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### **Refining Oil – A Way Out Of The Resource Curse?:**

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## **Abstract**

This paper analyses variation in the refining capacities of oil-producing countries and its economic and institutional outcome within the resource curse framework. It argues that the absence of refining capacities in oil-producing countries is not simply the result of the nature of the commodity, but rather the outcome of engineering political relations out of energy flows. Increasing refining capacities in oil-producing countries may not only improve the economic outcome by enhancing linkages between oil production and other sectors of the economy but also mitigate the negative institutional effect associated with oil rents and power concentration as political groups linked to the petrochemical sector increase their bargaining power vis-à-vis the government.

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## Acronyms

B&B	Bulte and Brunnschweiler
BP	British Petroleum
CFO	Chief Financial Officer
IIR	Industrial Information Resources, Incorporated
J&W	Jones Luong and Weinthal
MNOC	Multinational Oil Companies
NOC	National Oil Companies
OECD	Organization for Economic Cooperation and Development
OLS	Ordinary Least Squares
OPEC	Organisation of Petroleum Exporting Countries
Total S.A.	Total Société Anonyme
UNDP	United Nations Development Program
WHO	World Health Organisation

## I. Introduction

The highly charged nature of the process of increasing refining capacities is clearly shown in the current negotiations between the government of Uganda and international oil companies. The centre of the debate is whether Uganda should invest in pipelines or in the construction of a refinery to make the most out of its newly explored oil fields at Lake Albert. The president of Uganda is campaigning to construct a large refinery so as to provide added value to the industry, ensure energy security and foster domestic consumption (“Museveni Blasts Oil Companies over Refinery” 2013). Considering the economies of scale in oil processing, however, a refinery only becomes internationally competitive when producing large quantities. Seeing that demand for refined products in Uganda is relatively low the Chief Financial Officer (CFO) of Total S.A., the French oil giant, argues that it is more efficient to build pipelines to the coast, export crude oil and buy fuel from mega-refineries abroad (“Total CFO: ‘Difficult to Understand’ Uganda” 2013). Hence, Museveni’s campaign to build a large refinery and to use the mineral wealth for domestic and regional consumption faces criticism from international oil companies, which are warning against another white elephant project. An insensible decision at this stage could add another country to the list of those suffering from the resource curse (“Pipeline Poker” 2013).

The main objective of this paper is to explore how increased refining capacities in oil-producing countries may mitigate the effects of the resource curse. The upstream sector refers to the exploration and production of petroleum, while processing of oil is associated with the marketing and distribution of petroleum products, which is commonly referred to the ‘downstream sector’ of oil production and used interchangeably in this analysis (Vassilou 2009, xi). Mineral-based development is perceived to have largely failed in latecomer economies, giving rise to the idea of the resource curse, which describes the paradox that an abundance of resources results in a negative socioeconomic outcome (Rosser 2006, 7). According to literature on the resource curse, an abundance of primary commodities causes low economic growth (Sachs and Warner 1995); civil conflict (Collier and Hoeffler 2005); and weak institutions (Isham et al. 2002). In particular, oil production is considered to be capital-intensive and have few linkages to other sectors of the economy. Along with the perceived failure of mineral-based development the research on linkages has decreased sharply since the 1970s (Karl 1997, 52; Ross 1999, 305). However, recent studies suggest that the extractive sector can be strongly linked to other sectors of the economy (Fattouh and El-Katiri 2012, 29). Moreover, Chinese state-owned oil

companies are increasingly investing in 'grassroots refineries' in developing countries, demanding a more detailed investigation of the potential socioeconomic outcome of downstream sector expansion ("Africa: CNPC Leads Africa's Refining Investments" 2010). An analysis of the literature illustrates that the absence of refining capacities in poor oil-producing countries is not necessarily a function of the nature of the commodity but also a result of engineering political relations which favoured the energy security of consumer countries over expansion of the refining industry in oil producers. Countries that were able to expand refining capacities appear to have benefitted from the linkages of oil production (Clark 1990, 330; Mitchell 2011, 5).

This analysis is encouraged by recent findings which show that mineral wealth does not inevitably lead to low economic performance and bad institutional outcomes. Instead of using the ratio of export share to GDP, the conventional explanatory variable in the resource curse literature, Bulte and Brunnschweiler (henceforth B&B, 2008) use new measurements of resource abundance in their cross-country analysis and provide contradicting evidence that mineral wealth positively affects growth and institutional quality. In line with B&B, case studies also show that several latecomer economies have turned mineral wealth into a blessing (Acemoglu et. al 2001; Dunning 2008).

The central argument of this paper is that increasing refining capacities mitigates the resource curse effects by improving the economic and institutional outcomes of oil-producing countries. Firstly, increased downstream capacities may improve the economic outcome by increasing the availability and accessibility of fuel, enhancing linkages to other sectors and diversifying the economy (Fattouh and El-Katiri 2012, 29; Bazilian et al. 2013, 45). Secondly, coupling national strategies for developing downstream capacities with supplying internal demand and energy self-sufficiency may reduce the 'rentier effects' associated with serving an external market (Jones Luong and Weinthal, henceforth J&W, 2010, 62/79). The linkages that emerge as a result of increased downstream capacities may increase the bargaining power of political groups linked to the petrochemical sector (e.g. transport unions), potentially diluting the concentration of power and improving the institutional outcome of oil producing countries (Tornell and Lane 1999, 32).

To my knowledge, this is the first attempt to quantitatively estimate the impact of refining capacities on economic growth and institutional quality. As expected, the empirical results show

that an expansion of refining capacity are statistically significant and positively correlated with economic growth and reduce mineral dependence. However, in contrast to the expected positive effects on institutions, the results show that refining capacity does not have any statistically significant effect on rule of law or government effectiveness. Due to empirical limitations, these results are to be interpreted with caution and do not provide sufficient grounds to make any causal statements. Considering the statistical limitations, this paper engages in a discussion of the results to provide further explanations of potential socioeconomic outcomes which seem to prevail despite increased refining capacities, including ownership structure, corruption and inequality. The findings of this paper are then used to discuss contrasting policies between Western and Chinese oil-related development interventions.

The rest of this paper is structured as follows: Section II provides a review and analysis of the literature on the refining industry within the resource curse framework. Section III will discuss the empirical methodology. Section IV reveals the results. Section V discusses the results. Section VI provides policy implications. Section VII will conclude.

## **II. Literature Review**

### **II.1. Mineral wealth, refining and enclave economy**

The resource curse literature argues that oil-abundant countries experience low economic growth because of the enclave nature of the industry. Studies focussing on oil producing countries and economic growth after the 1970s have linked natural resources to the development of insular industries around the extractive sector, with a congruent neglect of the growth of an essential manufacturing sector (Fattouh and El-Katiri 2012, 29). Karl's (1997) analysis of the effects of the oil booms in the 1970s on the major oil exporting countries is central to the concept of the oil curse. The author advances the claim that oil-exporting countries such as Nigeria, Venezuela and Saudi-Arabia experienced poor growth and became increasingly autocratic because of the enormous oil revenue during oil shock. Among other reasons, the author's explanation of the oil curse centres on the 'enclave nature' of oil production. Karl's argument of the enclave economy focuses on the nature of the commodity, which is capital-intensive with few employment opportunities. The author argues that oil

production has few linkages to other sectors, is transported in pipelines and does not facilitate regional development (ibid., 52). However, recent studies suggest that the extractive sector can be strongly linked to other sectors (Fattouh and El-Katiri 2012, 29). For this reason the linkages of oil production are analysed in the following section.

