GREDI

Groupe de Recherche en Économie et Développement International

Cahier de Recherche / Working Paper
16-03

A Conditional Revenue Curse? Progressive Taxation and Resource Rents in Developing Countries

Kodjovi M. EKLOU

UNIVERSITÉ DE SHERBROOKE

A Conditional Revenue Curse? Progressive Taxation and Resource Rents in Developing Countries *

Kodjovi M. Eklou †

Department of Economics and GREDI, Université de Sherbrooke, Canada

June 2016

Abstract

One of the main obstacles to the sustainability of governments' revenues in developing countries is the dependency on the rent generated by nonrenewable natural resources. Resource-rich countries have weak incentives to design and maintain efficient tax systems. I consider a theoretical model where the government of a resource-rich country, has to decide whether to undertake a costly investment in its ability to collect taxes and I incorporate progressive income tax. The model predicts that a resource-rich country has more incentives to invest in its ability to collect tax revenues, the more progressive is the tax schedule because expected returns to that investment may be higher. I test this prediction, named the conditional revenue curse hypothesis, in a sample of 57 developing countries over the period 1981-2005. In order to deal with the endogeneity of natural resources, I construct a country-specific natural resource price index and use its growth rate as an instrument for natural resource rent windfalls. I find that an increase in resource rent windfalls of $1 reduces domestic tax revenues by $0.25. Moreover, at a progressivity level of 0.05 (a tax schedule such that an increase in gross income by 1% yields an increase in the average tax rate by 0.0005% point), an increase in resource rent windfalls of $1 reduces domestic tax revenues by only $0.14. Following a resource windfall, countries with a high level of progressivity collect more tax revenues than their counterparts with a low level of progressivity.

Key Words: Natural resources, Revenue curse, Fiscal capacity, Progressive taxation, Developing countries.

JEL Codes: H20; 011; Q38.

*I am grateful to Dr. Michael Keen for kindly providing me with data. I thank my advisors Marcelin Joanis and Martino Pelli for their comments and directions. I would like to thank also prof. Joel Slemrod and prof. Wojciech Kopczuk for their comments during the third IIPF Doctoral school presentation. Finally I thank the participants of the following conferences, seminar or workshop: GREDI MIDI seminar in Sherbrooke, the 55^{th} SCSE conference in Montréal, the 49^{th} CEA conference in Toronto (particularly Fatih Yilmaz), the 5^{th} Montpellier-Sherbrooke scientific meeting and the CIREQ Workshop for their comments.

†E-mail addresses: kodjovi.eklou@gmail.com/ kodjovi.mawulikplimi.eklou@usherbrooke.ca, PhD candidate, Department of Economics, Université de Sherbrooke

Introduction

For a long time, official development assistance has been the centerpiece of the financing of development. Recently, more and more interest is being devoted to tax revenues collection.[1] In 2011, the OECD Development Centre published a report showing that "achieving the first 6 MDGs [(Millenium Development Goals)] globally requires approximatively [...] twice the size of the potential increase in tax revenues obtainable from improved tax collection effort in developing countries". Fiscal capacity, i.e the ability to effectively raise tax revenues varies largely accross countries. For instance, low-income countries collect between 10 and 20 percent of GDP in taxes, while the average for high-income countries is around 40 percent. Natural resource dependence is among the key reasons behind "why do developing countries tax so little" (Besley and Persson, 2014).[2] In this vein, McGuirk (2013) finds that governments may lower the tax burden on citizens in order to reduce the demand for democratic accountability in african countries that are resource-rich.

The recent collapse of oil prices has deprived many oil-dependent countries of substantial public revenues. The Wall Street Journal reports the case of Angola (Africa's second largest oil-producing country) seeking bailout from the IMF in order to cope with the collapse in government revenues. It is also reported that the country has not been able to pay the company that removes the trash its capital, Luanda because of this lack of revenue.[3] Thus in developing countries, the dependency on nonrenewable natural resources to generate revenues may be an obstacle to the sustainability of governments' revenues. Taxation is crucial both for a state's ability to raise revenues and to produce public goods. The volatility of natural resource revenues coupled with the fact that these resources are mostly nonrenewable may hinder the government's ability to provide public goods in the long run. In addition, there is evidence that the state's fiscal capacity have a positive effect on governance and democracy (Baskaran and Bigsten, 2012 ; Baskaran, 2014).

In this paper, I study the effect of natural resource rent windfalls on tax revenues collection effort in resource-rich developingcountries and I show that this effect is conditional on the progressivity of the tax system both with theory and data. First, the fact that in these countries, governments tend to have weak incentives to implement and sustain efficient tax systems (Knack, 2009), motivates the use of a theoretical framework allowing to model the incentive problem faced by their governments. I exploit the inovative framework by Besley

[1]See for instance the declaration of Doha on financing for development (2008) and the Busan partnership for effective development cooperation (2011).

[2]See also Bräutigam (2008) who stresses that except imperial Spain, no OECD country was ever reliant on resources revenues to the extend that many developing countries are now.

[3]`http://www.wsj.com/articles/angola-to-seek-imf-aid-to-cope-with-looming-financial-crisis-1459957868`

and Persson (2009, 2010). In this framework, a government in a resource-rich country has to decide how much to invest in its fiscal capacity (at a cost). Besley and Persson (2010) emphasize the fact that some resource-rich countries may have low levels of tax revenues because they have low investments in fiscal capacity. An investment in fiscal capacity corresponds to fiscal infrastructures that may allow the government to increase its ability to tax (Besley and Persson, 2010). I incorporate to the model a progressive income tax following Pencavel (1979) in order to explore the effect of this particular tax design on the incentives of the government of a resource-rich country to invest in fiscal capacity. The model predicts that this government has more incentives to invest in its ability to collect tax revenues the more progressive is the tax schedule because expected returns to that investment may be higher. In this model, the progressive income tax by allowing to tax more the high incomes, increases the government's expected revenues. This theoretical result suggests that the "revenue curse" (Crivelli and Gupta, 2014), that is the negative effect of natural resources on tax collection effort may be conditional on the progressivity of the tax system. The first contribution of this paper is to show that one size does not necessarily fit all and so the effect of natural resources on tax revenues may be heterogenous among resource-rich countries. To the best of my knowledge, this paper is the first to show how a particular tax policy design, may dampen the "revenue curse". Henceforth, I identify the fact that the negative impact of natural resource rents on tax revenues may depend on the level of progressivity of the tax system as the "conditional revenue curse" hypothesis. In the second part of the paper, I propose an empirical test of this hypothesis.

The estimation of the effect of natural resource revenues on tax revenues is difficult because of an endogeneity problem. Resource-rich countries may extract more natural resources because they are unable to effectively raise tax revenues. Again, Knack (2009) shows that countries that are rich in natural resources tend to have weak incentives to implement and sustain efficient tax systems because they may rely too much on windfall revenues. It is important therefore to separate the causal effect of natural resources from the effect of inefficient tax policies on tax revenues. Another potential problem is the measurement error in resource rents. Van der Ploeg and Poelhoeke (2010) show that the overestimation of extraction costs may lead to an underestimation of natural resource rents. Bornhorst et al. (2009) and Crivelli and Gupta (2014) analyze the effect of natural resource revenues on non resource or tax revenues and employ the Generalized Method of Moment (GMM) in order to deal with the endogeneity problem. I tackle the endogeneity problem using an instrumental variable strategy. The second contribution of this paper is to identify the causal effect of natural resource rent windfalls on domestic tax revenues. For each country in the sample, I construct a natural resource price index and use the growth rate as an instrument for natural resource rent windfalls. Thus, the empirical strategy exploits at the country-level the plausibly exogenous variation coming from the international determination of natural resources' prices. The argument is the following. An increase in the price of a natural resource may lead to an increase in its extraction because governments expect more revenues. The instrumental variable approach, by allowing to exploit only the exogenous part of the variation in natural resource rent windfalls, has the potential to address the bias that may arise when estimating the effect of natural resources on tax revenues. Instrumenting for natural resource rents should deal with the bias due to the reverse causality problem, the potential measurement error in resource rents and omitted variables that may determine within country changes in tax revenues and resources' extraction.

Using a sample of 57 developing countries over the period 1981-2005, I find that a $1 increase in natural resource rent windfalls causes a reduction in domestic tax revenues by $0.25. This result indicates a partial substitution between natural resource revenues and tax revenues of 25%. However, progressive taxation may dampen the detrimental effect of natural resources on fiscal capacity as predicted by the theoretical model. Following a resource windfall, countries with higher degrees of progressive taxation collect more tax revenues than their counterparts with lower levels of progressive taxation. At a progressivity level of 0.05 (a tax schedule such that an increase in gross income by 1% yields an increase in the average tax rate by 0.0005% point) an increase in resource rent windfalls of $1 reduces domestic tax revenues by only $0.14. This level of structural progressivity is less than the average in advanced economies which is around 0.08. For instance in the United States the average level of structural progressivity over this period is 0.06. The "revenue curse" seems to be conditional and therefore does not seem to be cast in stone. Conversely to the traditional idea that progressive taxation may have a negative economic impact by harming the incentives of high skilled individuals or by leading to a reduction in labor supply, this paper suggests that progressive taxation may also have positive effects. Policy reforms aimed at strengthening progressive taxation may help resource-rich countries to enhance their fiscal capacity.

This paper is related to a recent literature (Bornhorst et al., 2009; Crivelli and Gupta, 2014; James, 2015) showing that natural resource revenues have a negative effect on tax collection efforts by governments. More specifically, Bornhorst et al. (2009) find in a sample of 30 hydrocarbon producing countries over the period 1992-2005 that there is a partial substitution of 20% between government revenues from hydrocarbon related activities and revenues from other domestic sources. Also, Crivelli and Gupta (2014) in a sample of 35 resource rich countries over the period 1992 to 2009 find a partial substitution of 30%. James (2015) finds that in US States, an increase in resource revenues results in a decrease in non resource revenues equivalent to a partial substitution of 25%. This last finding suggests that the "revenue curse" is not confined to developing countries. This paper complements the literature by suggesting a novel empirical strategy for cross-countries studies in order to estimate a causal effect of natural resources on tax revenues, using a larger sample of countries and by showing that the design of the tax system matters.

The remainder of the paper is organized as follows. Section 1 presents the theoretical framework. Section 2 describes the data and Section 3 outlines the empirical approach. Section 4 discusses the baseline empirical results. Section 5 presents robustness tests and Section 6 discusses other potential channels through which progressive taxation may operate to dampen the "revenue curse". Finally, Section 7 concludes.

1 Model

In this section I analyze the incentive problem faced by a resource-rich government choosing the amount of investment in the ability to raise tax revenues. The model presented here stems from Besley and Persson (2010) and Cárdenas et al. (2011). I extend their framework by introducing progressive income taxation and this is meant to set the stage for the empirical analysis.

1.1 Setup

The model is composed by two periods, s=1, 2 and the world ends after the second period. The population has a size normalized to 1 and divided in 2 groups. Each group represents a share θ_j of the total population, with $j \in \{I, O\}$ and $\theta_I + \theta_0 = 1$. From the perspective of the second period, the group in power at the end of the first period is the incumbent government (I_1) that may stay in power with an exogenous probability γ. The opposition group is denoted O_1. The winner in the political transition process, becomes the new incumbent (I_2) and the looser becomes the new opposition (O_2). The government (I_s) sets a group-specific tax rate on the income of each individual (t_{js}) at the end of each period. Particularly at the end of the first period, I_1 also chooses the level of the investment in the next period's fiscal capacity. In addition to income taxation, each period the government gets exogenously determined natural resource rents R from its own stock of natural resources. In this version of the model individuals earn an exogenous market income which is group-specific in order to keep the model tractable.[4]

[4]In the original version, the market income depends on the legal support to each group.

