

Is there a fiscal resource curse?

Resource rents, fiscal capacity and political institutions in developing economies

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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 or neutralise such negative effect. We provide empirical support for this hypothesis using a recently constructed data set on non-resource taxes and panel methods for 91 developing countries covering the period 1981-2011. 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. Our findings imply that 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.

Keywords: state capacity, fiscal capacity, resource curse, institutions, constraints on the executive, economic development

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1. Introduction

The effect of natural resource abundance on less developed economies has been a lively area of research for many years.¹ 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).² 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 capacity³. 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 an 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 91 developing countries from 1981 to 2011. Our fiscal capacity measure, the share of non-resource taxes on income, profits and capital gains on non-

¹ 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 have also been used as terms encompassing all the above aspects. Here we use them in this latter sense.

² 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.

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

resource total taxes, is based on the intuition that collecting income taxes requires a more developed and competent administrative structure than raising other types of taxes (see Besley and Persson, 2014) and is constructed using the recent ICTD Government Revenues Dataset (Prichard et al., 2014), with improved coverage and the crucial distinction between resource and non-resource revenues. After extensive robustness checks, we find evidence that political institutions placing institutionalised constraints on the executive power may mitigate or neutralise 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 evidence suggesting that the effect works mainly through institutions that make the tax system accountable to and transparent for 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. This is an area that has so far 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 at the heart of state formation and is indispensable for the provision of public goods and investments in infrastructure in less developed economies (e.g., Besley and Persson (2013); Osafo-Kwaako and Robinson, 2013), but stylised facts suggest that they 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 weaker 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 revenues results in a \$0.25 decrease in non-resource revenues, a \$0.43 increase in government spending and a \$0.32 increase in public savings. Morrison (2009) finds that an increase in non-tax revenues 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 revenues 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, 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) provides 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 (e.g., measurement of fiscal capacity, endogeneity, sample size), and so in need of systematic investigation. Moreover, existing studies do not consider a crucial aspect at the heart of our analysis: the interplay between natural resources 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).⁴ 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).⁵ 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 rent seeking is fostered. 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 ruling groups with more funds that can be used to retain power (e.g., to influence the outcome of elections), thereby increasing resource misallocation in the rest of the economy.

Perverse effects from rent seeking and patronage are not mutually exclusive and can operate together. However, the presence of accountability mechanisms for state leadership can neutralise the perverse incentives that resource rents create. This is where political institutions that place effective constraints on a ruler can play a major role, such that an economy can have both private sector and state institutions that avert rent-seeking and patronage mechanisms. For example, it has been argued that limits on the executive power 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). Similarly,

⁴ The literature interested in the effects on growth has proposed additional mitigating mechanisms. 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 on growth 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).

⁵ 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.

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).

Coming to the focus of this paper, if natural resource rents harm fiscal capacity, why should a higher level of checks and balances on the executive power can change this effect? This is because, when subject to institutionalised checks and balances, a ruler has less discretion over public finance decisions than one who is not, including over decisions on the use of natural resource rents. One mechanism concerns the presence of independent institutional actors within the national government that can control and subject to limits the use of state resources, so to demand greater accountability with respect to budgetary planning and implementation. For example, in parliamentary systems, an effective parliament can institutionally oversee and audit the state budget. This implies that the executive may be more likely to promote an effective and 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. Another mechanism concerns the possibility that chief executives subject to formal limitations to their power may be more likely to follow the rule of law, so that the judicial system may counter rent seeking and patronage 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 resources 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.⁶

[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.*

⁶ Taxes are defined as the non-resource component of total tax revenues excluding social contributions, from ICTD (2015), and are averaged over 2000-2011. Total natural resources rents are averaged between 1970 and 1999 and are from World Bank (2016). To divide the sample, we consider 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). Note also that resource rents does not include diamond revenues amongst its minerals, hence obscures interesting comparisons such as Botswana vs. Sierra Leone.

- ii. *Political institutions placing limits on the executive powers promote accountability and common interests. The negative effect of natural resource rents on fiscal capacity is therefore mitigated or neutralised in countries with a higher level of executive constraints.*

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

3. Empirical strategy and data

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

The former 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 so 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 rents 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 rents 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 institutions within 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.⁷ 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 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, potentially able to influence world prices.

We estimate:

$$FC_{it} = b_0 + b_1RR_{it-4\text{-bar}} + b_2EC_{it-4} + b_3RR_{it-4\text{-bar}} * EC_{it-4} + \mathbf{bX}_{it} + \mu_i + \lambda_t + u_{it} \quad (1)$$

FC_{it} is fiscal capacity for country i at time t . Capturing this concept is particularly challenging.⁸ The literature identifies two approaches. The first one, which is 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.⁹ 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

⁷ 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.

⁸ The 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).

⁹ 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).