### **II.1.1. Linkages of oil production**

Major advances in the conceptualization of linkage analysis were made by Hirschman (1981). Hirschman elaborated the work of economic historians which sought to explain the development of manufacturing in Canada as arising in large part from linkages to primary commodities, also known as 'staples theory' (Innis 1957, Watkins 1963). Hirschman's analysis characterizes successful resource-based development as an incremental unfolding of linkages between the commodity and related economic activities and proposed three major types of linkages from the commodity sector: fiscal, consumption and production linkages. Fiscal linkage is defined as the resource rents which are used to fund the development of industry in sectors unrelated to commodity production. Consumption linkage refers the demand for locally produced industrial goods which is generated by the incomes earned in the production of commodities. Production linkages are divided into forward and backward linkages. Backward linkages refer to the supply of inputs. Forward linkages, the focus of this paper, describe the processing of commodities (Kaplinsky et al. 2012, 20).

Ideally, development is based on staples that encourage the simultaneous presence of all linkages. However, given that oil production employs relatively few workers, their aggregate final consumption expenditure is relatively low. Production linkages such as oil processing have also rarely emerged. For this reason, low growth rates among oil producing countries are explained by the dominance of fiscal linkage over other linkages. As a result of the high revenues from oil, fiscal linkages may block production linkages, since tapping the income stream provides the foreign exchange to buy abroad and removes incentives for economic activity at home (Karl 1997, 52).

In contrast to the weak linkages observed among many oil exporting economies of today, development of early industrializing countries with mineral wealth was successful because of the linkages of oil production. Wright and Czelusta's (2003) study of mineral-based development



shows that there are strong linkages between oil and other sectors. The authors argue that the development of manufacturing in the U.S. in the 19th and 20th centuries, as well as the recent development of industry in Norway, can be directly traced back to the synergies arising between mineral production and the domestic industry. Economic development in the US was based on the exploitation and domestic consumption of fossil fuels, which was accompanied by investments in both the upstream and downstream sectors. Extraction of oil in California went hand in hand with an expansion of refining activities which provided a secure supply of fuel to the transport industry and, later, the petrochemical industry. Moreover, manufacturing activity, which quadrupled in the same period, stands in stark contrast to the Dutch Disease<sup>1</sup> effects prevalent among countries with a high resource relative to GDP ratio. However, apart from the US and Norway the expansion of downstream activities has largely been unsuccessful in latecomer economies, particularly in Sub-Saharan Africa (ibid., 2/14).

Alongside successful linkage development in the US, there are also potential linkages between oil production and other sectors in low income countries with mineral wealth. Economic activity in many oil-producing countries has been hampered by unstable energy markets and the unmet demand for energy products. An analysis of energy markets in Sub-Saharan Africa shows that landlocked countries in Africa have been particularly affected by fuel shortages, rationing, and other supply disruptions in the countries from which they import petroleum products. For instance, Rwanda and Uganda have experienced disruptions and substantial increases in the price of fuel as a result of logistical problems (Kojima 2009, 5/17). Clearly, domestic production of petrochemical products can reduce the need for procurement from abroad and provide a stable source of energy, especially for landlocked oil producers.

A closer observation of the oil industry shows that the absence of production linkages in latecomer economies is the result of international oil politics rather than the enclave nature of the commodity. Notwithstanding the intention of oil producing countries to add value to their mineral wealth, they have not been able to increase downstream capacities, mainly due to oligopolistic control over technology. Oligopolistic control of the industry by multinational oil companies (MNOCs) has thwarted competition to secure energy supply by controlling international production and oil technologies, especially in the refining sector (Clark 1990, 370). An emphasis on local refining has been an essential strategy of consumer countries to secure

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<sup>1</sup> For a further discussion on Dutch Disease, see section V.1.1.

their energy supply, regardless of economic factors (OPEC 2012, 227). In the Middle East, for example, MNOCs have collaborated to delay the emergence of an oil industry. When Royal Dutch/Shell, now known as British Petroleum (BP), began building an oil industry in Iraq in the 1920s, it planned a pipeline to carry the crude oil to refineries in Europe. When a nationalist government later requested that BP build a modern refinery in Iraq, the company vigorously opposed the demand (Mitchell 2011, 5). World Bank policies aided and abetted the MNOC's control by refusing credits for oil and gas development and denying funding to nationally owned ventures (Clark 1990, 166).

As illustrated by the example of Iraq above, the failure of this producing country to increase refining capacities was caused in part by collaboration between MNOCs and international organizations which favored energy security in consumer countries over mineral-based development of oil producers. Taxation became the most important source of returned value in the latecomer economies with mineral wealth because of the tendency to locate refineries in consuming countries, with the result that production linkages, a potential source of employment and local expenditure, were lost (Philip 1994, 135).

Clark (1990) argues that newcomers succeeded to increase refining capacities not because of competitive superiority but because the producing states sought to diminish the role of the MNOCs. Iran and Algeria, for example, nationalized the oil industry during the 1960s and implemented policies to improve their share of downstream activities, aiming at independent sales of oil products and liquefied natural gas. As a consequence of this intervention, the author argues, Iran enjoys much higher non-fiscal returned value, while consumer goods output and industrial employment significantly increased in the country. The relative success of increasing downstream capacities may have thus reduced the dominance of fiscal linkage. Nigeria and Venezuela, on the other hand, had not nationalized their oil industries or promoted their downstream sector. Despite the fact that Nigeria and Venezuela expanded oil revenues through upstream activities, linkages between oil and the economy remained more tenuous than those in Algeria and Iran (ibid., 165/293/370).

### **II.1.2. Competitiveness of refining industry in developing countries**

Another explanation of the enclave is the competitive disadvantage of poor oil-producing countries. Karl (2007, 7) argues that downstream processing industries have typically not

emerged in low-income countries, and when they do, they are often at a competitive disadvantage. In line with Karl's argument that refineries in developing countries are not competitive, the economics of oil movement and refining imply that there is a preference for locating refining capacity in consuming regions. In addition to poor returns in immature markets, the transport costs for crude oil are lower, as opposed to oil products (OPEC 2012, 227). As a result of the prevalent political instability in poor oil producers, operating oil companies also have hardly any interest in investing capital in oil producing countries (Bazilian et al. 2013, 45). Moreover, downstream activities do not emerge in oil producing countries because of the economies of scale. As a rule of thumb, refineries are said to become competitive in a liberalized market only when they process more than 100 000 barrels per day. This represents a significant entry barrier for developing countries to construct a refinery (Kojima et. al 2010, 19).

Further investigation into recent developments in the oil markets illustrates that refineries are not necessarily at a competitive disadvantage in developing countries. Firstly, global oil production is experiencing a large shift from a reduction of refining capacities in high-income countries to an expansion of downstream activities in developing countries. In many OECD countries, refineries have been closed down or are scheduled to be closed down within the following years. In non-OECD countries, on the other hand, the demand for refined products is rapidly increasing. As has been the case in recent years, the largest additions to refinery capacity to meet the growing demand are expected to occur not only in China, India, and the Middle East, but also in Africa (OPEC 2012, 241).