1.2 Individuals' preference

Following Cárdenas et al. (2011), individuals' utility in period s is linear in consumption as in Besley and Persson (2010) but quasilinear in the public good. I intoduce nonlinear taxation following Pencavel (1979). Individual utility takes the following form:

$$\alpha_s V(G_s) + C_{js} = \alpha_s V(G_s) + W_j - t_{js} W_j^{\sigma} \tag{1}$$

where G_s is the level of public goods, $V(\cdot)$ is a strictly concave function of G_s with $V(0) = 0$. The concavity of $V(\cdot)$ implies that the marginal utility of public goods' consumption is diminishing. W_j is the group-specific exogenous market income and C_{js} is the private consumption, which is equal to the market income after tax. σ is the parameter capturing the degree of progressivity of the income tax schedule (with $\sigma > 1$). When $\sigma = 1$, the income tax is linear and when $\sigma > 1$, the income tax is progressive because the marginal tax rate increases with respect to W_j. Therefore, the progressivity of the income tax is increasing in σ. The tax schedule exhibits a particular non linear form such that the average tax rate increases with pre-tax income.[5] α_s is a parameter reflecting the valuation of public goods in the economy. α_s has a two-point distribution $\{\alpha_L, \alpha_H\}$, with $\alpha_H V_G(G_s) > 1 > \alpha_L V_G(G_s)$, and ϕ denotes the probability that $\alpha_s = \alpha_H$. α_H denotes a high public good valuation and α_L a low public good valuation. When α_H is realized, the economy is in a "common interest state" while if α_L is realized the economy is in a "redistributive state". In the "common interest state", it is desirable to produce a public good that every citizen regardless of its group, could consume. On the other hand, in the "redistributive state" the preference is in favour of private consumption.

1.3 Government

The only constraint on tax policy is the level of fiscal capacity. This level of fiscal capacity τ_s results from previous periods' choices. The level of fiscal capacity for period 2 is choosed by the first period's incumbent. τ represents for example fiscal infrastructure that may allow the government to increase its ability to tax income (Besley and Persson, 2010). At the beginning of the first period, the governement is endowed with an initial level of fiscal capacity τ_1. The initial stock of fiscal capacity does not depreciate, but can be increased by I_1 through positive investments which cost $F(\tau_2 - \tau_1)$. $F(\cdot)$ is a linear function such that ($F_\tau > 0$ and $F_{\tau\tau} = 0$) with $F(0) = F_\tau(0) = 0$.[6] A higher fiscal capacity (τ_s) allows the incumbent I_s to raise more tax per citizen as $t_{js} \leq \tau_s$. In this model, to allow for a

[5]This modelling of progressive taxation is similar to Corneo (2002). The only difference is that Corneo (2002) focuses on the residual progressivity.

[6]I consider a linear cost function without a loss of generality in order to make the model more tractable. I discuss the model in the theoretical appendix, assuming a general convex cost function with $F_{\tau\tau} \geq 0$.

redistribution motivated by political considerations, tax rates can be negative. In other words, the government can choose to tax the opposition group in order to subsidize its own group. The government is subject to the following budget constraint in period s :

$$0 = (\theta_I t_{Is} W_I^\sigma + \theta_O t_{Os} W_O^\sigma) - G_s + R - \begin{cases} F(\tau_2 - \tau_1) & \text{if } s = 1 \\ 0 & \text{if } s = 2 \end{cases} \quad (2)$$

The government collects income tax $(\theta_I t_{Is} W_I^\sigma + \theta_O t_{Os} W_O^\sigma)$ and resource rents R that are used for public good (G_s) production and particularly in period 1, to cover the cost of the investment in fiscal capacity ($F(\tau_2 - \tau_1)$).

1.4 Timing of events

Each period s is structured in three different stages. In the first stage, the group in power is known, the exogenous valorization of public goods α_s and natural resources rents R_s are realized. In the second stage, the incumbent makes the policy choices (level of tax rates and level of public goods). Moreover, the incumbent government of period 1 chooses the level of investment in fiscal capacity (τ_2). Finally, individuals consume in the last stage.
The problem of the incumbent government is to maximize tax revenues and its own group's utility. Therefore, the incumbent puts no weight on the utility of the opposition group. Let v_{Is} be the objective function of the incumbent government with $s \in \{1, 2\}$. The first period's problem is:

$$\underset{\{\tau_2,\, t_{I1},\, t_{O1},\, G_1\}}{\text{Max}} \qquad v_{I1}(t_{I1}, G_1) = \alpha_1 V\left(G_1\right) + W_I - t_{I1} W_I^\sigma + \eta$$

$$\text{s.t}$$

$$G_1 = R - F(\tau_2 - \tau_1) + (\theta_I t_{I1} W_I^\sigma + \theta_O t_{O1} W_O^\sigma)$$

$$t_{I1} \leq \tau_1,\ t_{O1} \leq \tau_1,\ G_1 \geq 0$$

where η is the expected payoff of the first period's ruler. The incumbent's payoff depends on the probability of staying in power (γ). Recall that the decision to invest in fiscal capacity is taken at the second stage of period 1.

The second period problem is:

$$\underset{\{t_{I2},\, t_{O2},\, G_2\}}{\text{Max}} \quad v_{I2}(t_{I2}, G_2) = \alpha_2 V\left(G_2\right) + W_I - t_{I2} W_I^{\sigma}$$

$$\text{s.t}$$

$$G_2 = R + (\theta_I t_{I2} W_I^{\sigma} + \theta_O t_{O2} W_O^{\sigma})$$

$$t_{I2} \leq \tau_2,\ t_{O2} \leq \tau_2,\ G_2 \geq 0$$

The main difference between the first and the second period problems is the decision to invest and the cost associated to the investment taking place only in the first period.

The maximization problem of the government is linear in the policy variables and this feature allows to solve the problem of optimal policies before the problem of the choice of the level of fiscal capacity for period 2 (τ_2).

1.5 Equilibrium policy : tax rates and public goods' provision

In the "common interest" state (high valuation of public goods), $\alpha_s = \alpha_H$. The incumbent government values the public good more than its private consumption because the marginal utility of public goods' consumption is higher than the marginal utility of private consumption. This situation comes from the following assumption: $\alpha_H V_G(G_s) > 1 > \alpha_L V_G(G_s)$. Therefore, it is optimal for the incumbent I_s to tax its own group at the level of fiscal capacity ($t_{Is} = \tau_s$) and since it does not care about the opposition group, it implements ($t_{Os} = \tau_s$). In this equilibrium both groups are taxed maximally (the tax rate is only constrained by fiscal capacity). Public good production is given by:

$$G_s = \begin{cases} R - F(\tau_2 - \tau_1) + \tau_1(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}) & \text{if } s = 1 \\ R + \tau_2(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}) & \text{if } s = 2 \end{cases} \tag{3}$$

In the "redistributive state" (low valuation of public goods), $\alpha_s = \alpha_L$. The incumbent government values the public good less than its private consumption. In this case, no public good is provided ($G_s = 0$) and the opposition group is still taxed at the maximum level in order to subsidize the incumbent's group. Therefore, $t_{Os} = \tau_s$. Finally, substituting $t_{Os} = \tau_s$ and ($G_s = 0$) in the government budget constraint yields:

$$\begin{cases} -\theta_I t_{I1} W_I^{\sigma} = R - F(\tau_2 - \tau_1) + \theta_O \tau_1 W_O^{\sigma} & \text{if } s = 1 \\ -\theta_I t_{I2} W_I^{\sigma} = R + \theta_O \tau_2 W_O^{\sigma} & \text{if } s = 2 \end{cases} \tag{4}$$

The level of demand for common interest public good is central in the model. For $\alpha = \alpha_H$, the incumbent government uses its full fiscal capacity to tax and allocate the available revenues (net of the cost of investment in fiscal capacity in period 1) on pubic goods. When public goods are not valuable, no public good is produced and the incumbent government employs the available revenue to subsidize its own group (through negative tax rates).

The realized value of government funds in period s (λ_s) is obtained by differenciating the incumbent objective function with regard to Z_s. Where $Z_s = R - F(\tau_2 - \tau_1)$ if $s = 1$ and $Z_s = R$ if $s = 2$. Thus, $\lambda_s = Max[\alpha_s V_G(Gs), 1]$.

1.6 Equilibrium fiscal capacity

Equilibrium policies are used to write the expected payoff of the incumbent at stage 2 of period 2, considering the fiscal capacity of period 2 (τ_2) as given. The expected payoff is given by :[7]

$$\begin{aligned} \eta = \phi\alpha_2 V\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] + \gamma\left\{\phi W_I - \phi\tau_2 W_I^\sigma + (1-\phi)\left[W_I + \theta_O\tau_2 W_O^\sigma + R\right]\right\} \\ + (1-\gamma)\left\{\phi W_O - \phi\tau_2 W_O^\sigma + (1-\phi)\left[W_O + \theta_I\tau_2 W_I^\sigma + R\right]\right\} - \lambda_1 F(\tau_2 - \tau_1) \end{aligned} \tag{5}$$

λ_1 is the realized value of public revenues in the first period. The problem of the incumbent government I_1 is to choose the value of τ_2 which maximizes η. This problem is a trade off between the expected payoff of period 2 against the cost of investment in period 1 given the realized value of public funds. The incumbent takes into account the uncertainty about the future value of public goods, resource rents and the probability of staying in power.

The first order condition of the problem of I_1 is the following:

$$\begin{aligned} \lambda_1 F_{\tau_2}(\tau_2 - \tau_1) = \phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) V_{G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] - \gamma\phi W_I^\sigma \\ + \gamma(1-\phi)\theta_O W_O^\sigma - (1-\gamma)\phi W_O^\sigma + (1-\gamma)(1-\phi)\theta_I W_I^\sigma \end{aligned} \tag{6}$$

Equation (6) shows that the level of investment in fiscal capacity is a function of the future valuation of public goods (α_2), the probability of staying in power (γ), the level of progresivity (σ) and the level of resource rents (R). It states that the optimal level of investment in fiscal capacity equalizes the marginal cost of the investment in fiscal capacity to the marginal return of investment in fiscal capacity. To explore the effect of natural resource rents R on investment in fiscal capacity, the first order condition (6) is used through the implicit function theorem. Let

$$\begin{aligned} Q = \phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) V_{G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] - \gamma\phi W_I^\sigma \\ + \gamma(1-\phi)\theta_O W_O^\sigma - (1-\gamma)\phi W_O^\sigma + (1-\gamma)(1-\phi)\theta_I W_I^\sigma - \lambda_1 F_{\tau_2}(\tau_2 - \tau_1) \end{aligned}$$

[7]The details of the calculation are in Appendix A.

By the implicit function theorem,

$$\frac{\partial\tau_2}{\partial R} = -\frac{1}{(\theta_I W_I^\sigma + \theta_O W_O^\sigma)} < 0 \tag{7}$$

The derivative in equation (7) shows the so-called "revenue curse" : higher natural resource rents lead to a lower investment in fiscal capacity. Equation (7) shows that the impact of a (postive) natural resource shock on the investment in fiscal capacity is negative and inversely proportional to the taxbase. The higher the taxbase, the weaker the curse will be. This result is intuitive. The government has two sources of benefit from an investment in fiscal capacity: tax revenues and the public good. Recall that the government's objective is to maximize its own group utility (which depends on public good) and tax revenues.

Proposition: Progressive taxation unambiguously mitigates the "revenue curse" because returns to the investment in fiscal capacity are higher with progressivity of the tax system.

The proof of this proposition is the following:

$$\frac{\partial\tau_2}{\partial R\partial\sigma} = \frac{\theta_I W_I^\sigma ln W_I + \theta_O W_O^\sigma ln W_O}{(\theta_I W_I^\sigma + \theta_O W_O^\sigma)^2} > 0 \tag{8}$$

Equation (8) shows the conditional revenue curse: Progressive taxation dampens the "revenue curse". The intuition is linked to equation (7). As the progressive tax allows the government to collect more tax revenues (by taxing more high incomes), it increases the government's incentives to invest in fiscal capacity. In other words, the progressivity of the tax schedule increases the government's expected returns from investing in fiscal capacity.

2 Data

To assess the empirical relevance of natural resources' impact on fiscal capacity, I exploit a macroeconomic panel dataset on 57 developing countries over the period 1981-2005.[8] The sample contains 25 low income countries and 32 middle income countries according to the World Bank's classification. The panel dataset is unbalanced which is quite frequent when

[8]The choice of the period of analysis is constrained by the coverage of the data on the structural progressivity.

working on developing countries because of weak data availability. Table A_1 in Appendix shows the summary statistics of the different variables used in the empirical work. Detailed informations about the variables used in the empirical work follow.

