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Commodities and Corruption

How the Middle Class and Democratic Institutions Lead to Less Corruption in Resource-Rich Countries

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According to a rent-seeking approach to corruption, resource-rich countries are more vulnerable to rent-seeking behavior than resource-poor countries. However, not all resource-rich countries experience widespread corruption. To help explain this puzzle, I propose that the relationship between natural resources (e.g. the depletion of minerals) and corruption is dependent on the composition of the selectorate (through diverse levels of economic development) and the variation of political systems (democracies vs. autocracies). The large-N empirical analysis finds support for the hypotheses: on average, poor, autocratic, resource-rich countries suffer from more corruption than rich, democratic, resource-rich countries. This research contributes to the discussion of resource curses and blessings by suggesting that a closer inspection of a country's political and economic conditions is required to understand the causal link between natural resource wealth and corruption. Whereas the empirical analysis particularly focuses on the validity of the argument for mineral resource wealth and corruption, the overall theoretical and empirical scope of this paper is intentionally broader in nature: The paper also contributes to our collective research understanding of various forms of resource wealth (i.e. mineral depletion, fuel exports, oil wealth or energy depletion) and corruption.

Keywords: corruption; mineral depletion; natural resources; selectorate; middle class; economic development; democratic institutions

1. Introduction

Commodities can be either a blessing or a curse for resource-rich countries, with some suffering badly from corruption while others manage to prosper without any noteworthy bribery.[1] As far as natural resources are concerned, political scientists have identified mainly oil as a substantial cause of corruption, but they have also shown more generally that countries rich in many different kinds of natural resources experience considerably higher levels of corruption than countries without natural resources (Aslaksen, 2007; Gerring and Thacker, 2004; Montinola and Jackman, 2002; Ades and Di Tella, 1999; Leite and Weidmann, 1999; Zhan 2017). However, some empirical examples contradict this finding and demand further research: For instance, Norway (Eriksen and Soreide 2017) and the Netherlands have considerable oil and/or gas fields but are seemingly free from corruption. On the other hand, Sweden and Finland are also corruption-free, have similar societal and economic structures to Norway and the Netherlands but no notable hard commodities.[2]

The controversy among social scientists about whether or not resource abundance encourages corrpution is part of the greater inconclusive 'resource curse' literature.[3] Researchers have recently started to look more closely at the conditions that in some countries translate resource wealth into a *gift from nature*, while in others it becomes a *poisonous fruit*. Contemporary explanations for the causal impact of resource abundance on social, economic, or political conditions offer a rich new world of possibilities that condition the effect of resource richness: Natural resource wealth might increase or decrease economic growth depending on a country's learning process, or learning curve (Stijns, 2005), or on its institutions (see e.g. Tsani, 2013). Others look at the importance of benefit-sharing in high-income mining countries to encourage regional development (Soderholm and Svahn, 2015). The growing majority of literature forces the conclusion that corruption research must also consider country-

specific conditions when modeling the causal effect of resource wealth on corruption. It is only by looking at conditionalities that we can fully understand the relationship between the two.[4]

In this piece of research, I propose that the inconclusive findings on the relationship between resource endowment and corruption can be partly solved by looking at the economic and political conditions in a country. My argument and empirical testing clearly show that modeling the effect of commodities on corruption alone gives too much credit to the negative relationship between resources and graft, as so often found in past research (Aslaksen, 2007; Gerring and Thacker, 2004; Montinola and Jackman, 2002; Ades and Di Tella, 1999; Leite and Weidmann, 1999). Instead, I provide an explanation that also considers resource-rich countries experiencing low levels of corruption, thus contributing theoretically and empirically to the debate about conditional consequences of natural resource wealth on corruption (and therefore also on the effect resource wealth has on the quality of government).

The first part of my argumentation rests on the assumption that the governments of resource-rich countries have more money to spend (also on corruption) because they have larger budgets than resource-poor countries.[5] Budgets are higher because, compared to resource-poor countries, resource-rich governments have an additional source of money: ownership of or taxes on commodities. Higher government budgets mean there is the potential for a corrupt actor (*bribe payer*) to receive larger benefits from bribing the government compared to countries that have few or no resources and therefore lower government budgets. In the same manner, a political actor (*bribe acceptor*) can demand higher grafts if a *bribe payer*'s profit is larger. Further, government officials can also engage in embezzlement of government funds (obtained through natural resources). In sum, natural resource abundance in a country increases incentives for corrupt behavior.

However, given these incentives and the aforementioned puzzle, the question remains: *What causes some governments to spend their money in the interests of the voters (for the good of the general public) and others for the benefit of interest groups (for the good of corrupt actors)?* I contend that the allocation of government money depends on two primary factors: how many actors are competing for the budget and what they offer in return for government spending. In other words, can they offer to elect the government into office (the legal way for voters), or are they offering government officials (im)material benefits (corruption)?

Among other factors, a country's economic development influences the number of competitors for government money. Economic development needs innovation, which, in turn, requires educated workers (or other factors such as foreign direct investments). As an economy develops, one particular group among voters gains strength: the middle class. This group constitutes an additional competitor in the battle over the government's budget distribution and demands that the government spends more money on public goods (e.g. education), offering the government support in the next elections in return. However, it is only when a government is forced to rely on the support of the people to stay in office, i.e. if the voters can determine governmental decision-making through elections (in democracies) that it will agree to voter demands for public goods. Thus, governments have a greater motivation to spend more money on public goods in democratic countries that are experiencing high levels of economic development, which limits the amount of money available for corruption. However, autocratic governments also cannot survive without the support of the people and must respond to certain demands – albeit to a far lesser extent than in a democracy. In comparison to a democratic country, in an autocracy, an additional competitor such as the middle class reduces the budget available for private interests far less. Thus, the increasing effect of commodities on corruption depends on a country's wealth and on its political situation.

My empirical analysis of time-series cross-sectional data tests the hypotheses against space and time, using data from up to 139 countries over 24 years (1984 to 2007).[6] Using an ordered logit model and ordinary least squares regression, I find (significant) empirical support that the increasing effect of commodities on corruption depends on a country's wealth and its political conditions.

2. Natural Resources, Economic Development, Political Rights, and Corruption: A Review of the Literature

Three literature streams are crucial to this research: the effects of natural resources, economic development, and political rights on corruption. The vast majority of previous research on how the availability of natural resources affects corruption appears to focus on individual rent-seeking behavior. There has been little research to date on the relationship between natural resources and corruption (Bhattacharyya and Hodler, 2010). Researchers typically model the interactions between *bribe payers* and *bribe acceptors* to explain that natural resources increase corruption levels by offering incentives for *bribe payers* and opportunities for *bribe acceptors* in government. While these studies contribute to the political economy understanding of the reasons why resource-rich countries often combine poor political governance with slow economic growth, they often neglect the equally important effect of natural resources on the relationship between a government and its selectorate. The rapidly growing amount of literature on patronage also deals with another aspect of a greater effect of natural resources on corruption: how politicians utilize natural resource rents to buy political support. Natural resource rents provide governments with the financial means to offer political supporters material or immaterial benefits in return for their political support. This literature discusses

how the existence of natural resources in a country encourages rent-seeking behavior and patronage, thereby increasing that nation's level of corruption.

The literature on economic development and corruption illustrates how an improvement in economic conditions increases voter education and information levels. Voters who are better informed threaten a government's ability to stay in power since they may uncover corrupt behavior by politicians. Research on democracy and corruption discusses how transparency unveils corrupt behavior and how political rights empower voters to oust corrupt politicians.

A large collection of data allows for more in-depth testing than ever before, and researchers are using these data extensively to increase and improve our level of understanding.

2.1 The Increasing Effect of Natural Resources on Corruption: Rent-seeking and Patronage

Rent-seeking and patronage both offer explanations for the increasing effect of natural resources on corruption. While patronage provides reasoning for the government's engagement in corruption, rent-seeking behavior analyzes the incentives and opportunities for both government officials and actors outside the political sphere to engage in corruption.

Rent-seeking arguments describe three aspects of the causal mechanism of how natural resources provide inducements and opportunities that can lead to corrupt actions between *bribe payers* and *bribe acceptors*. First, natural resource rents constitute important incentives for corruption. Second, political institutions reduce or add to the opportunities for *bribe payers* to obtain these natural resource rents. Third, the recent debate shifted to looking at how rent-

seeking can be reduced by managing resource wealth differently – for instance through resource funds (Tsani, 2015).

Natural resource rents generate incentives for corruption because actors in resource-rich countries may profit more from engaging in rent-seeking behavior than from legal economic activities such as founding a business (Kolstad and Soreide, 2009, 216).[7] Therefore, in resource-rich countries, a substantial number of groups seek to get their share of the natural resource rents.

Yet, the presence of rents from commodities alone does not lead to more corruption. Three conditions are crucial for natural resources to result in increased corruption (Kolstad and Soreide, 2009): the incentive for corruption must be rents from commodities; the political actor must have the authority to decide on the distribution of these rents; and the political actors must only face a slight risk of being caught.

The abundance of rents generated by natural resources can go up either due to a lower number of competitors for a constant amount of total rents or the discovery of additional natural resources (Ades and Di Tella, 1999). For the actors controlling the distribution of rents (i.e. the bureaucrats), higher rents indicate that *bribe payers* will be willing to pay higher prices to get access to the rent market (or "(…) local officials [will] (…) successfully require bribes." [Knutsen et al. 2017]). The price of corruption therefore increases, but larger rents from natural resources can also make the general public more concerned about controlling the bureaucrats – though some empirical examples do contradict this theory (Ades and Di Tella, 1999). While the variability of rents becomes clear from this reasoning, the authors failed to explain the conditions under which the number of competitors changes.

The second stream of argumentation on the increasing effect of natural resources on corruption outlines how commodities encourage governments to engage in *patronage* because natural resources give governments both incentives and opportunities to buy enough political support to stay in office (Vincente, 2010; Kolstad and Soreide, 2009). For a government, being in office means having access to rents from natural resources. Thus, staying in office for another legislative period means ensuring future rents (for a more elaborate discussion see, for instance, Dunning 2008). To stay in office, a government can therefore engage in corruption and buy support (Dunning 2008). A slightly different approach specifically focuses on interactive effects of political institutions and natural resources: Adams et al. (forthcoming: 7) find "(…) that quality governance, quality of institutions, government effectiveness, accountability and corruption control mechanisms, as well as natural resources sustainability accounting are the key determinants in escaping the 'natural resource-curse'."

Despite only looking at Ghana, their case study further supports the usefulness and applicability of my argument that we need to look at natural resource wealth in combination with other contextual factors (such as political institutions or the level of development) to fully understand the impact of natural resources on societies.

For the third stream of argumentation, Tsani outlines that "[t]he primary aim of resource funds is to assist the macroeconomic and inter-generational management of resource wealth insulating the economies from the abrupt fluctuation of commodity prices and save part of current wealth for future generations" (ibid, 2015, 94). Tsani (2013) also finds that resource funds help a government to stay effective, encourage control of corruption, and support the rule of law.

2.2 Political Rights and Corruption

Transparency of political institutions is a crucial condition for voters to identify corrupt government officials (Lindstedt and Naurin, 2010). Political rights empower voters to control a government more intensively, thereby increasing the chances of corrupt government officials being uncovered (Bhattacharyya and Hodler, 2010; Tavits, 2007; Lederman et al. 2005; Treisman, 2000; Sandholtz and Koetzle, 2000). In democratic states, free media or the opposition inform voters about governmental decision-making, meaning voters can make informed choices. By contrast, citizens have very few possibilities to make informed decisions in autocracies. Nevertheless, autocracies also have variation in their corruption levels: Autocratic countries led by one person are more corrupt than autocracies governed by a military group or political party (Chang and Golden, 2010). Building on the selectorate theory, personalistic autocracies have a smaller ratio of the winning coalition to the selectorate (W/S) than military juntas; however, governments provide more public and fewer private goods with increasing ratios of winning coalition to selectorate (Bueno de Mesquita et al. 2003). As the winning coalition is smaller in personalistic autocratic systems, the government needs to provide more private goods than in autocratic systems that are run by a group (e.g. the military). As a result, corruption is higher in personalistic autocratic systems.

