

# **Is there a fiscal resource curse?**

## **Resource rents, fiscal capacity and political institutions**

Tania Masi (University of Milano-Bicocca)  
Antonio Savoia (GDI, University of Manchester)  
Kunal Sen (GDI, University of Manchester)

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### **ABSTRACT**

While several studies have focused on the effect of natural resources on economic development, less attention has been paid to their effects on other development outcomes. We contribute to this literature by studying the impact of resource rents on fiscal capacity, i.e., the ability of states to raise revenues from broad tax bases. We posit that natural resource rents reduce the incentives to invest in fiscal capacity. However, political institutions that limit the power of the executive, by reducing rulers' discretion over the use of resource revenues, may mitigate, neutralise or reverse such negative effect. We provide empirical support for this hypothesis using panel methods covering the period 1981-2011 and 98 developing countries. Moreover, we show that the effect of resource rents is likely to work mainly through institutions that make the tax system accountable and transparent to the citizens.

**Keywords:** state capacity, fiscal capacity, resource curse, institutions, economic development

**JEL Codes:** O4, P5, N4

## 1. Introduction

The effect of natural resource abundance on the economy has been a lively area of research for many years.<sup>1</sup> Traditionally, most research has concentrated on long-term growth effects, initially finding a “resource curse”, and more recently arguing that the long-term effect of specialising in natural resources depends on the type of resources (e.g., Isham et al. 2005) and the quality of the institutional environment in the economy (e.g., Mehlum et al. 2006).<sup>2</sup> As yet, less analysis has been devoted to other development outcomes. For example, underexplored areas include the effects on inequality (Carmignani 2013; Goderis and Malone 2011; Fum and Hodler 2010), education (Ebeke et al 2015; Stijns 2006), health and living standards (Edwards 2016; Pineda and Rodriguez 2010; Caselli and Michaels 2013). This paper contributes to the literature by looking at a further underexplored issue: the effects of natural resource income on state capacity and, in particular, fiscal capacity<sup>3</sup>. We provide a systematic econometric analysis of the effect of resource rents on tax systems, arguing that it appears to depend on the quality of political institutions.

Our hypothesis is that natural resource rents reduce the incentives to invest in fiscal capacity, but such effect depends on whether political institutions limit the power of the executive and hence promote accountability and common interests. To test this hypothesis, we use panel methods on a sample of 98 developing countries, from 1981 to 2011. Our fiscal capacity measure, the share of non-resource taxes on income, profits and capital gains on non-resource total taxes, is based on the intuition that collecting income taxes requires a more

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<sup>1</sup> To explain its effects, research has referred to resource “abundance” or “rich”, “dependence”, “intensity”, “boom” or “windfall” (see Norman (2009), Stijns (2006), Brunnschweiler and Bulte (2008)). The term “dependence” usually refers to the structure of the economy (e.g., captured as resource exports/GDP). “Intensity” refers to the rate at which one exploits natural resources. “Boom” and “Windfall” pertain to shocks, either because new natural resources are discovered or because there is an increase in commodity prices. “Abundance” or “rich” concern the value of the natural resource endowments or the income they generate, measurable as subsoil wealth or resource rents, but they has also been used as terms encompassing all the above aspects. Here we use them in this latter sense.

<sup>2</sup> Many studies have addressed the counter-intuitive idea that countries rich in exploitable natural resources perform worse than those without. Much of the early literature argues the adverse effect of natural resource abundance on economic growth (e.g., Sachs and Warner, 1999, 2001; Rodriguez and Sachs, 1999; Gylfason 2001). See van der Ploeg (2011) for a comprehensive survey of the hypotheses and evidence. Alongside the focus on growth, the literature has also shown that natural resources abundance leads to higher level of corruption (e.g., Caselli and Michaels, 2013), civil conflicts (e.g., Collier and Hoeffler 2004), and less democracy (e.g., Ross 2001). The negative effects of natural resources are, however, controversial. For example, Alexeev and Conrad (2009) claim that a large endowment of oil and mineral resources has a positive effect on long-term economic growth and does not negatively impact on the quality of institutions. Cotet and Tsui (2013) contradict the statistical association between the value of oil reserves and the onset of civil war, and Haber and Menaldo (2011) find that increasing resource dependence does not promote dictatorship over the long run. Bjorvatn and Naghavi (2011) argue that higher resource rents may promote political stability. Finally, Stijns (2006) denies the negative correlation between resource abundance and human capital.

<sup>3</sup> Following Besley and Persson (2011), we consider fiscal capacity the ability of a fiscal system to raise revenues from a broad tax base.

developed and competent administrative structure than raising other types of taxes (see Besley and Persson 2014) and is constructed using the ICTD Government Revenues Dataset (Prichard et al., 2014), with improved coverage and the crucial distinction between resource and non-resource revenues. We find persuasive evidence that political institutions placing institutionalised constraints on the executive power, after extensive robustness checks, may mitigate, neutralise or even reverse the negative effect of natural resources rents on fiscal infrastructures. Hence, a fiscal resource curse does not necessarily materialise. These results are complemented with further analysis to assess how the interaction between political institutions and resource rents impacts on specific aspects of fiscal capacity. Using a recent set of indicators provided by the Public Expenditure and Financial Accountability project (PEFA, 2006), we provide initial evidence suggesting that the effect works mainly through institutions that make the tax system accountable and transparent to the citizens.

In addition to contributing to the literature on the resource curse, our paper adds to the research on the determinants of state capacity, an area that has as yet seen relatively little empirical analysis (Savoia and Sen 2015), despite now being considered strategically important for economic development (Besley and Persson 2011). Indeed, the capacity to collect revenues is indispensable for the provision of public goods and investments in infrastructure, as stylised facts suggest that developing economies collect, on average, a significantly smaller share of taxes compared to advanced market economies (Besley and Persson 2014). Hence, assessing whether a geographical feature shaping the structure of the economy, such as the presence of a significant natural resources sector, comes with the likely price of underdeveloped tax systems may have relevant policy trade-offs. We find that this is not the case, if countries have suitable political institutions.

The paper is structured as follows: Section 2 reviews the literature and sets out our hypotheses; Section 3 describes the empirical strategy and data. In Section 4, we test our hypotheses and identify the specific channels through which natural resources affect the fiscal system. Section 5 concludes.

## **2. Resource rents, fiscal capacity and political institutions**

There seems to be a consensus in the literature that increasing natural resources rents may be harmful to taxation, as governments tend to substitute tax revenues with resource revenues. Part of the literature has discussed this effect with respect to the short-term macroeconomic consequences for taxation, in terms of the amount and composition of tax revenues, as well as

spending. James (2015) argues that a benevolent government decreases non-resource tax rates and increases spending and savings in response to higher resource revenues, providing US-state level evidence: a \$1 increase in resource revenue results in a \$0.25 decrease in non-resource revenue, a \$0.43 increase in government spending and a \$0.32 increase in public savings. Morrison (2009) finds that an increase in non-tax revenue is associated with reduced taxation on elites in democracies and more social spending in dictatorships. Focussing on the consequences for tax composition in resource-rich economies, Crivelli and Gupta (2014) find a large negative impact of resource revenues on the taxation of goods and services and a more modest impact on corporate income tax and trade taxes. Looking at tax performance, Morrissey et al. (2016) find that a reliance on natural resources amplifies the negative effects of macroeconomic shocks (terms of trade, exchange rates and natural disasters) on total revenues. Interestingly, they also find that democracies tend to outperform non-democracies in revenue resilience to shocks in lower income countries.

Recently, increasing attention has been paid to the long-term consequences, i.e., the effect of natural resources rents on tax system building. The political science literature had long characterised *rentier states*, whose main features are their weakness, lack of accountability of state institutions, and their dependence on revenue from natural resources (e.g., see Karl 2004). Building on this, the negative effect of resource rents on taxation can be explained by considering the incentives for investing in fiscal capacity, modelled as governments' investment choice under uncertainty (Besley and Persson, 2010, 2011). As incumbent governments can use resource revenues to provide public goods and services, and thereby increase political support, "windfall" revenues increase the likelihood that incumbents' choices is dominated by such *redistributive interest*, rather than a *common interest*, so reducing the incentive to invest in fiscal capacity. Knack (2009) provided initial cross-section evidence, partly consistent with this hypothesis. Jensen (2011) provide further evidence from a panel of thirty hydrocarbon-rich economies, finding that a 1% increase in hydrocarbon revenues causes a 1.5% decrease in non-resource tax effort, a proxy for fiscal capacity. An earlier panel study by Bornhorst et al. (2009), on a similar sample of countries and variables, finds a smaller effect: an additional percentage point of revenue from hydrocarbons reduces revenues from other domestic sources by 0.19 percentage points of GDP.

Although there is agreement on the negative effect of natural resources rents on fiscal capacity, the actual empirical evidence is fairly limited, often fraught with methodological challenges, and in need of systematic investigation. Moreover, existing studies do not

consider a crucial aspect at the heart of our analysis: the interplay between natural resource rents and the quality of institutions. A number of papers argues, and empirically demonstrates, that institutions can mitigate or even reverse the resource curse (e.g., Melhum et al. 2006; Brunnschweiler 2008; Boschini et al. 2007; El Anshasy and Katsaiti 2013; Bhattacharyya and Hodler 2010, 2014; Ebeke et al. 2015; Omgba 2015).<sup>4</sup> Two explanations have been put forward to understand the role of institutions: the “rent-seeking model” (Tornell and Lane 1999; Torvik 2002; Melhum et al. 2006) and the “patronage model” (Robinson et al. 2006; Caselli and Cunningham 2009).<sup>5</sup> According to the former, the economic institutions governing the private sector are what matters. Resource rents change the preferences of private individuals so they switch from productive to unproductive activities. Thus, natural resources hinder economic growth only if the quality of institutions that govern the profitability of productive enterprise is such that incentivises rent seeking. For example, Melhum et al. (2006) argue that the combination of resource abundance and “grabber friendly” institutions is detrimental for economic development, while “producer friendly” institutions help countries take full advantage of their natural resource endowments. On the contrary, the “patronage model” focuses on the institutions governing the use of public sector resources. Resource rents increase the value of incumbency and provide politicians with more funds that can be used to influence the outcome of elections, thereby increasing resource misallocation in the rest of the economy. However, institutions that promote accountability and state competence discourage the perverse political incentives that resource rents create.

Perverse effects from rent seeking and patronage are not mutually exclusive and can operate together. But is there an institutional environment where an economy can have both private sector and state institutions that avert rent-seeking and patronage mechanisms? This is where political institutions that place effective constraints on a ruler can play a major role. Such political systems promote contracting and property rights institutions, fostering productive activities, so that a large cross-section of society can take advantage of economic opportunities (Acemoglu, Johnson and Robinson 2005). At the same time, limits on executive power promote a *common interest* environment, in which the ruling minority is unable to hand out favours to cronies or themselves (Besley and Persson 2011). In this paper, focussing

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<sup>4</sup> Andersen and Aslaksen (2008) argue that what matters in reducing negative effects on growth is the constitutional arrangement: presidential regimes and proportional electoral systems are more likely to be afflicted by the resource curse. The detrimental effect of natural resources may also be reversed by high human capital endowments (Kurtz and Brooks, 2011), while public spending could mitigate civil conflicts related to oil wealth (Bodea et al. 2016).