Domestic tax revenues

I use real domestic tax revenues per capita as the main measure for fiscal capacity. The data are constructed using data on domestic tax revenues in percentage of GDP from Baunsgaard and Keen (2010). Domestic tax revenues are defined as total tax revenues excluding trade taxes. I multiply the tax variable in percentage of GDP by the per capita GDP in constant USD 2000 to get the per capita tax revenues in constant USD 2000. The outcome is divided by 100 to correct for the fact that the measure in % of GDP were already multiplied by 100. Indeed, by doing so the GDP disappears from the expression.[9]

The use of the domestic tax revenues variables in per capita terms unlike much of the empirical works on tax revenues has its justification in the theoretical framework. I exclude trade taxes because collecting these taxes does not require high administrative capacity (Besley and Persson, 2014). Indeed, in order to collect trade taxes, it is sufficient to observe trade flows at borders. Domestic tax per capita is therefore a better proxy for fiscal capacity and therefore investment in fiscal capacity because it captures on average the tax amount that a government raises per citizen. Collecting these domestic tax revenues requires a much more elaborate system of monitoring, enforcement, and compliance. The argument is that, the investment in fiscal capacity should be strongly correlated with the effective fiscal capacity as underlined in the theoretical model. Indeed, in the theoretical model, taxation is only constrained by the level of investment in fiscal capacity, and the government taxes at its full fiscal capacity. A country with a high investment in fiscal capacity has the means to collect high tax revenues per citizen. Besides, using domestic tax per capita allows me to isolate the direct effect of natural resource windfalls on tax revenues. However, I also use the domestic tax revenues in percentage of GDP as an alternative measure in robustness tests to facilitate comparison with previous studies. Total tax revenues per capita are also used as an alternative measurement for fiscal capacity. Finally, because of the scarcity of good data on non resource tax revenues for a large sample of developing countries, the measure of tax revenues used in this paper may include tax revenues from the resource sector. Therefore if this is the case (as discussed in the result section), it follows that my estimates of the effect of natural resource rents on tax revenues would reflect the lower bound of the true effect.

[9] $real\ tax_{pc} = \frac{tax\ revenue}{GDP} \times \frac{GDP}{population} \times \frac{100}{Deflator} = \frac{tax\ revenue}{Population} \times \frac{100}{Deflator}$.

Natural resource windfall

The natural resource rent data come from the World Bank. The World Bank's data on natural resource rents are available for 14 different natural resources.[10] The World Bank defines the rent as the difference between the unit price and the unit cost multiplied by the production. Data are available for each of the 14 natural resources and are expressed in USD. I use the raw data to construct measures of natural resource rents in percentage of GDP. The GDP data come from the World Development Indicators. The total resource rent is obtained by summing the rent from the 14 resources. Oil is at the center of the literature on the "resource curse" (Ross, 2001 ; Sala-i-Martin and Subramanian, 2003 ; Tsui, 2011). Therefore, I separate oil rents from other natural resource rents and then use three different measures of natural resource rents. The measures are the total resource rents, oil rents and other resource rents. All the resource rent measures are expressed in percentage of GDP. The share of resource rents in GDP captures the importance of resource rent in the economy. I then calculate a measure of natural resource windfall as the yearly change in resource rents. In other words I first difference the data to compute the yearly change in resource rents. This definition of windfall is similar to the one of Arezki and Brückner (2012). The measure of windfall captures the change in the importance of natural resource rents in the economy over the period.

Structural progressivity

The data on the structural progressivity come from Andrew Young School World Tax Indicators (Volume 1). The data contain informations on personal income tax reforms around the world over the period 1981-2005. Again, the availability of these data is the binding constraint on the period of analysis. Peter et al. (2010) constructed the data on Average Rate Progressions (ARP) which characterize the structural progressivity of national tax schedules with respect to the changes in average rate along the income distribution. They compute the average tax rate for each country and each year at 100 different levels of pre-tax income that are evenly spread in the range from 4 to 400% of country's per capita GDP. The income boundaries around each country's GDP per capita is suitable for comparison and are large enough to represent most of the actual income distribution (Peter et al. 2010). I use two variants of the ARP. The first variant of structural progressivity measures the ARP up to an income level equivalent to 4 times the country's per capita GDP and assumes a linear relationship between the rates and the levels of income (prog_1).[11] Therefore prog_1 is

[10] natural resources are: bauxite, coal, copper, forest, natural gas, gold, iron ore, lead, nickel, oil, phosphate, silver, tin and zinc.

[11] prog_1 corresponds to ARP_{all} and prog_2 corresponds to ARP_{mid} in the database from Andrew Young School World Tax Indicators (Volume 1).

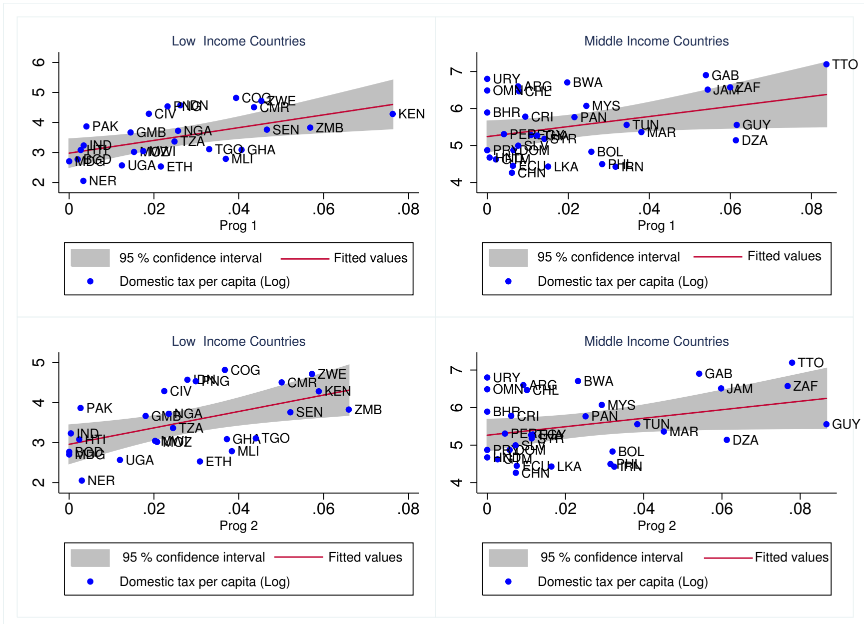
obtained by regressing average tax rates on the log of gross GDP. The second one measures the ARP for the levels of income in the middle portion of the income distribution (in the range from 100 to 300% of country's GDP per capita) and allows to account for the possibility of a non linear relationship between the rates and the levels of income ($prog_2$).[12]

These two variables are increasing in the degree of structural progressivity. The tax structure is interpreted as progressive, proportional or regressive if the ARP is positive, zero, or negative, respectively. Also, the methodology used to construct the data suggests an interpretation of theses measures as semi-elasticities. For instance, a level of structural progressivity of 0.05 means that the tax system is characterized as follows: If the gross income increases by 1% , the average tax rate increases by 0.0005% point. See Table A_{15} in Appendix B for the average structural progressivity of each country in the sample. The two measures of structural progressivity have also an important advantage for the empirical analysis. Peter et al. (2010) argued that because they are not derived directly from collected revenues and the existing income distribution of individuals, they offer the advantage of causal inference over measures of effective progressivity. While structural progressivity captures changes in the calculated nominal tax burden along the income distribution, effective progressivity describes changes in actual income inequality (Musgrave and Thin, 1948). Furthermore the measure is focused on structural measures that depend on the tax law (including for instance rates, deductions, exemptions and credits).

Figure 1 displays the correlation between the average degree of structural progressivity and the average domestic tax revenues per capita (in logarithm). It shows that there is a positive and statistically significant correlation between the measures of structural progressivity and domestic tax revenues no matter the income group. The positive correlation is consistent with the theoretical intuition which is relative to the high return to the investment in the government's ability to tax under progressive taxation (leading to high investment in fiscal capacity and thus high tax revenues).

[12]Table A_{15} in Appendix B shows the average level of structural progressivity for each country in the sample.

Figure 1
Correlation between Domestic tax per capita and structural progressivity



In addition, Figure 2 shows the correlation between domestic tax revenues and natural resource windfalls for countries with an average progressivity below and above the median structural progressivity in the sample (0.02). It shows consistently with the theory that the "revenue curse" is less pronounced in the subsample of countries with a structural progressivity above the median progressivity in the sample. Overall, this figure suggests a conditional revenue curse: Countries with a high degree of progressive may have more incentive to invest in fiscal capacity and therefore collect more domestic tax revenues.

Figure 3 shows that for the two measures of the structural progressivity there is no apparent correlation with real GDP per capita. Figure 3 then supports the fact that $Prog_1$ and $Prog_2$ are probably not endogenous as argued by Peter et al. (2010).

Figure 2
Conditional revenue curse

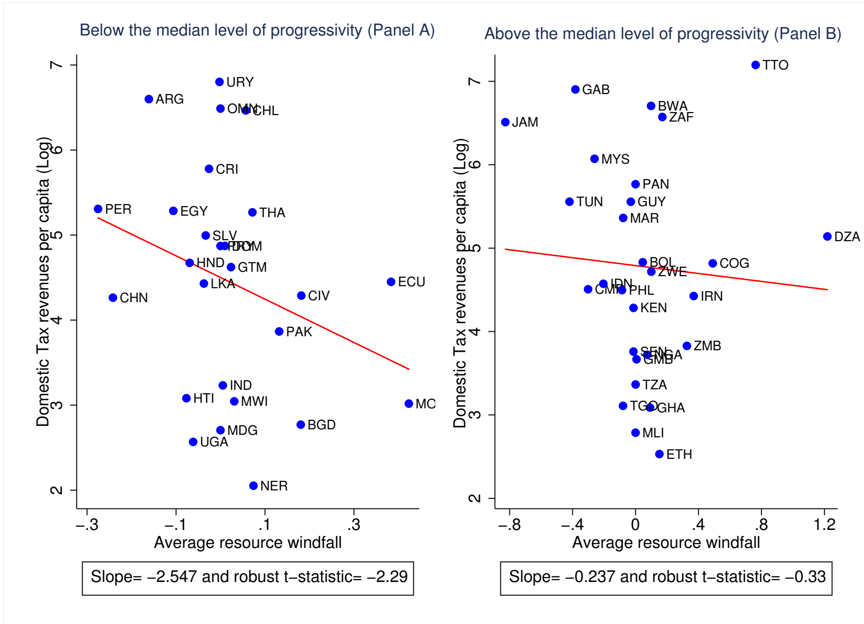
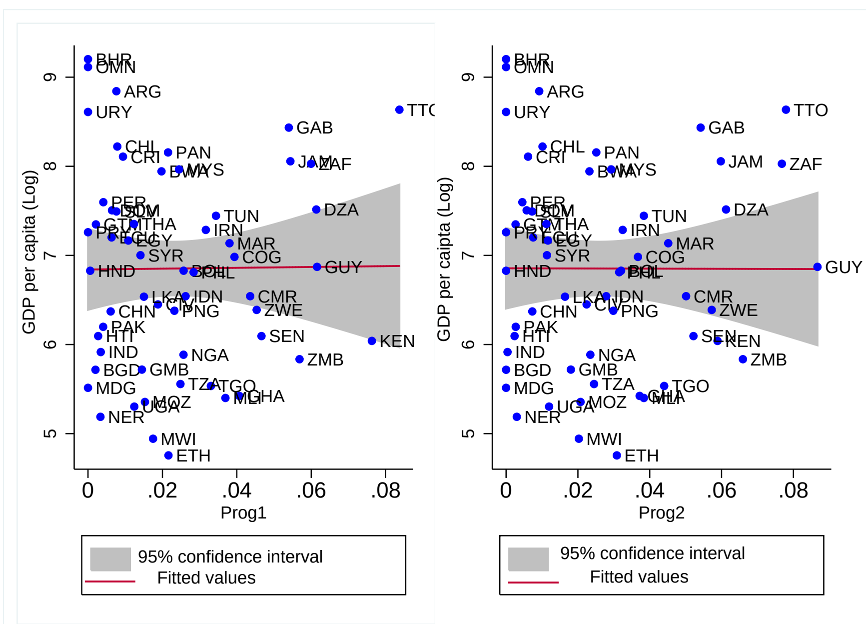


Figure 3
Correlation between structural progressivity and GDP per capita



Other controls

Following the empirical literature on the determinants of tax revenues (Rodrik, 1998 ; Baunsgaard and Keen, 2010), I control for potential confounding factors. GDP per capita may capture the level of development and the tax administration capacity of a country. Real

GDP per capita in terms of constant USD 2000 is from the World Development Indicators (WDI). As a consequence of the Wagner's Law, high income level may induce a greater demand for public services and so a positive correlation with the tax revenues is expected.