Political competition increases the risk of corrupt actors being removed from office, thereby decreasing corruption (Montinola and Jackman, 2002). In democracies, political parties compete to be elected to public office. Once political parties or politicians come into power, they risk being voted out at the next opportunity since elections are held regularly in democracies. One reason for voters to deselect politicians is corrupt behavior. In competitive democratic systems, voters have the opportunity to vote for an alternative candidate.[8] Democratic norms comprise equal opportunities for all citizens for government service, with

society expecting their government officials to serve the common interest and not to use their jobs for self-enrichment. Corruption runs against these norms, since engaging in corruption results in government officials favoring citizens who pay bribes and bureaucrats who pursue self-enrichment instead of the common good. Government officials are either discouraged from engaging in corruption because citizens are unwilling to pay bribes or because government officials are bound by democratic norms to not engage in corruption.[9] Unsurprisingly, Dunning (2008) concludes that "(…) resource rents increase the incentives of elites to block democratization or to stage coups against existing democracies." (ibid:100) Dunning (ibid) analyzes the relationship between political institutions and resource rents in a formal model.

2.3 Economic Development

The available research offers two different explanations for the positive effect of wealth on corruption. The first is that poverty produces economic incentives that make actors prone to corruption (Nwabuzor, 2005; Xin and Rudel, 2004; Montinola and Jackman, 2002; Sandholtz and Koetzle, 2000). In poor countries with low wages, government officials' families sometimes face a battle to make ends meet. Therefore, to secure the survival of their families, they may come under pressure to increase their income by accepting bribes, operating under the assumption that everyone else is doing the same. Thus, corruption tends to be higher in countries where bureaucrats have low wages (i.e. poor economic development) than in countries where government officials are well paid. Although low wages are a fairly convincing argument when it comes to corruption on the part of the *bribe acceptor* (the political side), it still does not explain why a *bribe payer* would be willing to bribe a government official to obtain a service.

Another aspect of a decreasing influence of economic development on corruption is that a stronger economy increases the likelihood that *bribe acceptors* will be detected. Citizens' education levels typically increase the wealthier they become (Treisman, 2000). Better-educated voters are able to control governments more effectively. As a result, corrupt behavior is more likely to be revealed and accepting bribes could cost politicians their jobs. Thus, economic development augments the cost of politicians engaging in bribery, meaning the incentives for corruption decrease.

I will now develop an argument that brings together the three aforementioned research areas on the causes of corruption. Offering in-depth and systematic argumentation, I will outline how economic development and democratic institutions reduce the incentives and opportunities for rent-seeking in resource-rich countries. I amend past research by proposing that economic development strengthens one actor in the selectorate: the middle class. As a consequence, the number of competitors for a share of a government's budget increases, meaning less government money is available for each individual actor, which reduces the potential benefits an actor can obtain through bribery. Furthermore, I show that democratic institutions reduce the opportunities for and benefits from engaging in corruption, as political rights determine how risky corruption is for all actors engaged in bribery.[10]

3. THEORY AND HYPOTHESES

3.1 The Central Argument

Some resource-rich countries (e.g. Norway, Ecuador, or Venezuela[14] in the 1980s and 1990s) have no or much less corruption than prior studies would predict. This theory offers a solution to this empirical puzzle: Natural resources offer large rents (benefitting the *bribe payer*) and

create incentives for bribery, which is why the presence (and high volume) of commodities goes together with a higher level of political corruption. Yet, this increasing effect of resources on bribery varies according to the demand for the provision of public goods by the middle class (a group inside the selectorate that is determined by a country's economic development) as well as the selectorate's ability to punish corrupt governments (determined by a country's level of democracy). I will develop this argument in more detail in the following paragraphs.

3.2 The Government and the Selectorate

To outline the causal mechanism between natural resources and corruption, one must consider two actors: the *government* and its *selectorate*: "We define the selectorate as the set of people whose endowments include the qualities or characteristics institutionally required to choose the government's leadership and necessary for gaining access to private benefits doled out by government's leadership" (Bueno de Mesquita et al. 2003, 234). Political corruption is generally a transaction of (im)material goods and services between a political actor (government official, the *bribe acceptor*) and an actor outside the political sphere (a group in the selectorate, the *bribe payer*).[11] Here, corruption involves government officials deciding whether or not they want to engage in corruption. Depending on the situation a government faces – such as a specific institutional setting in a country or the configuration of the selectorate – both strategies can help a government to stay in power.

3.2.1 The Selectorate, Public and Private Goods, and Corruption

The selectorate is assumed to consist of a mixture of three societal groups: the rich, the poor, and the middle class. A government provides the selectorate with a mixture of two types of governmental goods: *public* and *private goods*. These two governmental goods are rivals, with each group within the selectorate preferring one of these goods. While the rich and the poor prefer a government to spend large proportions of the budget on the provision of private goods, the middle class prefers public goods (such as education or infrastructure).

Public goods are non-excludable goods that benefit the general public (i.e. all three groups of the selectorate). In contrast, *private goods* are excludable goods that benefit only a specific, preferred group in society (here, assumed to be preferred by the rich and the poor).[12]

The wealthy make a substantial contribution to a government's budget in the form of taxes. If a government spends a large proportion of the budget on public goods, a larger group enjoys the subsequent benefits (i.e. redistribution). Thus, the rich are forced to share the benefits of their tax payments even though they want to share governmental goods with as few people as possible. Furthermore, wealthy people can afford to pay for private education or healthcare, for instance, and are comparably less dependent on public goods than the rest of society. The middle class is financially less able to pay for private education and healthcare, meaning it profits more from public goods than the rich. Ultimately, all taxpayers bear the costs of providing public goods. However, the middle class is in the position of benefiting more from public goods than it contributes in tax.

The primary concern of the poor is usually to ensure their own survival. Good infrastructure and high-quality education usually rank lower than direct support from government in the form of food aid, crop seeds, or small financial donations (i.e. excludable private goods). The poor

are, on average, inadequately represented: various researchers have established a close link between poverty (social exclusion) and poor political representation. “One of the enduring findings of political science research over the past fifty years is that poor people participate less than the wealthy across the entire spectrum of political activities” (Macedo 2005, 37). Thus, it is usually easy and not very costly for political leaders to buy off the poor with private goods. Various examples in Latin America and Africa support this conclusion (Krieckhaus, 2006). Therefore, the poor are assumed to play no significant role in the distribution of government budgets.

Due to the excludable vs. non-excludable nature of the two types of governmental goods, their attractiveness for bribery varies. Corruption is particularly interesting for the *bribe payer* if the benefits resulting from the bribe will mainly go to them alone. Private goods yield the kind of benefits corrupt actors are interested in and therefore boost the incentives for corrupt behavior. The societal group that benefits most from a private good can increase the benefit it gets from this good by bribing the relevant governmental decision-makers. The government determines the extent of the provision of private goods and thereby chooses how much a societal group benefits from the private good. For illustrative purposes, imagine a tax cut on oil products: The small group that makes profits from oil products benefits most from this tax cut and, thus, has incentives to bribe government officials to gain even higher profits from oil products in the form of even lower taxes. Consequently, private goods are more prone to corruption, since the benefit is limited to a small societal group. In contrast, public goods are far less prone to corruption because bribing the government to supply more public goods would be cost-intensive for the *bribe payer* and only result in a small personal benefit that simultaneously benefits the general public.

All groups in the selectorate (the poor, the middle class, and the wealthy) are assumed to vote based on economic reasons and can therefore determine government policy in elections – even by simply threatening to abstain from voting. However, the rich obviously possess more financial resources than the middle class, meaning they are more able to offer bribes. Thus, besides voting, the rich have an additional way of influencing a government's decisions on how to distribute its budget: corruption. This raises the question: under which circumstances do the rich engage in corruption? The rich are assumed to always be involved in corruption and be interested in continuing it as long as, first, the government is willing to engage in corruption and, second, they can benefit from corruption via the provision of private goods. Bribing the government will always increase the benefits the rich get from private goods.

What restricts governments from spending money on private goods? A government does not need all members of the selectorate in order to survive politically; normally a subgroup of powerful individuals is sufficient. Bueno de Mesquita et al. (2003) refer to the subgroup that votes political leaders into office as the *winning coalition*. The number of winning coalition members required from the selectorate depends on a country's political institutions. I used political institutions as a proxy to determine the size of the winning coalition because the argument rests not only on the ratio between the winning coalition and the selectorate but also on other important factors determined by a country's political institutions.

A government spends less of its budget on private goods if more members of the selectorate (i.e. potential members of the winning coalition) demand public goods. Since each government's objective is to stay in office, it will always look to satisfy the selectorate's demands so as to survive politically. Thus, the benefits *bribe payers* get from corruption depend on whether and to what extent their government is willing to engage in corruption. In turn, a government's willingness to engage in corruption is a function of the amount of private goods

the selectorate asks it to provide and, as a result, what it must offer the selectorate in return in order to survive politically.

3.2.2 The Government, the Selectorate, and Corruption

Assuming that all governments want to remain in power, the utility of a government is to maximize the probability that it will stay in office (and not be ousted): If, for instance, the selectorate consists mainly of middle class people, the government should provide mainly public goods to secure their support. Nevertheless, the government would still also need to provide a small amount of private goods. As a rule, every government provides at least a small amount of public and private goods regardless of whether the selectorate comprises mainly middle class or rich people.

I will now look at different selectorate configurations and what mixtures of public and private goods the government would offer under these circumstances.

3.3 Economic Development, the Middle Class, and Corruption

Past research has outlined extensively that incentives for corrupt behavior in resource-rich countries are stronger because natural resources are prone to rent-seeking. I contend that the positive effect of the existence (and amount) of natural resources on the level of political corruption is weaker in more economically developed countries because economic development changes the composition of the selectorate (especially the ratio of middle class to rich) by increasing the share of the middle class.

Suppose the selectorate in a resource-rich country comprises a mixture of the middle class and the rich, with the latter playing a dominant role in the selectorate. Based on the assumptions that governments want to survive politically and that the rich prefer the provision of private goods while the middle class want public goods, the government chooses to provide a mixture that favors private goods. A large amount of private goods consequently means potentially high benefits from corruption. I would therefore expect a high level of corruption for resource-rich countries with a weak middle class. By way of example, look at the resource-rich and corrupt country Angola (a short illustrative case study on Angola is provided in the online appendix), which has a weak middle class and distributes much of its resource wealth to the country's elite.

I contend that economic development expands and strengthens the middle class. Economic development is based on innovation and investment, which both require educated workers.[13] Thus, with increasing economic development, companies provide fewer jobs for unskilled employees since a growing number of educated workers are needed. These better-educated people constitute the emerging middle class in society. As the demand from companies for skilled workers grows, so too does the demand for education from companies and citizens alike. Similarly, economic development increases the need for other public goods, such as better infrastructure, so that firms can transport their goods via road and rail, for instance. In other words, middle class members of the selectorate want their fair share of natural resource wealth. Soderholm and Svahn (2015) explicitly name public investment in education and healthcare (and to a lesser extent, infrastructure) as important benefit-sharing areas for a government. Thus, countries with a developing economy experience increasing demands from the middle class for the government to provide more public goods. In sum, the middle class's size and influence increase with higher economic development, and it forces the government to comply with its demands for public goods.

In this case, the government would offer the overwhelmingly middle class selectorate a large amount of public goods for fear of not being re-elected. When providing more public goods for the whole population, the government has less money available to freely distribute private goods to the rich (for their benefit alone). When the government has less money available for private goods, it means that external actors will reap fewer benefits for their corrupt actions. With fewer potential benefits on offer from corruption, the incentives decrease. My theoretical argument predicts low levels of corruption in resource-rich countries with a strong middle class. By way of example, look at the resource-rich country Norway, which has a very strong middle class yet seems to be corruption-free.