Secondly, technological progress in the oil industry has made the construction of refineries commercially viable in low-income producers. An analysis of Chinese national oil companies (NOCs) in Africa and Central Asia suggests that Chinese NOCs have developed technologies over the years that can turn certain oil projects in Africa, those considered by Western oil companies to be of no value, into profitable operations (Jiang 2009, 602). Evidence seems to confirm that the refineries are fully competitive in local and regional markets. For instance, the Djermaya refinery project in Chad was considered unprofitable by French and US oil companies (Dittgen and Large 2012, 10). A recent analysis by the International Monetary Fund (IMF), however, finds that the newly built refinery by the Chinese National Petroleum Corporation (CNPC) in Chad is economically viable, meaning that there is a considerable margin between the costs of crude oil input and operation of the refinery and the sales of refined products (IMF 20013b, 12).

Chad does not seem to be unique with regard to the feasibility of increased refining capacities, as other assessments on the downstream sector also find that a refinery is financially feasible. In contrast to the claim made by the CFO of Total S.A. outlined in the introduction of this paper, a study by Foster and Wheeler finds a refinery to be feasible in Uganda and recommends that the country should refine oil domestically instead of exporting crude oil. Domestic refining capacity ensures more secure domestic fuel supplies, creates more jobs and has a more favourable outcome on the balance of payments and exchange rate compared to a model where all crude oil is exported (“Swiss Study Urges Uganda to Build Oil Refinery” 2013).

### **II.1.3. Refining and economic diversification**

Latecomer economies that pursued policies to increase downstream capacities were able to benefit from production and consumption linkages. As the example of Iran highlights, oil production has numerous linkages which may foster economic development. In the oil industry, the term forward linkage refers to the actual physical output from the petroleum sector, which feeds into the rest of the economy as intermediate inputs. The forward linkages in the oil and gas sector include the crude oil input into the refining industry, the input of refined products into the petrochemical industry, the input of oil and gas fuels into electricity production and energy-intensive industries (Oyejide and Adewuyi 2011, 18).

Remarkably, the processing of oil and the associated increased consumption of petrochemical products has been the first step towards diversification among oil-producing countries. In Arab countries, policies that encouraged the downstream sector facilitated economic diversification and have contributed to the development of not only the oil industry but also the manufacturing sector. For instance, exploitation of production and consumption linkages in Arab countries has led to growing shares of manufacturing and services and, hence, the non-oil activities in GDP. The first contribution of the oil sector towards diversification in countries such as Saudi-Arabia and Bahrain was the development of the refining industry. Today, In Bahrain the petrochemical industry represents the main driver of economic diversification, selling rubber, plastics and other petrochemicals to more than 150 countries (Al-Moneef 2006, 18; “Bahrain Investing in Plastic Polymers.” 2013).

In other oil producing countries, strong linkages can also be observed between the petrochemical sector and other sectors of the economy. In India the vast majority of fertilizer plants access petrochemical products from domestic refineries, making India one of the largest fertilizer producer in the World (Clarke and Graczyk 2010, 27/45). Similarly, the plastics industry in Enuge state, Nigeria, benefits from the production linkage by sourcing its petrochemical products from the domestic refinery. It is one of the few industries that have proven to be competitive against the inflow of cheap Chinese products (Brautigam 2009, 207).

As can be seen from the examples above, increased refining capacities may mitigate the resource curse effect by diversifying the economy. Increased availability, accessibility and reliability to fuel provide considerable production and consumption linkages and may thus offer the possibility to break out of the enclave economy in oil-producing countries by providing a source of energy to other sectors of the economy (Al Moneef 2006, 18/19). Once the significant intra-sector and inter-sector linkages emerge, the institutional outcome of oil producing countries may considerably change, which will be analysed in the following section.

## **II.2. Mineral wealth, refining and institutions**

According to the resource curse theory, one of the central mechanisms by which mineral-rich countries experience low economic growth is through its effect on institutions. Institutions refer to the humanly devised constraints that structure political, economic and social interaction (North 1991, 97). The literature on the resource curse considers the problems associated with the 'rentier state' central to the negative institutional outcome of mineral-rich countries (Rosser 2006, 16). Mahdavy (1970, 1) coined the term in terms of its current meaning: a state that receives substantial rents from foreign individuals, concerns or governments. In oil-producing countries, 'rentier effects' refers to the unearned income received in the form of taxes on mineral exports or royalties on mineral production. Because these states have large amounts of oil rents to spend from external sources, they are geared towards the political distribution of rents rather than promotion of private economic activity, production and economic growth (Rosser 2006, 16). This claim is supported by the empirical findings of Isham et. al (2002, 2) whose study on export structures illustrates that countries rich in 'point source' natural resources, such as oil or metals, experience lower economic growth since the 1970s compared to countries with 'diffuse' natural

resources such as wheat or rice. These findings are explained by the negative effects of point source resources on institutional quality. The resource curse literature provides several explanations as to why a high oil export share leads to a deterioration of institutional capacity and autocratic regimes, including capture of oil rents, concentration of political power, weak accountability and corruption (Isham et. al 2002; Rosser 2006; Tornell and Lane 1999).

Turkmenistan embodies the classic model of the rentier state based on the rapid exploitation of its oil and gas reserves for export (J&W 2010). As a result, energy rents accruing directly to Turkmenistan's government between 1994 and 1999 were estimated to be between 33 and 64 per cent of GDP. The employment of substantial mineral rents enabled the government to fill its capital city with gold-plated statues and four-star hotels and provide its rural population with free gas, water, and salt. Yet, the rural population is deprived of basic education and healthcare (ibid., 78-79). Next to Turkmenistan, Nigeria reflects one of the most dramatic examples of the deleterious impact of oil rents on institutional quality. Sala-i-Martin and Subramanian (2003, 5) argue that corruption, weak governance and rent-seeking as a result of high oil revenues are the main cause of low economic performance.

From these observations, the literature on the resource curse presumes that societies in rentier states react uniformly to their mineral wealth (J&W 2010, 335). However, Dunning (2008, 3-4) argues that this empirical relationship between mineral wealth and bad institutional quality does not always apply to oil-abundant countries. For instance, in Latin America mineral wealth are positively correlated to democracy in time-series cross-section data. For this reason, the author demands an identification of missing variables to explain the variation in institutional outcome among oil producers.

### **II.2.1. Refining and using mineral wealth for domestic consumption**

The institutional outcome may be different in a country whose strategy is to expand its refining capacities and use its mineral wealth for domestic consumption rather than foreign markets. The rentier state theory excludes the possibility of using mineral wealth for domestic consumption. J&W's (2010) analysis on post-Soviet successor states finds that societal expectations in mineral-rich states vary across countries and over time. Domestic refining capacity enable a country to channel its mineral wealth towards domestic consumption rather than exports. The

author argues that societal expectations regarding state spending and taxation are diminished where the mineral sector in question is developed primarily for internal consumption. Because it is not receiving large windfalls from export rents, the perception and reality of the country's wealth are diminished. Consequently, there is less immediate pressure on the state either to embark upon the expansion of public goods and social services or to promote white elephant projects during windfalls. This serves to elongate the time horizons of both governing elites and the population vis-à-vis reaping benefits (ibid., 62/335).

A comparison between Turkmenistan and Uzbekistan's mineral sector confirms this claim. L&W justify this comparison as both countries nationalized their oil industry in the 1990s and did not have a significant petroleum industry prior to Soviet rule. Furthermore, the perception regarding the countries' abundance of mineral wealth was also similar. In contrast to Turkmenistan, Uzbekistan aimed to exploit its mineral wealth to satisfy internal demand and sought international financing to build or upgrade local refineries rather than to discover and exploit new reserves. Remarkably, Uzbekistan became self-sufficient in energy in 1995. In 2000, the share of domestic producer rent relative to total energy rents was very high compared to other post-Soviet states (26.2 per cent of GDP), while the export rent remained low (6.3 per cent of GDP). By way of comparison, in 2000 Turkmenistan's export rent was 43.0 per cent of GDP and the domestic producer rent was even negative, at 5.2 per cent of GDP. Among other factors, the fact that these rents were generated domestically meant that the Uzbekistani government could continue both to tax across sectors and to avoid pledging an immediate expansion of public goods and social services (ibid., 78-79).