Trade openness is defined as the share of exports and imports of goods and services in GDP and it is expected to have a positive effect on tax revenues. Since more open economies have larger public expenditures in order to cope with a higher degree of vulnerability to risk and to provide for higher need for social insurance (Rodrik, 1998) the correlation with tax revenues should be positive. The data on trade openness are from the WDI .

Data on the annual change of the Consumer Price Index are from the International Financial Statistics. According to the Keynes-Olivera-Tanzi effect through which high inflation reduces the tax base, I expect a negative effect on tax revenues.

The share of agriculture value added in GDP comes from the WDI. The agricultural sector is often said to be a "hard to tax" sector. The more the share of agriculture value added in GDP is important, the less likely a government will be able to collect tax revenues. The effect is then expected to be negative.

The net official development assistance received in percentage of gross national income data come from WDI. Since aid may relax government budget constraint, I expect a negative effect on tax revenues.

Finally, I control also for variables that capture the quality of institutions or quality of governance. Two variables on armed conflicts from the UCDP/PRIO conflict Dataset (Version 4-2014) are considered.[13] Internal conflict is a dummy variable which takes the value of 1 if in a given year there is an internal armed conflict and 0 otherwise. External conflict is a dummy variable which takes the value of 1 in a given year if there is an interstate armed conflict and 0 otherwise. Because Besley and Persson (2009) argued that internal conflicts may have a detrimental effect on the incentive to build state capacity, I expect a negative effect on tax revenues. Besides, they also argued that external conflicts are an important source of common interest public goods and then may positively affect tax revenues.

Three variables on governance quality from International Country Risk Guid (ICRG) are also used. The first one is the corruption index ranging from 0 (highest degree of corruption) to 6 (lowest degree of corruption). Corruption is expected to have a negative effect on

[13]Uppsala Conflict Data Program (UCDP)/ International Peace Research Institute (PRIO), Gleditsch et al.(2002).

fiscal capacity and so a positive sign is expected given the structure of the index. The second variable is the democratic accountability. The index ranges from 0 to 6 and increases in the degree of democratic accountability. The index of democratic accountability is a measure of how responsive a government is to its peoples. The intuition is that the more a government is responsive to its peoples the more likely they will pay their taxes. The last variable capturing the quality of governance is the quality of bureaucracy. The index ranges from 0 to 4 and increases with the quality of bureaucracy. It captures the strength and expertise to govern without drastic changes in policy or interruptions in governments services. Therefore, the quality of bureaucracy may be positively correlated to tax revenues. Finally I employ also the polity2 index from the polity IV database (Marshall and Jaggers, 2009). The polity2 index ranges from -10 to 10 and increases with the degree of democracy. The score is based on subscores for constraints on the chief executive, the competitiveness of political participation, and the openness and competitiveness of executive recruitment. The effect of polity2 score on taxation may be negative reflecting a political budget cycle in taxation.

3 Empirical Approach

The empirical strategy relies on an original instrumental variable approach to examine the causal effect of natural resource rent on fiscal capacity. The empirical specification follows James (2015). The endogeneity of resource rent may be a serious concern. First, resource-rich countries may extract more natural resources because they are unable to effectively raise tax revenues. In addition, Knack (2009) shows that countries that are rich in natural resources tend to have weak incentives to implement and sustain efficient tax systems. Another potential problem is the measurement error in natural resource rents. Van der Ploeg and Poelhoeke (2010) argue that the overestimation of extraction costs may lead to an underestimation of natural resource rents. These threats to the identification of the causal effect of natural resource rents should be addressed properly.

Let Y_{it} be a measure of fiscal capacity where i and t denote country and year respectively. First I test the "revenue curse" hypothesis which is the negative effect of natural resource rents on fiscal capacity. The second stage equation is:

$$Y_{it} = \alpha_1 \text{windfall}_{it} + \alpha_2 X_{it} + D_i + D_t + \epsilon_{it} \tag{9}$$

windfall_{it} is natural resource rent windfalls; X_{it} is a set of control variables; D_i is a country fixed effect; D_t is a year effect and ϵ_{it} is the error term. Countries fixed effects help remove all time invariant unobserved countries heterogeneities such as cultural preferences for redistribution, while the year fixed effects control for changes common to all countries

within the same year. α_1 is the coefficient of interest and testing for the "revenue curse " hypothesis implies testing for $\alpha_1 < 0$.
The corresponding first stage is :

$$\text{windfall}_{it} = \beta_1 \text{Price growth}_{it} + \beta_2 X_{it} + D_i + D_t + \epsilon_{it} \tag{10}$$

Price growth$_{it}$ is the growth of the international price index of natural resources which is country-specific. β_1 identifies a country-specific price shock because I control for year effects. I construct the growth rate of country-specific prices following Deaton (1999) and Brückner and Ciccone (2010). The starting point is the raw data on monthly nominal international prices from International Monetary Fund (IMF) supplemented by the data from the World Bank when the information is not available in the IMF dataset.[14] Following the standard approach, when for the same resource different market places prices are available, I take an average over the markets. All the prices are set equal to unity in 1995 in order to obtain a price index with 1995 as the base year. I then obtain each country's export share of the resources from United Nations Conference on Trade and Development (UNCTAD) in 1995.[15] I construct the country-specific natural resource price index as a weighted average : Price index$_{it} = \sum_{r=1}^{13} \varpi_{ir} \times$ Price$_{rt}$ where ϖ_{ir} is the country i's time invariant export share of resource r and Price$_{rt}$ is the international price of resource r in year t. Finally, I obtain the growth rate by first differencing the logarithm of the country specific price index. I then instrument resource windfalls by the country-specific international price growth.

The empirical strategy relies on the variation in international prices of natural resources as an exogenous source of variation in natural resource windfalls. The two other components of the resource rent namely the extraction cost and the production are potentially plagued by measurement error and endogeneity respectively. The variation in the quantity of resources produced may change in response to within-country variation in institutions. Indeed, Robinson et al. (2006) show in their theoretical framework that politicians tend to over-extract natural resources relative to the efficient extraction path because they discount the future too much. Again, Van der Ploeg and Poelhekke (2010) show that the measure of resource rent may suffer from an overestimation of the marginal cost of resource extraction which may lead to underestimation of resource rents. Because the country-specific international price index uses a time invariant weight, it allows the measurement of price growth

[14] All the prices are from IMF except for natural gas, silver, gold and phosphate which are from the World Bank. The data on bauxite's international price were not available. The monthly data were averaged across the calendar year to compute annual price series. The price of wood is used to capture the international price of forest rent.

[15] The data were available from 1995 to 2013. The export share of a given resource is the ratio of this resource's export over the total export of the country in 1995. Brückner, Chong and Gradstein (2012) employ a similar approach for their index of country-specific oil price shock.

to be plausibly exogenous. The time invariant weights are not endogenous to policy change that may take place in response to price change (Deaton, 1999). The first stage mechanism that I suggest is a positive correlation between the country specific international price growth and resource windfalls. That is $\beta_1 > 0$. The intuition is that since the weight is the share of a specific resource in exports, an increase in international prices may encourage resource extraction because governments should expect more revenues. Figure 4 shows the correlation between the instrument and natural resource windfalls. There is a positive and statistically significant correlation (that is consistent with the first stage mechanism) between the country specific price growth and the natural resource windfalls.

However, the plausible exogeneity of the instrument implies that the countries in the sample are mostly price takers. One may argue that some countries can have a market power and therefore may have an influence on these international prices. A previous study (Kilian, 2009) suggests in the case of oil that supply side shocks have a little influence on the real oil price over the period 1975-2007. In the light of this finding, oil prices are more sensitive to demand shocks and therefore it is correct to assume that these prices are under international determination. The present study is over the period 1981-2005 which is included in the period of Kilian (2009). The argument presented so far is focused on oil prices. I employ also thirteen (13) other natural resources. To the best of my knowledge, there is not a study similar to Kilian (2009) to inform about the possibility of the market power regarding these other 13 natural resources. The evidence about the case of oil, for which there is a solid organization of the producing countries (OPEC) that should grant a market power to the members may suggest the difficulty for producing countries in the case of the 13 natural resources to have a systematic influence on the determination of international prices. Despite this evidence on oil, I undertake a serie of robustness checks by gathering informations about the leading exporters of the 13 other natural resources in order to identify countries with a potential market power.

Second, I test the conditional revenue curse hypothesis. Now, I introduce an interaction term reflecting the fact that the effect of natural resource rents on fiscal capacity may be conditional on the level of progressive taxation. The second stage equation is :

$$Y_{it} = \theta_1 \text{windfall}_{it} + \theta_2 \text{windfall}_{it} \times \text{Prog}_{it} + \theta_3 Prog_{it} + \theta_4 X_{it} + D_i + D_t + \xi_{it} \tag{11}$$

Prog_{it} is the measure of structural progressivity. The coefficients of interest are θ_1 and θ_2. Testing for the conditional revenue curse hypothesis is equivalent to testing for $\theta_1 < 0$ and $\theta_2 > 0$. $\theta_2 > 0$ means that progressive taxation may dampen the "revenue curse" as predicted by the theoretical model. The theoretical prediction about the sign of θ_3 is ambiguous (see

Appendix A). Now consider the effect of natural resource rent windfalls on domestic tax revenues in equation (11) as follows:

$$\frac{\partial Y_{it}}{\partial windfall_{it}} = \theta_1 + \theta_2 \times prog_{it} \tag{12}$$

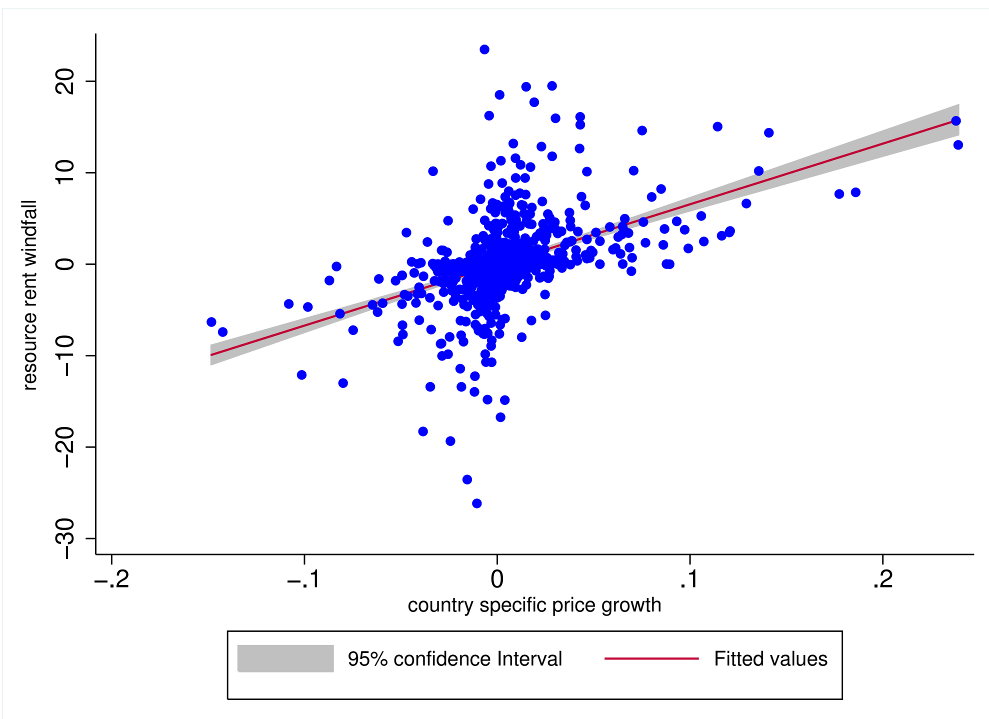
In equation (11), there are two endogenous variables which are windfall$_{it}$ and windfall$_{it}$ $\times$ $Prog_{it}$. Therefore there are two corresponding first stage equations. I use Price growth$_{it}$ $\times$ $Prog_{it}$ as instrument for windfall$_{it}$ $\times$ $Prog_{it}$. The first stage equation for windfall$_{it}$ is :

$$\text{windfall}_{it} = \lambda_1 \text{Price growth}_{it} + \lambda_2 \text{Price growth}_{it} \times Prog_{it} + \lambda_3 Prog_{it} + \lambda_4 X_{it} + D_i + D_t + \zeta_{it} \tag{13}$$

and finally the first stage for the interaction term windfall$_{it}$ $\times$ $Prog_{it}$ is:

$$\text{windfall}_{it} \times Prog_{it} = \gamma_1 \text{Price growth}_{it} + \gamma_2 \text{Price growth}_{it} \times Prog_{it} + \gamma_3 Prog_{it} + \gamma_4 X_{it} + D_i + D_t + \omega_{it} \tag{14}$$