3.4 The Middle Class, the Political System, and Corruption

I have outlined how the share of the middle class increases with further economic development and how, as a result, the demand for the provision of public goods rises. However, the middle class is unable to influence governmental decision-making equally in every society. In democratic countries, voters decide which politicians will be elected into office. Voting is a rather direct way to influence government decisions. In return for the middle class's votes, politicians must (at least partly) satisfy their demands to secure their support in the next election. Thus, in democracies, the middle class has greater success in getting the public goods it demands from the government since the political system includes political participation, for instance, with voting.

In contrast, in autocracies the middle class finds it more difficult to influence government decision-making, and the population is less successful in getting the public goods it demands

from the government. Although no government can live without at least some public support (as outlined by Bulte and Damania [2008:20] "(…) autocratic leaders have to consider opposition (…)"), an autocratic regime supplies fewer public goods on average than a democratically elected government. Based on these considerations, I make the following predictions:

Hypothesis 1: *The positive effect of natural resources on corruption is weaker in countries with a strong middle class and democratic institutions than in autocratic countries with a strong middle class.*

Hypothesis 2: *In countries with a strong middle class and democratic institutions, commodities increase corruption less strongly than in countries with a weak middle class and weak democratic institutions.*

Hypothesis 3: *In countries with a weak middle class and an autocratic system, natural resources increase corruption more strongly than in autocratic countries with a strong middle class.*

Hypothesis 4: *In countries with a weak middle class and a democratic system, natural resources increase corruption more strongly than in democratic countries with a strong middle class.*

4. Research Design

4.1 Dependent Variable

It is difficult to measure a country's corruption level. Corrupt behavior is seldom revealed,[16] and therefore corruption indices usually base their information on expert ratings. Nevertheless, several organizations publish corruption indicators by averaging the values of different corruption surveys, including Daniel Kaufman and his team at the World Bank (WB)[17] and Transparency International (TI)[18]. As the World Bank only issued its index every second year in the early years of its publication, and TI changed its indicator calculation method, I decided to use the *International Country Risk Guide* (ICRG) corruption index, which is an expert survey that has been collected since 1984. The Political Risk Services (PRS) Group, which publishes the ICRG, defines corruption as "excessive patronage, nepotism, job reservations, 'favor-for-favors', secret party funding, and suspiciously close ties between politics and business" (PRS Group, 2012). Since the ICRG index is made available annually, does not change its method of construction, and has been published the longest, its indicator is the best available operationalization of corruption for this analysis. Treisman (2007) raises concerns about using panel data in cross-country analysis, pointing out that it is hard to compare corruption changes between different years. He suggests instead using only cross-sectional data. Nevertheless, I decided to use a panel dataset to test my hypotheses for two primary reasons: First, the time dimension is indispensable to test the hypotheses over space and time. Second, the argument mainly predicts corruption levels and not changes. The interpretation of changes between years is less important for the prediction of levels. Thus, these valid concerns are less significant here. I transformed the ICRG index to range between 0 (*not corrupt*) and 6 (*very corrupt*), with 0.5 intermediate values rounded up to full values. I then used the WB and TI corruption indicators as robustness checks. Researchers usually subsume the three abovementioned corruption indicators under the heading of *perception-based* indicators. In the

literature, there is a second group of corruption indicators: the so-called *experience-based* measures. However, I used a *perception-based* indicator for three reasons: First, the ICRG measure of corruption is a good operationalization of the type of corruption I address (*grand* corruption), as outlined in the abovementioned definition of corruption by the PRS Group. *Experience-based* indicators usually address primarily petty corruption.[19] Second, the coverage of years for the ICRG indicator is much greater than that of *experience-based* measures. Third, the ICRG indicator is widely used by other researchers.[20]

4.2 Explanatory Variables

GDP per capita measures wealth in a country (and serves as a proxy for the size of the middle class), and numerous studies have applied this operationalization of *economic development* (Treisman, 2007; Persson, Tabellini, and Trebbi, 2003; Adsera et al. 2003; Treisman, 2000; Ades and Di Tella, 1999; La Porta et al. 1999). As there is no obvious measure of the size of a country's middle class, among those proxies used in quantitative analyses, GDP per capita is second to none with respect to coverage of countries and time. Other measures, such as the GINI coefficient or percentage of labor force with tertiary education, are much more limited. The specific data set I looked at as a possible source for data on the GINI coefficient is provided by the World Bank. In the data description, the World Bank already highlights the commonly mentioned problems of the use of GINI coefficients in general and for times-series cross-sectional analysis in particular: "Gini coefficients are not unique. It is possible for two different Lorenz curves to give rise to the same Gini coefficient." (World Bank 2018a) and "(…) data are not strictly comparable across countries or even across years within a country." (ibid) A further alternative operationalization to measure the size of the middle class could be tertiary education (compare e.g. [Fontana 2017] or Easterly [2001]). My arguments states that with

increasing economic development companies need more educated workers. Tertiary education (measured as percentage of the labor force with tertiary education) is a possible operationalization for the middle class but again the coverage for such data (provided, for instance, by the World Bank 2018b) is limited particularly with respect to the time frame of available data. In summary, GDP per capita measures what my argumentation outlines and the available data covers nearly all countries and years my corruption variable covers. Therefore, GDP per capita as a measurement for the middle class provides us with the least biased sample.

Among the indicators available to operationalize *democracy*, two are most widely used and provide data for the longest periods: the Freedom House indicators and the Polity IV dataset. Although both indicators are equally suitable since I used a dummy variable to identify democratic vs. autocratic countries, I decided to use the Polity IV Project to operationalize political accountability.[21] The operationalization of *dependency on natural resources* is, first, fuel exports (Treisman, 2007) and, second, mineral depletion as percentage of gross national income and third, energy depletion as a percentage of gross national income.[22] The variable is calculated as follows (de Soysa and Neumayer, 2007, 206-7):

> "For oil, gas, and coal, the unit rent is the world price minus lifting costs. For some resources, such as natural gas, where, strictly speaking, there is no single world price, a shadow world price is computed as the average free-on-board price from several points of export."

"The dataset represents the most ambitious and comprehensive attempt yet at estimating the value of natural resource extraction" (de Soysa and Neumayer, 2007, 206). One further

advantage is that it not only provides information on the presence of natural resources but also a ratio of how many natural resources are available relative to GNI. In a way this also measures the diversity of the economy. A higher percentage of resource wealth in a country in relation to GNI and exports indicate a less diverse economy. Third, I used data on the presence of oil or gas (Lujala, 2009). The disadvantage of this dummy variable is that it does not consider the total capacity of oil or gas but only indicates resource existence. I used all three measures to operationalize natural resources but assessed robustness only for the model that uses the energy depletion variable.

4.3 Control Variables

Treisman (2007) and Serra (2006) provide good summaries of common control variables in research on the causes of corruption. The empirical testing of the hypotheses only includes a small number of control factors but as many variables as necessary. The robustness section deals with additional controls to test whether other control variables change the results. Firstly, the analysis controls for the effect of *presidential systems* on corruption – one of the most common control variables (Kunicova and Rose-Ackerman, 2005; Lederman et al. 2005; Gerring and Thacker, 2004). Only Adsera et al. (2003) found a decreasing effect on corruption since presidential election campaigns require substantial amounts of money. Sometimes donors to presidential campaigns demand political influence in return for their contributions, especially if they donate large sums of money. Secondly, the model includes *government spending* as a control variable. Adsera et al. (2003) suggested operationalizing government spending using the percentage of government consumption in relation to GDP. Lederman et al. (2005) found an increasing effect of government consumption on corruption. Adsera et al. (2003) put forward that higher government consumption decreases corruption since more

extensive financial opportunities allow a government to pay its civil servants higher salaries (which, in turn, makes them less likely to engage in corruption). Thirdly, this study controls for *foreign direct investment* as a percentage of GDP. Gerring and Thacker (2005) found that foreign direct investments lower corruption. Further, foreign direct investment is one causal factor driving economic diversification (United Nations 2016) and economic growth in general (e.g. Almfraji and Almsafir 2014). Table 1 provides an overview of the variables for the statistical estimation, while Table 2 presents descriptive statistics.

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Table 1 and 2 - about here
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5. Empirical Analysis

The dependent variable 'corruption' designates the method to be used for the empirical testing of the postulated hypotheses. Since the differences between the seven categories of the ICRG index cannot be interpreted as equal, ordinary least squares regression is not an appropriate method. Long and Freese (2014) suggested three different estimation procedures: ordered logit, multinomial, or ordered probit models. As a multinomial would not consider the order of the dependent variable, thereby leading to a loss of useful information, an ordered model is preferred. While ordered probit and logit models differ very little and produce similar estimation results, I opted to use an ordered probit model for the ICRG data. To account for potential endogeneity, I lagged all explanatory variables by one year (e.g. as done by Colgan (2010) and Humphreys (2005)). As a robustness check, I estimated a panel-corrected standard error model (Beck and Katz, 1995) with a panel-specific autoregressive process using CPI and WB data. To test the hypotheses, the model needed to include a triple interaction effect, which

is difficult to interpret. The results section provides margin graphs to illustrate the interaction. For the interaction effect, the models include the coefficients A, B, C, A×B, A×C, B×C, and A×B×C – as suggested by Matt Golder et al.[23] The following function estimates a country's corruption level:

$$Corruption^{*}_{i,t} = \beta_0 + \beta_1 \text{ Natural Resources}_{i,t} + \beta_2 \text{ Economic Development}_{i,t} + \beta_3 \text{ Political Development}_{i,t} + \beta_4 \text{ Natural Resources * Economic Development}_{i,t} + \beta_5 \text{ Natural Resources * Political Development}_{i,t} + \beta_6 \text{ Political Development * Economic Development}_{i,t} + \beta_7 \text{ Natural Resources * Economic Development * Political Development}_{i,t} + \beta_8 \text{ Control } 1_{i,t} + ... + \beta_k \text{ Control k}_{i,t} + \epsilon_{i,t} \text{ ; i = 1, ... , N ; t = 1, ... , T}$$

For estimating my triple interaction effect, I constructed a dummy variable for democracies (take on value 1) versus autocracies (take on value 0) to allow for an easier interpretation of the results.

Beck et al. (1998) proposed using splines to control and account for autocorrelation (originally introduced for binary dependent variables). To generate splines, a dummy variable 'corruption change' is needed. This variable takes on the value 1 whenever the corruption level changes between years (regardless of whether the corruption level rises or falls). I used the btscs command for Stata (Beck et al. 1998) to determine the duration of the same corruption level persisting. To test whether splines needed to be included, I tested the full Models 1 to 3 and 6 in Table 3 against the models without splines (restricted). The test revealed that the hypothesis stating all spline coefficients are simultaneously 0 could be rejected at the 1% level. It was therefore necessary to include splines; the splines account for temporal dependence.

5.1 Empirical Results

Table 3 shows the empirical results for the effect of commodities on corruption, conditional on wealth (size of the middle class) and democracy: Model 1 includes the operationalization of natural resources using fuel exports, Model 2 measures commodities based on energy depletion, Model 3 uses a dummy for the presence of oil and/or gas reserves. Models 4 and 5 use a different operationalization of the dependent variable (corruption), using WB and CPI data respectively, and Model 6 measures resource wealth using mineral depletion as percent of the gross national income (GNI). The main models for the empirical analysis of this paper are Models 1 and 6 of Table 3.

All models provide empirical support for a significant effect of natural resources on corruption that is conditional on democratic institutions and GDP per capita. However, the effect is not necessarily significant for the whole range of natural resource richness. To see the overall effect of the interaction variables (GDP per capita, democracy, and natural resources) on corruption, we have to look at all interaction variables together. The effects of the three variables depend on one another: Ai and Norton (2003, 124) wrote: "Firstly, the interaction effect could be nonzero, even if $\beta_{12} = 0$. (...) Fourthly, the interaction effect may have different signs for different values of covariates. Therefore, the sign of β_{12} does not necessarily indicate the sign of the interaction effect." To test the significance of the whole interaction effect (all seven coefficients) for the ICRG models, I performed a likelihood-ratio (LR) test, which tests the null hypothesis that all seven excluded coefficients are simultaneously 0.[24] For all natural resource variables, the LR test rejects the null hypothesis. Thus, the three-way interaction (GDP per capita, democracy, and natural resources) is jointly different from 0 at the 1% level for all models (1 to 3 and 6 in Table 3). For each of the four hypotheses, the results are presented in several margins graphs. Owing to a lack of space, I chose here to only present the results for fuel exports and mineral depletion, GDP per capita, and democracy (Figures 1 to 8). The other graphs (using WB and CPI data) are included in the Online Appendix (Figures A.1 to A.12).[25]

I will now briefly outline the overall conclusions for each natural resource variable as well as the alternative operationalizations of corruption.