<sup>5</sup> Caselli and Cunningham (2009) define the underlying mechanisms of these models as decentralised and centralised, respectively. Other mechanisms (soft budget constraint and wealth effect) are considered of secondary importance.

on this kind of political institutions, we assess if natural resource rents harm fiscal capacity and if having a higher level of checks and balances on executive power can change this effect. Subject to checks and balances, a ruler has little discretion over the use of natural resource rents. Hence he or she may be more likely to promote an effective independent civil service (rather than one based on patronage, which may undermine the competence of the state bureaucracy) and so maintain or innovate fiscal infrastructures and the state's ability to raise tax revenues. Similarly, subject to clear limitations to his or her powers, a ruler is more likely to follow the rule of law, so that the judicial system may counter rent seeking more effectively, and to have a more transparent policy process, so to reduce waste and corruption. Figure 1 suggests that a fiscal resource curse does exist: countries with a high level of total natural resource rents collect a low level of taxes as a percentage of GDP. However, splitting the sample into countries with political institutions placing high and low levels of constraints on the executive power (right-hand scatter plot) shows that the effect of resource rents on taxation can be heterogeneous.<sup>6</sup>

[Figure 1 about here]

Let us reformulate our argument on the role of natural resource rents in developing fiscal capacity and their interplay with political institutions via two testable hypotheses:

- i. *Resource rents reduce the incentives to invest in fiscal capacity, so resource-rich countries have less developed tax systems.*
- ii. *Political institutions placing limits on the executive powers foster productive activities and promote common interests, so raising the incentives for investing in fiscal capacity. The negative effect of natural resources rents on fiscal infrastructure is therefore mitigated, neutralised or even reversed in countries with a higher level of executive constraints.*

The following sections investigate the above hypotheses, using different measures of fiscal capacity.

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<sup>6</sup> Taxes are defined as the non-resource component of total tax revenues excluding social contributions, from ICTD (2014), and are averaged over 2000-2011. Total natural resource rents are averaged between 1970 and 1999 and are from World Bank (2016). The sample is split, considering the median value of *executive constraints* from Polity IV (Marshall et al. 2014) Variables and sources are described in Table 1A in the Appendix. The apparently heterogeneous effect of natural resource rents is confirmed even when a possible outlier such as Lesotho is excluded from the sample (Figure 1A in the Appendix).

### 3. Empirical strategy and data

The previous section suggests that there may be a non-linear relationship between resource income and fiscal capacity, depending on the type of political institutions. In principle, there are two possible approaches to estimate this relationship.

The first estimates the relationship under investigation using cross-country data in levels, since the types of mechanism we seek to document look at the structural conditions under which countries develop capable states, and are, therefore, long-term in nature. In this case, regressions based on cross-section averages, as shown in Figures 1 and 1A, are suitable. However, there are at least two problems with this approach. The first is the vulnerability to omitted variable bias, as there may be several hard-to-capture factors correlated with both the volume of resource rents and state capacity. The second is that shaping the structure of the economy, including its degree of reliance on natural resources, is a process driven by a variety of social forces, including state institutions. Hence, the estimated effect of natural resource reliance could be affected by reverse causality and be subject to bias.

The second approach relies on assessing if the type of relationship documented in Figures 1 and 1A disappears when looking at the effect of changes in resource income on fiscal capacity. If it does not, we are probably capturing a causal effect. This approach involves the use of panel methods, conditional at the initial level on political institutions. In particular, looking at the effect of changes in resource income on fiscal capacity eliminates confounding time-invariant country-specific factors. That is, fixed effects can be added to take care of country-specific factors affecting both resource income and fiscal capacity, while time effects can be added to control for global trends.

We prefer the panel approach, but we also present cross-section estimates (as we attempt to capture the effects of resource rents on specific institutional aspects of the tax systems). This is coupled with the choice of a resource income variable allowing clean identification of its effect. We use resource rent data, as a share of national income, provided by the World Bank.<sup>7</sup> Such variables are based on commodity prices. Assuming that both the identity of a country's commodities and world prices are largely exogenous to state

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<sup>7</sup> Resource rent estimation is based on sources and methods fully described by the World Bank (2011), i.e., on the difference between the price of a commodity and the average cost of producing it, estimating the world price of units of specific commodities and subtracting estimates of average unit costs of extraction or harvesting costs (including a normal return on capital). The unit rents are then multiplied by the quantities countries extract or harvest to determine the rents for each commodity as a share of gross domestic product (GDP). Such measures are based on estimates and therefore are subject to measurement error. However, as long as the noise approximates classic errors in variables case, this is a source of attenuation bias. Therefore, it stacks the odds against our results implying that estimates of the effects of natural resource rents may be conservative.

institutions, this measure avoids identification problems related to the estimation of the effects of natural resources (this approach was first proposed by Caselli and Tesei, 2016). This assumption can be tested, albeit indirectly. We investigate whether it holds by excluding from the sample large commodity producing countries able to influence world prices.

We estimate:

$$FC_{it} = b_0 + b_1 RR_{it-4-\text{bar}} + b_2 EC_{it-4} + b_3 RR_{it-4-\text{bar}} * EC_{it-4} + \mathbf{bX}_{it} + \mu_i + \lambda_t + u_{it} \quad (1)$$

$FC_{it}$  is fiscal capacity at time  $t$ . Capturing this concept is particularly challenging.<sup>8</sup> The literature identifies two approaches. The first one, which near ideal as closer to the concept one wants to capture, is to have a direct measure of the institutions that are part of the tax system, but such measures are scarce, cover few countries (when available), and are not immune from methodological challenges themselves.<sup>9</sup> The second one is to resort to outcome-based proxies, such as tax effort ratios. Such measures may well reflect political preferences of a polity towards the size of the public sector and the scope for redistribution (Lieberman 2002), but they have the major advantage of being available for a large number of countries over time. We use both types of fiscal capacity measures. In cross-section results, we use the first type. In panel regressions, instead, the second one: our measure of fiscal capacity is given by the ratio between non-resource taxes on income, profits, and capital gains and total non-resource tax revenues. Contrary to previous proxies of fiscal capacity, often based on the amount of total taxes as a percentage of GDP, ours is more likely to separate the capacity to raise taxes from governments' policy choices. Indeed, collecting income taxes requires major investments in fiscal infrastructures compared to other types of taxes (Besley and Persson 2011: 41-42). Data was taken from the recent Government Revenues Dataset (GRD) (see Prichard et al. 2014). This dataset combines data from several international databases, with marked improvements in data coverage. Crucially, it also allows distinguishing the natural resources component of tax revenues from the non-resource one, so improving the accuracy of measurement.<sup>10</sup>

$RR_{t-4-\text{bar}}$  is the resource rent, as described above, averaged over  $t-4$  to  $t-1$  (with a non-overlapping structure), allowing for possible lags in the reaction of fiscal authorities to events

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<sup>8</sup> The perennial challenge of measuring state capacity is to avoid conflating *state capacity* (which is about institutions) with *state performance* (which is about outcomes). See the discussion in Centeno et al. (2017).

<sup>9</sup> The practice of measurement involves making choices subject to significant trade-offs (e.g., *objective* versus *subjective* measurement, or *de jure* versus *de facto*). On this, see Savoia and Sen (2015).

<sup>10</sup> We use the merged version of the GRD dataset in order not to underestimate fiscal capacity in countries with a federal system.

in the natural resources sector and in the political system.<sup>11</sup>  $EC_{t-4}$  captures the quality of political institutions at  $t-4$ , the beginning of each episode. In line with our hypothesis, it is measured by the *Executive Constraints* variable ( $xconst$ ), provided by the Polity IV dataset (Marshall et al., 2014) and capturing the extent of constitutional limits on the exercise of arbitrary power by the executive.  $RR_{it-4-bar} * EC_{it-4}$  is the interaction between natural resources and institutional quality.

$X_{it}$  is a set of time-varying controls (also averaged over  $t-4$  to  $t-1$ , with a non-overlapping structure). Some of them are standard variables from the literature on the origins of state capacity, including population density, external war and civil war. Population density should be positively correlated with state capacity, assuming that it is less challenging to develop taxation infrastructures in states where the population is concentrated in urban areas (Herbst 2000). We use the number of people per square kilometres of land, as calculated by the World Bank (2016). External conflicts increase the demand for public services such as defence and thereby increase the incentive to invest in state capacity. On the contrary, civil wars, promoting redistributive interests, hinder the construction of an efficient fiscal apparatus (Besley and Persson 2010). To capture these effects, we use the hostility level of interstate disputes (Palmer et al., 2015) and the intensity level of internal and internationalised internal armed conflict (UCDP/PRIO 2016), respectively. Finally, given the nature of our proxy for fiscal capacity, we also add controls that are macroeconomic in nature, as suggested in empirical studies on tax effort (e.g., Crivelli and Gupta 2014): the level of external debt, the sum of exports and imports of goods and services measured as a share of gross domestic product, and the level of aid measured as official development assistance per capita. Table 1A (in the Appendix) describes variables and sources, and Table 2A describes the sample.

All regressions include country and year dummies ( $\mu_i$  and  $\lambda_t$ , respectively). Standard errors are clustered at the country level to allow for unknown forms of heteroskedasticity and serial correlation. We study a sample of 98 developing countries from 1981 to 2011. The descriptive statistics presented in Table 1 show that our key variables vary both across countries and over time. Breaking the period down into decades shows that such a pattern of variation is not driven by any particular sub-period (Table 1, panel b).

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<sup>11</sup> This approach appears to be standard in the resource curse literature (e.g., Caselli and Tesei 2016, and Bhattacharyya and Hodler 2010), as well as broader political economy literature investigating institutional factors (e.g., Clomp and de Haan 2016). Presumably, empirical analyses using a panel with “high frequency” data (e.g., yearly) would fail to properly capture structural characteristics..

[Table 1 about here]

## 4. Results

This section presents the results, in four steps. We first consider the total amount of resource rents. Then, we decompose it to look at how different natural resources affect fiscal capacity. A series of robustness checks follows. Finally, we present further results, based on cross-section estimates, unpacking fiscal capacity to identify which institutions within the tax system are affected.

### 4.1 The effect of natural resources rents on fiscal capacity

Table 2 presents our baseline results. Columns 1-3, where the variable of interest enters in linear form, show a negative but not significant effect of total natural resource rents on fiscal capacity. However, once we consider the possibility of a non-linear relationship between resource rents and fiscal capacity, the coefficient of total natural resource rents is significant and so is its interaction term with our measure of political institutions. Column 4 shows that on average fiscal capacity tends to be lower when countries experience an increase in resource rents. However, the interaction term appears significantly positive, suggesting that the negative effect of resource rents diminishes when the level of executive constraints increases. This result holds when the set of controls is included (Column 5). External debt, population density and civil war are significant and have the expected signs: fiscal capacity is higher for less sparsely populated states, whereas external debt and civil war decrease the investments in tax infrastructures.