### **II.2.2. Engineering institutions with oil production**

A closer examination of political processes in oil producing countries shows that the presence or absence of refining capacities may play a significant role in the institutional outcome of oil-producing countries. The early history of oil production in Venezuela clearly illustrates how the transformation of oil into unaccountable government incomes is not necessarily a cause of the anti-democratic effects of the commodity, but rather the result of particular ways of engineering political relations out of energy flows. When Royal Dutch/Shell, now known as British Petroleum (BP), began producing oil in Venezuela in the early 19<sup>th</sup> century, the country's dictator asked the

company to build its refinery offshore so as to avoid the large concentration of workers and accompanying labour demands that a refinery would bring. In this regard, the author argues that studies of oil tend to focus only on the problems of oil money, the income of oil and its corrupting power, rather than how oil is produced and distributed. For instance, the invention of pipelines was a means of reducing the ability of humans to interrupt the flow of energy. In the 1860s, the first pipelines were introduced in Pennsylvania to circumvent the wage demands of teamsters who transported oil barrels in horse-drawn wagons. Similarly, companies operating in the Baku oil fields in modern Azerbaijan, which produced more than half of the world's petroleum for a brief period in the early 20<sup>th</sup> century, borrowed the pipeline innovation of American oil drillers to undermine the emergence of labour demands in the transport sector (Mitchell 2011, 5/36). Therefore, despite the efficiency of a pipeline to channel energy products, its construction may reduce the potential of linkages to other sectors whose workforce could potentially contribute to a better institutional outcome.

The political effects of the presence of refining capacities and the accompanying labour demands may induce pro-democratic effects. For instance, Iran promoted the development of the refining sector, which produced a large workforce employed in oil processing. As a result, the associated labour unions acquired considerable power given that strikes at the refineries could paralyse the whole economy. Several studies on the history of Iran highlight the political power of the workforce at domestic refineries such as the one in Abadan, which was the largest in the world for a large part of the 20<sup>th</sup> century and employed more than 40 000 workers in 1950 (Parsa 1989, 158; Vassiliou 2009, 51/454). For instance, the 'Abadan strike' in 1929 was the first instance of major industrial action in the country's history and was largely led by refinery workers. The Abadan oil workers were well organised, with a long history of trade unions that stood up to the government in Tehran. In 1979, the strike of 12 000 oil workers in Abadan, demanding higher wages and political reforms, played a significant role in mobilizing other cities to resisting the army and, ultimately, bringing on the Islamic Revolution (Dumper and Stanley 2007, 2). While the development of the downstream sector in Venezuela was initially hindered by fears of opposition forces, the presence of large refining capacities in Iran and the associated industrial workforce appear to have induced democratic processes.



### **II.2.3. Diluting power concentration with refining capacity**

The weak institutional outcome is associated with a concentration of power, whereby oil rents are captured by the political elite. Tornell and Lane (1999) analyse the relationship between the concentration of power and economic growth and illustrate that mineral-dependent countries frequently respond in a perverse fashion to favourable shocks by increasing more than proportionally fiscal redistribution and investing in inefficient capital projects. Their political model shows that a dilution of power concentration and an increase in the number of political groups lead to better economic performance as multiple powerful groups extract fiscal subsidies. This negative relationship between power concentration and economic performance shows up in their model with a smaller growth rate in the formal sector and a more negative response of the growth rate to a terms of trade improvement (ibid., 32).

An examination of countries with domestic refining capacity shows that labour unions linked to the petroleum industry gain substantial bargaining power, possibly leading to a dilution in the concentration of power and a better institutional outcome. The example of the strikes by petrochemical workers union at the Abadan refinery in Iran, which played a significant role in the democratic processes of the country, has already highlighted how an expansion of the refining sector may dilute the concentration of power. Similar to the situation in Iran, the presence of refinery capacity in Niger shall illustrate how increased refining capacities may improve the institutional outcome in an oil producing country.

While still an unusual country of reference in the resource curse literature, there is reason for Niger to receive more attention in research on oil production and the associated socioeconomic outcome. Boschini et. al 2007 shows that whether mineral wealth is a curse or a blessing is largely determined by the interaction between technical appropriability and institutional quality. Ranked bottom of the Human Development Index (UNDP 2013), Niger does not seem to be able to appropriate the technology-intensive industry of oil due to the country's weak governance structures and low human capital. As a consequence, Niger may not be able to translate the recent oil investments into sustained economic growth. However, the particular contract between Niger and the CNPC includes the investment in the Soraz refinery in Zinder with a capacity of 20 000 barrels per day, as part of mineral extraction in the Agadem oil fields (Idrissa and Decalo 2012, 406). Shortly after the inauguration of the refinery in 2011, fuel

imports nearly came to a halt, while internal demand was almost exclusively satisfied by the NOC (IMF 2013a, 42).

An analysis of the recent political trends in Niger shows that the linkages that emerged as a result of domestic refining capacity may have pro-democratic effects, possibly improving the institutional outcome. In particular, an increase in the bargaining power of labour unions linked to the petrochemical sector may diffuse the distribution of power. In the absence of a pipeline in Niger, the regional distribution of petrochemical products from the Soraz refinery depends exclusively on the domestic transport sector. An ethnographical observation suggests that, as a result, social groups linked to the petrochemical sector such as the truckers have started to express political interests and demanded more accountability from the government<sup>2</sup>. The newly-emerged linkage between oil production and distribution requires the government to meet the demands of workers in the transport and petrochemical sector. For instance, following a notice of the transport, trader and petrochemical unions to go on strike, the government signed an agreement protocol to rehabilitate the roads to ensure smooth transport, clearly outline the necessary payment of taxes levied on the distribution of fuel and accelerate the release of political prisoners ("Signature de protocole d'accord" 2012).

As the example of Niger highlights, the presence of domestic refining capacity and sales of petrochemical products requires the government to respond to the demands of workers linked to the petrochemical industry (e.g. transport unions), whose economic activity may contribute to the development of the non-hydrocarbon sector. This observation is in line with Ross's argument on the relationship between mineral wealth and democracy in Latin America. The author argues that Latin American countries are more democratic than other oil-producing countries because of their strong labour unions, which makes it harder for governments to keep oil revenues secret (Ross 2012, 229). Therefore, the increased bargaining power of political groups linked to the petrochemical sector vis-à-vis the government may dilute the concentration of power, possibly improving the institutional outcome (Thornell and Lane 1999, 32).

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<sup>2</sup> Schritt, Jannik 2013. Telephone interview by author. London, July 7, 2013

### III. Methodology

I will be testing how refining capacities may mitigate the effects of the resource curse by regressing refining capacities with economic growth and institutional variables. The first hypothesis, whether increased refining capacities may reduce mineral dependence and spur economic growth, is tested using a common equation used in the resource curse literature. Sachs and Warner (1995) found a negative relationship between mineral dependence and economic growth by regressing economic growth with the ratio of mineral exports relative to GDP per capita. Equation (1) is a replication of Table 3, column 1, of B&B (2008, 257) using their dataset:

$$(1) \text{ g7000} = \text{minxp7080s} + \text{lgdp70} + \text{ttgrowth7098}$$

“g7000” is the log of growth of real GDP per capita between 1970 and 2000, “minxp7080s” represents the GDP share of total yearly mineral exports, averaged over 1970 and 1989, “lgdp70” and “ttgrowth7098” are additional control variables: the log of real GDP per capita in 1970 and change in terms of trade between 1970 and 1998, respectively.