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Table 3 and 4 – about here

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Three-way interactions are complicated to interpret, as we have to oversee three dimensions at a time. Looking at various corruption indices and different measures of natural resources further increases complexity. To keep track of the results, I provide a straightforward overview of the results for each hypothesis (H1 to H4) in one table (Table 4). The three main columns represent the different natural resource wealth variables and each has sub-columns for the four hypotheses. The rows show the results for the three corruption indicators. The empirical support for each hypothesis is rated from no support ("o") to high support ("+++"). On the lower end of the scale, I concluded that there was no significant support for a hypothesis if the confidence bounds of the estimations overlapped for the full range of resource wealth (mineral or energy depletion and fuel export respectively). Thus, if there is no support for a hypothesis the cell in Table 4 shows "o" to illustrate this non-finding. On the upper end of the scale, the statistical models strongly endorse the hypothesis ("+++") if there is significant support for the hypothesis for more than 75 percent of the range of natural resource wealth. Intermediate levels of statistical support for a hypothesis are represented by "+" (for below 50% of the natural resource data showing significant support) and "++" respectively (for around 50% of the natural resource data showing significant support). The signs are based on Figures 1 to 8 and Figures A.1 to A.12 (in the online appendix).

The statistical models lend the strongest, most consistent support to hypotheses 2 and 4: Poor autocracies are on average more corrupt than rich democracies (hypothesis 2) and poor democracies are on average more corrupt than rich democracies (hypothesis 4). Wealth matters to prevent corruption but so does the political system. It is not politics or economics alone that does the trick to reduce corrupt behavior in natural resource rich countries but the combination of the two. If a country is democratic, it matters whether this country also has a strong middle class or not. In autocracies, the size of the middle class also makes a difference for the corruption level (hypothesis 3) but the support is less strong. On the other hand, if a country does not have a middle class (a very low level of economic wealth), no political system can prevent corruption: poor democracies and poor autocracies are roughly equally corrupt. Overall, hypotheses 1 and 3 also find some support (e.g. Figure 3c shows that poor autocracies have a higher corruption level than rich autocracies) but the predictions sometimes fall short of the level of significance.

I will now evaluate all hypotheses in more detail explaining each cell of Table 4 separately by looking at the margin graphs that were the basis for Table 4. Due to the level of specificity, the explanation of the results gets more detailed but also more complicated to keep track of (some might say the interpretation gets messier). For reason of completeness, I go into this level of detail but highly recommend keeping Table 4 in mind when reading the next paragraphs. For the sake of simplicity, I will call the varyingly prosperous countries either *wealthy/rich* (strong middle class) or *poor* (weak middle class). Overall, the figures clearly show that growing resource-richness increases the probabilities for high levels of corruption and decreases the probabilities for low levels of corruption in a country. Yet, in accordance with the theoretical argument made above, economic development and democratic institutions reduce this augmenting effect.

Hypothesis 1 predicts that in countries with a large middle class, resource richness increases corruption more in autocracies than in democracies. To evaluate this hypothesis, I hold the level of economic development constant at a high level (the proxy for a large middle class). Then I look at the predicted probabilities for a low (value=0), medium (value=2), and a relatively high (value=4) level of corruption (Figures 1a to 1c, 5a to 5c).[26] If the evidence supports hypothesis one, rich autocracies have lower predictions for low corruption levels (ICRG value = 0) than rich democracies. For high corruption (ICRG value = 4), the prediction lines for rich autocracies would be above those for rich democracies.

As to the evidence: with increasing mineral depletion, rich autocracies have significantly higher predicted probabilities for high levels of corruption than rich democracies (ICRG value =4 – compare Figure 1c), *ceteris paribus*. These results support hypothesis 1. For low levels of corruption, there are no significant differences between rich autocracies and rich democracies (see Figures 1a and 1b) when mineral depletion increases. This is not in line with the expectation. More intuitive and straightforward to interpret than the ICRG corruption index are the results for ordinary least square estimations (TI's Corruption Perception Index and the World Bank Corruption Index): from resource poorness to resource wealth, corruption continuously spreads in rich autocracies but stays relatively the same in rich democracies (Figure A.5a in the online appendix). These results strongly support hypothesis 1. The World Bank Corruption Index shows support for hypothesis 1 up to the 75th percentile (compare Figure A.6a) but not beyond.

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Figure 1 – 8 – about here

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The results for *fuel exports* again support hypothesis 1. When a country exports more fuel, the predicted values of a high level of corruption are higher for rich autocracies than for rich democracies (Figure 5c). Accordingly, with growing fuel exports, the marginal effects for a low level of corruption in rich democracies exceed the probability of rich autocracies having a low level of corruption (Figure 5a). The disparities between democracies and autocracies are significantly different from 0 if the confidence bounds for rich democracies and rich autocracies do not overlap. Yet, they overlap for countries with very high fuel exports (at least well above the 75th percentile). For the CPI index, the difference between democracies and autocracies becomes significant for fuel exports below the 70th percentile (Figure A.5c). Results are not significantly different using the WB indicator (Figure A.6c**).** However, the number of observations using the World Bank indicator is comparably small and the confidence bounds are, unsurprisingly, extremely wide. The results for energy depletion are fairly similar to mineral depletion (compare Figures A.1a to A.1c).

In summary, there is support for hypothesis 1 but this support is not as strong as for the other hypotheses. This might be due to the fact that the number of rich autocracies is small and therefore the confidence bounds for the predictions are rather large and therefore more likely to miss the significance level of 95%.

According to **hypothesis 2**, resources increase corruption less markedly in rich, democratic countries compared to poor, autocratic countries. The analysis supports the hypothesis that rich and democratic countries have a lower probability of experiencing high levels of corruption than poor autocracies (Figures 2c [mineral depletion] and 6c [fuel export]).[27] The interaction is significant for nearly the whole range of fuel exports and mineral depletion. Accordingly, rich democracies have higher probabilities of low and medium corruption levels than poor autocracies (low corruption: Figures 2a [mineral depletion] and 6a [fuel export]; medium

corruption: Figures 2b [mineral depletion] and 6b [fuel export]).[27] The predictions for poor autocracies versus rich democracies are significantly different up to around the 90th percentile. Again, the conclusions for energy depletion are very similar to those for mineral depletion (see Figures A.2).

For the CPI and WB corruption data, the confidence bounds for rich democracies and poor autocracies are different from each other: rich democracies have lower corruption levels than poor autocracies even when mineral depletion or fuel export increase. For the CPI corruption index, the differences between poor autocracies and rich democracies are always significant for mineral depletion (A.7a), fuel export (A.7c), or energy depletion (A.7b). When using the WB corruption data, the predicted lines are significantly different up to around the 90th percentile for mineral depletion (A.8a and energy depletion A.8b) and from around the 50th percentile onwards for fuel export (A.8c).

In summary, the results for hypothesis 2 (as well as for hypothesis 4 - see details further below) are the strongest of all four hypotheses supporting the conclusion that for a resource-rich country's corruption level it truly matters whether it is poor and autocratic or rich and democratic.

Hypothesis 3 predicts that autocracies with a strong middle class suffer less from corruption than those with a weak middle class. Whereas for the ICRG corruption data and mineral depletion there are hardly any significant differences between poor and rich autocracies (Figures 3a to 3c), there is at least some support for significant differences between poor and rich autocracies for very high mineral resource richness and high levels of corruption (Figure 3c). For autocracies with a lot of *fuel exports,* it does not matter whether they are economically rich or poor – they always experience the same level of corruption independent from their economic wealth. However, it does matter if they do not possess an extreme resource wealth

(up to around the 50th or even the 75th percentile - Figures 7b and 7c [fuel export]) when looking at the ICRG corruption index.

The conclusion for the CPI corruption measure is different: for resource-rich autocracies it always matters whether the country is rich or poor. Poor autocracies experience higher levels of corruption for up to the 90th percentile or the maximum of resource wealth (Figures A.9a [mineral depletion], A.9b [energy depletion], and A.9c [fuel export]). For the World Bank corruption data, there are only significant differences for energy depletion (Figure A.10b) but not for fuel exports or mineral depletion (Figures A.10a and A.10c respectively).

Hypothesis 4 forecasts that poor democratic countries have higher levels of corruption than rich democratic countries. The statistical models based on the ICRG index find support for this hypothesis for nearly the full range of values of mineral depletion (Figure 4a-c), fuel export (Figure 8a-c), and energy depletion (Figure A.4a-A.4c): poor democratic countries are more likely to experience high levels of corruption whereas rich democratic countries are more likely to have low levels of corruption. The results fully support hypothesis 4.

Similarly, the statistical models using the CPI data as the corruption measure support hypothesis 4 for the full range of values for mineral depletion (Figure A.11a), fuel export (Figure A.11c), and energy depletion (Figure A.11b). When measuring corruption with the World Bank indicator, there is empirical support for hypothesis 4 for most values of mineral depletion (Figure A.12a) and fuel export (Figure A.12c) but not for energy depletion (Figure A.12b).

Overall, we can conclude that there is a conditional effect of resource wealth on corruption depending on democracy/autocracy and economic wealth. This effect is particularly evident for hypothesis 2 (rich democracies versus poor autocracies) and hypothesis 4 (rich democracies

versus poor democracies) and it is a particularly persistent finding because we can see significant differences for different kinds of resource wealth (energy depletion, fuel export, and mineral depletion) as well as for different corruption indicators (ICRG, CPI, and World Bank corruption data). There is also support for hypotheses 1 and 3 but to a lesser extent.

Regarding the control variables, the empirical analysis strongly suggests that countries with a presidential system suffer from more corruption than countries with a parliamentary system – in line with past research. What's more, government consumption mostly significantly reduces corruption. This empirical finding supports previous analyses by Adsera et al. (2003). Unexpectedly, FDI increases corruption in most of the six models.

The estimated model 1 of Table 3 predicts real observations quite successfully: for instance, in 2000, Zimbabwe had a corruption level of 4 on the ICRG index. Using actual values of the independent variables for Zimbabwe in 2000, the model predicts category 4 with a probability of 0.49. Neighboring categories 3 and 5 are predicted with a probability of 0.34 and 0.06 respectively. Norway is a good example of a country with little corruption. In 1994, the actual corruption level of 0 is predicted with a probability of 0.54 (category 1 has a probability of 0.33).

5.2 Discussion of the Results and Robustness

In the empirical analysis, I tested the hypotheses on the positive/increasing effect of commodities on corruption, conditional on a country's economic development and level of democracy. The findings support the proposed hypotheses: Natural resources have a significant positive influence on the corruption level, and influence that weakens when switching from autocracies to democracies and with increasing wealth. Sensitivity analyses suggest that a

variable has a robust influence if the coefficient does not change signs when using different model specifications (Sala-i-Martin, 1997). As the interaction builds on three variables, I looked at the margin graphs for all robustness checks to see whether they generally lead to the same overall conclusions when using the ICRG corruption data (i.e. the lines gradually increase or decrease as in the main model). Testing models 1 and 6 of Table 3, the robustness checks provide further empirical support for an interactive effect of natural resources, economic development, and democracy on corruption: excluding regions (Plümper and Neumayer, 2006; Hausken et al., 2004), supplementary control variables (Protestantism, OECD dummy, trade as a percentage of GDP, imports per GDP, and women in the workforce), and bootstrap, the effect holds up. Further, I also accounted for economic diversification as an alternative causal factor for the three-way relationship between resource wealth, democratic institutions, the middle class and corruption. Diverse economies could potentially provide alternative income sources additional to resource wealth for people in a country. To measure economic diversification, I use the investment variable published by the International Monetary Fund and included in the Quality of Government Standard data set 2017 (*imf_inv - "Total investment [Percent of GDP]" ibid: 410*) (Teorell et al. 2017). Empirical findings (Longmore et al. 2014, United Nations 2016) suggest that there is a positive relationship between investment and economic diversification. The robustness results are presented in Table A.1 – A.5 in the online appendix. The robustness results remain robust when looking at the margin graphs for ICRG corruption data. As all additional variables do not substantially improve the model fit but sometimes reduces the number of observations, I keep the original model.