[Table 2 about here]

Column 1 in table 4 shows the marginal effects of total natural resource rents at different levels of constraints on the executive. The results confirm our hypotheses: resource rents negatively affect fiscal capacity when the level of executive constraints is very low, but they can even be a blessing for countries where the executive power is subject to effective checks and balances. For countries, such as Congo, Gabon and Uzbekistan, where constitutional restrictions on executive action are weak ( $xconst=1$  for significant periods), a 1% increase in total natural resource rents would reduce the ability to raise direct taxes, our proxy for fiscal capacity, by approximately 0.41 percentage points. On the other hand, in

countries with the highest level of executive constraints (e.g., Albania and Costa Rica), the same increase in resource rents would improve fiscal capacity by 0.37 percent.<sup>12</sup> Considering that the (within) standard deviation in resource rents is above three percentage points, such effects also appear to be economically significant.

Next, we assess the effect of specific natural resources. Some studies suggest that the resource curse may be driven by specific types of natural resource endowments (Isham et al., 2005; Boschini et al., 2007), hence we consider individual components of total natural resource rents: forest, oil, gas, and mineral rents.<sup>13</sup> Disaggregating the effects, Table 3 indicates that none of the four types of resource rents is the sole force driving the heterogeneous effect on fiscal capacity. Indeed, linear restriction tests always reject the null that the effects of different are jointly equal to zero. Moreover, we also test the linear restriction that the coefficient of each type of resource and its interaction term are jointly equal to zero, always rejecting it.<sup>14</sup> As a final check, in Table 5, we repeat the regression in the last column of table 2 excluding, in turn, each type of resource from total rents. The interaction effect stays unchanged in all cases. All this suggests that the interaction effect is at work for each specific resource and that no specific type of resource rents dominates the results. The general message remains that natural resources may be a curse or a blessing, depending on the level of executive constraints.

[Tables 3 about here]

However, these results also suggest that different resource rents may affect fiscal capacity differently. Table 4 shows the marginal effects for each type of resource rent calculated using the coefficients from the first column of table 3. Interestingly, the largest negative effect on fiscal capacity is mainly due to mineral rents (and then forest), but vanishes when the level of executive constraints is at least 4. This echoes earlier findings on minerals

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<sup>12</sup> For the sake of thoroughness, we have also considered the partial effect of executive constraints at different levels of resource rents. For instance, natural resource rents in developing economies can stifle democratic governance and political institutions via rent-seeking activities by influential private actors or through patronage by the local elite. Hence, an alternative interpretation to our interaction term is that developing economies with less natural resource income may be less prone to such effects. To test this hypothesis, we estimated the magnitude and significance of the partial effect of executive constraints calculated at different levels of resource rents. Such estimates, available on request, show that the effect of executive constraints can decrease in magnitude and even change sign in environments with higher resource rents. However, there is no evidence that such effects are significant at conventional levels.

<sup>13</sup> The World Bank also provides data for coal rents, but they are ignored due to the lack of variation (very few observations are different from zero).

<sup>14</sup> The related p-value for mineral rents is 0.045. For gas rents is 0.057, while for both oil and forest rents is 0.000. This also indicates that collinearity may be spoiling the statistical significance of individual coefficients.

and health outcomes (Edwards 2016), but crucially extends and qualifies them, suggesting that negative effects may not materialise, depending on the nature of political institutions; whereas oil and gas rents either have no effect or can actually foster investments in fiscal infrastructures if the level of executive constraints is high ( $xconst \geq 3$ ). Bearing in mind that collinearity may be affecting the standard errors, one can cautiously say this partly contradicts initial empirical findings on the negative effects of point-source resources, while offering some support to those who cast doubt on the apparent curse of oil resources for economic and political development (e.g., Aleexev and Conrad 2009).

[Tables 4 - 6 about here]

#### **4.2 Robustness checks: the identifying assumption**

The above findings are robust to controlling for all time-invariant variables and for a number of time-varying variables included in the regressions, as well as common trends. However, these results are based on the assumption that resource rents, measured on the basis of international commodity prices, are exogenous to a country's institutions, whereas our results may be driven by large commodity producers, who can influence world commodity prices, raising endogeneity concerns with respect to our variable. Therefore, all OPEC members and countries accounting for more than 3% of total world production of a certain commodity have been excluded from the sample.<sup>15</sup> In all our key regressions, the result on the heterogenous impact of natural resources proves to be robust (Table 7, columns 5-8).

Finally, we present further robustness checks based on the importance of natural resource rents for the economy. We exclude countries in the top and bottom decile of resource rents. Excluding the bottom and top decile, the baseline results are confirmed.

[Tables 7-11 about here]

#### **4.3 How do resource rents affect fiscal capacity?**

Our findings indicate that political institutions limiting executive power create the conditions to offset (or even reverse) the negative effects that reliance on natural resources can have on fiscal systems. However, we have not identified hitherto which specific fiscal institutions are affected, an exercise that could deliver insights on the channels of causation.

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<sup>15</sup> We identify OPEC members and big producers following Caselli and Tesei (2016).

Here we do consider two possible channels. Unpacking the concept of fiscal capacity, we distinguish between two aspects of tax systems: the accountability and transparency of such institutions, *impartiality*, and their *effectiveness* in extracting revenues.

*Impartiality* concerns fairness in the exercise of taxation powers: it is the ability of tax systems to make the state accountable to, and transparent for, its citizens, and so building state-society relations conducive to quasi-compliance (e.g., Levi 1988). The other concerns their effectiveness in raising tax revenues, i.e., the ability to coerce citizens to pay taxes. Outcome-based measures of fiscal capacity, such as the tax to GDP ratio or the measure used so far, cannot differentiate between these two quite different dimensions of fiscal systems related to the exercise of taxation powers.

To test whether a fiscal resource curse works through *impartiality* or *effectiveness* (or both), we use a recently created set of indicators provided by PEFA (2006), the Public Expenditure and Financial Accountability project developed by a partnership of national and international organisations (e.g., IMF and the World Bank). In particular, we use five indicators selected from the PEFA database, neatly capturing the *impartiality* and *effectiveness* of tax systems. They are described below:<sup>16</sup>

1. *Transparency of taxpayer obligations and liabilities*, which evaluates taxpayers' access to information on tax liabilities and administrative procedures;
2. *Tax appeals*: assessing the functioning of a tax appeals mechanism;
3. *Controls in the taxpayer registration system*, assessing the quality and maintenance of a taxpayer database;
4. *Effectiveness of penalties for non-compliance*: this addresses failures in registration and tax declaration obligations assessing whether penalties for all areas of non-compliance are set sufficiently high to act as deterrence and are consistently administered;

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<sup>16</sup> Full details of the PEFA framework, indicators and assessment method are given in the database codebook at [http://www.pefa.org/sites/pefa.org/files/attachments/PMFEng-finalSZreprint04-12\\_1.pdf](http://www.pefa.org/sites/pefa.org/files/attachments/PMFEng-finalSZreprint04-12_1.pdf). To save space, we only report the scoring method for *Tax appeals*: 3. A tax appeals system of transparent administrative procedures with appropriate checks and balances, and implemented through independent institutional structures, is completely set up and effectively operating with satisfactory access and fairness, and its decisions are promptly acted upon. 2. A tax appeals system of transparent administrative procedures is completely set up and functional, but it is either too early to assess its effectiveness or some issues relating to access, efficiency, fairness or effective follow up on its decisions need to be addressed. 1. A tax appeals system of administrative procedures has been established, but needs substantial redesign to be fair, transparent and effective. 0. No functioning tax appeals system has been established.

Apart from the PEFA variables used here, we experiment with two further effectiveness measures (one looking at the effectiveness of transfer of tax collections to the Treasury by the revenue administration, the other looking at the frequency of complete accounts reconciliation between tax assessments, collections, arrears records and receipts by the Treasury), finding that effect of resource rents are not robust.

5. *Quality of tax audit* evaluates whether and how tax audits and fraud investigations are undertaken;

The first two indicators capture the *impartiality* of fiscal capacity, since they hinge on the relationship between the State and the public: empowering it against the taxation power of the former or making such power clearly defined and not subject to discretion. The final four measures assess the coercive aspects of the tax system: they are all desirable features of a tax machine aiming at raising revenues.<sup>17</sup> Higher scores indicate greater levels of fiscal capacity: both *impartiality* and *effectiveness*. Below we estimate an OLS cross-section version of (1), for over sixty developing economies, where each of the above measures acts as a dependent variable.<sup>18</sup> The results (Tables 12 and 13) suggest that, to some extent, the interaction between political institutions and resource rents affects the *Transparency of taxpayer obligations and liability* only. This conclusion, however, could be misleading. A re-examination of the regressions shows that this finding is not a general one: it may be driven by a small set of influential observations (which we formally identify using DFITS and DFBETA statistics). Indeed, when we re-estimate each of the above regressions excluding such influential observations, the results suggest that the interaction effect between political institutions and resource rents looks more relevant than initially appeared (Tables 14 and 15).

[Tables 12-13 about here]

Subject to the limitations of the cross-section approach discussed earlier, the above results suggest that the effect of natural resources is likely to work through institutions relating to *impartiality* of tax systems, while the evidence that they affect their *effectiveness* is weaker. In particular, the marginal effects indicate that a fiscal resource curse may affect the *impartiality* of tax systems, as well as basic infrastructure for tax collection (such as the taxpayer registration system), only in political systems with low levels of checks and balances on executive power. The curse disappears, or becomes a blessing, in economies that can successfully limit the power of the executive. Under such political conditions, the fiscal bargain between a ruler and citizens, at the heart of the construction of a fiscal state (Brautigam et al. 2008), may be facilitated.

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<sup>17</sup> Methodologically, these are *de facto* measures: what matters is the actual working of the system and not what is merely written in the law. This ensures that the assessment is based on institutional reforms, reacting to the pressure of external authorities, to some degree internalised by those who implement them.

<sup>18</sup> Although the PEFA dataset is gradually expanding, its structure is such that it does not yet allow for panel analysis. In particular, PEFA variables range only from 2005 to 2013 and have a T-bar of 1.5, as well as exhibiting very little variation within countries.

[Table 14-15 about here]

## 5. Conclusions

This paper investigates how natural resource rents affect the incentives for investing in fiscal capacity and the role of political institutions in this process. Building on previous studies demonstrating that institutions can create the conditions to offset (or even reverse) the resource curse, we posit that the negative effect of resource rents on the ability of states to raise revenues depends on whether political institutions effectively limit executive power, as they give incumbents little discretion over the use of resource rents. Using panel data covering the period 1981-2011 for 98 developing countries, we find that resource rents are negatively associated with fiscal capacity, measured as the share of non-resource taxes on income, profits and capital gains in non-resource total taxes. However, countries with a high level of executive constraints are able to neutralise or even reverse this effect, depending on the type of resource rents. Further analysis, based on cross-section estimates, shows that the effect of natural resources is likely to work mainly through institutions that make the tax system accountable and transparent to the citizens.