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 to distinguish the natural resources component of tax revenues from the non-resource one, so improving the accuracy of measurement compared to previous sources.¹⁰

$RR_{t-4\text{-bar}}$ 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 in the natural resources sector and in the political system.¹¹ 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. $RR_{it-4\text{-bar}} * EC_{it-4}$ 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 political stability, population density, external and internal conflict, and aid. According to Besley and Persson (2011), if political instability is higher, that is, an incumbent faces a higher probability of replacement, the incentive to invest in fiscal capacity may decrease, as such investments may enable more redistribution to rival groups. We control for this variable using the sum of *Openness of executive recruitment* ($xropen$) and *Competitiveness of executive recruitment* ($xrcomp$) from the Polity IV dataset (Marshall et al., 2014). Population density should be positively correlated with state capacity, assuming that it is less challenging to develop a fiscal apparatus 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, 2011). 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. Development assistance has often been compared to natural

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

¹¹ 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., Klomp and de Haan, 2016). Presumably, empirical analyses using a panel with “high frequency” data (e.g., yearly) would fail to properly capture structural characteristics.

resources in terms of its possible *patronage effect* (e.g., Morrison 2010). We use data from the World Bank (2016) to assess whether aid dependence decreases investments in fiscal capacity. 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 and the sum of exports and imports of goods and services measured as a share of gross domestic product. Table 1A (in the Appendix) describes variables and sources, and Table 2A describes the sample.

All regressions include country and year dummies (μ_i and λ_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 91 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).

[Table 1 about here]

4. Results

This section presents the results. We begin by assessing the evidence on whether the effect of resource rents on fiscal capacity depends on the level of constraints on the executive. A series of robustness checks follows. We first look at whether and which type of natural resources drives the results. Then we assess the identifying assumption. Finally, we present further results, based on cross-section estimates, investigating which specific 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 constraints on the executive. 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 is offset when the level of executive constraints increases, so

confirming our hypotheses. 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 5 shows the marginal effects of total natural resource rents at different levels of constraints on the executive. Resource rents negatively affect fiscal capacity when the level of executive constraints is very low. For countries, such as Congo, Gabon and Uzbekistan, where constitutional restrictions on executive action are weak ($xconst=1$ for significant periods), a one percentage point 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. Considering that the (*within*) standard deviation in resource rents is above three percentage points, such effects also appear to be economically significant. Resource rents, instead, have no effect (or they can even be a blessing) for countries with medium or high levels of checks and balances on the executive power (e.g., Albania and Costa Rica, which are in the top quintile).¹²

4.2 Do specific natural resources dominate the interaction effect?

Next, we assess if the interaction effect is driven by specific natural resources. Some studies suggest that the resource curse may be specific to certain 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.¹³ 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

¹² 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.

¹³ Future research should also consider the distinction between ‘lootable’ and ‘non-lootable’ natural resources, as proposed by Vahabi (2016). However, whether the impact on fiscal capacity is specific to the appropriability profile of certain natural resources is not something that available resource rents data allow to investigate. Incidentally, the World Bank also provides data for coal rents, but they are ignored because of lack of variation (very few observations are different from zero).

that the effects of different resources are jointly equal to zero. 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.¹⁴ As a final check, in Table 4, 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 not, depending on the level of executive constraints.

[Tables 3 and 4 about here]

However, these results also suggest that different resource rents may affect fiscal capacity differently. Table 5 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 rents), but vanishes when the level of executive constraints is at least 4. This echoes earlier findings on minerals 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).

[Table 5 about here]

4.3 Does the identifying assumption hold?

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

¹⁴ 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 is affecting the standard errors and, in turn, statistical significance of individual coefficients.

of international commodity prices, are exogenous to a country's institutions, whereas large commodity producers, who can influence world commodity prices, raising endogeneity concerns with respect to our variable, may drive them. 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.¹⁵ In all our regressions, the key result on the heterogeneous impact of natural resources proves to be robust (Table 6, 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 6-10 about here]

4.4 How do resource rents affect fiscal capacity?

Our findings indicate that political institutions limiting executive power create the conditions to offset the negative effects that natural resource abundance can have on fiscal systems. However, we have not identified hitherto which specific tax institutions are affected, an exercise that could deliver insights on the channels of causation. 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, which we call *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 and transparent to its citizens, so building state-society relations conducive to quasi-compliance (e.g., Levi 1988). The other aspect concerns the ability of tax administration to coerce citizens to pay taxes, hence its effectiveness in raising revenues. These two different dimensions of tax systems constitute the key ingredients needed to develop revenue authorities so that to have fiscally capable states.¹⁶ Outcome-based measures of fiscal capacity, such as the tax to GDP ratio or the measure used so far, cannot differentiate between the two.

¹⁵ We identify OPEC members and big producers following Caselli and Tesei (2016).

¹⁶ For example, Besley and Persson (2013) note that fiscal capacity is the product of investments in tax systems including better tax administration and features of that increases voluntary compliance of taxation by citizens. Improved tax administration can be related to the effectiveness dimension of fiscal capacity, while processes of tax payment and collection that lead to greater transparency and accountability of tax authorities (and consequently, making taxation systems more consensual between states and citizens) can be related to the impartiality dimension of fiscal capacity.