The positive relationship between commodities and corruption is consistent with previous studies, such as those by Gerring and Thacker (2004) as well as by Adsera et al. (2003), who also found that the presence of natural resources increases corruption. However, I put forward a new theoretical argument that solves a crucial empirical puzzle and offers empirical support

for the claim that this positive effect depends on a country's wealth and political institutions. With more than 100 countries in the ICRG index[28] over more than 20 years, the empirical findings can be considered to be reasonably general, and limitations for conclusions arise mainly from missing data.

6. Conclusion

Commodities provide potential for rents. The level of rents *bribe payers* can get from government through the provision of private goods is determined by a country's political system and its economic wealth. With increasing levels of economic development, a new class emerges in society: the middle class. This new actor demands more public goods (e.g. education) from government than the poor. A government will provide this good to get re-elected if it needs the support of the middle class. The more democratic a country is, the more the voters control governmental decision-making. As a result, governments must account for voter preferences, which influences the way they distribute their budgets. The provision of more public goods decreases the part of the budget that provides incentives for rent-seeking (private goods) and is therefore prone to corruption. As a result, economic development and democratic institutions reduce corruption in resource-rich countries compared to poor autocracies. The explanatory power of the theoretical argument (as well as the empirical analysis) is that it is able to simultaneously explain the corruption levels in natural resource-rich countries such as Norway (a democratic, wealthy country that is free from corruption) and autocratic, poor, and corrupt countries such as Zimbabwe.

The empirical analysis, which uses data from more than 100 countries over more than 20 years, supports a conditional effect of commodities on corruption: increasing wealth in a

country paired with high political accountability decreases the influence of natural resources on corruption. Economic development constantly weakens the increasing effect of commodities on corruption and a democratic system further lowers corruption levels. These empirical findings are significant (though not across the full range of natural resources when using ICRG but for the vast majority of values when using CPI and WB as corruption measures) and robust for various robustness checks, such as alternative estimation methods, a group-wise jack-knife, a bootstrap, additional control variables, and alternative operationalization of natural resources and corruption.

This study shows empirical support for a conditional effect of commodities on corruption endogenous to economic development and democracy. It contributes to the literature by offering a new political economy perspective on these interaction effects as well as vigorous empirical testing of this relationship. In line with previous research, this study supports the proposition that the presence of natural resources can lead to higher corruption levels. However, it augments previous research in important ways by demonstrating, both theoretically and empirically, that the augmenting effect of commodities on corruption is conditional on a country's wealth and its political system. Not modeling this conditionality leads to biased results in the estimation of the effect of natural resources on corruption. The consequence would be overestimating the effect in wealthy, democratic countries and underestimating the effect in poor, autocratic countries, both of which have serious negative consequences.

By explicitly demonstrating that conditionality is an important factor when determining whether natural resources are a curse or a blessing concerning corruption, the way has been opened for future research in this area. The causal relationship between resource wealth and corrupt is not yet completely clear, and my conclusions, while mixed (more support for

hypotheses 2 and 4 and less support for hypothesis 1 and 3), are consistent enough in that we continuously see that democracy and economic development are crucial conditioning variables for the relationship between resource wealth and corruption. Since natural resources are often concentrated in one region of a country, looking at subnational variation in resource wealth and corruption might deepen our understanding (which is already partly done through single country studies such as for China [Zhang 2017] or survey data analysis for Africa [Knutsen et al. 2017] and could be expanded in the future).[20] Further, the results also suggest that the relationship between different kinds of resource wealth (mineral or energy depletion, fuel export or oil/gas dummy) and corruption needs further exploration.

In conclusion, very wealthy countries with a high standard of political rights need not worry that the domestic discovery of natural resources will increase their corruption level. Furthermore, this article also allows for conclusions to be drawn for international organizations – such as the World Bank – and their good governance programs: international organizations could link their efforts to decrease corruption in countries with a high dependency on natural resources with the promotion of economic development and democratic institutions.

7. Endnotes

[1] Corruption is defined as the misuse of an official political position for one's private benefit or the benefit of a particular societal group. This definition follows common examples in corruption research (e.g. see Hansen, 2011; Le Billon, 2001).

[2] We also found similar examples outside the OCED: While Trinidad and Tobago (resource-rich) and Uruguay (resource-poor) differ in their resource wealth, they are similar in many respects and both experience middle-range levels of corruption.

[3] Tsani (2015) and Tsani (2013) looks at the effects of resource funds on institutional quality (measured as control of corruption), while others look at the negative or positive consequences of resource endowment on the society (e.g., political trust) (Miller 2015) or the economy (Stijns, 2005; Sachs and Warner, 2001).

[4] Other researchers came to the same conclusion and stressed the importance of considering conditioning factors. See, for example, Petermann et al. (2007).

[5] For instance, compare Norway and Sweden in 2004: They spent U.S. $7,879 and U.S. $7,328 per capita respectively (values constant for the year 2000). Another example is the government of Zimbabwe, which spent U.S. $61 per inhabitant compared to Ghana (an otherwise similar country but without commodities), which spent U.S. $23 per person.

[6] To assess robustness, I used alternative measures of corruption: The Corruption Perception Index (CPI) and the World Bank (WB) data on corruption. The empirical analysis using CPI includes between 36 and 126 countries from 1995 to 2012, while the WB data cover between 109 and 128 countries from 1996, 1998, 2000, and 2002.

[7] Similarly, Leite and Weidmann (1999) also argue that commodities generate possibilities for rent-seeking behavior. Bulte and Damania (2008) support their findings using formal modelling.

[8] Another aspect of democracy is that democratic norms affect whether bureaucrats make use of the corruption opportunities (Sandholtz and Koetzle, 2000).

[9] Most studies find empirical support for a decreasing effect of the democracy level or of democratic tradition on corruption (Tavits, 2007; Lederman et al., 2005; Treisman, 2000; Sandholtz and Koetzle, 2000).

[10] I also contribute to the research on the *resource curse* by demonstrating that natural resources can be either a blessing or a curse. Whether it is one or the other depends on the configuration of the selectorate and the extent of the political rights in place.

[11] Citizens are extremely interested in benefit sharing from mining wealth (see the case study research on Australia, Chile, and the U.S. provided by Soderholm and Svahn (2015). However, not all consequences from mining are positive. Knutsen et al. 2017 find "(…) that mining boosts short-term economic activity, the negative long-term consequences of corruption and poor governance are widely assumed."

[12] This definition is in line with Bueno de Mesquita et al. (2002, 561 sq.): "Private goods are excludable and awarded by the leader to specific members of society. Such private goods cover (…) benefits for particular individuals, such as state-granted monopolies, access to hard currency, (…) and bribes secured by government officials."

[13] Educated workers are not the only precondition for economic growth and there are other causal factors for economic growth (such as foreign direct investments [FDI]). When looking at a reduced part of my sample with 728 observations (due to a lot of missing data for these particular variables), I find a Pearson's correlation coefficient of 0.432 with the level of GDP and labor force with tertiary education. For economic development and FDI per GDP I find a Pearson's correlation coefficient of 0.3473. Hence, both factors play a role in determining economic growth. Past research shows that the relationship of FDI and economic growth is mixed: "The results show that the main finding of the FDI-EG [Economic Growth] relation is significantly positive, but in some cases it is negative or even null. And within the relation, there exist several influencing factors such as the adequate levels of human capital, the well-developed financial markets, the complementarity between domestic and foreign investment and the open trade regimes, etc." (Almfraji and Almsafir 2014: 206) This research shows that while FDI plays an important role in increasing economic growth, human capital (such as educated/skilled workers) is a crucial factor for economic development, too. Hence, I emphasize that higher levels of economic development go along with a more highly skilled workforce and, as a consequence, a stronger middle class. To account for the effect of FDI, I include it as a control variable.

[14] I picked Venezuela as an example because other researchers consider it to be a country that is undergoing positive development in Latin America (Nwabuzor, 2005). A short illustrative description is provided in the online appendix.

[15] Whereas in 1997 GDP depended heavily on industry (4% agriculture, 63% industry, and 33% services), industry's contribution was substantially lower in 2009 at only 36.8%, with the service sector dominating at 59.2%, and agriculture remaining at 4% (CIA, 1998; CIA, 2009).

[16] "Transactions in corruption are, by definition, unrecorded in available databases while the empirical observation of corruption puts the researcher and her/his informants at significant risk." (Robbins, 2000, 424)

[17] Data was used, among others, by Haass and Ottmann (2017) and Kunicova and Rose-Ackerman (2005).

[18] TI's Corruption Perception Index (CPI) is used, among others, by Gerring (2004); Xin and Rudel (2004).

[19] For an in-depth discussion of *perception-based* vs. *experience-based* corruption measures, see, among others, B. Neudorfer and N. S. Neudorfer (2015). One example of an *experience-based* corruption measure is the Global Corruption Barometer (GCB) by Transparency International. Based on a survey of *'ordinary'* people, the GCB provides the following two variables: *'percentage of people that have paid a bribe in the past 12 months'* or *'percentage of people that have paid a bribe to each of 9 institutions'* (education system, judiciary, medical services, police, registry and permit service, utilities, tax revenue, land services, customs). Data downloadable at www.transparency.org, accessed on March 23, 2016.

[20] For instance: Adsera et al. (2003); Aslaksen (2007); Bhattacharyya and Hodler (2010); Cheon et al. (2014); La Porta et al. (1999); Neudorfer and Theuerkauf (2014); Okada and Samreth (2017); Persson et al. (2003); Swamy et al. (2001).

[21] I followed Plümper and Neumayer (2009) to identify a country as a democracy: "For polity2, which runs from -10 to 10, we call a regime democratic if it has a value above 6." (Plümper and Neumayer, 2009, 56) Numerous studies use polity IV to measure democracy (for instance Okada and Samreth 2017).

[22] "Mineral depletion is the ratio of the value of the stock of mineral resources to the remaining reserve lifetime (capped at 25 years). It covers tin, gold, lead, zinc, iron, copper, nickel, silver, bauxite, and phosphate." (World Bank Website: http://api.worldbank.org/indicator/NY.ADJ.DMIN.GN.ZS?format=xml) Knutsen et al. 2017 analyze the effect of mining on local corruption. They use the opening of new mines to measure the discovery of new/more mining wealth. ; "Energy depletion is the ratio of the value of the stock of energy resources to the remaining reserve lifetime (capped at 25 years). It covers coal, crude oil, and natural gas." (World Bank Website: http://api.worldbank.org/indicator/NY.ADJ.DNGY.GN.ZS?format=xml); "Energy depletion covers crude oil, natural gas, and coal (hard and lignite). As in the case of all other nonrenewable resources, rent was estimated as: Rent = (Production Volume) * (International Market Price - Average Unit Production Cost)" (Bolt et al., 2002, 8).

[23] The information is taken from https://files.nyu.edu/mrg217/public/interaction.html##code (last checked on February 7, 2014); the supporting website for Brambor et al. (2006) and Berry et al. (2012).

[24] For the use of the LR test, see, among others, Long and Freese (2014).

[25] **WB** as a corruption measure: Figures A.5, A.7, A.9, and A.11. **CPI** as a corruption measure: Figures A.6, A.8, A.10, and A.12. Interaction with **energy depletion**: Figures A1. to A4.

[26] Categories 5 and 6 of the ICRG indicator have very few observations (only about 7% overall). Thus, category 4 is used to represent high corruption levels.