Our results are in line with the recent literature arguing that resource abundance does not lead to worse development outcomes, if a country has the “right” institutions (e.g., Wiens 2013; Melhum et al. 2006), extending this view to the case of fiscal capacity. Perhaps they are even more relevant to the literature on the determinants of state capacity, where it had recently been argued that political institutions limiting the executive power foster fiscal (and legal) capacity by creating a situation of “common interest” (Besley and Persson 2011). We add to this claim that another channel through which such political institutions may foster state capacity is by averting any deleterious effect of resource rents. In policy terms, our findings indicate that, in polities providing strong checks and balances on the executive power, it is possible to develop both fiscal capacity and the natural resources sector, without any trade-off. Whether a fiscal resource curse exists or not is a question of what type of political institutions countries have adopted before they became resource-rich.

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Table 1 – Summary Statistics

Panel (a)	Observations	Mean	Std. Dev			Minimum	Maximum				
			overall	between	within						
Fiscal capacity	350	29.858	11.827	10.286	5.947	7.052	68.692				
Executive constraints	350	4.446	2.003	1.711	1.200	1	7				
Total natural resources rents	350	8.497	10.954	12.878	3.212	0.003	70.624				
Forest rents	350	3.449	5.685	5.893	2.196	0	41.770				
Oil rents	350	3.028	8.242	10.372	1.597	0	50.107				
Gas rents	350	0.895	4.105	5.192	1.275	0	55.528				
Mineral rents	350	1.045	2.863	2.718	1.432	0	20.618				
Political stability	350	3.093	1.187	1.007	0.485	2	7				
External Debt	350	71.510	87.168	78.008	53.229	2.725	759.970				
Trade	350	75.696	38.127	35.851	14.345	13.037	253.047				
Net ODA and aid per capita	350	71.208	84.082	76.157	34.113	-3.785	620.926				
Population density	350	98.265	142.726	139.294	18.085	1.462	1145.363				
External war	350	0.955	1.326	1.252	0.704	0	5				
Civil war	350	0.238	0.492	0.335	0.340	0	2				
			1981 - 1990		1991 - 2000		2001 - 2011				
Panel (b)			Std. Dev			Std. Dev			Std. Dev		
			overall	between	within	overall	between	within	overall	between	within
Fiscal capacity			12.348	11.502	3.654	12.106	11.342	4.415	11.642	10.982	4.077
Executive constraints			2.050	1.960	0.762	1.992	1.776	1.017	1.829	1.736	0.672
Total natural resources rents			12.983	11.753	3.487	7.742	9.040	1.758	12.920	14.113	3.172
Forest rents			8.665	7.330	2.480	5.251	4.837	1.170	5.287	6.003	1.201
Oil rents			11.167	9.922	2.398	5.631	7.999	1.078	8.418	10.644	1.161
Gas rents			0.648	0.731	0.095	1.212	1.351	0.278	6.553	6.266	1.583
Mineral rents			2.962	4.608	0.358	2.625	2.306	0.788	2.982	2.663	1.483

Table 2 - Baseline results: fiscal capacity and total natural resources rents

	(1)	(2)	(3)	(4)	(5)
Total natural resources rents	-0.127 (0.157)	-0.122 (0.158)	-0.0759 (0.194)	-0.591*** (0.223)	-0.544** (0.254)
Executive constraints		0.238 (0.354)	0.360 (0.458)	-0.612 (0.432)	-0.522 (0.493)
Tot. nat resource. rents*Exec. constraints				0.126*** (0.0315)	0.131*** (0.0368)
Political Stability			0.651 (0.950)		0.461 (0.870)
External Debt			-0.0188** (0.00747)		-0.0165*** (0.00578)
Trade			0.0211 (0.0302)		0.00306 (0.0296)
Net ODA and aid per capita			-0.00353 (0.0139)		-0.0114 (0.0138)
Population density			0.0521* (0.0269)		0.0588** (0.0265)
External war			0.502 (0.720)		0.482 (0.679)
Civil war			-2.638** (1.317)		-2.947** (1.303)
Constant	31.50*** (2.480)	30.65*** (2.620)	22.99*** (5.530)	35.43*** (3.219)	29.91*** (5.794)
Observations	350	350	350	350	350
Number of countries	91	91	91	91	91
Adjusted R-squared	0.094	0.093	0.148	0.144	0.200
Year FE	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES
Joint(p)				0.000615	0.00217

Notes: The dependent variable is non-resource income tax as a percentage of non-resource total tax revenue. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 3 - Fiscal capacity and different natural resources rents

	(1) All Rents	(2) no forest	(3) no oil	(4) no gas	(5) no mineral
Executive constraints	-0.602 (0.509)	0.0818 (0.451)	-0.313 (0.463)	-0.650 (0.516)	-0.545 (0.532)
Forest rents	-1.108*** (0.177)		-1.046*** (0.165)	-1.107*** (0.184)	-0.997*** (0.179)
Forest rents*Executive constraints	0.169*** (0.0548)		0.158*** (0.0539)	0.164*** (0.0553)	0.182*** (0.0522)
Oil rents	-0.289 (0.364)	-0.193 (0.357)		-0.211 (0.367)	-0.267 (0.365)
Oil rents*Executive constraints	0.122*** (0.0386)	0.0992** (0.0457)		0.145*** (0.0378)	0.117*** (0.0398)
Gas rents	0.410 (0.464)	0.451 (0.428)	0.317 (0.505)		0.555 (0.402)
Gas rents*Executive constraints	0.0354 (0.0864)	0.0238 (0.0776)	0.0938 (0.101)		0.0169 (0.0745)
Mineral rents	-1.244** (0.588)	-0.756 (0.555)	-1.146* (0.586)	-1.382** (0.581)	
Mineral rents*Executive constraints	0.180 (0.126)	0.0894 (0.125)	0.156 (0.127)	0.210* (0.124)	
Political Stability	0.273 (0.916)	0.304 (0.972)	0.456 (0.847)	0.226 (0.952)	0.155 (0.898)
External Debt	-0.0133*** (0.00487)	-0.0223*** (0.00791)	-0.0138*** (0.00505)	-0.0138*** (0.00509)	-0.0118*** (0.00534)
Trade	-7.97e-05 (0.0316)	0.0132 (0.0295)	-0.00299 (0.0316)	0.00237 (0.0321)	-0.00149 (0.0313)
Net ODA and aid per capita	-0.0113 (0.0146)	-0.00355 (0.0143)	-0.0118 (0.0152)	-0.0111 (0.0145)	-0.0112 (0.0149)
Population density	0.0569** (0.0250)	0.0578** (0.0271)	0.0549** (0.0247)	0.0564** (0.0246)	0.0585** (0.0256)
External war	0.299 (0.674)	0.366 (0.699)	0.247 (0.702)	0.388 (0.664)	0.345 (0.696)
Civil war	-3.070** (1.304)	-2.736** (1.374)	-2.919** (1.303)	-3.045** (1.296)	-3.018** (1.305)
Constant	32.24*** (5.862)	25.69*** (5.712)	30.10*** (5.586)	32.39*** (5.990)	30.76*** (6.023)
Observations	350	350	350	350	350
R-squared	0.286	0.225	0.268	0.275	0.271
Number of Countries	91	91	91	91	91
Year FE	YES	YES	YES	YES	YES
Country FE	YES	YES	YES	YES	YES
Joint(p)	8.55e-09	0.00665	2.16e-07	1.15e-08	1.75e-06

Notes: The dependent variable is non-resource income tax as a percentage of non-resource total tax revenue. Robust standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 4 – Marginal effects of resource rents at different levels of executive constraints

executive constraints	Total natural resources rents	Forest rents	Oil rents	Gas rents	Mineral rents
	b/se	b/se	b/se	b/se	b/se
1	-0.413* (0.23)	-0.939*** (0.14)	-0.166 (0.36)	0.446 (0.39)	-1.064** (0.47)
2	-0.282 (0.21)	-0.771*** (0.12)	-0.044 (0.37)	0.481 (0.33)	-0.884** (0.37)
3	-0.151 (0.19)	-0.602*** (0.12)	0.079 (0.37)	0.516* (0.28)	-0.705** (0.28)
4	-0.020 (0.18)	-0.434*** (0.14)	0.201 (0.38)	0.552** (0.24)	-0.525** (0.23)
5	0.111 (0.17)	-0.265 (0.18)	0.323 (0.40)	0.587** (0.24)	-0.345 (0.24)
6	0.242 (0.18)	-0.097 (0.23)	0.446 (0.41)	0.623** (0.27)	-0.165 (0.31)
7	0.373** (0.19)	0.072 (0.28)	0.568 (0.43)	0.658** (0.32)	0.015 (0.40)

Notes: The marginal effects are calculated using the coefficients from Table 3, Column 1.

Table 5 - Fiscal capacity and different natural resources rents – sum of rents

	(1) no forest	(2) no oil	(3) no gas	(4) no mineral
Executive constraints	0.0471 (0.456)	-0.359 (0.464)	-0.516 (0.516)	-0.454 (0.520)
total_noforest	-0.230 (0.154)			
int_noforest	0.0905*** (0.0275)			
total_nooil		-0.761*** (0.220)		
int_nooil		0.157*** (0.0468)		
total_nogas			-0.732*** (0.247)	
int_nogas			0.142*** (0.0399)	
total_nomineral				-0.433* (0.242)
int_nomineral				0.131*** (0.0364)
Political Stability	0.167 (0.907)	0.525 (0.875)	0.620 (0.865)	0.259 (0.883)
External Debt	-0.0198*** (0.00629)	-0.0160*** (0.00544)	-0.0142** (0.00550)	-0.0178*** (0.00664)
Trade	0.0198 (0.0286)	-0.00527 (0.0325)	0.00927 (0.0300)	0.00212 (0.0291)
Net ODA and aid per capita	-0.00244 (0.0136)	-0.0136 (0.0143)	-0.0126 (0.0136)	-0.0122 (0.0146)
Population density	0.0623** (0.0267)	0.0565** (0.0259)	0.0545** (0.0257)	0.0601** (0.0267)
External war	0.541 (0.710)	0.433 (0.706)	0.480 (0.666)	0.431 (0.691)
Civil war	-2.906** (1.384)	-2.809** (1.305)	-3.019** (1.270)	-2.783** (1.291)
Constant	24.84*** (5.645)	29.11*** (5.587)	30.65*** (5.932)	29.60*** (5.866)
Observations	355	350	350	350
R-squared	0.204	0.227	0.245	0.233
Number of Country	92	91	91	91
Year FE	YES	YES	YES	YES
Country FE	YES	YES	YES	YES
Joint(p)	0.00607	0.00204	0.00180	0.00155

Notes: The dependent variable is non-resource income tax as a percentage of non-resource total tax revenue. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 6 – Marginal effects of resource rents at different levels of executive constraints – sum of rents