I estimate the effect of refining capacities on economic growth and mineral dependence by adding the logarithm of refining capacities to equation (1):

$$(2) \text{ g7000} = \text{minxp7080s} + \text{lgdp70} + \text{ttgrowth7098} + \text{lref00}$$

“lref00” is the log of worldwide refining capacities in 2000. The logarithm of refining capacity is used because the data is badly skewed (see Appendix 1). The data on refining capacities was obtained from a survey published by the Oil & Gas Journal (1999).

To test the hypothesis that increased refining capacities may improve the institutional outcome of countries with mineral wealth, I will replicate two further equations and add the variable on refining capacity. Institutional outcomes are distinguished between durable and changeable institutions. ‘Durable institutions’ refer to persistent constitutional variables such as regime type or electoral rules; ‘Changeable institutions’ are defined as more flexible policies such as rule of law, contract enforcement, police and crime (ibid., 250). Equation (3) is a replication of of B&B (2008, 255) table 2, column 6, and estimates the effect of mineral exports and subsoil wealth on durable institutions:

$$(3) \text{ goveffect} = \text{latitude} + \text{Insubsoil}_{1994} + \text{minxp}$$

Equation (4) is a replication of table 2, column 8 (ibid.), and estimates the effect of mineral exports and subsoil wealth on changeable institutions:

$$(4) \text{ rule} = \text{latitude} + \text{Insubsoil}_{1994} + \text{minxp}$$

“*rule*” represents the quality of contract enforcement, the police and the courts, as well as the likelihood of crime and violence in 1996; “*Insubsoil\_{1994}*” is the log of subsoil assets, estimated in US\$ per capita for 1994; “*goveffect*” measures the quality of the bureaucracy and of public services in 1996. “*Latitude*” is measured in absolute terms and is used as an instrument for institutions, which is common in the literature.

I estimate the effect on refining capacities on the institutional outcome by adding the refining variable to equation (3) and (4):

$$(5) \text{ goveffect} = \text{latitude} + \text{Insubsoil}_{1994} + \text{minxp} + \text{lref00}$$

$$(6) \text{ rule} = \text{latitude} + \text{Insubsoil}_{1994} + \text{minxp} + \text{lref00}$$

### III.1. Limitations

Seeing that B&B extensively discuss their dataset in their publication, this section only considers data limitations with regard to refining capacities<sup>3</sup>. Due to lack of data, this analysis does not include data on refining prior to the year 2000. Ideally, the dependent variable (*lref00*), refining capacities, would reflect the time period of the independent variable (1997 for *goveffect*, 1996 for *rule*, and the average between 1970 and 2000 for *g7000*). Seeing that the refining capacities increased globally between 1970 and 2000, the effects of refining capacity on growth are biased upwards. Nevertheless, as refining capacities change only slowly over time, the data on worldwide capacities from the year 2000 appears to be a good explanatory variable (compare Appendix 1 and 2). Furthermore, refining capacities do not necessarily reflect actual production. For instance, Nigeria produces well below capacity due to inefficient management of the refineries (Odulari 2008, 9). Another data limitation is the small sample size in B&B’s publication.

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<sup>3</sup> For a critical discussion on the limitations of the B&B dataset, see their study.

The observations do not include oil producers of the post-Soviet region. Seeing that post-Soviet countries have considerable variation with regards to mineral wealth and refining capacities the inclusion of these countries may change the results.

Several endogeneity concerns arise in estimating the equations. Studies on energy transition do not clarify whether an increase in energy consumption causes economic growth, or vice versa (Elias and Victor 2005, 11). The results may thus suffer from reverse causality, whereby economic growth is driving the demand for petroleum products and refining capacity. Reverse causality is also a concern when regressing refining capacity with institutional variables, since good institutions may provide a legal environment that encourages investments in refinery projects. Refining capacity may also suffer from omitted variable bias. For instance, studies on oil often treat downstream capacities as a function of upstream capacities (e.g. Wetherill 2010, 3). However, the literature review illustrates that there are countries which promoted the downstream sector (e.g. Uzbekistan) and others that did not do so (e.g. Venezuela), independent from their upstream activities. Consequently, this analysis argues that refining capacities are not only a reflection of upstream capacities but also the result of national strategies to use mineral wealth for domestic consumption instead of exports. Finally, the estimation does not identify the causal mechanisms behind the empirical relationships.

These endogeneity concerns could be mitigated by instrumenting for refining capacities. In this empirical analysis, however, I could not find an appropriate instrument for refining capacity which would allow a better empirical identification of causal relationships.

## IV. Results

### IV.1. Economic effects

In Table 1 I show the OLS results of equation (1) and (2), regressing economic growth and mineral exports, without and with refining capacity. In column 1 the regression of economic growth (*g7000*) and mineral exports (*minxp*) without refining capacity confirms the resource curse literature. The coefficient of *minxp* enters with a significant and negative sign, controlling for initial income (*gdp70*) and the change in terms of trade (*ttgrowth7089*). In column 2 I introduce the variable for refining capacity (*lref00*), which only reduces the number of observation from 56 to 51. As expected, the relationship between refining capacity and economic growth is positive and statistically significant at the 1% level. Interestingly, when introducing refining capacity, the effect of the coefficient *minxp* is reduced and becomes insignificant. This indicates that an increase in refining capacity is empirically correlated with positive economic growth and reduces mineral dependence.

**Table 1**  
**Mineral exports, growth impacts and refining capacity**

	(1) <u>g7000</u>	(2) <u>g7000</u>
<i>minxp</i>	-6.57519* (3.55492)	-4.14304 (3.26893)
<i>lgdp70</i>	0.13384 (0.22858)	-0.36340** (0.17405)
<i>ttgrowth7098</i>	0.51305*** (0.13236)	0.49730*** (0.12049)
<i>lref00</i>		1.33882*** (0.30071)
Constant	5.46397** (1.81853)	1.63534 (1.75015)
Observations	56	51
R-squared	0.26342	0.53795

Notes: Dependent variable is (log) economic growth 1970 – 2000. All regressions are OLS. Robust standard errors in parentheses. \*, \*\*, \*\*\* Statistically significant at 10%, 5%, and 1%, levels, respectively.

## IV.2. Institutional effects

In Table 2 I show the OLS results of the equations (3), (4), (5), and (6), regressing institutional quality against subsoil wealth and mineral dependence, without and with refining capacity. Column 1 and 3 show that mineral wealth is positively and statistically significant at the 5% level, whereas the *minxp* is negative but statistically insignificant, controlling for *latitude*. As expected, when introducing log of refining capacity in column 2 and 4, the coefficient *Iref00* enters with a positive sign, only reducing the number of observations from 61 to 55. However, *Iref00* is not statistically significant. In contrast to our expectation, refining capacity does not have a significant effect on neither rule of law nor government effectiveness.