[27] Refer to the figure references for CPI and WB above.

[28] The CPI covers up to 126 countries over 17 years, while the WB data cover up to 128 countries and over 16 years.

[29] For instance, Miller (2015) found that the impact of natural resource wealth on political trust varies with district-level conditions.

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Figures and Tables

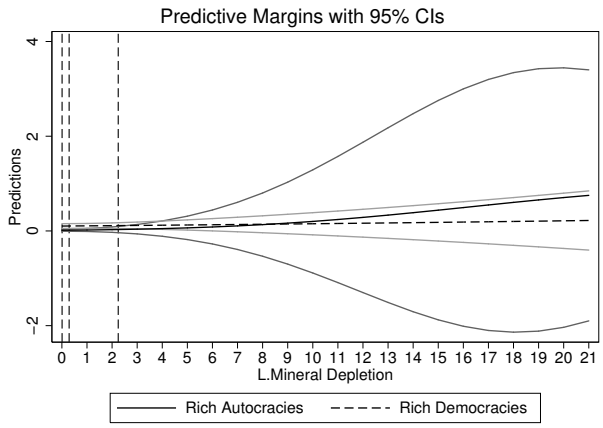


Figure 1a: Hypothesis 1 Mineral Depletion: ICRG Value 0 = Low Corruption

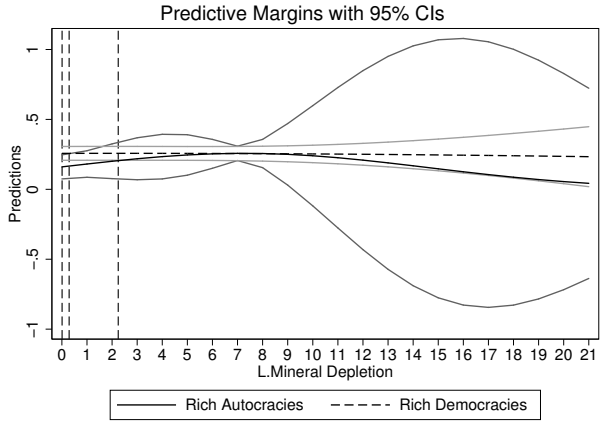


Figure 1b: Hypothesis 1 Mineral Depletion: ICRG Value 2= Medium Corruption

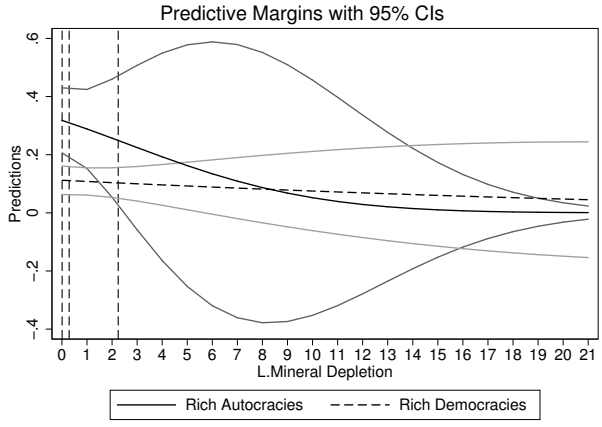


Figure 1 c: Hypothesis 1 Mineral Depletion: ICRG Value 4 = High Corruption

Figure 1: Margins Plots for Hypothesis 1 Based on Model 6 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Mineral Depletion) on Different Levels of Corruption. Increasing Values for Mineral Depletion from Minimum to Maximum. Lines Represent Rich Democracies (1) and Rich Autocracies (0) Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Mineral Depletion.

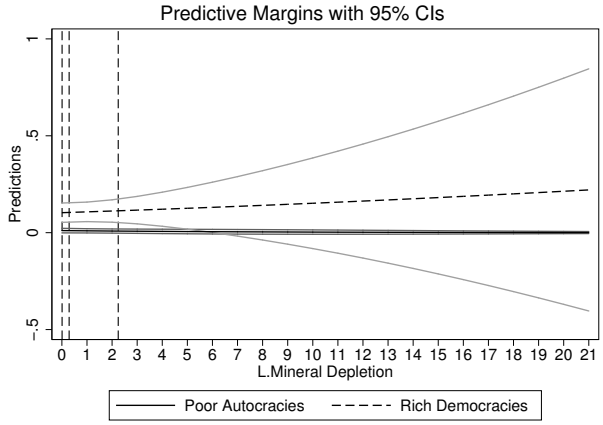
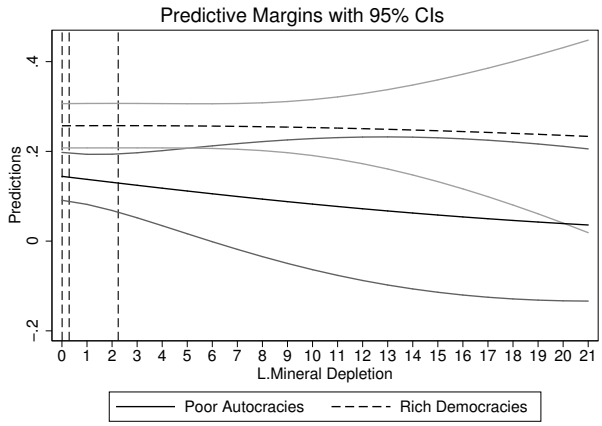


Figure 2 a: Hypothesis 2 Mineral Depletion: ICRG Value 0 = Low Corruption



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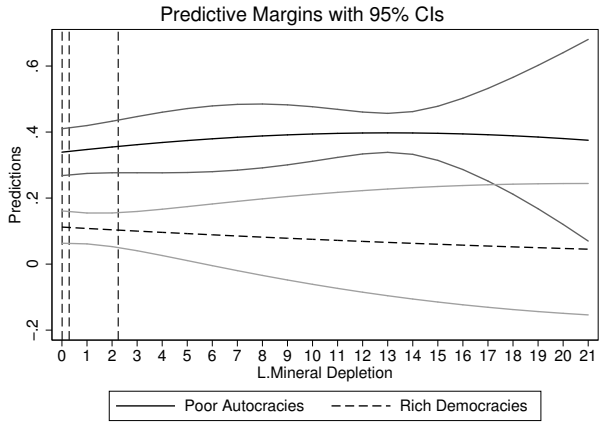
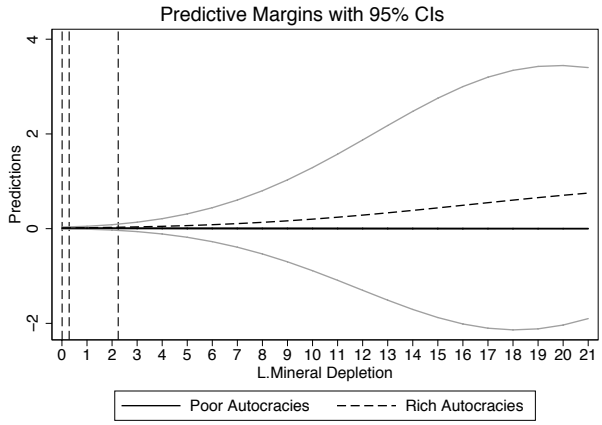


Figure 2 c: Hypothesis 2 Mineral Depletion: ICRG Value 4 = High Corruption

Figure 2: Margins Plots for Hypothesis 2 Based on Model 6 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Mineral Depletion) on Different Levels of Corruption. Increasing Values for Mineral Depletion from Minimum to Maximum. Lines Represent Poor Autocracies and Rich Democracies Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Mineral Depletion.



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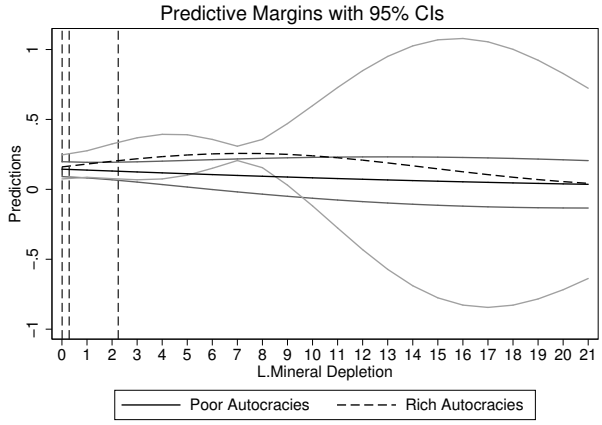


Figure 3 b: Hypothesis 3 Mineral Depletion: ICRG Value 2 = Medium Corruption

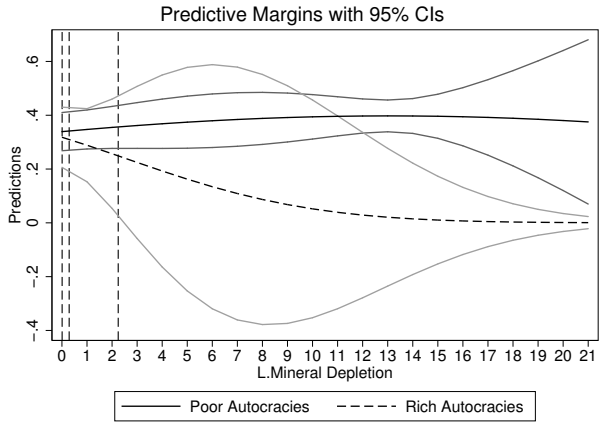
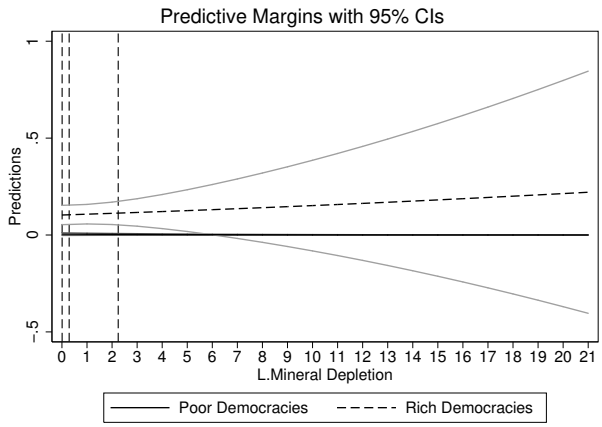


Figure 3 c: Hypothesis 3 Mineral Depletion: ICRG Value 4 = High Corruption

Figure 3: Margins Plots for Hypothesis 3 Based on Model 6 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Mineral Depletion) on Different Levels of Corruption. Increasing Values for Mineral Depletion from Minimum to Maximum. Lines Represent Rich and Poor Autocratic Countries Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Mineral Depletion.



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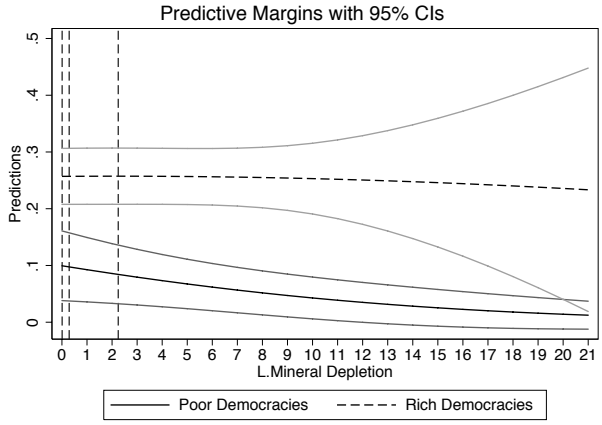

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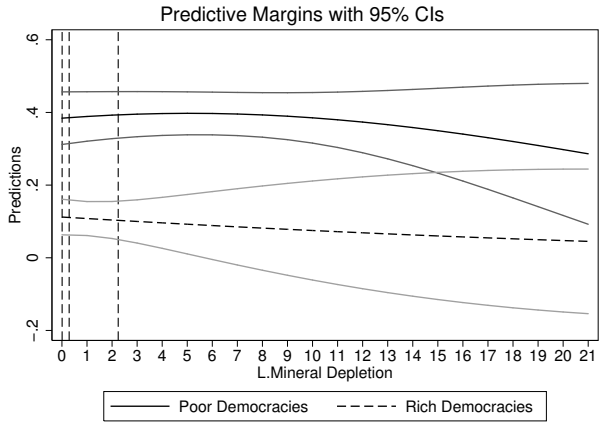


Figure 4 c: Hypothesis 4 Mineral Depletion: ICRG Value 4 = High Corruption

Figure 4: Margins Plots for Hypothesis 4 Based on Model 6 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Mineral Depletion) on Different Levels of Corruption. Increasing Values for Mineral Depletion from Minimum to Maximum. Lines Represent Rich and Poor Democratic Countries Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Mineral Depletion.