Executive constraints	No Forest rents	No Oil rents	No Gas rents	No Mineral rents
	b/se	b/se	b/se	b/se
1	-0.140 (0.14)	-0.604*** (0.19)	-0.591*** (0.22)	-0.302 (0.22)
2	-0.049 (0.14)	-0.447*** (0.16)	-0.449** (0.21)	-0.171 (0.20)
3	0.041 (0.14)	-0.290** (0.15)	-0.308 (0.20)	-0.040 (0.18)
4	0.131 (0.14)	-0.133 (0.14)	-0.166 (0.19)	0.090 (0.17)
5	0.222 (0.15)	0.024 (0.16)	-0.025 (0.20)	0.221 (0.17)
6	0.312* (0.17)	0.181 (0.18)	0.117 (0.21)	0.352* (0.18)
7	0.403** (0.18)	0.338 (0.22)	0.258 (0.23)	0.483** (0.19)

Table 7 - Robustness checks – the identifying assumption

VARIABLES	Excluding bottom decile		Excluding top decile		Excluding big producers		Excluding OPEC countries	
	(1) Total Rents	(2) Rents	(3) Total Rents	(4) Rents	(5) Total Rents	(6) Rents	(7) Total Rents	(8) Rents
Executive constraints	-0.219 (0.548)	-0.270 (0.591)	-0.617 (0.504)	-0.443 (0.619)	-0.844* (0.501)	-0.872* (0.477)	-0.443 (0.516)	-0.371 (0.569)
Total natural resources rents	-0.482* (0.252)		-1.033*** (0.346)		-0.832*** (0.199)		-0.943*** (0.220)	
Total natural resources rents*Executive constraints	0.101*** (0.0384)		0.173*** (0.0614)		0.173*** (0.0408)		0.171*** (0.0487)	
Forest rents		-0.992*** (0.179)		-1.529*** (0.402)		-1.187*** (0.167)		-1.127*** (0.186)
Forest rents*Executive constraints		0.124** (0.0608)		0.216*** (0.0771)		0.216*** (0.0557)		0.173*** (0.0598)
Oil rents		-0.237 (0.366)		-0.248 (0.502)		-0.429 (0.427)		-0.759 (0.610)
Oil rents*Executive constraints		0.101** (0.0425)		0.00158 (0.101)		0.104* (0.0551)		0.101 (0.173)
Gas rents		0.337 (0.377)		-0.186 (1.323)		-0.646 (0.451)		0.0328 (0.365)
Gas rents*Executive constraints		0.0318 (0.0707)		0.142 (0.191)		0.563** (0.267)		0.102 (0.0697)
Mineral rents		-1.152* (0.605)		-1.314* (0.702)		-1.200** (0.555)		-1.418** (0.580)
Mineral rents*Executive constraints		0.142 (0.130)		0.183 (0.143)		0.216 (0.143)		0.208 (0.126)
Political Stability	0.613 (0.948)	0.413 (0.995)	0.227 (0.939)	0.680 (1.012)	-0.282 (0.861)	-0.0825 (0.819)	0.782 (0.934)	0.798 (0.974)
External Debt	-0.0163*** (0.00595)	-0.0133** (0.00515)	-0.0181** (0.00694)	-0.0149** (0.00691)	-0.0141*** (0.00504)	-0.0110** (0.00481)	-0.0123** (0.00507)	-0.0113** (0.00481)
Trade	0.0262 (0.0305)	0.0248 (0.0321)	0.0195 (0.0371)	0.0203 (0.0368)	0.00921 (0.0312)	-0.00408 (0.0317)	0.00757 (0.0323)	0.00758 (0.0326)
Net ODA and aid per capita	-0.0118 (0.0150)	-0.00957 (0.0169)	-0.0178 (0.0128)	-0.0114 (0.0158)	-0.0199 (0.0152)	-0.0209 (0.0165)	-0.0159 (0.0139)	-0.0152 (0.0158)
Population density	0.0498* (0.0281)	0.0470* (0.0268)	0.0793*** (0.0299)	0.0722** (0.0295)	0.0737*** (0.0276)	0.0667** (0.0266)	0.0721** (0.0284)	0.0673** (0.0280)
External war	1.044* (0.541)	0.855 (0.534)	0.301 (0.702)	0.103 (0.725)	0.382 (0.733)	0.234 (0.759)	0.267 (0.716)	0.159 (0.722)
Civil war	-2.229* (1.130)	-2.382** (1.161)	-2.927** (1.360)	-2.675* (1.367)	-2.108 (1.326)	-1.999 (1.324)	-3.038** (1.346)	-2.975** (1.356)
Constant	25.11*** (5.696)	27.32*** (5.717)	30.33*** (6.266)	28.59*** (6.954)	33.63*** (5.864)	34.31*** (5.533)	29.53*** (6.412)	30.29*** (6.862)
Observations	313	313	315	315	296	296	326	326
Number of countries	84	84	79	79	78	78	84	84
Adjusted R-squared	0.232	0.270	0.203	0.218	0.222	0.249	0.217	0.227
Year FE	YES	YES	YES	YES	YES	YES	YES	YES
Joint(p)	0.0354	1.38e-08	0.0140	0.000383	5.81e-05	2.22e-10	0.000255	6.07e-07

Notes: The dependent variable is non-resource income tax as a percentage of non-resource total tax revenue. Robust standard errors in parentheses.

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 8 – Marginal effects of resource rents at different levels of executive constraints - Excluding bottom decile

Executive constraints	Total natural resources rents	Forest rents	Oil rents	Gas rents	Mineral rents
	b/se	b/se	b/se	b/se	b/se
1	-0.381* (0.23)	-0.868*** (0.14)	-0.136 (0.36)	0.369 (0.32)	-1.010** (0.49)
2	-0.280 (0.20)	-0.744*** (0.11)	-0.034 (0.37)	0.401 (0.27)	-0.869** (0.38)
3	-0.179 (0.18)	-0.620*** (0.12)	0.067 (0.38)	0.433* (0.23)	-0.727** (0.29)
4	-0.077 (0.17)	-0.496*** (0.15)	0.168 (0.39)	0.464** (0.21)	-0.585** (0.23)
5	0.024 (0.17)	-0.371* (0.20)	0.269 (0.40)	0.496** (0.21)	-0.444* (0.25)
6	0.125 (0.18)	-0.247 (0.25)	0.371 (0.42)	0.528** (0.24)	-0.302 (0.32)
7	0.226 (0.19)	-0.123 (0.30)	0.472 (0.45)	0.560** (0.28)	-0.161 (0.42)

Notes: The marginal effects of specific natural resources are calculated using the coefficients from Table 5, Columns 1 and 2

Table 9 – Marginal effects of resource rents at different levels of executive constraints - Excluding top decile

Executive constraints	Total natural resources rents	Forest rents	Oil rents	Gas rents	Mineral rents
	b/se	b/se	b/se	b/se	b/se
1	-0.860*** (0.29)	-1.313*** (0.34)	-0.247 (0.45)	-0.044 (1.14)	-1.131** (0.57)
2	-0.687*** (0.24)	-1.097*** (0.30)	-0.245 (0.42)	0.098 (0.95)	-0.948** (0.45)
3	-0.515*** (0.20)	-0.882*** (0.26)	-0.243 (0.41)	0.240 (0.77)	-0.766** (0.34)
4	-0.342** (0.17)	-0.666*** (0.25)	-0.242 (0.43)	0.381 (0.59)	-0.583** (0.27)
5	-0.169 (0.15)	-0.450* (0.26)	-0.240 (0.46)	0.523 (0.43)	-0.400 (0.27)
6	0.004 (0.16)	-0.234 (0.29)	-0.239 (0.52)	0.665** (0.30)	-0.217 (0.33)
7	0.176 (0.20)	-0.019 (0.33)	-0.237 (0.58)	0.807*** (0.27)	-0.035 (0.44)

Notes: The marginal effects of specific natural resources are calculated using the coefficients from Table 5, Columns 3 and 4

Table 10 – Marginal effects of resource rents at different levels of executive constraints - Excluding big producers

Executive constraints	Total natural resources rents	Forest rents	Oil rents	Gas rents	Mineral rents
	b/se	b/se	b/se	b/se	b/se
1	-0.659*** (0.18)	-0.971*** (0.13)	-0.325 (0.40)	-0.083 (0.33)	-0.985** (0.43)
2	-0.487*** (0.16)	-0.755*** (0.10)	-0.221 (0.38)	0.480 (0.39)	-0.769** (0.33)
3	-0.314* (0.16)	-0.539*** (0.10)	-0.116 (0.37)	1.043* (0.58)	-0.553** (0.26)
4	-0.141 (0.17)	-0.323** (0.13)	-0.012 (0.37)	1.606** (0.82)	-0.338 (0.26)
5	0.031 (0.18)	-0.107 (0.17)	0.092 (0.37)	2.169** (1.07)	-0.122 (0.34)
6	0.204 (0.20)	0.109 (0.22)	0.196 (0.38)	2.732** (1.33)	0.094 (0.44)
7	0.377 (0.23)	0.325 (0.27)	0.300 (0.40)	3.295** (1.59)	0.310 (0.57)

Notes: The marginal effects of specific natural resources are calculated using the coefficients from Table 5, Columns 5 and 6

Table 11 – Marginal effects of resource rents at different levels of executive constraints - Excluding OPEC countries

Executive constraints	Total natural resources rents	Forest rents	Oil rents	Gas rents	Mineral rents
	b/se	b/se	b/se	b/se	b/se
1	-0.772*** (0.18)	-0.954*** (0.14)	-0.658 (0.47)	0.135 (0.32)	-1.209*** (0.46)
2	-0.601*** (0.15)	-0.781*** (0.12)	-0.556 (0.36)	0.237 (0.28)	-1.001*** (0.36)
3	-0.430*** (0.13)	-0.607*** (0.12)	-0.455 (0.31)	0.339 (0.25)	-0.793*** (0.26)
4	-0.259** (0.12)	-0.434*** (0.14)	-0.353 (0.36)	0.442* (0.24)	-0.584*** (0.21)
5	-0.088 (0.13)	-0.261 (0.19)	-0.252 (0.46)	0.544** (0.26)	-0.376* (0.23)
6	0.083 (0.16)	-0.088 (0.24)	-0.151 (0.60)	0.646** (0.28)	-0.168 (0.30)
7	0.254 (0.20)	0.086 (0.29)	-0.049 (0.75)	0.748** (0.33)	0.041 (0.40)

Notes: The marginal effects of specific natural resources are calculated using the coefficients from Table 5, Column 11

Table 12 - Tests of possible channels of causation from resource rents to fiscal capacity