Interestingly, in table 2 the coefficient *rule*, negative in column 1, turns positive with refining capacity in column 2. This indicates that refining capacity may reduce the negative effect of mineral exports on rule of law. The introduction of the refining variable also reduces the effect of subsoil wealth (*Insubsoil\_1994*) in column 2 but remains statistically significant at the 10% level. Nevertheless, the effect is marginal and has little statistical power. Overall, refining capacity does not seem to have any significant effect on either changeable or durable institutions.

**Table 2**  
**Institutional quality, mineral resources and refining capacity**

	(1) <u>rule</u>	(2) <u>rule</u>	(3) <u>goveffect</u>	(4) <u>goveffect</u>
latitude	2.88676*** (0.63242)	2.99637*** (0.64037)	2.17116** (0.67856)	2.30101** (0.65668)
Insubsoil_1994	0.11024** (0.04725)	0.08980* (0.05092)	0.13155** (0.05593)	0.11650** (0.05222)
minxp	-0.19396 (0.82222)	0.26824 (0.85440)	-1.14459 (0.76979)	-1.14779 (0.87616)
Iref00		0.11727 (0.12330)		0.04975 (0.12644)
Constant	-0.66812 (0.59206)	-1.95977** (0.60559)	-0.29011 (0.57863)	-1.49556** (0.62102)
Observations	61	55	61	55
R-squared	0.77833	0.78881	0.76983	0.77621

Note: All regressions are OLS. Regional dummy variables and constant term included in all specifications. Robust standard errors in parentheses. \*, \*\*, \*\*\* Statistically significant at 10%, 5%, and 1%, levels, respectively.

## **V. Discussion**

### **V.1. Refining and economic growth**

Despite the strong empirical correlation between refining capacities, positive economic growth and less mineral dependence, the results presented in Table 1 should be interpreted with caution. As discussed in the section III.1., due to endogeneity concerns these empirical findings require further identification to make causal statements. It is also important to point out that mineral-based industrialization, emphasizing large-scale industries such as refining largely failed in Latin America. Similarly in Iran, the relatively successful development of the downstream sector in Iran did not lead to broad industrialization (Clark 1990, 310; Karl 1997, 65). This may be due to factors which may negatively impact an oil-producing country, even after development of the downstream sector. Economic theory offers two conceptual approaches, Dutch Disease and inequality, to explain how economic development may be hindered despite refining capacities, which are analysed in the following sections.

#### **V.1.1. Refining and Dutch Disease**

The failure of mineral-based development in latecomer countries may be due to the negative economic effects of oil production, which potentially remain unchanged despite the presence of linkages between refined petroleum products and other sectors. For instance, the negative impact of Dutch Disease effects may also occur in countries which increased their refining capacities. Van der Ploeg and Poelhekke (2009, 746) argue that the positive effect of natural resources on growth is outweighed by the negative effects of commodity price volatility, making price volatility the main driver of Dutch Disease effects. According to the logic of the Dutch Disease, price booms lead to large inflows of foreign exchange. As a consequence, the country's exchange rate appreciates which draws capital away from agriculture and manufacturing (Pegg 2006, 3-4). As outlined in section II, some countries such as Uzbekistan and Niger may have been able to mitigate the effects associated with oil price volatility by expanding the refining capacity and using its mineral wealth for internal consumption rather than exports (J&W 2010, 62). Nevertheless, further research is required to identify how variation in refining capacities alter the Dutch Disease effects.



### **V.1.2. Refining and inequality**

Another cautionary note with regard to the economic impact of increasing refining capacities in oil-producing countries is inequality. Despite the linkages identified in the literature review, the strategy to increase refining capacity does not seem to be sufficient to overcome inequality. The resource curse literature considers the entrenched inequality as one of the mechanisms by which point source resources lead to low economic performance (Isham et al. 2002, 10). Karl's (2007, 2) observation that economic growth in oil-producing countries is hampered by inequality also seems to apply to oil-producing countries which expanded downstream capacities. For instance, despite the presence of mega refineries and relatively high GDP per capita in Saudi Arabia, the country has the highest income inequality among Arab states (WHO 2006, 24). Karl (2007, 14) argues that inequality in Saudi Arabia is encouraged by oil wealth and the recruitment of foreign labour who are generally paid less than nationals, undermining work ethics and contributing to the negative attitude towards manual labour.

Nevertheless, the empirical results confirm the theoretical predictions that countries which develop their downstream capacities may have been able to sustain and achieve higher rates of economic growth. By using mineral wealth for domestic consumption and by promoting the downstream sector oil-rich countries appear to reduce mineral dependence and diversify their economy.

### **V.2. Refining and Institutions**

The absence of a significant effect on the institutional outcome in Table 2 might be due to the fact that the negative effects of oil production outweigh the positive effects of increased downstream capacities. As already mentioned in section II.2., the political effects of increased downstream capacities imply a larger industrial workforce, possibly leading to a dilution of the concentration of power and a better institutional outcome. However, certain negative institutional effects also apply for the refining industry and oil production in general.

### **V.2.1. Corruption in the downstream sector**

Corruption is central in explaining the negative institutional impact of mineral wealth and is defined as the misuse of public office for private gains (Hammond 2011, 352). Karl (2007, 667) argues that corruption in the oil industry takes place not only at the production and export stage but also at the upstream and downstream stage, where massive resources tend to disappear through price transfers that are difficult to track. Despite the difficulty surrounding the empirical measurement of corruption (Olken 2009), there is quite robust evidence from a quasi-natural experiment in Cape Verde, São Tomé and Príncipe that high oil revenues reinforce corruption (Vicente 2010). Similarly, in the downstream industry, there have been strong allegations of corruption against NOC. For instance, the IMF accuses Sonangol, the Angolan NOC, to have misused more than \$4.3 billion in state finances whilst operating the refinery north of Lubito (“IIR Industry Alert” 2002). The negative institutional effects of oil production may thus outweigh the democratic effects of refining outlined in section II.2.

### **V.2.2. State ownership of refineries**

The weak effect on institutions may be contingent on ownership structure and not necessarily a result of downstream strategies of the oil-producing country. Because of the commodity's strategic and economic importance, oil production is predominantly in state ownership. In the 1970s, 80 percent of all petroleum-rich countries in the developing world had nationalized their oil production. During the international context in particular, host governments' interests were fiercely protected over those of foreign investors. Consequently, it is argued that the oil curse is largely a result of nationalization in the 1970s and the negative outcomes promoted by this ownership structure, including corruption, lack of transparency and fuel subsidization, which has led to a decline in the quality and authority of government (IMF 2007, 22; J&W 2010, 28). On the other hand, private domestic ownership of oil wealth is argued to have led to a better institutional outcome, with the state focusing on oil sector regulation. J&W (2010, 123) advance the claim that Russia has turned mineral wealth into a blessing by transferring the oil industry to private domestic ownership. Hence, the weak effects of increased refining capacities on institutions in Table 2 may be explained by public ownership and the negative outcome which this form of ownership promotes. Clearly, certain institutional challenges associated with oil production may remain despite increased refining capacities.

Overall, the findings of this study may provide relevant insights for conceptualizing oil-related development projects and contribute to the discussion on Chinese oil investments in Africa, which is pursuing the integration of both upstream and downstream activities, which shall be further investigated in the following section.