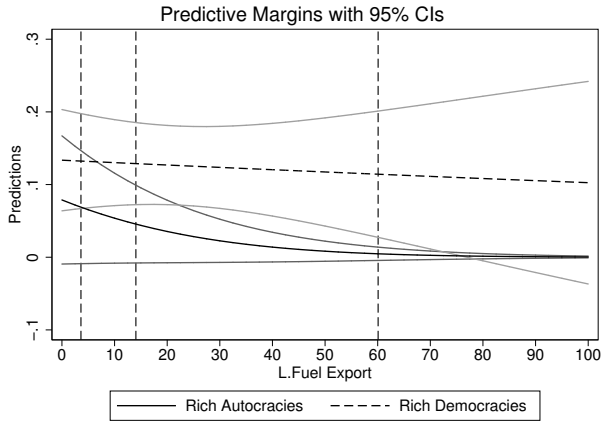
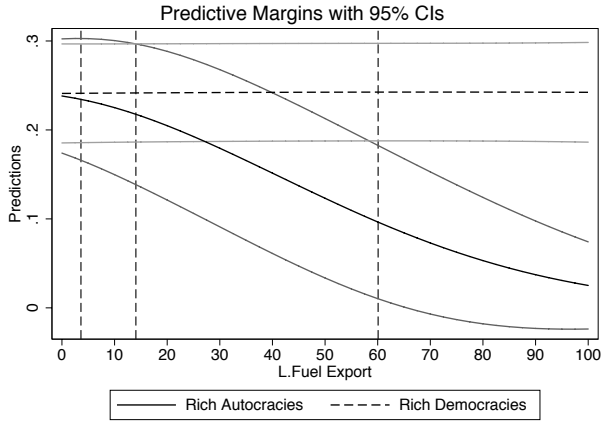


Figure 5 a: Hypothesis 1 Fuel Export: ICRG Value 0 = Low Corruption



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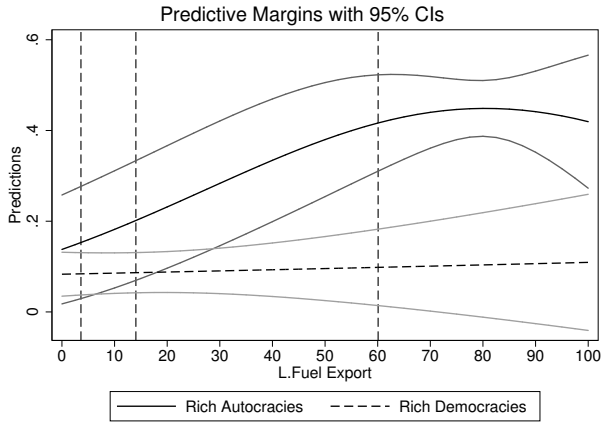


Figure 5 c: Hypothesis 1 Fuel Export: ICRG Value 4 = High Corruption

Figure 5: Margins Plots for Hypothesis 1 Based on Model 1 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Fuel Export) on Different Levels of Corruption. Increasing Values for Fuel Export from Minimum to Maximum. Lines Represent Rich Democracies (1) and Rich Autocracies (0) Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Fuel Export.

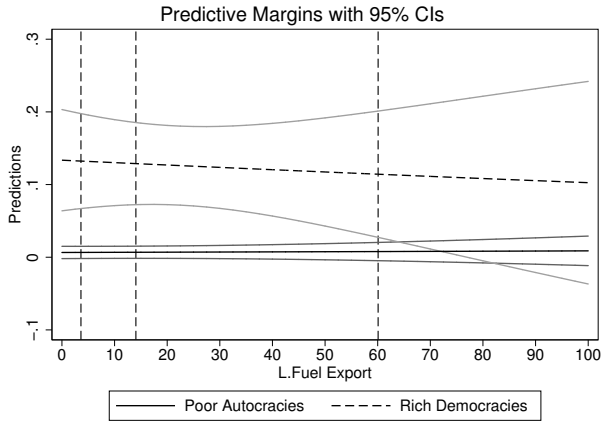


Figure 6 a: Hypothesis 2 Fuel Export: ICRG Value 0 = Low Corruption

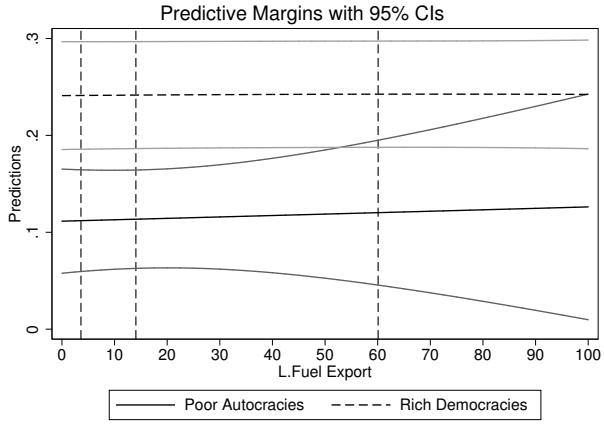


Figure 6 b: Hypothesis 2 Fuel Export: ICRG Value 2 = Medium Corruption

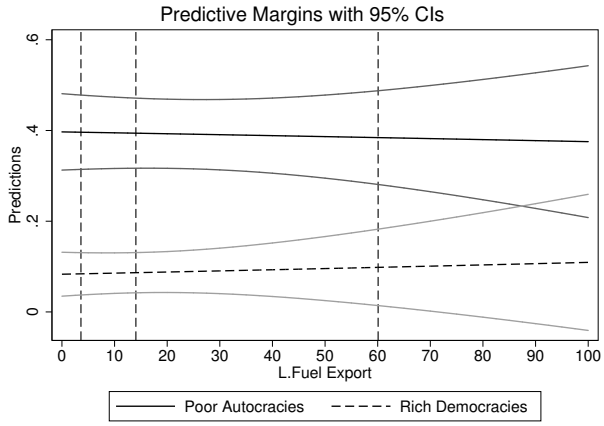


Figure 6 c: Hypothesis 2 Fuel Export: ICRG Value 4 = High Corruption

Figure 6: Margins Plots for Hypothesis 2 Based on Model 1 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Fuel Export) on Different Levels of Corruption. Increasing Values for Fuel Export from Minimum to Maximum. Lines Represent Poor Autocracies and Rich Democracies Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Fuel Export.

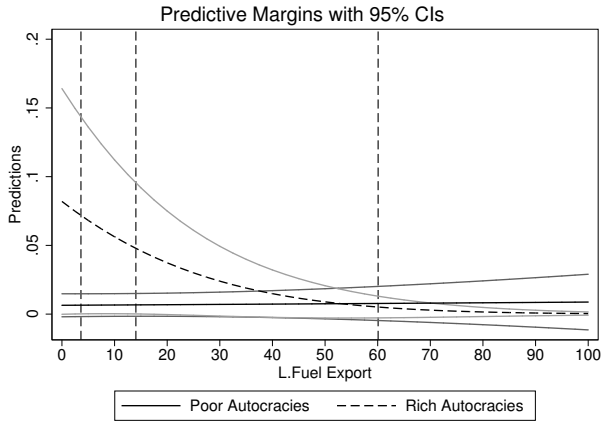


Figure 7 a: Hypothesis 3 Fuel Export: ICRG Value 0 = Low Corruption

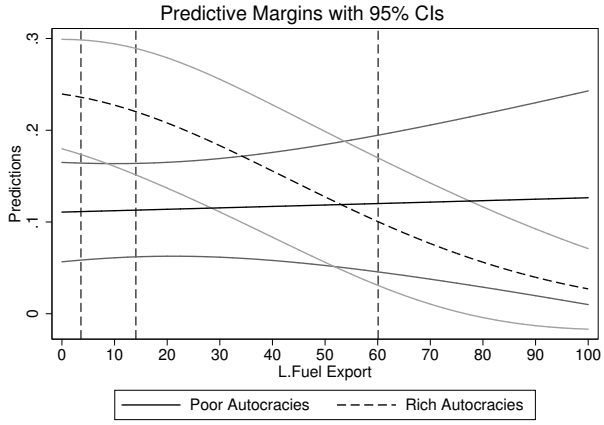


Figure 7 b: Hypothesis 3 Fuel Export: ICRG Value 2 = Medium Corruption

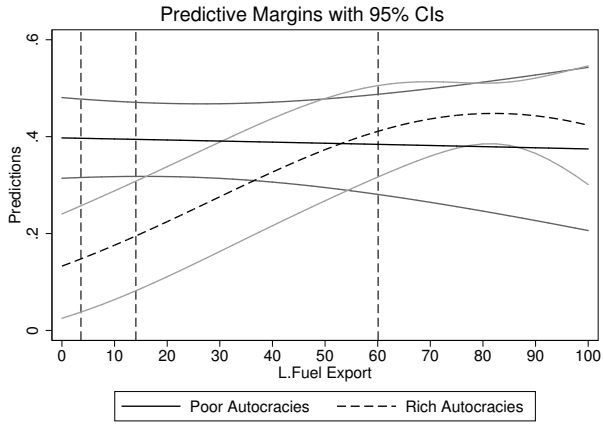


Figure 7 c: Hypothesis 3 Fuel Export: ICRG Value 4 = High Corruption

Figure 7: Margins Plots for Hypothesis 3 Based on Model 1 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Fuel Export) on Different Levels of Corruption. Increasing Values for Fuel Export from Minimum to Maximum. Lines Represent Rich and Poor Autocratic Countries Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Fuel Export.

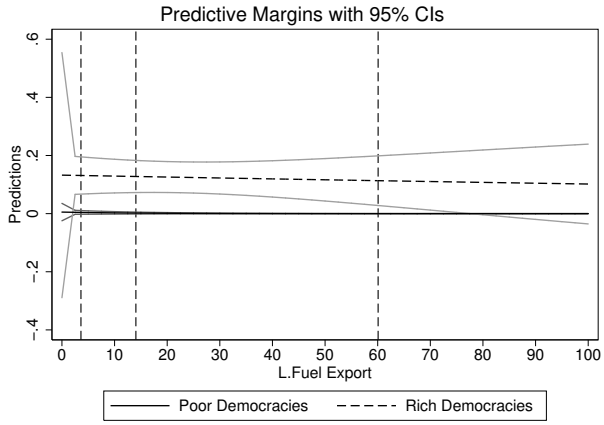
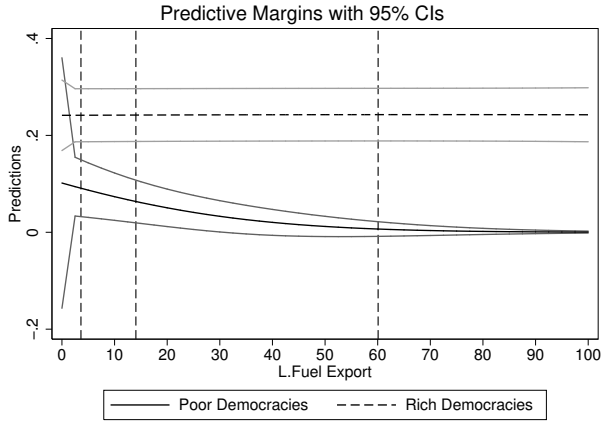


Figure 8 a: Hypothesis 4 Fuel Export: ICRG Value 0 = Low Corruption



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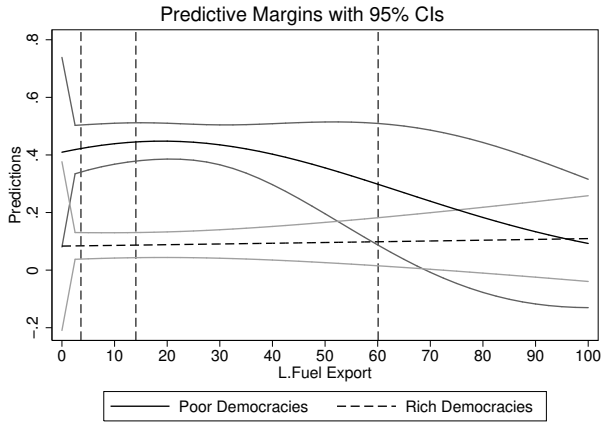

Figure 8 c: Hypothesis 4 Fuel Export: ICRG Value 4 = High Corruption

Figure 8: Margins Plots for Hypothesis 4 Based on Model 1 in Table 3. Influence of the Interaction Effect (Democracy, GDP per Capita, and Fuel Export) on Different Levels of Corruption. Increasing Values for Fuel Export from Minimum to Maximum. Lines Represent Rich and Poor Democratic Countries Including 95% Confidence Bounds. Dotted Vertical Lines: 50th, 75th, and 90th Percentile of Fuel Export.