DEPENDENT VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Transparency of taxpayer obligations and liabilities	Transparency of taxpayer obligations and liabilities	Tax appeals	Tax appeals	Controls in the taxpayer registration system	Controls in the taxpayer registration system	Effectiveness of penalties for non-compliance with registration and tax declaration	Effectiveness of penalties for non-compliance with registration and tax declaration	Quality of tax audit	Quality of tax audit
Total natural resources rents	-0.00945 (0.00982)	-0.0409** (0.0162)	-0.00498 (0.0103)	-0.0229 (0.0212)	-0.00881 (0.00836)	-0.00135 (0.0193)	-0.0116 (0.0160)	-0.0437* (0.0225)	-0.000753 (0.0116)	0.00435 (0.0170)
Executive constraints	0.148 (0.0898)	0.0659 (0.0997)	0.244*** (0.0822)	0.197** (0.0879)	0.295*** (0.0653)	0.315*** (0.0778)	0.238** (0.0925)	0.154 (0.0998)	0.108 (0.0827)	0.121 (0.0945)
Tot. res rents*Ex. constraints		0.0118** (0.00449)		0.00670 (0.00643)		-0.00280 (0.00574)		0.0121* (0.00629)		-0.00192 (0.00388)
Political stability	0.0367 (0.144)	0.000691 (0.145)	0.108 (0.111)	0.0875 (0.112)	-0.0605 (0.133)	-0.0520 (0.134)	0.0680 (0.153)	0.0308 (0.161)	-0.325** (0.128)	-0.319** (0.132)
Net ODA and aid per capita	0.000181 (0.00155)	0.000630 (0.00150)	-0.00250*** (0.000931)	-0.00224** (0.000915)	0.000219 (0.00155)	0.000113 (0.00160)	-6.41e-05 (0.00171)	0.000393 (0.00167)	0.000312 (0.00208)	0.000239 (0.00213)
Population density	0.000531 (0.000754)	0.000557 (0.000716)	0.000152 (0.000720)	0.000167 (0.000667)	-0.000229 (0.000450)	-0.000235 (0.000459)	-0.000169 (0.000604)	-0.000138 (0.000552)	0.000445 (0.000596)	0.000440 (0.000592)
External war	0.283** (0.137)	0.297** (0.136)	0.177 (0.123)	0.185 (0.125)	0.0928 (0.138)	0.0894 (0.140)	0.178 (0.112)	0.193* (0.112)	0.171 (0.127)	0.169 (0.129)
Civil war	-0.0363 (0.237)	-0.0326 (0.230)	0.0328 (0.212)	0.0349 (0.217)	0.126 (0.259)	0.125 (0.264)	-0.182 (0.203)	-0.179 (0.203)	0.175 (0.193)	0.174 (0.196)
Length of statehood	0.00439 (0.00517)	0.00522 (0.00519)	0.00440 (0.00412)	0.00488 (0.00407)	0.000380 (0.00269)	0.000182 (0.00278)	0.00626 (0.00550)	0.00715 (0.00527)	0.00563 (0.00370)	0.00549 (0.00378)
Constant	0.589 (0.834)	0.923 (0.864)	-0.266 (0.745)	-0.0762 (0.769)	0.622 (0.805)	0.542 (0.826)	0.350 (0.936)	0.690 (1.001)	1.501* (0.881)	1.447 (0.912)
Observations	61	61	61	61	61	61	62	62	62	62
Adjusted R-squared	0.206	0.236	0.234	0.238	0.278	0.266	0.110	0.136	0.344	0.332
Joint(p)		0.0380		0.553		0.434		0.127		0.874

Notes: The dependent variable is calculated as 2006-2011 average. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 13 – Effects of resource rents on fiscal capacity at different levels of executive constraints

Executive constraints	Transparency of taxpayer obligations and liabilities	Tax appeals mechanisms	Controls in the taxpayer registration system	Effectiveness of penalties for non-compliance with registration and tax declaration	Quality of tax audit
	b/se	b/se	b/se	b/se	b/se
1	-0.029** (0.01)	-0.016 (0.02)	-0.004 (0.01)	-0.032* (0.02)	0.002 (0.01)
2	-0.017* (0.01)	-0.009 (0.01)	-0.007 (0.01)	-0.020 (0.02)	0.001 (0.01)
3	-0.006 (0.01)	-0.003 (0.01)	-0.010 (0.01)	-0.007 (0.02)	-0.001 (0.01)
4	0.006 (0.01)	0.004 (0.01)	-0.013 (0.01)	0.005 (0.02)	-0.003 (0.01)
5	0.018* (0.01)	0.011 (0.02)	-0.015 (0.01)	0.017 (0.02)	-0.005 (0.01)
6	0.030** (0.01)	0.017 (0.02)	-0.018 (0.02)	0.029 (0.03)	-0.007 (0.02)
7	0.042** (0.02)	0.024 (0.03)	-0.021 (0.02)	0.041 (0.03)	-0.009 (0.02)

Notes: The marginal effects of total natural resources rents are calculated using the coefficients from Table 12, Columns 2, 4, 6, 8, 10.

Table 14 - Tests of possible channels of causation from resource rents to fiscal capacity – Excluding outliers

DEPENDENT VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Transparency of taxpayer obligations and liabilities	Transparency of taxpayer obligations and liabilities	Tax appeals	Tax appeals	Controls in the taxpayer registration system	Controls in the taxpayer registration system	Effectiveness of penalties for non-compliance with registration and tax declaration	Effectiveness of penalties for non-compliance with registration and tax declaration	Quality of tax audit	Quality of tax audit
Total natural resources rents	-0.0150 (0.0101)	-0.0606** (0.0227)	-0.00964 (0.00910)	-0.0439*** (0.0133)	-0.0144** (0.00613)	-0.0177 (0.0138)	-0.0120 (0.0174)	-0.0503* (0.0257)	-0.00189 (0.0127)	0.00123 (0.0221)
Executive constraints	0.0901 (0.0893)	0.000992 (0.0983)	0.260*** (0.0834)	0.188** (0.0861)	0.315*** (0.0646)	0.308*** (0.0762)	0.275*** (0.0868)	0.190* (0.0952)	0.113 (0.0843)	0.120 (0.0947)
Tot.resources rents*Ex. constraints		0.0207** (0.00892)		0.0118*** (0.00430)		0.00116 (0.00444)		0.0135** (0.00530)		-0.00111 (0.00470)
Political Stability	-0.00570 (0.145)	-0.0149 (0.146)	0.130 (0.109)	0.108 (0.110)	-0.0341 (0.134)	-0.0363 (0.136)	0.0966 (0.152)	0.0673 (0.158)	-0.318** (0.129)	-0.316** (0.132)
Net ODA and aid per capita	0.000585 (0.00148)	0.000932 (0.00153)	-0.00258*** (0.000910)	-0.00218** (0.000860)	0.000119 (0.00154)	0.000159 (0.00158)	-1.62e-05 (0.00160)	0.000417 (0.00157)	0.000277 (0.00209)	0.000241 (0.00214)
Population density	0.000393 (0.000775)	0.000690 (0.000731)	0.000136 (0.000735)	0.000152 (0.000646)	-0.000249 (0.000453)	-0.000247 (0.000458)	-1.48e-05 (0.000625)	1.37e-05 (0.000556)	0.000446 (0.000593)	0.000443 (0.000594)
External war	0.301** (0.130)	0.319** (0.130)	0.170 (0.121)	0.181 (0.122)	0.0852 (0.138)	0.0863 (0.140)	0.177 (0.112)	0.192* (0.111)	0.170 (0.127)	0.169 (0.128)
Civil war	-0.0290 (0.230)	-0.0470 (0.227)	0.0391 (0.212)	0.0466 (0.218)	0.133 (0.261)	0.134 (0.263)	-0.203 (0.208)	-0.202 (0.206)	0.174 (0.194)	0.174 (0.197)
Length of statehood	0.00545 (0.00543)	0.00454 (0.00547)	0.00461 (0.00409)	0.00556 (0.00395)	0.000624 (0.00272)	0.000718 (0.00274)	0.00346 (0.00457)	0.00491 (0.00428)	0.00577 (0.00366)	0.00566 (0.00375)
Constant	0.756 (0.822)	1.057 (0.879)	-0.402 (0.735)	-0.150 (0.748)	0.460 (0.808)	0.485 (0.831)	0.296 (0.929)	0.576 (0.984)	1.453 (0.882)	1.430 (0.910)
Observations	59	59	60	60	60	60	60	60	61	61
Adjusted R-squared	0.209	0.237	0.258	0.295	0.309	0.294	0.149	0.182	0.343	0.330
Joint(p)		0.0324		0.00699		0.0616		0.0477		0.937
Excluding:	Trinidad and Tobago, Moldova		Liberia		Liberia		Jamaica, Liberia		Liberia	

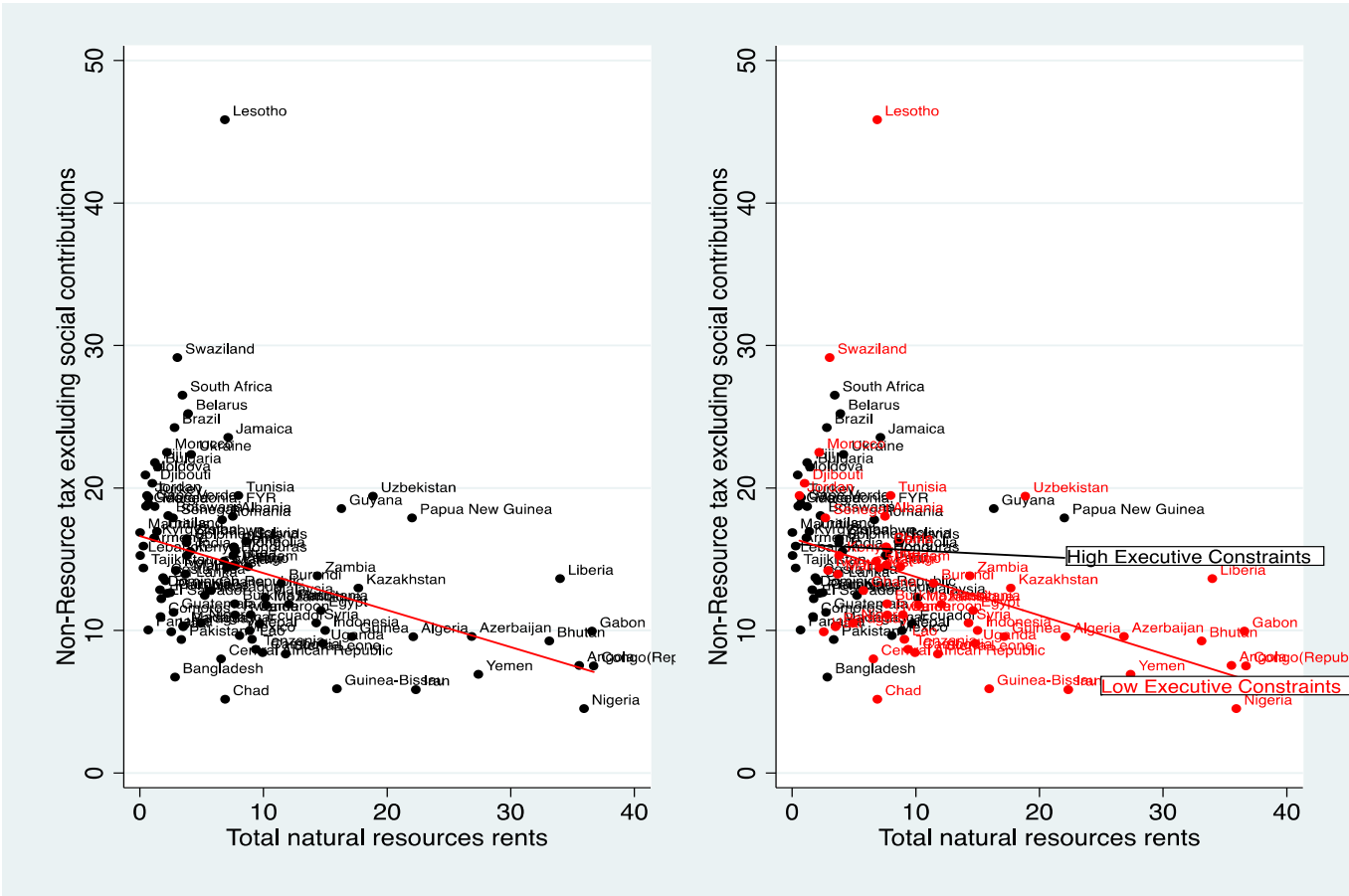
Notes: The dependent variable is calculated as 2006-2011 average. Robust standard errors in parentheses. \*\*\* p<0.01, \*\* p<0.05, \* p<0.1.