To test whether a fiscal resource curse works through *impartiality* or *effectiveness* (or both), we use a novel set of indicators provided by the Public Expenditure and Financial Accountability project (PEFA 2006). PEFA is a partnership of national and international donors (e.g., IMF and the World Bank) assessing public financial management performance in developing economies according to over thirty indicator areas of public finance. In particular, we use five indicators from the PEFA database, neatly capturing the *impartiality* and *effectiveness* of tax systems. They are described below:¹⁷

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;
5. *Quality of tax audits* 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 three measures assess the coercive aspects of the tax system: they are all desirable features of a tax administration machine that can successfully raise revenues.¹⁸ 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.¹⁹ The results (Tables 11 and 12) suggest that, to some extent, the

¹⁷ The appendix describes each PEFA variable in full. Details of the PEFA framework, indicators and assessment method are given in the database codebook at https://pefa.org/sites/default/files/PMFEng-finalSZreprint04-12_1.pdf.

¹⁸ Methodologically, these are *de facto* measures: based on 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.

¹⁹ Although the PEFA dataset is gradually expanding, its structure is such that it covers a relatively small number of developing economies and it does not allow for panel analysis yet. In particular, PEFA variables range from 2005 to 2013 and have a T-bar of only 1.5, as well as exhibiting very little variation within countries. Apart from the 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 the results are robust.

interaction between political institutions and resource rents affects the *Transparency of taxpayer obligations and liability* only.

[Tables 11-12 about here]

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 13 and 14).

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 can even become 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.

[Table 13-14 about here]

5. Conclusions

This paper investigates how natural resource rents affect the incentives for investing in fiscal capacity under political institutions holding, or failing to hold, the ruler accountable. 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 91 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). Further analysis, based on cross-section estimates and a recent dataset on the characteristics of tax systems in developing economies, shows that the effect of natural resources is likely to work mainly through institutions that make the tax system accountable to and transparent for 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, 2014; Melhum et al., 2006), extending this view to the case of fiscal capacity. Our findings are equally relevant to the literature on the determinants of state capacity, where it has recently been argued that political institutions constraining the power of the executive 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. Moreover, our results echo recent case studies showing that, in historical perspective, becoming a resource-rich economy has concurrently promoted state building, contingent on the social roots of political coalitions that rule during the boom (Saylor 2014) or on having a stable democracy (Dargent et al. 2017). Finally, 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 conflict	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 conflict			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 types of 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 conflict	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 - Fiscal capacity and types of natural resources rents – excluding specific rents

	(1)	(2)	(3)	(4)
	no forest rents	no oil rents	no gas rents	no mineral rents
Executive constraints	0.0471 (0.456)	-0.359 (0.464)	-0.516 (0.516)	-0.454 (0.520)
Total Resources Rents without forest rents	-0.230 (0.154)			
Interaction without forest	0.0905*** (0.0275)			
Total Resources Rents without oil rents		-0.761*** (0.220)		
Interaction without oil rents		0.157*** (0.0468)		
Total Resources Rents without gas rents			-0.732*** (0.247)	
Interaction without gas rents			0.142*** (0.0399)	
Total Resources Rents without mineral rents				-0.433* (0.242)
Interaction without mineral rents				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 conflict	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 5 – 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 of Total natural resources rents are calculated using the coefficients from Table 2, Column 5. The marginal effects of forest, oil, gas, and mineral rents are calculated using the coefficients from Table 3, Column 1.

Table 6 - 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 conflict	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 7 – 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 6, Columns 1 and 2

Table 8 – 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 6, Columns 3 and 4

Table 9 – 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 6, Columns 5 and 6

Table 10 – 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 6, Columns 7 and 8

Table 11 - Potential channels of causation from resource rents to fiscal capacity

DEPENDENT VARIABLES	(1) Transparency of taxpayer obligations and liabilities	(2) Transparency of taxpayer obligations and liabilities	(3) Tax appeals	(4) Tax appeals	(5) Controls in the taxpayer registration system	(6) Controls in the taxpayer registration system	(7) Effectiveness of penalties for non-compliance with registration and tax declaration	(8) Effectiveness of penalties for non-compliance with registration and tax declaration	(9) Quality of tax audits	(10) Quality of tax audits
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 conflict	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 12 – Effects of resource rents on fiscal institutions 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 audits
	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 11, Columns 2, 4, 6, 8, 10.

Table 13 - Potential channels of causation from resource rents to fiscal capacity – Excluding outliers

DEPENDENT VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	Transparenc y of taxpayer obligations and liabilities	Transparenc y of taxpayer obligations and liabilities	Tax appeals	Tax appeals	Controls in the taxpayer registration system	Controls in the taxpayer registration system	Effectivenes s of penalties for non- compliance with registration and tax declaration	Effectivenes s of penalties for non- compliance with registration and tax declaration	Quality of tax audits	Quality of tax audits
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 conflict	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	

