. Also, the development status of the Netherlands is higher than Sierra Leone. In other words, though the resource rent size to be 10 percent of GDP was not applied for these two countries, it is possible to see that selecting these countries did not hinder the purpose of this section and results.