Table 15 – Effects of resource intensity on fiscal capacity at different levels of executive constraints – no outliers

Executive constraints	Transparency of taxpayer obligations and liabilities	Tax appeals mechanisms	Controls in the taxpayer registration system	Effectiveness of penalties for non-compliance with registration and tax declaration	Quality of tax audit
	b/se	b/se	b/se	b/se	b/se
1	-0.040*** (0.01)	-0.032*** (0.01)	-0.017* (0.01)	-0.037* (0.02)	0.000 (0.02)
2	-0.019** (0.01)	-0.020*** (0.01)	-0.015** (0.01)	-0.023 (0.02)	-0.001 (0.01)
3	0.001 (0.01)	-0.009 (0.01)	-0.014** (0.01)	-0.010 (0.02)	-0.002 (0.01)
4	0.022 (0.02)	0.003 (0.01)	-0.013 (0.01)	0.004 (0.02)	-0.003 (0.01)
5	0.043* (0.02)	0.015 (0.01)	-0.012 (0.01)	0.017 (0.02)	-0.004 (0.01)
6	0.063* (0.03)	0.027* (0.02)	-0.011 (0.02)	0.031 (0.02)	-0.005 (0.01)
7	0.084** (0.04)	0.039** (0.02)	-0.010 (0.02)	0.044* (0.02)	-0.007 (0.02)

Notes: The marginal effects of total natural resources rents are calculated using the coefficients from Table 14, Columns 2, 4, 6, 8, 10.

Figure 1 - Relationship between non resource-tax and natural resources rents



## Appendix

Table 1A – Variables and sources

Variable	Description	Source
Non-Resource tax excluding social contributions	Non-resource component of total tax Revenue excluding social contributions and natural resource revenue	GRD dataset, ICTD (2015)
Fiscal capacity	Non-resource component of taxes on income, profits, and capital gains as a percentage of non-resource component of total tax revenue excluding social contributions and natural resource revenue	Own elaboration based on data from GRD dataset, ICTD (2015)
Executive constraints	Institutionalised constraints on the decision making power of chief executives ranging from 1 (unlimited authority) to 7 (limited authority). Values outside [1;7] are treated as missing.	Polity IV Project (Marshall et al. 2014)
Total natural resources rents	Total natural resources rents (% of GDP). It is the sum of oil rents, natural gas rents, mineral rents, and forest rents.	World Bank (2016)
Forest rents	Forest rents (% of GDP).	World Bank (2016)
Oil rents	Oil rents (% of GDP).	World Bank (2016)
Gas rents	Gas rents (% of GDP).	World Bank (2016)
Mineral rents	Mineral rents (% of GDP).	World Bank (2016)
Political stability	Sum of <i>xropen</i> (openness of executive recruitment) and <i>xrcomp</i> (competitiveness of executive recruitment) variables in the Polity IV dataset ranging from 2 (instable) to 7 (stable)	Polity IV Project (Marshall et al. 2014)
External Debt	External debt stocks (% of GNI).	World Bank (2016)
Trade	Trade (% of GDP).	World Bank (2016)
Net ODA and aid per capita	Net official development assistance and official aid received (constant 2013 US\$) per capita.	Own elaboration based on data from World Bank (2016)
Population density	Population density (people per sq. km of land area).	World Bank (2016)
External war	Hostility level of interstate dispute ranging from 0 (no dispute) to 5 (war).	Palmer et al. (2015)
Civil war	Intensity level of Internal and internationalised internal armed conflict ranging from 0 (no conflict) to 2 (more than 1000 battle-related deaths).	UCDP/PRIO (2016), Armed Conflict Dataset

Table 2A – Countries

(a) Panel			
Albania	Dominican Republic	Lebanon	Peru
Algeria	Ecuador	Lesotho	Philippines
Angola	Egypt, Arab Rep.	Liberia	Romania
Armenia	El Salvador	Macedonia, FYR	Senegal
Azerbaijan	Eritrea	Madagascar	Sierra Leone
Bangladesh	Fiji	Malawi	Solomon Islands
Belarus	Gabon	Malaysia	South Africa
Benin	Gambia, The	Mali	Sri Lanka
Bhutan	Georgia	Mauritania	Swaziland
Bolivia	Guatemala	Mauritius	Syrian Arab Republic
Botswana	Guinea-Bissau	Mexico	Tajikistan
Brazil	Guyana	Moldova	Tanzania
Bulgaria	Haiti	Mongolia	Thailand
Burundi	Honduras	Morocco	Togo
Cabo Verde	India	Mozambique	Tunisia
Cameroon	Indonesia	Nepal	Turkey
Central African Republic	Iran, Islamic Rep.	Nicaragua	Uganda
China	Jamaica	Niger	Ukraine
Comoros	Jordan	Nigeria	Uzbekistan
Congo, Rep.	Kazakhstan	Pakistan	Vietnam
Costa Rica	Kenya	Panama	Zambia
Cote d'Ivoire	Kyrgyz Republic	Papua New Guinea	Zimbabwe
Djibouti	Lao PDR	Paraguay	
(b) Cross section			
Afghanistan	Dominican Republic	Lao PDR	Peru
Albania	El Salvador	Lesotho	Philippines
Armenia	Ethiopia	Liberia	Senegal
Bangladesh	Gabon	Madagascar	Sierra Leone
Belarus	Georgia	Malawi	South Africa
Benin	Ghana	Mali	Swaziland
Bolivia	Guatemala	Mauritania	Tajikistan
Botswana	Haiti	Mauritius	Thailand
Brazil	Honduras	Moldova	Trinidad and Tobago
Cabo Verde	India	Morocco	Tunisia
Cambodia	Indonesia	Mozambique	Uganda
Central African Republic	Jamaica	Nepal	Ukraine
Colombia	Jordan	Niger	Vietnam
Congo, Rep.	Kenya	Pakistan	Yemen, Rep.
Costa Rica	Kyrgyz Republic	Paraguay	Zambia
Cote d'Ivoire			

Figure 1A - Relationship between non resource-tax and natural resources rents

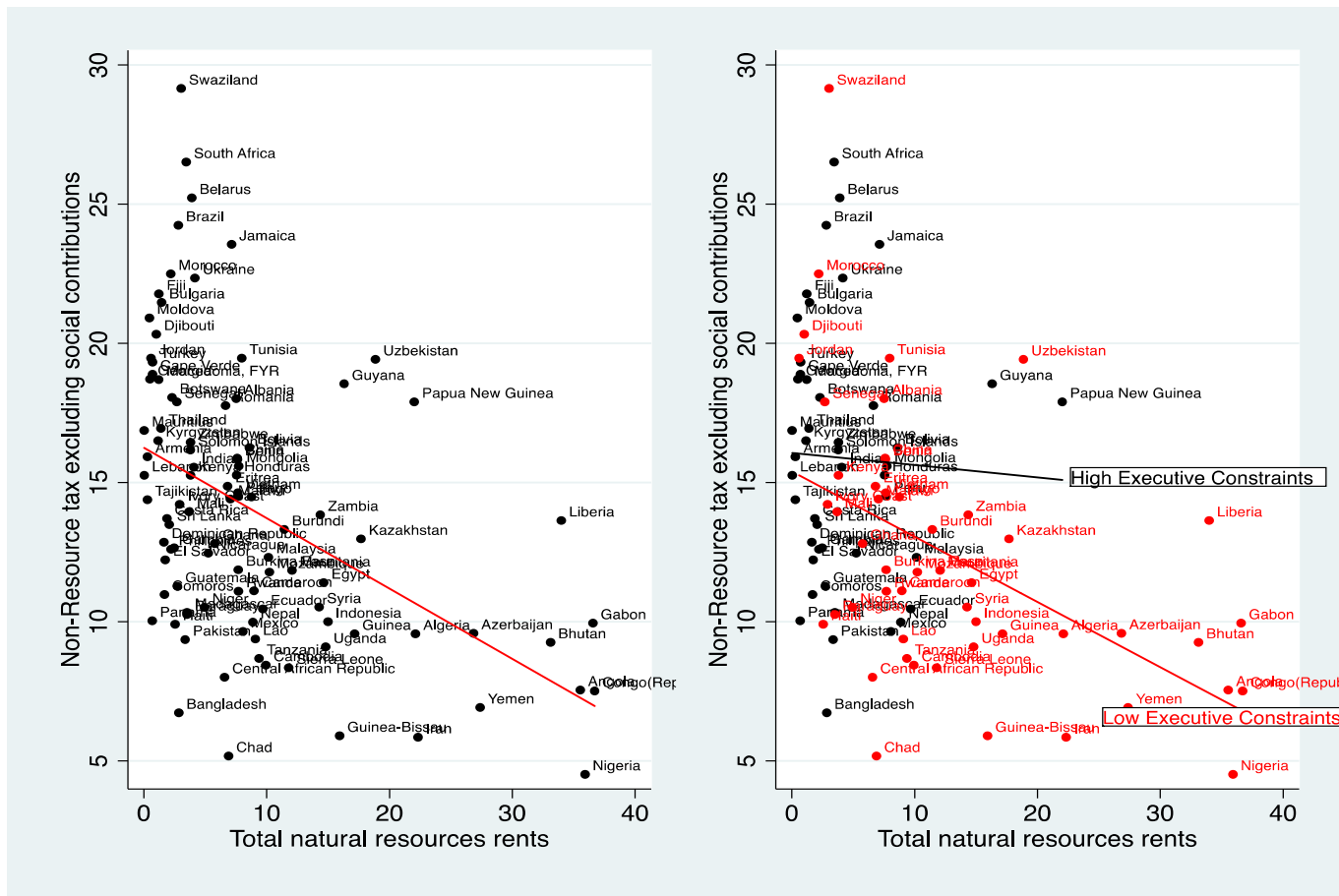


Figure 2A – Marginal effects of total natural resources rents at different levels of executive constraints