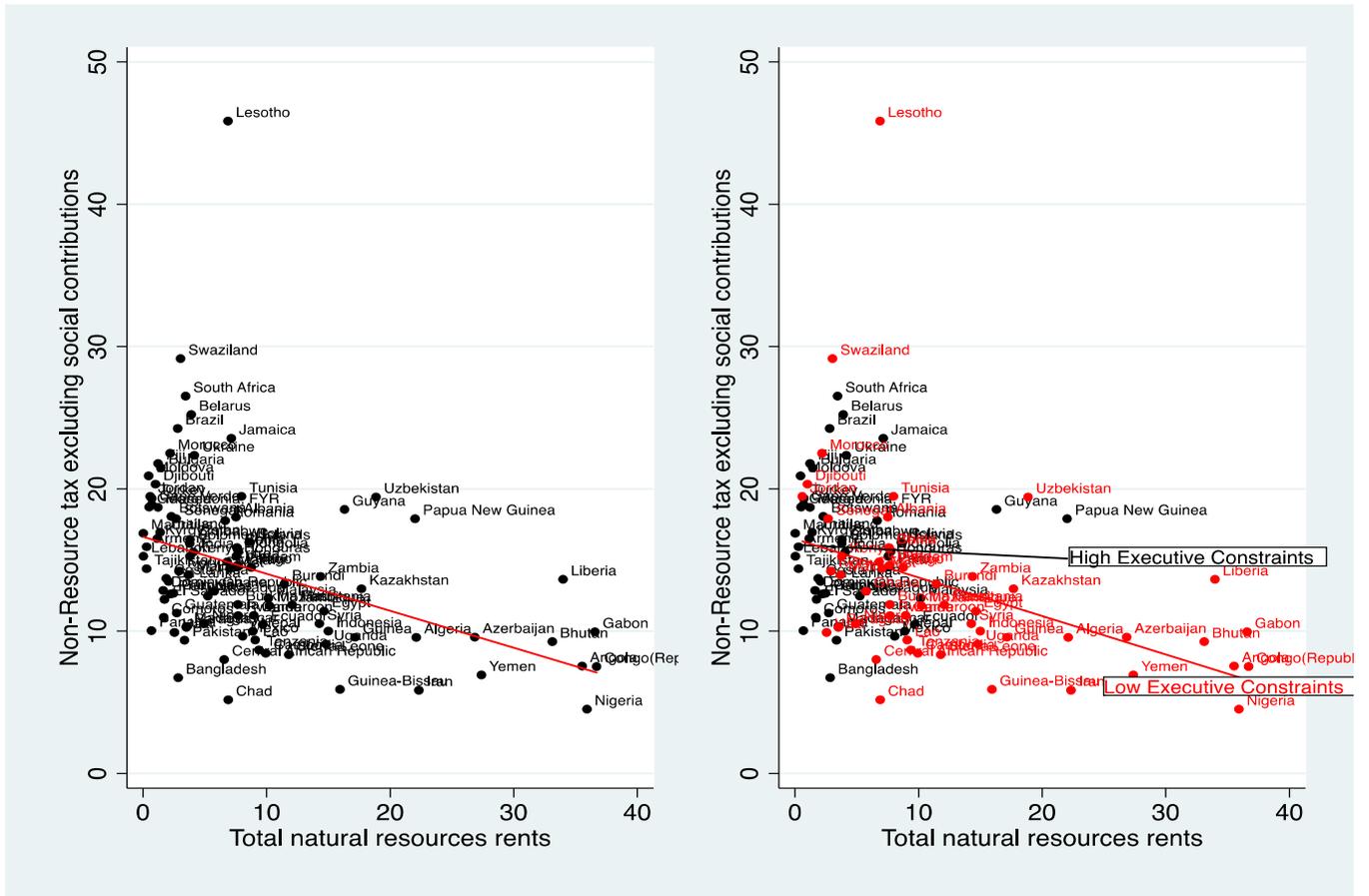
Notes: The dependent variable is calculated as 2006-2011 average. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 14 – Effects of resource rents on fiscal institutions 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 audits
	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 13, Columns 2, 4, 6, 8, 10.

Figure 1 - Relationship between non resource-tax and natural resource 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 conflict	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