Table 1 Variables, Operationalisations, Sources

	Variable	**Source and Operationalisation**
Dependent Variable	*International Country Risk Guide*	Political Risk Services Group. Variable transformed: high values indicate a high level of corruption.
Independent Variables	*GDP per capita*	World Bank. GPD per capita in constant 2000 US$. Values divided by 1000 for easier interpretation.
	democracy	Polity IV. Dummy variable coded 1 (`democratic') if Polity value >= 6, 0 (`autocratic') if Polity value < 6.
	energy depletion	World Bank. Adj. savings: energy depletion as per cent of GNI (NY.ADJ.DNGY.GN.ZS)
	mineral depletion	World Bank. Adj. savings: mineral depletion as per cent of GNI (NY.ADJ.DMIN.GN.ZS)
	fuel exports	World Bank. Fuel exports as per cent of merchandise exports (TX.VAL.FUEL.ZS.UN)
	oil or gas	Lujala 2009. Dummy variable coded 1 if oil or gas are present, 0 otherwise. Only onshore resources.
Control Variables	*presidential system*	Database of Political Institutions (World Bank Development Research Group). Transformed into dummy variable coded 1 if system is presidential, 0 otherwise.
	government spending	World Bank. General government final consumption expenditure as per cent of GDP (NE.CON.GOVT.ZS).
	foreign direct investment	World Bank. Net inflows as per cent of GDP (BX.KLT.DINV.WD.GD.ZS).
Robustness Section	*Protestantism*	Maoz (2013). Dummy coded 1 for countries with mainly protestant inhabitants, 0 otherwise.
	OECD	Dummy coded 1 if country is a OECD member, 0 otherwise.
	trade	World Bank. Trade as per cent of GDP (NE.TRD.GNFS.ZS).
	import	World Bank. Imports of goods and services as per cent of GDP (NE.TRD.GNFS.ZS).
	women in workforce	World Bank. Female labor force as per cent of total labor force (SL.TLF.TOTL.FE.ZS).
	law and order	Political Risk Services Group. 6 points.

Table 2 Descriptive Statistics

Variable	*Mean*	*Std. Dev.*	*Min*	*Max*
Corruption (ICRG)	2.76	1.37	0	6
Corruption (CPI)	5.50	2.25	0	9.6
Corruption (WB)	-.06	1.01	-2.59	1.49
L. Democracy Dummy	.55	.50	0	1
L. GDP per Capita	1.32	1.55	-2.10	4.20
L. Fuel Export	16.80	26.87	0	99.66
L. Democracy Dummy * GDP per Capita	1.13	1.44	-1.39	4.20
L. Democracy Dummy * Fuel Export	5.38	13.36	0	95.43
L. GDP per Capita * Fuel Export	22.98	55.59	-67.21	361.42
L. Democracy Dummy * GDP p. Cap. * Fuel Export	10.68	30.85	-43.00	284.93
L. Energy Depletion	4.62	10.11	0	155.06
L. Democracy Dummy * GDP per Capita	.94	1.39	-1.39	4.20
L. Democracy Dummy *Energy Depletion	.85	3.22	0	51.53
L. GDP per Capita *Energy Depletion	5.34	15.71	-19.06	136.14
L. Democracy Dummy * GDP p. Cap. * Energy Depl.	1.55	7.08	-9.93	136.14
L. Mineral Depletion	1.07	3.51	0	48.49
L. Democracy Dummy * Mineral Depletion	.65	2.88	0	48.49
L. GDP per Capita * Mineral Depletion	8.36	26.91	0	365.81
L. Democracy Dummy *GDP p. Cap. * Mineral Depl.	5.36	22.78	0	365.81
L. Oil or Gas Dummy	.68	.47	0	1
L. Democracy Dummy * GDP per Capita	.94	1.38	-1.39	4.20
L. Democracy Dummy * Oil or Gas Dummy	.35	.48	0	1
L. GDP per Capita * Oil or Gas Dummy	.87	1.42	-2.19	4.02
L. Democracy Dummy * GDP p. Cap. *Oil or Gas	.71	1.28	-1.39	3.98
L. Presidential System	.63	.48	0	1
L. Government Consumption	15.65	5.94	2.98	45.26
L. FDI	2.54	4.05	-55.24	45.15

ICRG: Fuel Export Variables and Control Variables Based on Model 1 of Table 3 (2090 Observations), Energy Depletion Based on Model 2 of Table 3 (2523 Observations), and Oil and Gas Dummy Based on Model 3 of Table 3 (2542 Observations), CPI: 1723 Observations, WB: 1665 Observations, Mineral Depletion Based on Model 6 of Table 3 (2359 Observations)

Table 3 Ordered Logit Estimation for the Conditional Effect of Commodities on Corruption (ICRG, WB and CPI Data) Dependent on Economic Development and Democracy (1984-2007 for ICRG, 1995-2012 CPI, 1996, 1998, 2000, 2002-2012 for WB)

	Model 1 ICRG Fuel Export	**Model 2** ICRG Energy Depl.	**Model 3** ICRG Oil/Gas Dummy	**Model 4** WB Fuel Export	**Model 5** CPI Fuel Export	**Model 6** ICRG Mineral Depl.
L. Democracy Dummy	0.966	1.048	1.041	-1.997	2.132 ***	3.077 ***
	(1.200)	(1.016)	(1.343)	(1.247)	(0.536)	(0.999)
L. GDP p.c.	-0.398 ***	-0.339 ***	-0.334 ***	-0.204	-1.041 ***	-0.034
	(0.134)	(0.114)	(0.114)	(0.130)	(0.071)	(0.110)
L. Fuel Export	-0.055 **			0.050	-0.017	
	(0.025)			(0.031)	(0.019)	
L. Democracy Dummy * GDP per	-0.125	-0.137	-0.109	0.251	-0.266 ***	-0.404 ***
Capita	(0.142)	(0.123)	(0.162)	(0.171)	(0.071)	(0.124)
L. Democracy Dummy * Fuel	0.137 ***			-0.051	0.023	
Export	(0.042)			(0.091)	(0.030)	
L. GDP per Capita	0.008 ***			-0.005	0.004	
*Fuel Export	(0.003)			(0.004)	(0.002)	
L. Democracy Dummy * GDP p.	-0.015 ***			0.005	-0.002	
Cap. * Fuel Export	(0.005)			(0.011)	(0.003)	
L. Presidential	0.420 ***	0.411 ***	0.493 ***	-0.080	0.347 ***	0.568 ***
System	(0.158)	(0.143)	(0.152)	(0.189)	(0.109)	(0.164)
L. Government	-0.051 ***	-0.049 ***	-0.047 ***	-0.014	-0.045 ***	-0.046 ***
Consumption	(0.012)	(0.010)	(0.010)	(0.011)	(0.008)	(0.011)
L. FDI	0.027 ***	0.020 **	0.019 **	-0.001	0.001	0.016 **
	(0.009)	(0.008)	(0.008)	(0.010)	(0.003)	(0.008)
L. Energy Depletion		-0.122 ***				
		(0.046)				
L. Democracy Dummy		0.402 ***				
*Energy Depletion		(0.097)				
L. GDP per Capita		0.016 ***				
* Energy Depletion		(0.005)				
L. Democracy Dummy		-0.043 ***				
* GDP p. Cap. *Energy Depl.		(0.011)				
L. Oil or Gas Dummy			-1.872			
			(1.676)			
L. Democracy Dummy			2.706			
* Oil or Gas Dummy			(2.047)			
L. GDP per Capita			0.303			
* Oil or Gas Dummy			(0.207)			
L. Democracy Dummy			-0.381			
* GDP p. Cap. *Oil or Gas			(0.246)			
L. Mineral Depletion						0.445
						(0.590)
L. Democracy Dummy						-0.218
* Mineral Depletion						(0.611)
L. GDP per Capita						-0.059
* Mineral Depletion						(0.079)
L. Democracy Dummy*GDP						0.034
p. Cap. *Mineral Depl.						(0.082)
Observations	1926	2359	2367	84	1037	2359
Pseudo R2	0.194	0.172	0.158			0.155
LR Chi2	271.344	241.832	229.911		1676.269	187.605
Prob > R2	0.000	0.000	0.000	0.000	0.000	0.000
Adjusted Count R2	0.185	0.157	0.125			0.140
Adjusted McFadden R2	0.188	0.167	0.153			0.150
R2				0.379	0.955	

Coefficients with clustered robust standard errors in parentheses for all models except for WB and CPI; WB and CPI panel corrected standard errors, panel specific AR 1 process,* p<0.1 ** p<0.05 *** p<0.01 (significant at the 10%, 5%, and 1% level respectively)

Table 4 Summary of the Empirical Results of Table 3 Based on the Margin Graphs (Figures 1--8 , A.1--A.12)

Indicators ->	Mineral Depletion				Fuel Export				Energy Depletion			
	H1	**H2**	**H3**	**H4**	**H1**	**H2**	**H3**	**H4**	**H1**	**H2**	**H3**	**H4**
	Fig.1a-1c	*Fig.2a-2c*	*Fig.3a-3c*	*Fig.4a-4c*	*Fig.5a-c*	*Fig.6a-6c*	*Fig.7a-7c*	*Fig.8a-8c*	*Fig.A.1a-A.1c*	*Fig.A.2a-A.2c*	*Fig.A.3a-A.3c*	*Fig.A.4a-A.4c*
ICRG Value=0	++	+++	o	+++	+	+++	o	++	+	+++	o	+++
ICRG Value=2	o	+++	o	+++	+	+++	++	+++	+	+++	++	+++
ICRG Value=4	+++	+++	+	+++	+	+++	+++	++	+	+++	+++	+++
	Fig.A.5a	*Fig.A.7a*	*Fig.A.9a*	*Fig.A.11a*	*Fig.A.5c*	*Fig.A.7c*	*Fig.A.9c*	*Fig.A.11c*	*Fig.A.5b*	*Fig.A.7b*	*Fig.A.9b*	*Fig.A.11b*
CPI	+++	+++	+++	+++	o	+++	+++	+++	o	+++	+++	+++
	Fig.A.6a	*Fig.A.8a*	*Fig.A.10a*	*Fig.A.12a*	*Fig.A.6c*	*Fig.A.8c*	*Fig.A.10c*	*Fig.A.12c*	*Fig.A.6b*	*Fig.A.8b*	*Fig.A.10b*	*Fig.A.12b*
WB	++	+++	o	+++	o	++	o	o	o	+++	+++	+++

Notes: ``o'' = no support, ``+'' = weak support (<50%), ``++'' = medium support (around 50%), ``+++'' = large support (>75%). These values are based on the distribution of the natural resource variable (i.e. the percentiles).