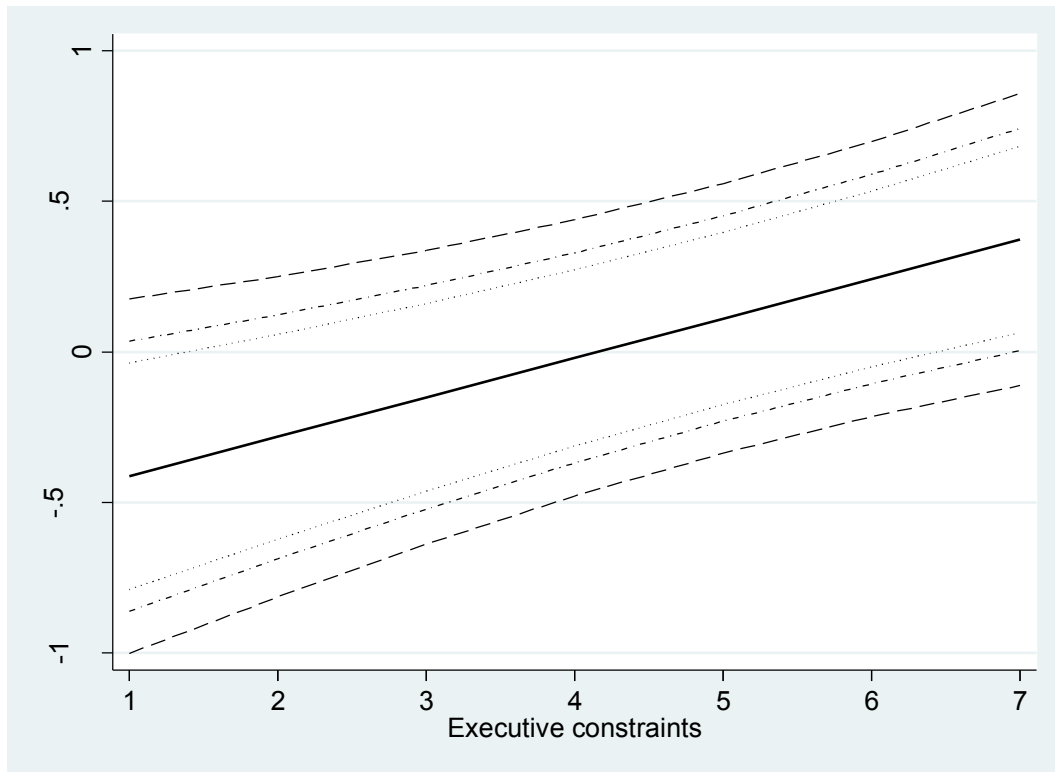


Figure 3A – Marginal effects of forest rents at different levels of executive constraints

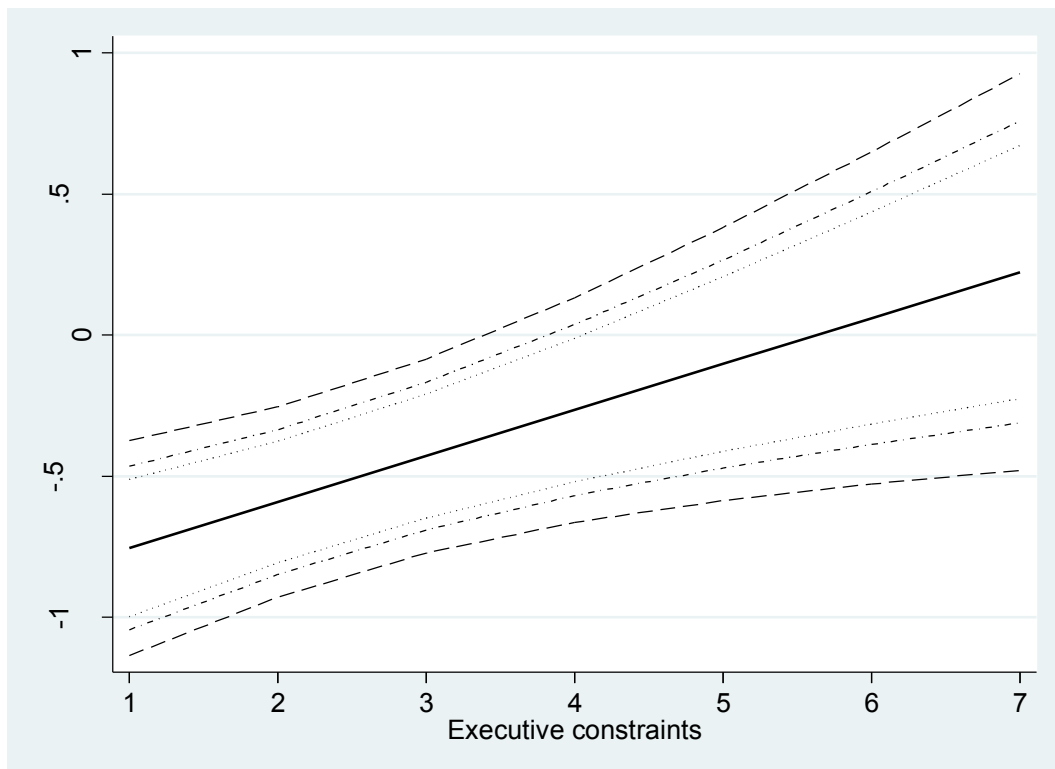


Figure 4A – Marginal effects of oil rents at different levels of executive constraints

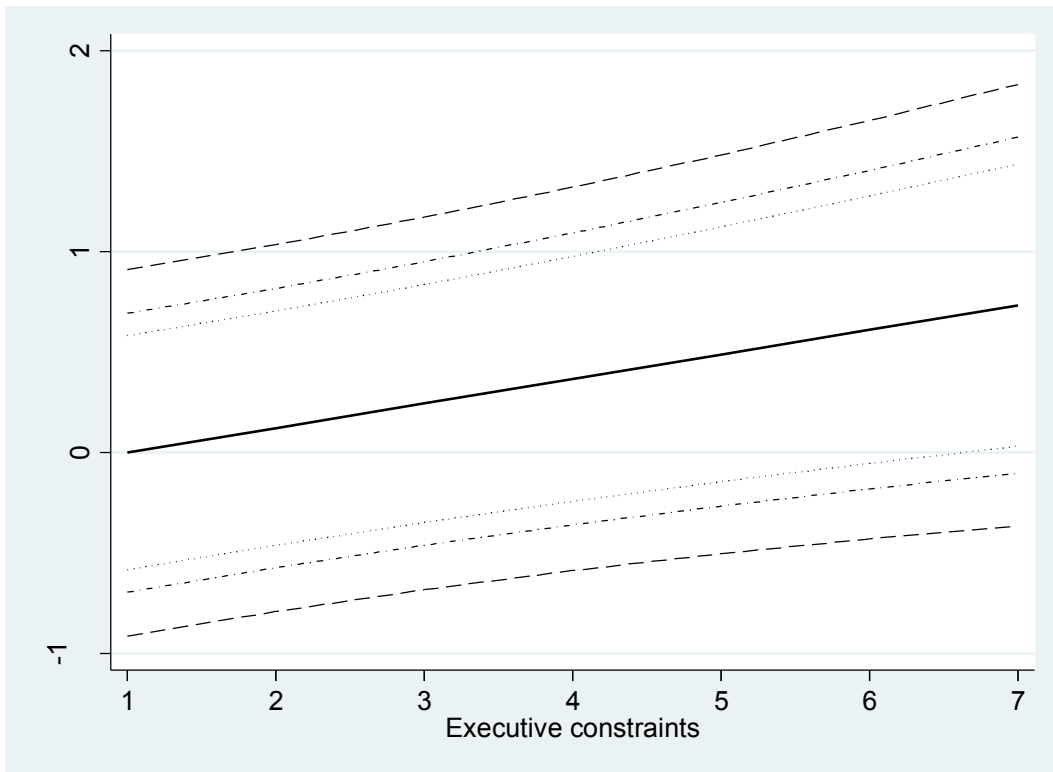


Figure 5A – Marginal effects of gas rents at different levels of executive constraints

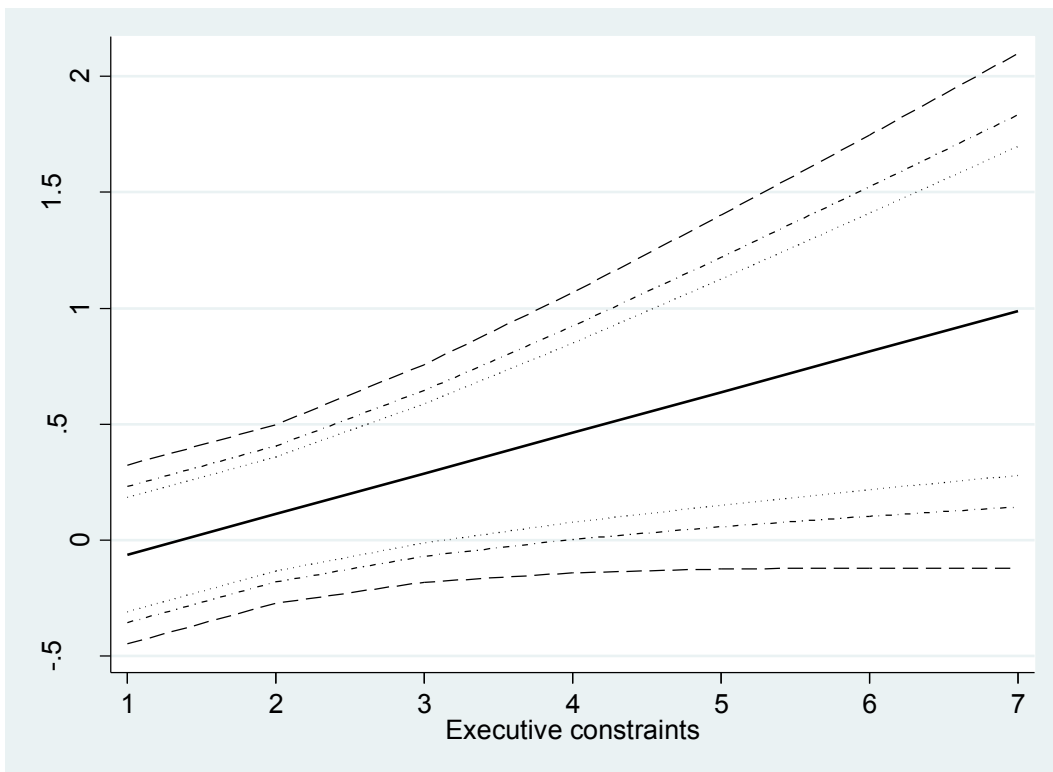


Figure 6A – Marginal effects of mineral rents at different levels of executive constraints