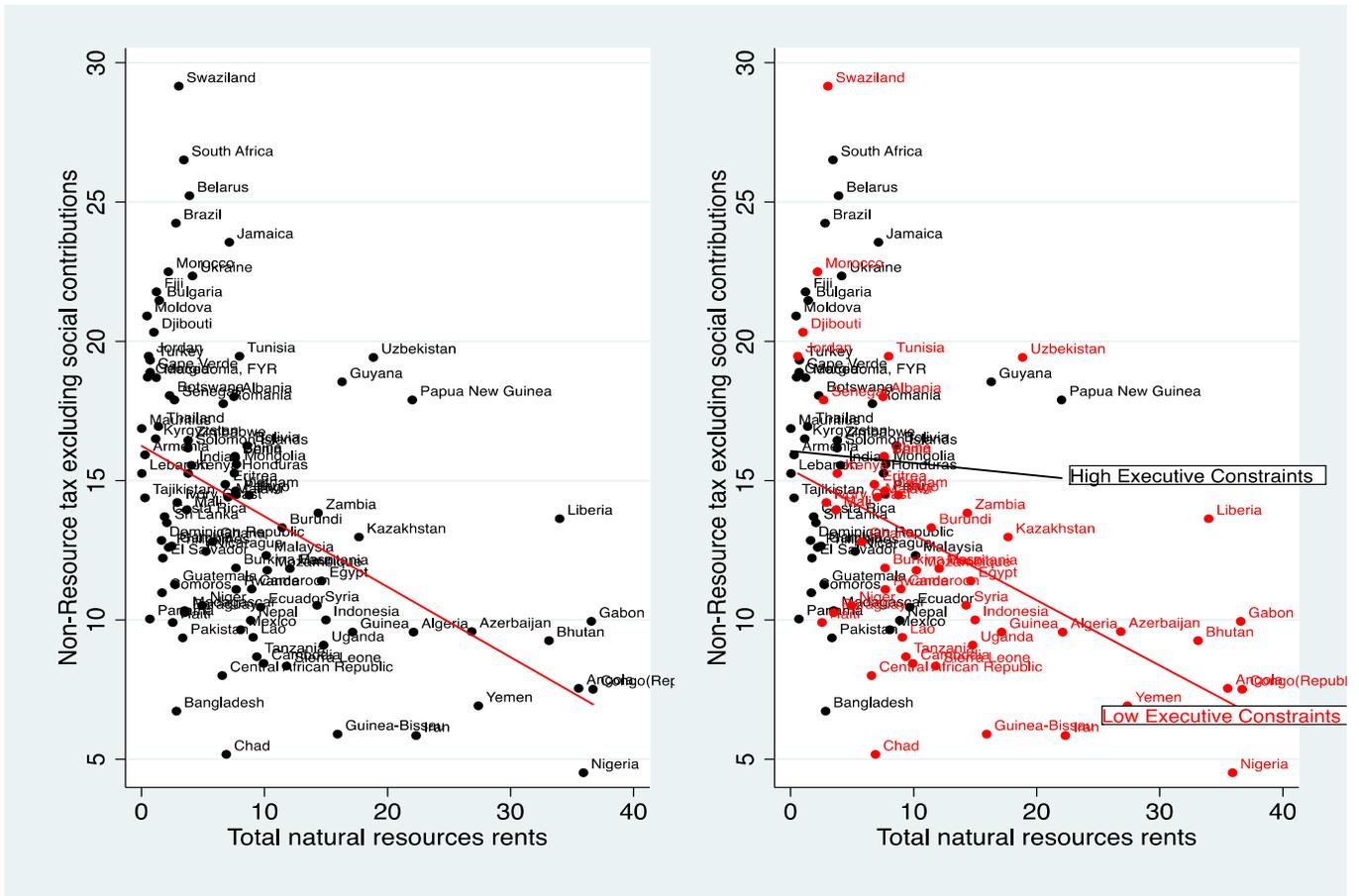


Figure 2A – Marginal effects of total natural resources rents at different levels of executive constraints

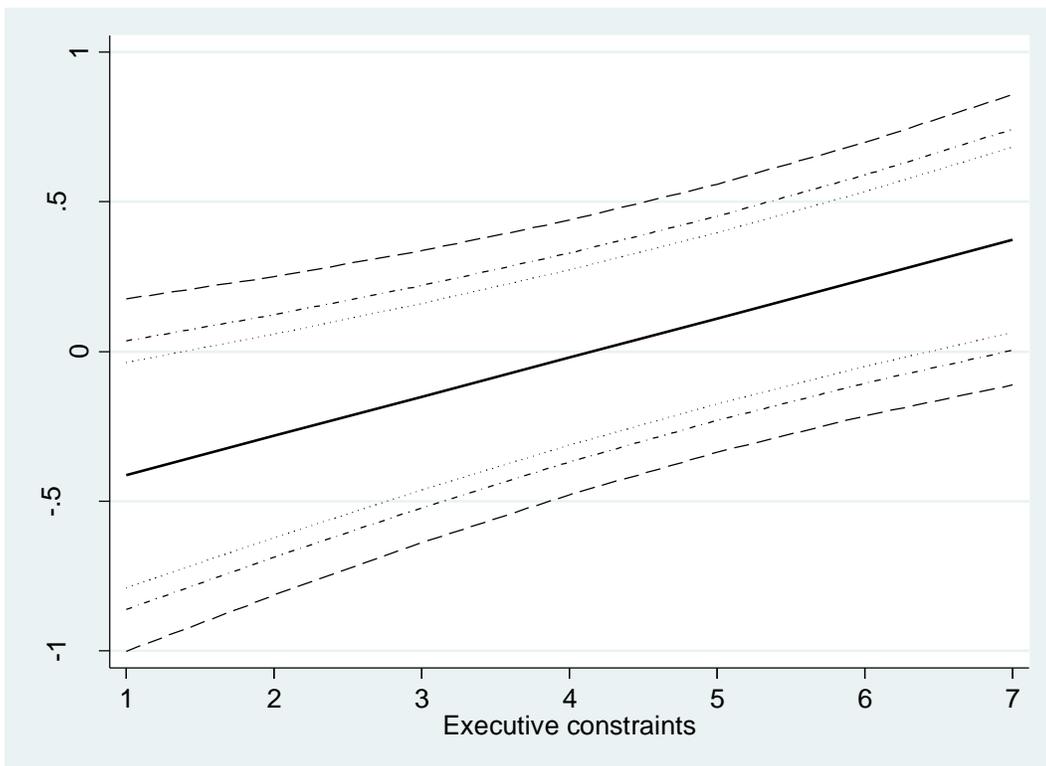


Figure 3A – Marginal effects of forest rents at different levels of executive constraints