Figure 4
Correlation between the country-specific price growth and resource windfall



The instrumental variable approach, by allowing to exploit an exogenous variation in natural resource rent windfalls, has the potential to address the bias that may arise when estimating the effect of natural resources on tax revenues. Instrumenting for natural resource rents may deal with the bias due to the reverse causality problem, the potential measurement error in resource rents and omitted variables that may determine within country changes in tax revenues and resource extraction. The fixed effects may also allow to account for country-specific time invariant preference for redistribution that may be correlated with the measure of strucutural progressivity. I estimate the previous equations by the within estimator to eliminate the country fixed effects. I use also Clustered standard errors at country level which correct the standard errors for arbitrary serial correlation.

4 Baseline Results

4.1 The revenue curse

Table 1 presents the results for the first stage describing the correlation between the instrument (country-specific price growth) and the natural resource rent windfall. The estimates correspond to equation (10). The estimates show that the price growth has a positive and statistically significant effect on natural resource windfalls. Indeed, 1 percent change in the price growth increases the resource windfall roughly by 0.49 percentage point. The other variables that have a significant effect in the first stage are GDP per capita, agricultural value added and corruption. The effect of corruption is consistent with the finding of Arezki and Brückner (2011). That is less corrupt countries may rely less on natural resources extraction.

Table 1
The revenue curse: First stage

Dependent variable: resource windfall	(1)	(2)	(3)	(4)
Price growth	**49.978***** **(5.365)**	**49.701***** **(5.396)**	**49.267***** **(5.169)**	**49.058***** **(5.188)**
GDP per capita (Log)		-0.309 (0.524)	-1.367** (0.667)	-1.343** (0.659)
Trade opennes (Log)		0.021 (0.485)	-0.069 (0.489)	-0.030 (0.482)
Inflation (Log)		-0.157 (0.272)	-0.121 (0.320)	-0.139 (0.318)
Aid (Log)		3.038 (2.632)	2.733 (2.548)	2.786 (2.508)
Agriculture Value Added (Log)			-2.055** (0.790)	-2.088** (0.798)
Corruption (0: Bad 6: Good)				-0.151* (0.085)
Observations	1054	1054	1054	1054
Countries	57	57	57	57
F Stat (first stage)	86.77	84.85	90.86	89.41

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 2 presents the results for the second stage. The estimates correspond to equation (9). The table shows OLS and IV estimates. In order to facilitate the comparison with the first stage estimates, Table 2 has the same exact structure as Table 1. Note that the rest of the result tables in the paper employ also the same structure. First, Table 2 shows the presence of the "revenue curse" (Crivelli and Gupta, 2014) in the sample. The comparison of the OLS estimates to the IV estimates reveals that the effect of resource windfalls is biased toward zero when using the OLS estimator.

The results suggest therefore that the OLS estimates suffer from an attenuation bias stemming from the potential underestimation of natural resource rents (Van der Ploeg and Poelhoeke, 2010). The results show that an increase in resource windfalls of 1 percentage point of GDP causes a reduction of 2.5% in domestic tax per capita collected (column (2) and (8)). While this result is in line with previous findings (Bornhorst et al., 2009; Crivelli and Gupta, 2014 and James, 2015), it can not be compared to them in terms of offset because the dependent variable is not appropriate for this purpose. In order to facilitate comparison to previous studies, I will employ a measure of domestic tax in percentage of GDP in robustness checks. Note also that as I cannot exclude the resource sector from my measure of tax revenues, my estimates could be seen as the lower bound of the true effect of natural resource windfalls.

Table 2
The revenue curse: Baseline

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resoure windfall	**-0.009***** **(0.003)**	**-0.025*** **(0.013)**	**-0.008***** **(0.002)**	**-0.026**** **(0.011)**	**-0.008***** **(0.002)**	**-0.026**** **(0.011)**	**-0.008***** **(0.002)**	**-0.025**** **(0.010)**
GDP per capita (Log)			1.072*** (0.139)	1.062*** (0.135)	1.061*** (0.145)	1.031*** (0.139)	1.053*** (0.140)	1.025*** (0.136)
Trade openness (Log)			0.230** (0.100)	0.232** (0.098)	0.229** (0.100)	0.230** (0.098)	0.216** (0.098)	0.217** (0.096)
Inflation (Log)			-0.173*** (0.037)	-0.179*** (0.035)	-0.173*** (0.037)	-0.178*** (0.034)	-0.167*** (0.036)	-0.172*** (0.033)
Aid (Log)			-0.334 (0.470)	-0.270 (0.459)	-0.337 (0.470)	-0.278 (0.458)	-0.356 (0.452)	-0.298 (0.442)
Agriculture Value Added (Log)					-0.021 (0.091)	-0.061 (0.100)	-0.009 (0.091)	-0.048 (0.098)
Corruption (0: Bad 6: Good)							0.052** (0.020)	0.048** (0.020)
Observations	1054	1054	1054	1054	1054	1054	1054	1054
Countries	57	57	57	57	57	57	57	57
F Stat (first stage)		86.77		84.85		90.86		89.41

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

4.2 The Conditional revenue curse

Table 3 and 4 present the result of the two first stages related to the test of the conditional revenue curse. Table 3 reports estimates from equation (13) and Table 4 is related to equation (14). The two tables show that the instruments have a positive and statistically significant effect on the corresponding endogenous variable. More specifically, a 1 standard deviation in the price growth increases the resource windfall by 0.63 standard deviation in Table 3 (Column (1)). Finally, Table 4 shows in column (1) that a 1 standard deviation in Price growth $\times$ Prog_1 increases windfall$\times$ Prog_1 by 0.57 standard deviation.

Table 5 presents the results for the second stage i.e estimates related to equation (11). The results in Table 5 are related to the test for the conditional revenue curse hypothesis. In all specifications, the direct effect of natural resource windfalls is negative and statistically significant. Also, all the specifications in Table 5 show a positive and statistically significant effect of the interaction term which is consistent with the conditional revenue curse hypothesis. The interpretation of the results in Table 5 follows equation (12). In column (2), at a level of structural progressivity of 0.05 a 1 percentage point increase in resource windfalls causes a reduction in domestic tax revenues per capita by only 1.21%.[16] This result depicts a dampening effect of the progressivity of the tax schedule. Regarding the coefficient of progressivity, it is not statistically significant in any specification.

Table 3
The Conditional revenue curse: First Stage (resource windfall)

Dependent variable: resource windfall	(1)	(2)	(3)	(4)
Prog˙1	-2.963	-4.059	-4.057	-3.634
	(4.094)	(3.982)	(4.199)	(4.044)
Price growth	**62.875*****	**62.509*****	**62.365*****	**61.916*****
	(14.585)	**(14.665)**	**(14.529)**	**(14.411)**
Price growth $\times$ Prog_1	-202.983	-198.740	-215.479	-208.469
	(218.066)	(219.064)	(215.109)	(214.536)
GDP per capita (Log)		-0.095	-1.326*	-1.381*
		(0.622)	(0.776)	(0.767)
Trade Openness (Log)		0.569	0.488	0.529
		(0.661)	(0.655)	(0.644)
Inflation (Log)		-0.058	0.045	-0.059
		(0.449)	(0.438)	(0.450)
Aid (Log)		4.183	3.389	3.493
		(3.479)	(3.573)	(3.515)
Agriculture Value Added (Log)			-2.398**	-2.447***
			(0.902)	(0.908)
Corruption (0:Bad 6: Good)				-0.206*
				(0.107)
Observations	850	850	850	850
Countries	57	57	57	57
F Stat (first stage)	33.66	33.74	36.26	36.41

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In order to shed more light on the conditional effect, Figure 5 shows the marginal effect of natural resources rent windfalls on tax revenues per capita derived from equation (12). The marginal effect is computed for each increment of 0.001 in structural progressivity using estimation (8) from Table 5.

[16]The marginal effect is computed as : $(-0.025 + 0.258 \times 0.05) \times 100$ where 0.05 is the value of the structural progressivity ($Prog_1$).

Table 4
The Conditional revenue curse: First Stage (Interaction term)

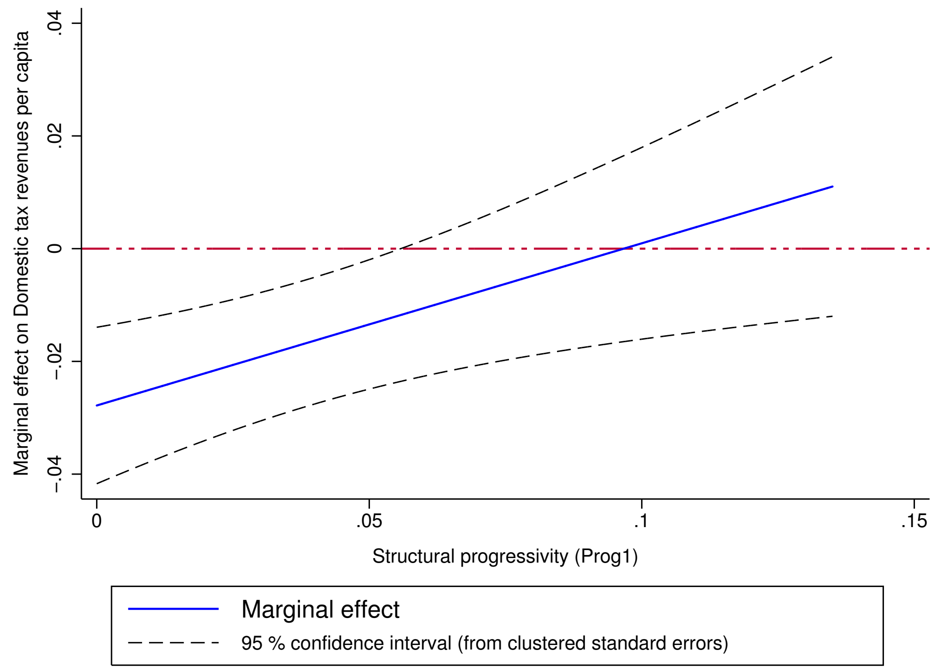
Dependent variable: resource windfall× $Prog_1$	(1)	(2)	(3)	(4)
Prog˙1	-0.170	-0.152	-0.152	-0.133
	(0.293)	(0.291)	(0.303)	(0.290)
Price growth	-0.212	-0.222	-0.226	-0.246
	(0.233)	(0.233)	(0.233)	(0.229)
Price growth × $Prog_1$	**57.643*****	**57.629*****	**57.133*****	**57.450*****
	(5.679)	**(5.749)**	**(5.456)**	**(5.508)**
GDP per capita (Log)		0.021	-0.016	-0.018
		(0.028)	(0.025)	(0.026)
Trade Openness		0.000	-0.002	-0.001
		(0.023)	(0.023)	(0.022)
Inflation (Log)		-0.020	-0.017	-0.022
		(0.015)	(0.015)	(0.014)
AId (Log)		0.160	0.136	0.141
		(0.164)	(0.168)	(0.164)
Agriculture Value Added (Log)			-0.071**	-0.073**
			(0.028)	(0.028)
Corruption (0: Bad 6: Good)				-0.009**
				(0.004)
Observations	850	850	850	850
Countries	57	57	57	57
F Stat (first stage)	66.38	64.36	71.78	70.84

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The plot allows to show how the effect of natural resource rent windfalls on domestic tax revenues varies over the entire observed values of structural progressivity. The positive slope reflects the positive coefficient for the interaction term suggesting that progressive taxation may dampen the “revenue curse”.