## **VI. Policy implications**

### **VI.1. Channeling development aid into refining?**

The findings of this analysis may have relevant insights for oil-related development projects. The last serious attempt to mitigate the negative socio-economic outcome associated with mineral extraction was the World Bank's support to the Chad-Cameroon pipeline project, completed in 2003. The central feature of World Bank's involvement in Chad was the establishment of a policy framework intended to avoid the resource curse through good governance. As part of the pipeline deal, Chad had agreed to pay 10 per cent of total direct revenues into a future generation fund and 90 per cent to the national treasury, mostly for social expenditure. However, World Bank's good governance approach has not prevented the government's rentier behaviour. The fund was cancelled in 2005 and the World Bank abandoned the project in 2008. In retrospect, evaluations of the project find that the World Bank's interventions have largely failed (Artur Colom-Jaén 2013, 22; Pegg 2006, 3). As outlined in section II.2.2., pipelines also considerably reduce the linkages in the oil-producing country and are built to circumvent labour demands, giving rise to the question development aid can be spent more efficiently.

Whereas the World Bank's interventions to support Chad's oil production focussed on good governance of a pipeline project, oil-related development projects may have a greater impact by supporting the linkages of mineral production. As the findings of this paper show, refineries are strongly correlated with economic growth and a decrease in mineral dependence (see Table 1). Furthermore, refineries in developing countries are competitive in local and regional markets, particularly in landlocked countries (IMF 2013b, 12; MF 2013c, 6). The criticism that development aid has not encouraged downstream activity in low-income oil producers may thus be largely justified (Clark 1990, 166). Only since Chinese NOCs started to invest heavily in the refining sector of African countries, the IMF appears to quietly admit that there are considerable opportunities for downstream activities in poor oil-producing countries by providing financial

support to the newly-built Chinese refinery in Niger. In 2013 the IMF negotiated a loan of US\$ 880 million with the Exim Bank of China to replace the current financing of the Soraz refinery (IMF 2013c, 34).

## **VI.2. Tying mineral extraction into refining – the Chinese mode of oil investments**

Large investments in downstream activity by Chinese NOCs represent a significant departure from the previous experience of African countries receiving oil investments. Whereas investments by 'Western' oil companies were usually limited to extraction and export of crude oil, Chinese engagement in mineral extraction in sub-Saharan Africa differs considerably by supporting downstream activity (Dittgen and Large 2012, 6). The recent oil deals between the CNPC, Chad and Niger were accompanied by investments in joint ventures of the Djermaya refinery and the Soraz refinery, respectively. Both refineries were built not only to process crude oil to satisfy internal demand but also to export petroleum products to neighbouring countries. Apart from the two refineries in Chad and Niger, China has also invested in joint venture projects in the refining industry of Sudan and Algeria ("Chinese Refineries, African Locations" 2012). The question arises whether the Chinese mode of oil investments by tying mineral extraction with refineries mitigates the resource curse effects in sub-Saharan Africa?

Studies on oil identify the trading partner to be a significant determinant of the resource curse effects. With regard to mineral extraction in Africa, it is disputed whether Chinese involvement positively contributes to economic growth in Africa or whether deals between Chinese NOCs and reinforces authoritarianism regimes on the continent (Meyersson et al. 2008, 2-3). The Chinese mode of resource extraction in Africa is different to other oil investments in that it is a package deal of resource extraction in return for infrastructure, supported by an element of aid. Tying mineral investments into particular expenditure may have advantageous for producers by providing an effective commitment technology that locks future governments into investment in resource revenues. As the money does not appear in the budget the government can avoid pressures from lobby groups to spend the money on consumption (Collier and Venables 2008, 20). According to the findings of this analysis it could be argued that locking African governments into processing oil may foster economic growth by providing production and consumption linkages and diversifying the economy. Hence, the effects of the resource curse in African countries with mineral wealth might not be as strong when contracting with China.

With regard to the impact of China on institutions in Africa, several authors highlight Chinese mode of oil investments oil deals may impede democratization in Africa (Collier and Venables 2008, 20; Power et. al 2012, 188). The findings of this paper also suggest that the Chinese mode of investing in mineral extraction and tying it in with refinery projects does not seem to lead to a more democratic outcome than other international oil investments. The negative rentier effects of oil production, reinforced by state ownership and corruption, may outweigh the pro-democratic effects of the refining industry outlined in section II.2.

The economic and political implications of tying oil investments in with refineries are in line with the findings of Meyersson et. al (2008). The authors argue that there is a causal relationship between exporting natural resources to China and economic growth in Africa. At the same time, exporting to China appears to negatively impacts political institutions (ibid., 7/20). Independent from the fact that oil contracts with Chinese NOCs may spur economic growth of African producers, the empirical results of this analysis also suggest that increased refining capacities do not necessarily lead to a better institutional outcome. Many challenges associated with oil production seem to remain. For this reason, by way of conclusion, as Clark (1990, 310) rightly observes, socioeconomic development cannot be bought with a refinery, and requires a balanced approach – one that emphasizes agriculture and rural employment as well as large-scale industry.

## **VII. Conclusion**

The institutional and economic outcome of using mineral wealth to promote economic development is still a topic of intense debate. The resource curse literature highlights the capital-intensity and weak linkages of oil production, resulting in an enclave economy (Karl 1997, 52). The rentier effects of mineral production, involving rent-seeking, corruption and inefficient management, are said to induce weak institutions and poor economic growth (Sala-i-Martin and Subramanian 2003, 5). On the other hand, authors who analyse oil-based development find that oil production does not necessarily produce a weak institutional outcome and low economic growth. To the contrary, the exploitation and domestic consumption of

petrochemical products has considerably contributed to economic growth and democratic processes of oil producers such as the US, Norway and Latin American countries (Dunning 2008, 3/4; Wright and Czelusta 2003, 14). Furthermore, the absence of refining capacities in developing countries with mineral wealth is not simply the result of the enclave nature of the commodity, but rather the outcome of engineering political relations out of flows of energy (Clark 1990, 166; Mitchell 2011, 5).

This paper attempts to contribute to the resource curse literature by focusing on the variation of refining capacities in countries with mineral wealth. National strategies that promote an expansion of the refining industry and internal consumption of fuel may have reduced the rentier effects associated with serving foreign markets (J&W 2010, 62). Increased downstream capacities may increase the availability, accessibility and reliability of energy products, enhance production and consumption linkages, and, ultimately, lead to economic diversification (Al-Moneef 2006, 18-19; Bazilian et al. 2013, 45). As a result, political groups among sectors linked to the petrochemical industry may increase their bargaining power relative to the government. As illustrated by the cases of Iran and Niger in section II.2., the presence of a refining industry large enough to satisfy domestic demand appears to have increased the political power of domestic political actors linked to the oil industry. As a consequence of the interdependence between oil revenue generation and domestic economic agents, governments with increased downstream capacities need to respond to the demands of numerous political groups, possibly leading to a dilution in the concentration of power and an improved institutional outcome (Tornell and Lane 1999, 32).

Merging B&B's (2008) dataset on the resource curse with worldwide data on refining capacity from the Oil & Gas Journal (1999) offers statistical results that provide relevant insights into the debate of development in oil-rich countries. With regard to the socioeconomic impact of refining capacity, the empirical results are mixed. An increase in refining capacity proves to be positively correlated with economic growth and statistically significant. At the same time, the negative effect of mineral dependence becomes insignificant, suggesting that an increase in refining capacity may lead to economic diversification (Table 1). The effect of refining capacity on institutions is also positive. However, the coefficient of refining capacity is statistically not significant in the regressions on rule of law and government effectiveness (Table 2).