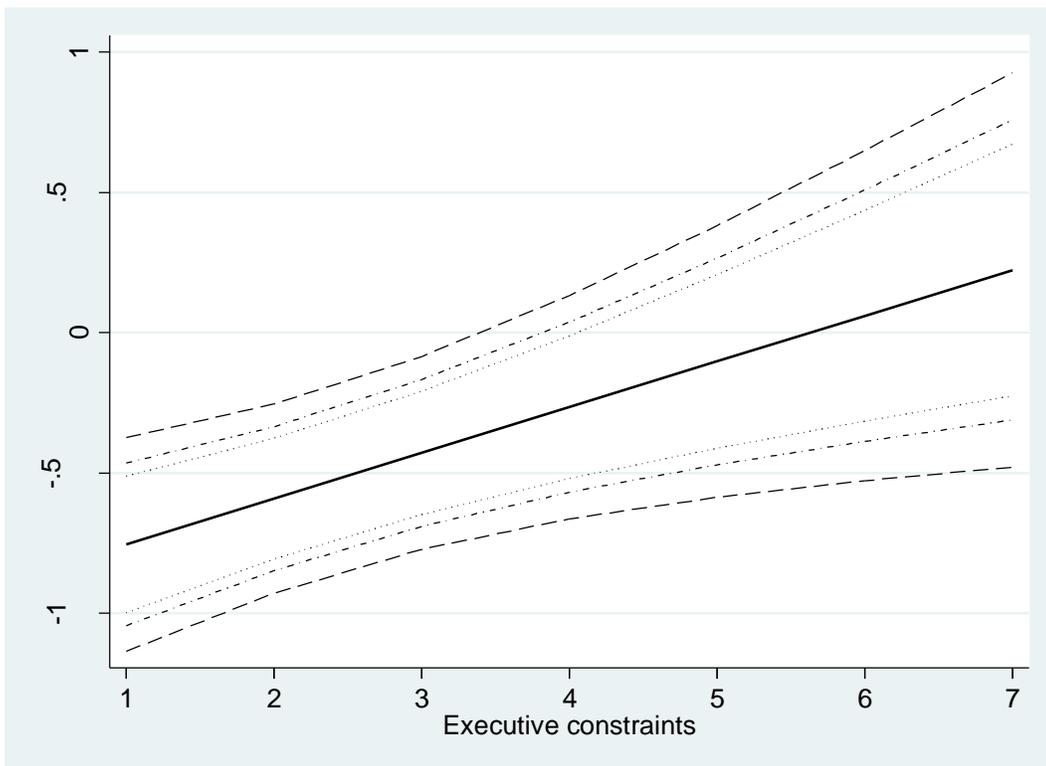


Figure 4A – Marginal effects of oil rents at different levels of executive constraints

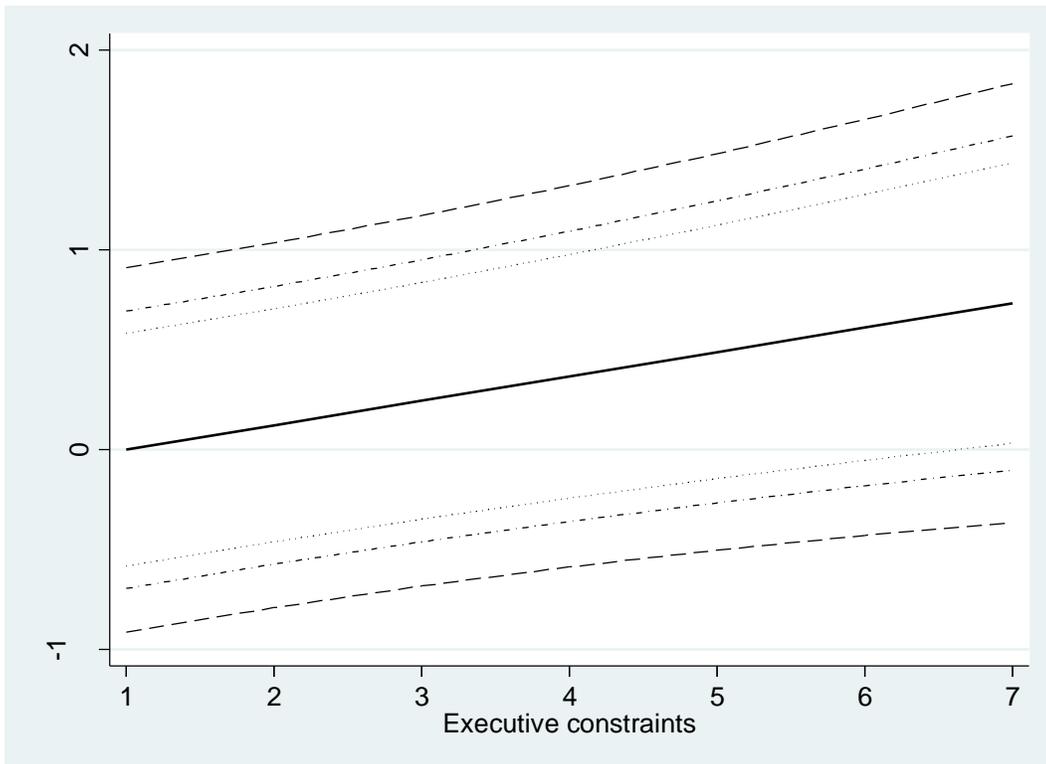


Figure 5A – Marginal effects of gas rents at different levels of executive constraints