Figure 5 shows that resource windfalls may have a positive effect on domestic tax revenues for higher level of structural progressivity but this effect is not statistically significant. Overall, the baseline results presented in Table 2 in addition to those in Table 5 show that the “revenue curse” seems to be a serious problem only in countries with low level of structural progressivity. The finding is consistent with the theoretical framework. The results suggest that progressive taxation may dampen the so-called “revenue curse”.

Figure 5
Marginal effect of resource windfalls on Domestic tax per capita as the level of structural progressivity increases



Notes: This figure shows the marginal effect of resource windfalls on domestic tax revenues per capita from equation (12). The marginal effect is computed for each increment of 0.001 in structural progressivity using estimation (8) from Table 5. I compute the confidence interval using the standard error of the marginal effect which is: $\sqrt{var(\theta_1) + prog^2 * var(\theta_2) + 2 * prog * cov(\theta_1, \theta_2)}$.

5 Robustness checks

I carry out various robustness checks. First I employ an alternative measure for fiscal capacity to ensure a comparability with previous studies (Bornhorst et al., 2009; Crivelli and Gupta, 2014 and James, 2015). Second, I show results of reduced forms estimates. I show estimations where the instrument and other covariates are regressed on domestic tax revenues. Indeed, while just identified instrumental variable estimates are median-unbiased the reduced forms are unbiased because they are OLS estimates (Angrist and Krueger, 2001). In addition, because I do not have data on bauxite's international prices, I subtract the bauxite rent from total rent to ensure that the results still hold. The fourth robustness check uses an alternative measurement of structural progressivity. The second measure of structural progressivity allows to account for potential nonlinear relationship between the tax rates and the level of income. Therefore, the alternative measure may allow me to account for the possibility of measurement error in the first one.

Table 5
The Conditional revenue curse: Baseline

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	**-0.008***** **(0.003)**	**-0.025***** **(0.008)**	**-0.008***** **(0.003)**	**-0.029***** **(0.007)**	**-0.008***** **(0.003)**	**-0.029***** **(0.007)**	**-0.007***** **(0.003)**	**-0.028***** **(0.007)**
Resource windfall × $Prog_1$	**0.147**** **(0.065)**	**0.258**** **(0.108)**	**0.118**** **(0.053)**	**0.300***** **(0.108)**	**0.122**** **(0.052)**	**0.305***** **(0.107)**	**0.122**** **(0.054)**	**0.288***** **(0.107)**
Prog˙1	-0.155 (1.637)	-0.186 (1.650)	-0.160 (1.296)	-0.205 (1.289)	-0.159 (1.289)	-0.204 (1.285)	-0.236 (1.291)	-0.276 (1.287)
GDP per capita (Log)			0.943*** (0.136)	0.938*** (0.137)	0.983*** (0.151)	0.956*** (0.149)	0.994*** (0.147)	0.967*** (0.146)
Trade openness (Log)			0.274** (0.118)	0.289*** (0.111)	0.276** (0.117)	0.290*** (0.111)	0.268** (0.116)	0.283** (0.110)
Inflation (Log)			-0.205 (0.143)	-0.206 (0.140)	-0.208 (0.141)	-0.207 (0.139)	-0.188 (0.144)	-0.190 (0.141)
Aid (Log)			-0.100 (0.415)	-0.035 (0.404)	-0.076 (0.418)	-0.024 (0.405)	-0.098 (0.398)	-0.044 (0.387)
Agriculture Value Added (Log)					0.077 (0.085)	0.035 (0.093)	0.087 (0.086)	0.045 (0.093)
Corruption (0: Bad 6: Good)							0.040** (0.019)	0.036* (0.019)
Observations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		33.66		33.74		36.26		36.41
F Stat (first stage): equation (14)		66.38		64.36		71.78		70.84

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Another robustness analysis consists in controlling for other institutional characteristics of the countries in the sample that may explain the ability to effectively raise tax revenues and may also explain policy reforms like progressive taxation. Peter et al (2010) argue that the structural progressivity measure favours causal inference and Figure 3 tends to support their claim. But controlling for the institutional framework may help ensure that the effect of progressive taxation is correctly identified and do not suffer from omitted variables bias. In a last robustness check I exclude countries with a potential market power and for which the violation of the exclusion restriction is likely. Tables 6-11 show the results and the structure of the tables is the same as before to allow comparison. Other robustness checks are showed in Appendix B.[17]

Table 6 shows results for testing the “revenue curse” hypothesis using the domestic tax in percentage of GDP to ensure comparability with previous results. In column (4), a 1% point increase in natural resource windfalls causes a reduction of 0.247 % point in domestic tax revenues. The interpretation of this result in terms of offset implies an offset of 24.7%

[17]The robustness checks are: testing the “revenue curse” hypothesis using other institutional controls; testing the conditional revenue curse hypothesis using alternative measures (total tax per capita and domestic tax in % of GDP); sample sensitivity analysis (dropping Oman and Iran, subsample analysis in low income and middle income countries, dropping countries with 0 rent over the period and finally dropping OPEC members), separating oil from other natural resources and specification controlling for the lag dependent variable. See Tables A_2-A_{14} and Figures A_1, A_2. I test also the effect of natural resources conditional on other characteristics of the personal income tax system which are the complexity and the top statutory rate. These tests show that progressivity is probably the only characteristic of the personal income tax system that matters. These results are not included but available upon request.

(roughly 25%). Controlling for other determinants of tax revenues does not change much the result which is around 24%. The result is roughly the same as the one by James (2015) on US states. It is comprised between the result of Bornhorst et al. (2009) who find an offset of 20% and the result of Crivelli and Gupta (2014) who find an offset of 30%. The corresponding effect for the conditional revenue curse is showed in Table A˙5 in Appendix B. In colum (4) of Table A˙5, at a progressivity level of 0.05 an increase in the resource rent windfalls of $1 reduces domestic tax revenues by only $0.14. Therefore the level of progressive taxation of 0.05 dampens the negative effect of natural resource windfalls by almost a half.

Table 6
The revenue curse: Domestic tax in % GDP

Dependent variable: Domestic tax in % of GDP	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	**-0.112*** (0.034)**	**-0.230** (0.111)**	**-0.118*** (0.032)**	**-0.247** (0.113)**	**-0.120*** (0.032)**	**-0.245** (0.110)**	**-0.116*** (0.031)**	**-0.236** (0.104)**
GDP per capita (Log)			0.864 (1.647)	0.797 (1.629)	0.583 (1.546)	0.466 (1.518)	0.470 (1.515)	0.366 (1.493)
Trade Openness			0.034** (0.015)	0.035** (0.015)	0.032** (0.016)	0.033** (0.016)	0.032** (0.015)	0.032** (0.015)
Inflation			-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)	-0.001*** (0.000)
Aid			-0.018 (0.036)	-0.015 (0.035)	-0.019 (0.036)	-0.016 (0.035)	-0.021 (0.034)	-0.018 (0.034)
Agriculture Value Added					-0.036 (0.062)	-0.043 (0.061)	-0.033 (0.062)	-0.040 (0.061)
Corruption (0:Bad 6: Good)							0.398* (0.230)	0.372* (0.224)
Observations	1054	1054	1054	1054	1054	1054	1054	1054
Countries	57	57	57	57	57	57	57	57
F Stat (first stage)		86.77		84.68		85.18		83.91

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 7 shows estimates of reduced forms. For the "revenue curse", in column (1), a 1% growth in natural resource prices reduces domestic tax revenues per capita by 1.251%. For the conditional revenue curse, In column (8) the estimates show that at a structural progressivity of 0.05, a 1% increase in natural resource prices causes a reduction in domestic tax revenues per capita by 0.68%. This effect is similar to the one found in the baseline result.

The remaining results are focused on the conditional revenue curse. Table 8 shows results for removing the bauxite rent from the total rent. The results are similar to the baseline results. Overall the results are not sensitive to excluding bauxite from natural resources.

Table 7
Reduced forms: The revenue curse & The conditional revenue curse

Dependent variable: Domestic tax per capita (Log)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price growth	**-1.251****	**-1.632*****	**-1.272*****	**-1.883*****	**-1.274*****	**-1.878*****	**-1.203*****	**-1.794*****
	(0.619)	**(0.551)**	**(0.485)**	**(0.445)**	**(0.488)**	**(0.446)**	**(0.445)**	**(0.446)**
Price growth × Prog$_1$		**19.968****		**23.078*****		**23.658*****		**22.334*****
		(8.144)		**(7.475)**		**(7.254)**		**(7.224)**
Prog$_1$		-0.156		-0.133		-0.133		-0.213
		(1.617)		(1.291)		(1.282)		(1.287)
GDP per capita (Log)			1.070***	0.947***	1.066***	0.990***	1.058***	1.000***
			(0.136)	(0.135)	(0.143)	(0.150)	(0.139)	(0.146)
Trade Openness (Log)			0.232**	0.273**	0.231**	0.275**	0.218**	0.268**
			(0.101)	(0.118)	(0.100)	(0.117)	(0.098)	(0.116)
Inflation (Log)			-0.175***	-0.210	-0.175***	-0.214	-0.169***	-0.194
			(0.039)	(0.147)	(0.039)	(0.145)	(0.037)	(0.147)
AId (Log)			-0.347	-0.109	-0.349	-0.081	-0.367	-0.101
			(0.473)	(0.411)	(0.474)	(0.414)	(0.455)	(0.393)
Agriculture Value Added (Log)					-0.008	0.083	0.003	0.092
					(0.089)	(0.084)	(0.089)	(0.084)
Corruption (0: Bad 6: Good)							0.051***	0.039**
							(0.020)	(0.019)
Observations	1054	850	1054	850	1054	850	1054	850
Countries	57	57	57	57	57	57	57	57

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 8
The Conditional revenue curse: Subtracting bauxite rent

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	**-0.008*****	**-0.025*****	**-0.008*****	**-0.029*****	**-0.008*****	**-0.029*****	**-0.007*****	**-0.028*****
	(0.003)	**(0.008)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.007)**
Resource windfall × Prog$_1$	**0.158****	**0.258****	**0.126****	**0.300*****	**0.129****	**0.305*****	**0.129****	**0.288*****
	(0.068)	**(0.108)**	**(0.055)**	**(0.108)**	**(0.053)**	**(0.107)**	**(0.056)**	**(0.106)**
Prog$_1$	-0.154	-0.185	-0.159	-0.206	-0.159	-0.205	-0.236	-0.276
	(1.635)	(1.650)	(1.295)	(1.287)	(1.288)	(1.283)	(1.290)	(1.286)
GDP per capita (Log)			0.943***	0.938***	0.983***	0.957***	0.994***	0.967***
			(0.136)	(0.137)	(0.151)	(0.149)	(0.147)	(0.146)
Trade Openness (Log)			0.274**	0.290***	0.276**	0.291***	0.268**	0.284***
			(0.118)	(0.111)	(0.117)	(0.111)	(0.116)	(0.110)
Inflation (Log)			-0.204	-0.206	-0.208	-0.207	-0.188	-0.190
			(0.143)	(0.140)	(0.142)	(0.139)	(0.144)	(0.141)
Aid (Log)			-0.101	-0.037	-0.077	-0.026	-0.098	-0.046
			(0.415)	(0.404)	(0.418)	(0.405)	(0.398)	(0.387)
Agriculture Value Added (Log)					0.077	0.036	0.088	0.046
					(0.085)	(0.093)	(0.086)	(0.093)
Corruption (0: Bad 6:Good)							0.040**	0.036*
							(0.019)	(0.019)
Observations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		33.80		33.86		36.40		36.54
F Stat (first stage): equation (14)		66.38		64.02		70.82		69.85

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 9 shows the results for an alternative measure for structural progressivity ($Prog_2$). Table 9 shows overall similar estimates to the baseline specification using $Prog_1$. The estimates in Column (8) imply that at a level of structural progressivity of 0.05, a 1% point increase in resource rents causes a reduction in domestic tax revenues per capita by 1.31%. This result is close to the baseline finding that is 1.21%. It means that allowing for a potential nonlinear relationship between the tax rates and the levels of income does not change the fact that the “revenue curse” may be conditional on progressive taxation.