The weak institutional effect may be due to the fact that certain rentier effects outweigh the pro-democratic impact of increased refining capacity outlined in section II.2. One of the rentier

effects that seems to remain is corruption, regardless of the size of the refining industry. Corruption is one of the central mechanisms of the deleterious effect of mineral wealth on institutional quality and appears to occur in the upstream as well as in the downstream stage of oil production (Karl 2007, 667). Another explanation of the weak empirical effects of refining capacity on institutional outcome could be the ownership structure of oil production. Due to the strategic importance oil production tends to be managed by public oil companies. The absence of significant effects of refining capacity on institutions may thus be a result of public ownership and the negative outcome promoted by this ownership, including corruption, lack of transparency and societal expectation of subsidizing fuel (J&W 2010, 28). Another factor which remains hidden in the positive empirical relationship between refining and growth is economic inequality. For instance, Saudi Arabia still faces high rates of economic inequality despite operating a large refining industry (Karl 2007, 14).

The findings of this paper provide relevant insights for development policy as regards oil-related investments. International development organizations have been reluctant to channel aid into the refining sector of developing countries (Clark 1990, 166). The central feature of World Bank's recent interventions to tackle the challenges related to investments in mineral extraction has been good governance. However, an evaluation of the Chad-Cameroon pipeline illustrates that the good-governance approach has not reduced rentier behaviour (Artur Colom-Jaén 2013, 22). The fact that the construction of pipelines is associated with circumventing labour demands and possibly delaying democratization processes gives rise to the question of how development aid may be spent more efficiently (Mitchell 2011, 5/36). In this regard, Clark's criticism (1990, 166) that development aid has not been used to encourage refining capacities and domestic sales of petrochemical products may be largely justified. Considering the findings that refining capacities appear to be improve socioeconomic outcome, development aid may be more efficiently spent in supporting the refining industry of oil producers. The Chinese mode of oil investments, tying mineral extraction to downstream sector activities, may be an alternative to the conventional good-governance approach of oil-related development interventions (Dittgen and Large 2012, 6).

Overall, the negative socioeconomic outcome of oil production may prevail despite increased refining capacity, requiring a balanced approach to development in countries with mineral wealth emphasizing agriculture, rural employment and large-scale industry (Clark 1990, 310).

The findings of this paper have also implications for research. Further research into the processing activities of other minerals might provide relevant insights into the possibility of deepening our understanding of mineral-based development countries. Improving the quality of the data on oil processing activities and providing further identification strategies would offer the possibility to identify causal mechanisms and find empirical results with more statistical power. Further observation of grassroots refineries built by Chinese NOCs may also provide relevant insights regarding the impact of refining capacity on socioeconomic outcome in oil-producing countries.



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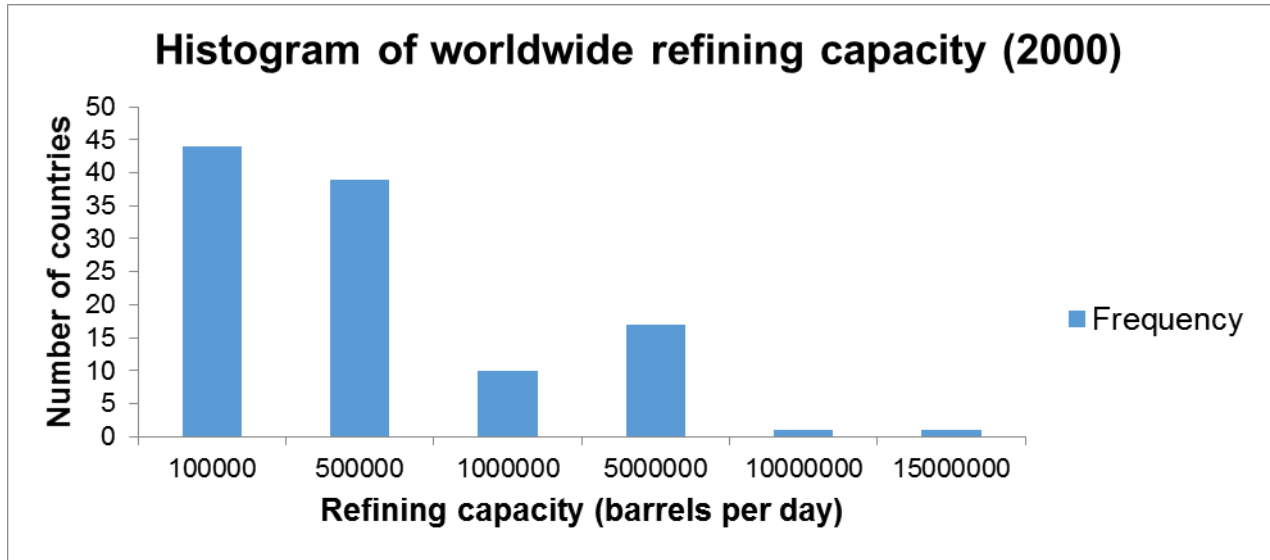
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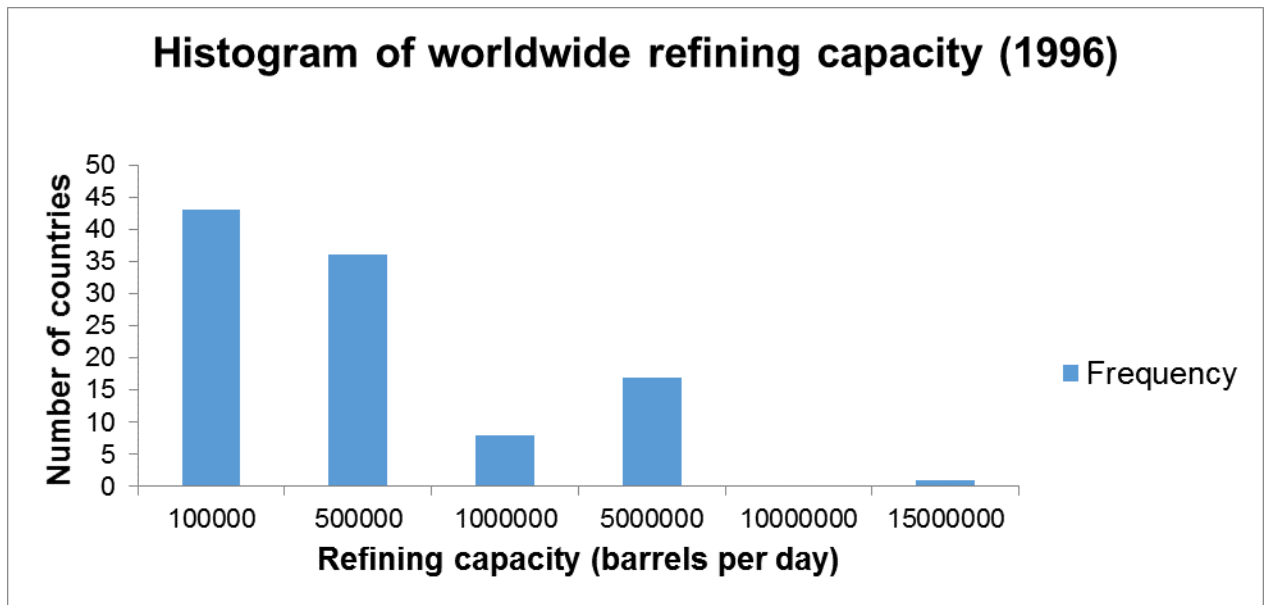
## Appendices

### Appendix 1



Source: Oil & Gas Journal (1999)

### Appendix 2



Source: Oil & Gas Journal (1995)