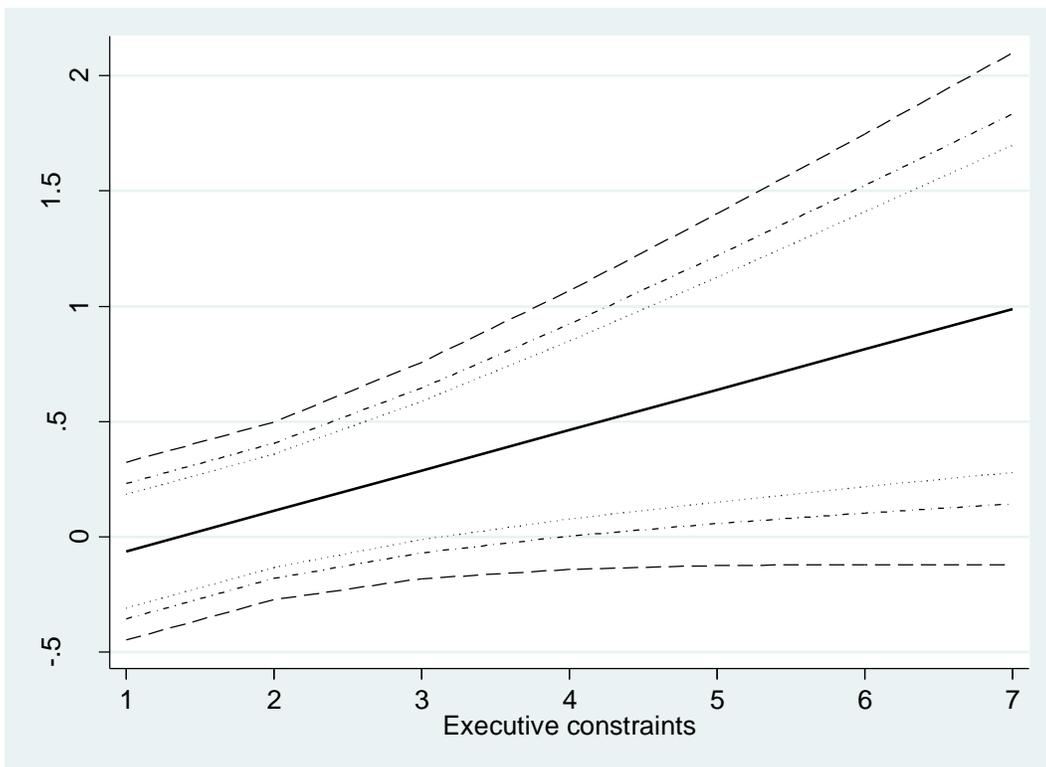


Figure 6A – Marginal effects of mineral rents at different levels of executive constraints