Table 9
The conditional revenue curse: $Prog_2$

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	**-0.007****	**-0.022*****	**-0.008*****	**-0.029*****	**-0.008*****	**-0.029*****	**-0.007*****	**-0.027*****
	(0.003)	**(0.008)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.007)**
Resource windfall × $Prog_2$	**0.134****	**0.196****	**0.133*****	**0.301*****	**0.132*****	**0.301*****	**0.132*****	**0.279*****
	(0.059)	**(0.090)**	**(0.049)**	**(0.100)**	**(0.047)**	**(0.099)**	**(0.050)**	**(0.098)**
$Prog_2$	-0.136	-0.163	0.043	-0.001	0.032	-0.004	-0.036	-0.065
	(1.190)	(1.209)	(0.983)	(0.981)	(0.970)	(0.977)	(0.991)	(0.995)
GDP per capita (Log)			0.945***	0.942***	0.983***	0.956***	0.994***	0.967***
			(0.137)	(0.138)	(0.152)	(0.150)	(0.148)	(0.147)
Trade Openness (Log)			0.273**	0.289***	0.276**	0.290***	0.268**	0.282**
			(0.117)	(0.111)	(0.117)	(0.111)	(0.115)	(0.110)
Inflation (Log)			-0.206	-0.208	-0.209	-0.209	-0.189	-0.192
			(0.144)	(0.141)	(0.143)	(0.140)	(0.145)	(0.143)
Aid (Log)			-0.103	-0.039	-0.080	-0.031	-0.102	-0.051
			(0.414)	(0.403)	(0.416)	(0.404)	(0.396)	(0.386)
Agriculture Value Added (Log)					0.074	0.028	0.085	0.039
					(0.085)	(0.094)	(0.085)	(0.094)
Corruption (0: Bad 6: Good)							0.040**	0.036*
							(0.019)	(0.019)
Observations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		30.76		31.20		33.89		34.01
F Stat (first stage): equation (14)		40.82		39.35		42.55		42.18

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 10 shows the results for using alternative controls for institutional characteristics of the countries. The results in Table 10 are very similar to the baseline results. Besides, the institutional variables do not have a statistically significant effect except for polity2. Indeed, since I use a within estimator and that institutional variables are persistent it is a quite logical outcome. The polity2 variable has a negative effect on domestic tax revenues per capita suggesting that democratic countries may tax less. The result can have an explanation in the political budget cycle in taxation that may take place in democratic countries. The results also suggest overall that controlling for institutions does not change the baseline result.

Table 10
The conditional revenue curse: Institutional controls

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.007***	**-0.029*** **	**-0.008*** **	**-0.029*** **	**-0.007*** **	**-0.029*** **	**-0.008*** **	**-0.027*** **
	(0.003)	**(0.007)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.006)**
Resource windfall × Prog$_1$	**0.120** **	**0.310*** **	**0.125** **	**0.301*** **	**0.119** **	**0.294*** **	**0.122** **	**0.291*** **
	(0.051)	(0.109)	(0.055)	(0.109)	(0.053)	(0.107)	(0.051)	(0.104)
Prog$^{\cdot}$1	-0.121	-0.170	-0.051	-0.098	-0.159	-0.205	-0.182	-0.222
	(1.291)	(1.286)	(1.259)	(1.258)	(1.294)	(1.291)	(1.313)	(1.310)
GDP per capita (Log)	0.978***	0.956***	0.960***	0.935***	0.986***	0.960***	0.972***	0.948***
	(0.147)	(0.146)	(0.142)	(0.141)	(0.146)	(0.145)	(0.150)	(0.148)
Trade Openness (Log)	0.276**	0.291***	0.263**	0.276**	0.271**	0.285**	0.286**	0.299***
	(0.117)	(0.110)	(0.120)	(0.114)	(0.117)	(0.112)	(0.118)	(0.113)
Inflation (Log)	-0.206	-0.206	-0.197	-0.197	-0.200	-0.201	-0.203	-0.202
	(0.141)	(0.139)	(0.136)	(0.133)	(0.146)	(0.143)	(0.137)	(0.135)
Agriculture Value Added (Log)	0.075	0.033	0.084	0.042	0.077	0.035	0.090	0.053
	(0.084)	(0.093)	(0.088)	(0.095)	(0.086)	(0.093)	(0.083)	(0.090)
Aid (Log)	-0.072	-0.020	-0.113	-0.061	-0.080	-0.027	0.013	0.064
	(0.417)	(0.405)	(0.404)	(0.391)	(0.426)	(0.413)	(0.378)	(0.367)
Internal conflict	-0.030	-0.017						
	(0.048)	(0.047)						
External conflict	0.023	0.029						
	(0.083)	(0.072)						
Bureaucracy quality			0.029	0.028				
			(0.032)	(0.031)				
Democratic accountability					0.013	0.013		
					(0.020)	(0.020)		
Polity2							-0.009*	-0.009**
							(0.004)	(0.004)
Observations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		35.90		36.20		36.70		38.06
F Stat (first stage): equation (14)		71.90		71.40		71.72		72.81

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 11 shows the results for excluding the countries with a potential market power. I exclude from these estimations, countries in the sample that are major exporters for each of the 13 other natural resources when the information is available.[18] The countries that are excluded are: Chile, China, Indonesia and Morocco. Chile is the world's lartest exporter of copper. Indonesia and China are among the top 3 exporting countries of coal (behind Australia) in 2003. Finally, Indonesia is the world's leading exporter of tin and Morocco is the world's largest exporter of phosphates. These 4 countries could influence the prices of natural resources that they export as leaders. If these countries have a market power, the instrument can no longer be considered as exogenous. Table 13 shows that the results are similar to the baseline results. The results are robust to the exclusion of these 4 countries holding a potential market power.

Table 11
The Conditional revenue curse: Excluding countries with market power

Dependent variable: Domestic tax per capita (Log)	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Resource windfall	**-0.008*****	**-0.023*****	**-0.007*****	**-0.025*****	**-0.007****	**-0.025*****	**-0.007****	**-0.023*****
	(0.003)	**(0.008)**	**(0.003)**	**(0.006)**	**(0.003)**	**(0.007)**	**(0.003)**	**(0.006)**
Resource windfall × Prog$_1$	**0.148****	**0.234****	**0.107****	**0.258****	**0.113****	**0.266****	**0.114****	**0.246****
	(0.063)	**(0.107)**	**(0.054)**	**(0.107)**	**(0.053)**	**(0.106)**	**(0.055)**	**(0.104)**
Prog˙1	-0.376	-0.410	-0.171	-0.213	-0.164	-0.207	-0.287	-0.321
	(1.663)	(1.675)	(1.303)	(1.299)	(1.293)	(1.292)	(1.291)	(1.291)
GDP per capita (Log)			1.082***	1.070***	1.144***	1.110***	1.150***	1.117***
			(0.146)	(0.147)	(0.168)	(0.165)	(0.170)	(0.167)
Trade Openness (Log)			0.263**	0.276**	0.265**	0.277**	0.258**	0.269**
			(0.123)	(0.117)	(0.122)	(0.117)	(0.120)	(0.115)
Inflation (Log)			-0.185	-0.188	-0.189	-0.190	-0.166	-0.170
			(0.141)	(0.139)	(0.139)	(0.137)	(0.142)	(0.140)
Aid(Log)			-0.018	0.032	0.016	0.053	-0.017	0.022
			(0.426)	(0.417)	(0.431)	(0.420)	(0.410)	(0.402)
Agriculture Vale Added (Log)					0.105	0.068	0.113	0.076
					(0.090)	(0.098)	(0.091)	(0.097)
Corruption (0: Bad 6: Good)							0.042*	0.039*
							(0.022)	(0.022)
Observations	786	786	786	786	786	786	786	786
Countries	53	53	53	53	53	53	53	53
F Stat (first stage): equation (13)		30.68		29.75		32.16		31.97
F Stat (first stage): equation (14)		64.34		61.81		69.02		67.78

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. The countries dropped are Chile (copper), China (coal), Indonesia (coal, Tin) and Morocco (Phosphate).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[18]The relevant informations are in Table A_{10} in Appendix B.

6 Other Potential channels

IIn this paper, the theoretical analysis of the "revenue curse" is focused on the incentive problem faced by governments in resource-rich countries as they tend to have weak incentives to implement and sustain efficient tax systems (Knack, 2009). The theoretical framework underlines the dampening effect of progressive taxation through its impact on governments' incentives to invest in fiscal capacity.

However, progressive taxation may operate through other channels to dampen the "revenue curse". For instance, there are microeconomic studies (Doerrenberg and Peichl, 2013; OECD, 2013; Daude et al., 2013; and Heinemann and Kocher, 2013) showing that progressive taxation has a positive effect on tax morale. Tax morale can be defined as the voluntary compliance with tax laws.[19] The idea is that progressive taxation may send a signal of fairness of the tax system. OECD (2013) on the determinants of tax morale, shows using a worldwide sample based on individual level data from public opinion survey that citizens who think of fiscal redistribution as an essential characteristic of a democracy tend to have a higher tax morale. Daude et al. (2013) find the same result in a sample of developing countries. In the same vein, Doerrenberg and Peichl (2013) show in a theoretical framework with inequality averse individuals that increased progressivity may favour tax morale. Their empirical results using micro level data on 19 OECD countries are consistent with this theoretical model. Also, Heinemann and Kocher (2013) using an experimental approach show that tax compliance is higher under progressive taxation than in proportionate taxation. Therefore, the difference in the progressivity of the tax system could capture a difference in the degree of tax compliance. In other words, tax evasion may be low in countries with a high degree of progressive taxation as suggested by Heinemann and Kocher (2013).

Although the theoretical framework does not account (directly) for tax evasion, there is a potential link with the microeconomic literature on the effect of progressive taxation on tax morale. First, investing in fiscal capacity is necessary to curb tax avasion. But, the cost of this investment is likely to be high if tax evasion is pervasive in the country. Thus, a high tax morale or tax compliance in countries with progressive taxation may make an investment in fiscal capacity less costly. Therefore, progressive taxation may reduce the cost of investment in fiscal capacity and may help dampen the so-called "revenue curse" by increasing tax compliance.

Finally, progressive taxation may also dampen the "revenue curse" by enhancing auto-

[19] Luttmer and Singhal (2014) report examples from India and Kenya about the valorisation of tax morale by tax administration authorities as a mean to collect tax revenues.

matic stabilizers. Baunsgaard and Symansky (2009) argue that increasing the progressivity of the personal income tax may reinforce the automatic stabilizers. Indeed a progressive income tax makes tax revenues more responsive to the economic cycle. The economic cycle in resource-rich countries is likely to be mostly sensitive to the changes in the resource sector. Therefore, progressive income taxation may help collect more tax revenues in resource-rich countries following a resource boom.

7 Conclusion

Tax revenues collection is crucial for economic development. The recent collapse in oil prices and its detrimental effect on public revenues in some oil dependent countries reinforces the importance of tax revenues collection in these countries. This paper analyzes the role of the design of the tax system in increasing tax revenues collection in developing countries that are rich in natural resources. I incorporate a progressive income taxation in a theoretical framework where a government in a resource-rich country, faces the incentive problem which is to undertake a costly investment in its own ability to collect tax revenues. The model predicts that a resource-rich country with a progressive income tax has more incentives to invest in its ability to collect tax revenues because the expected return to that investment is higher as the tax system becomes more progressive. In addition, I estimate the causal impact of natural resource rent windfalls on domestic tax revenues collection and I find that consistently with the theoretical model this effect is conditional on the degree of progressive taxation. The results may suggest some policy implications in order to help resource rich countries increase tax revenues.