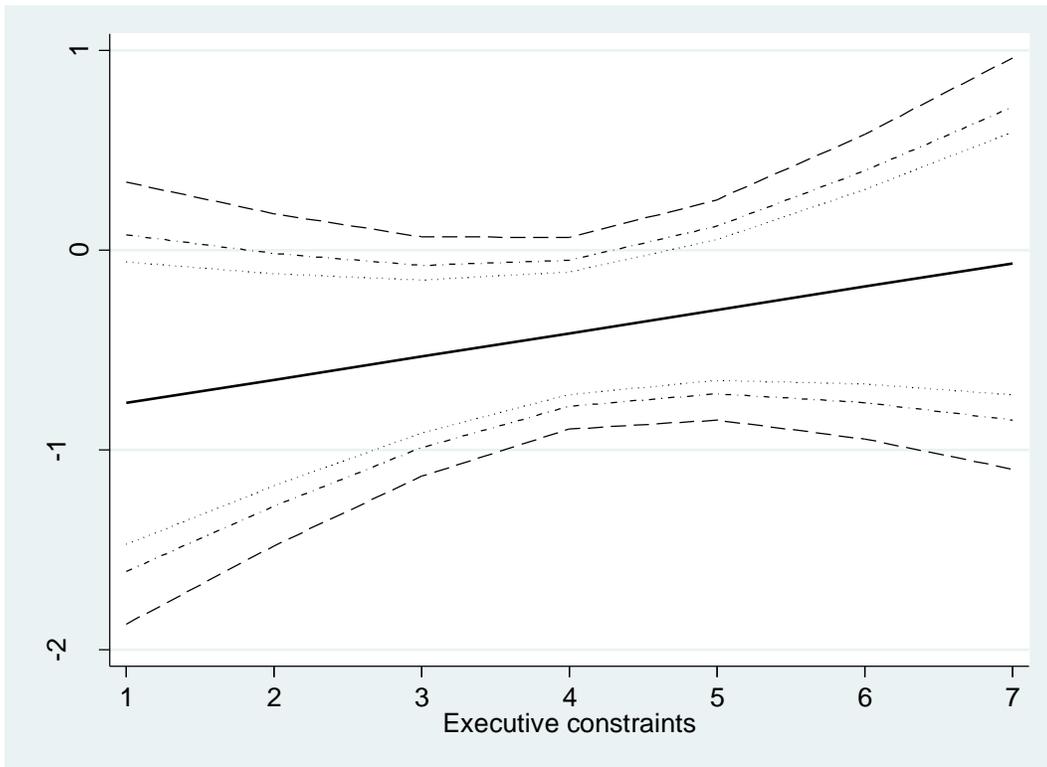


Table 3A – Description of PEFA variables

<p>Transparency of Taxpayer Obligations and Liabilities (PEFA PI13(ii))</p>	<p>Definition: Taxpayers access to information on tax liabilities and administrative procedures. Average score over 2005-2013. Scoring method: 3. Taxpayers have easy access to comprehensive, user friendly and up-to-date information tax liabilities and administrative procedures for all major taxes, and the RA supplements this with active taxpayer education campaigns. 2. Taxpayers have easy access to comprehensive, user friendly and up-to-date information on tax liabilities and administrative procedures for some of the major taxes, while for other taxes the information is limited. 1. Taxpayers have access to some information on tax liabilities and administrative procedures, but the usefulness of the information is limited due coverage of selected taxes only, lack of comprehensiveness and/or not being up-to-date. 0. Taxpayer access to up-to-date legislation and procedural guidelines is seriously deficient. Source: variable PI.13(ii), <i>Public Expenditure and Financial Accountability Performance Measurement Framework</i>, PEFA (2006), at http://www.pefa.org/en/content/pefa-framework.</p>
<p>Existence and functioning of tax appeals mechanisms (PEFA PI13(iii))</p>	<p>Definition: Existence and functioning of a tax appeals mechanism. Average score over 2005-2013. Scoring method: 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. Source: variable PI.13(iii), <i>Public Expenditure and Financial Accountability Performance Measurement Framework</i>, PEFA (2006), at http://www.pefa.org/en/content/pefa-framework.</p>
<p>Controls in the taxpayer registration system (PEFA PI14(i))</p>	<p>Definition: quality and maintenance of a taxpayer database. Average score over 2005-2013. Scoring method: 3. Taxpayers are registered in a complete database system with comprehensive direct linkages to other relevant government registration systems and financial sector regulations; 2. Taxpayers are registered in a complete database system with some linkages to other relevant government registration systems and financial sector regulations; 1. Taxpayers are registered in database systems for individual taxes, which may not be fully and consistently linked. Linkages to other registration/licensing functions may be weak but are then supplemented by occasional surveys of potential taxpayers; 0. Taxpayer registration is not subject to any effective controls or enforcement systems. Source: variable PI.14(i), <i>Public Expenditure and Financial Accountability Performance Measurement Framework</i>, PEFA (2006), at http://www.pefa.org/en/content/pefa-framework.</p>
<p>Effectiveness of</p>	<p>Definition: Effectiveness of penalties for non-compliance with registration</p>

penalties for non-compliance with registration and tax declaration (PEFA PI14(ii))	and tax declaration. Average score over 2005-2013. Scoring method: 3. Penalties for all areas of non-compliance are set sufficiently high to act as deterrence and are consistently administered; 2. Penalties for non-compliance exist for most relevant areas, but are not always effective due to insufficient scale and/or inconsistent administration; 1. Penalties for non-compliance generally exist, but substantial changes to their structure, levels or administration are needed to give them a real impact on compliance; 0. Penalties for non-compliance are generally non-existent or ineffective (i.e. set far too low to have an impact or rarely imposed). Source: variable PI.14(ii), <i>Public Expenditure and Financial Accountability Performance Measurement Framework</i> , PEFA (2006), at http://www.pefa.org/en/content/pefa-framework .
Quality of tax audits (PEFA PI14(iii))	Definition: Planning and monitoring of tax audits programs. Average score over 2005-2013. Scoring method: 3. Tax audits and fraud investigations are managed and reported on according to a comprehensive and documented audit plan, with clear risk assessment criteria for all major taxes that apply self-assessment; 2. Tax audits and fraud investigations are managed and reported on according to a documented audit plan, with clear risk assessment criteria for audits in at least one major tax area that applies self-assessment; 1. There is a continuous program of tax audits and fraud investigations, but audit programs are not based on clear risk assessment criteria ; 0. Tax audits and fraud investigations are undertaken on an ad hoc basis if at all. Source: variable PI.14(iii), <i>Public Expenditure and Financial Accountability Performance Measurement Framework</i> , PEFA (2006), at http://www.pefa.org/en/content/pefa-framework .