The empirical assessment of the effect of natural resources on domestic tax revenues is difficult because of the potential endogeneity of natural resource rents. The empirical strategy in this paper exploits the plausibly exogenous variation in international prices of natural resources at country level in order to isolate the causal impact of natural resource rents on domestic tax revenues. I use a macroeconomic panel dataset on 57 developing countries over the period 1981-2005. I find that there is a partial substitution of 25% between natural resource rent windfalls and domestic tax revenues. However, progressive taxation may dampen the detrimental effect of natural resources on domestic tax revenues. At a progressivity level of 0.05 an increase in the resource rent windfalls of $1 reduces domestic tax revenues by only $0.14. The results suggest that policy reforms aimed at strengthening progressive taxation may help resource-rich countries to enhance their fiscal capacity. The theoretical model suggests that the change in the incentive of governments is a potential channel through which progressive taxation may operate to dampen the so-called "revenue curse". However, other potential channels (tax morale and automatic stabilizers) may be at work as well .

While there is a growing research on the effect of natural resources on fiscal capacity, this paper is the first to the best of my knowledge to show how a particular tax policy design may dampen the "revenue curse". Conversely to the idea that progressive taxation may have a negative economic impact, this paper suggests that progressive taxation may also have positive effects. In addition to a theoretical model, the paper employs a novel instrumental variable to deal with the endogeneity of natural resource rents. The paper suggests a future avenue for research related to how the design of the tax policy may influence tax policy effectiveness.

References

1. Angrist, J. D., and Krueger, A. B. (2001). "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments". *Journal of Economic Perspectives*, 15(4), 69-85.

2. Arezki, R., and Brückner, M.(2011). "Oil rents, corruption, and state stability: Evidence from panel data regressions". *European Economic Review*, 55(7), 955-963.

3. Arezki, R., and Brückner, M. (2012). "Resource windfalls and emerging market sovereign bond spreads: the role of political institutions". *The World Bank Economic Review*, 26(1), 78-99.

4. Baskaran, T., and Bigsten, A. (2013). "Fiscal capacity and the quality of government in sub-Saharan Africa". *World Development*, 45, 92-107.

5. Baskaran, T. (2014). "Taxation and democratization". *World Development*, 56, 287-301.

6. Baunsgaard, T., and Keen, M. (2010). "Tax revenue and (or?) trade liberalization". *Journal of Public Economics*, 94(9), 563-577.

7. Baunsgaard, T., and Symansky, S. (2009)."Automatic Fiscal Stabilizers: How Can They Be Enhanced Without Increasing Government Size". SPN/09/23, *International Monetary Fund*.

8. Besley, T., and Persson, T. (2009). "The Origins of State Capacity: Property Rights, Taxation, and Politics". *American Economic Review*, 99(4), 1218-44.

9. Besley, T., and Persson, T. (2010). "State capacity, conflict, and development". *Econometrica*, 78(1), 1-34.

10. Besley, T., and Persson, T. (2014). "Why Do Developing Countries Tax So Little?". *The Journal of Economic Perspectives*, 28(4), 99-120.

11. Bornhorst, F., Gupta, S., and Thornton, J. (2009). "Natural resource endowments and the domestic revenue effort". *European Journal of Political Economy*, 25(4), 439-446.

12. Bräutigam, D. A., 2008, "Introduction: Taxation and State Building in Developing Countries" in *Taxation and State Building in Developing Countries: Capacity and Consent*, ed. by Deborah Bräutigam, Odd-Helge Fjelstad, and Mick Moore, pp. 1-33 (Cambridge: Cambridge University Press).

13. Brückner, M., Chong, A., and Gradstein, M. (2012). "Estimating the permanent income elasticity of government expenditures: Evidence on Wagner's law based on oil price shocks." *Journal of Public Economics*, 96(11), 1025-1035.

14. Brückner, M., and Ciccone, A. (2010). "International Commodity Prices, Growth and the Outbreak of Civil War in Sub-Saharan Africa". *The Economic Journal*, 120(544), 519-534.

15. Cárdenas, M., Ramírez, S., and Tuzemen, D. (2011). "Commodity dependence and fiscal capacity". *Washington DC, Brooking Institution, Latin American Initiative.*

16. Corneo, G. (2002). "The efficient side of progressive income taxation". *European Economic Review*, 46(7), 1359-1368.

17. Crivelli, E., and Gupta, S. (2014). "Resource blessing, revenue curse? Domestic revenue effort in resource-rich countries". *European Journal of Political Economy*, 35, 88-101.

18. Daude, C., Gutiérrez, H. and Melguizo, A. (2013). "What Drives Tax Morale? A Focus on Emerging Economies". *Review of Public Economics*, 207-(4/2013):9-40

19. Deaton, A. (1999). "Commodity prices and growth in Africa". *The Journal of Economic Perspectives*, 13(3), 23-40.

20. Doerrenberg, P., and Peichl, A. (2013). "Progressive taxation and tax morale". *Public Choice*, 155(3-4), 293-316.

21. Gleditsch, N. P., Eriksson, M., Sollenberg, M., and Strand, H. (2002). "UCDP/PRIO Armed Conflict Dataset Codebook".

22. Heinemann, F., and Kocher, M. G. (2013). "Tax compliance under tax regime changes". *International Tax and Public Finance*, 20(2), 225-246.

23. James, A. (2015). "U.S. State Fiscal Policy and Natural Resources". *American Economic Journal: Economic Policy*, 7(3), 238-257.

24. Kilian, L. (2009). "Not All Oil Price Shocks Are Alike: Disentangling Demand and Supply Shocks in the Crude Oil Market". *American Economic Review*, 99(3), 1053-69.

25. Knack, S. (2009). "Sovereign rents and quality of tax policy and administration". *Journal of Comparative Economics*, 37(3), 359-371.

26. Luttmer, E. F., and Singhal, M. (2014). "Tax Morale". *The Journal of Economic Perspectives*, 28(4), 149-168.

27. Marshall, M., and Jaggers, K. (2009) “Polity IV Project: Dataset Users’ Manual” (Arlington, VA: Center for Global Policy, George Mason University).

28. Meller, P., and Simpasa, A. M. (2011). “Role of Copper in the Chilean and Zambian Economies: Main Economic & Policy Issues” *Global Development Network Working Paper Series*.

29. McGuirk, E. F. (2013). “The illusory leader: natural resources, taxation and accountability”. *Public Choice*, 154(3-4), 285-313.

30. Musgrave, R. A., and Thin, T. (1948). “Income tax progression, 1929-48”. *The Journal of Political Economy*, 498-514.

31. OECD (2011), “Revisiting MDG cost estimates from a domestic resource mobilisation perspective”. *OECD Publishing No. 306*.

32. OECD (2013), “Tax and Development: What Drives Tax Morale?” Organization for Economic Cooperation and Development.

33. Pencavel, J. H. (1979). “A note on income tax evasion, labor supply, and nonlinear tax schedules”. *Journal of Public Economics*, 12(1), 115-124.

34. Peter, K. S., Buttrick, P., and Duncan, D. (2010). “Global reform of personal income taxation, 1981-2005: evidence from 189 countries”. *National Tax Journal*, 63(3), 447-478.

35. Robinson, J. A., Torvik, R., and Verdier, T. (2006). “Political foundations of the resource curse”. *Journal of Development Economics*, 79(2), 447-468.

36. Rodrik, D. (1998). “Why Do More Open Economies Have Bigger Governments?”. *The Journal of Political Economy*, 106(5), 997-1032.

37. Ross, M. L. (2001). “Does oil hinder democracy?”. *World politics*, 53(03), 325-361.

38. Sala-i-Martin, X., and Subramanian, A. (2003). “Addressing the natural resource curse: An illustration from Nigeria” . *National Bureau of Economic Research* (No. w9804)

39. Tsui, K. K. (2011). “More oil, less democracy: Evidence from worldwide crude oil discoveries”. *The Economic Journal*, 121(551), 89-115.

40. Van der Ploeg, F., and Poelhekke, S. (2010). “The pungent smell of “red herrings”: Subsoil assets, rents, volatility and the resource curse”. *Journal of Environmental Economics and Management*, 60(1), 44-55.

Appendix

Appendix A: Theoretical framework

Assuming a convex cost function

By the implicit function theorem,

$$\frac{\partial \tau_2}{\partial R} = -\frac{\partial Q/\partial R}{\partial Q/\partial \tau_2} \tag{15}$$

$$\begin{aligned} \frac{\partial Q}{\partial R} &= \phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) V_{G_2G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] \\ \frac{\partial Q}{\partial \tau_2} &= \phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right)^2 V_{G_2G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] - \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1) \end{aligned} \tag{16}$$

Equations (16) implies that

$$\frac{\partial \tau_2}{\partial R} = -\left\{\frac{\phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) V_{G_2G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right]}{\phi\alpha_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right)^2 V_{G_2G_2}\left[\tau_2\left(\theta_I W_I^\sigma + \theta_O W_O^\sigma\right) + R\right] - \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1)}\right\} < 0 \tag{17}$$

The sign of the derivative (17) comes from the properties of $V(\cdot)$ and $F(\cdot)$. The numerator and the denominator of (17) have the same sign. The derivative in equation (17) shows the so-called "revenue curse" : higher natural resource rents lead to a lower investment in fiscal capacity. The government has two sources of benefit from an investment in fiscal capacity: tax revenues and the public good. Recall that the government's objective is to maximize its own group utility (which depends on public good) and tax revenues. Again, by the properties of $V(\cdot)$, the consumption of public goods is characterized by a diminishing marginal utility. In addition, the properties of $F(\cdot)$ implies an increasing marginal cost of investment in fiscal capacity.

The intuitions for the "revenue curse" follow Cárdenas et al. (2011). Consider a scenario in which the world is in the common interest state at $s = 2$. The economy is characterized by a high valuation of public goods. The incumbent government uses its revenue to provide for public goods. The intuition for the "revenue curse" is the following. When natural resource rents are high and given the properties of $V(\cdot)$ and $F(\cdot)$, the government has less incentives in undertaking a costly investment because rents can be used to finance public goods' production without any cost. In a scenario where the world is in the redistributive state in $s = 2$, since public goods are not valuable, the incumbent governement will redistribute all the available revenue to its own group for private consumption. The intuition for the "revenue curse" is the following. Because of the uncertainty about remaining in power, the incumbent has less incentives to invest in fiscal capacity because its group will be taxed at a higher rate if he looses power. The incumbent government prefers to increase private consumption of its own group by redistribution of the increased natural resource rents. This choice is preferred over investing in fiscal capacity which may become a burden for the group in power if they loose power in the second period.

Proposition: Progressive taxation mitigates the "revenue curse" because returns to the investment in fiscal capacity are higher with progressive taxation.

The proof of this proposition consists in finding the condition for $\dfrac{\partial \tau_2}{\partial R \partial \sigma} > 0$

$$\frac{\partial \tau_2}{\partial R \partial \sigma} = -\left\{ \frac{\phi\alpha_2\left(\theta_I W_I^{\sigma} lnW_I + \theta_O W_O^{\sigma}\, lnW_O\right) V_{G_2G_2}\left[-\phi\alpha_2\left(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}\right)^2 V_{G_2G_2} - \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1)\right]}{\left\{\phi\alpha_2\left(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}\right)^2 V_{G_2G_2} - \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1)\right\}^2} \right\} \tag{18}$$

In equation (18),

$$\frac{\partial \tau_2}{\partial R \partial \sigma} > 0 \text{ if } \phi\alpha_2\left(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}\right)^2 |V_{G_2G_2}| > \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1) \tag{19}$$

The highest possible value of λ_1 which is the realized value of government funds in period 1 is attained in the "common interest state" and it is equal to $\alpha_H V_G(G_1)$, that is the marginal utility of public good consumption. The term $(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma})$ represents the tax base which is higher than the aggregated payroll in the economy because $\sigma > 1$ (and W $\ggg 1$). (19) gives some intuition about the explanation of the conditional revenue curse. The returns to the investment in fiscal capacity are higher the more progressive is the tax system. To see this, Consider the extreme cases of a country A characterized by a linear taxation and a country B by progressive taxation and assume that the two countries have the same tax rates and the same cost function for investment in fiscal capacity. It is easy to see that country B will raise more tax revenues than country A because equation (19) is more likely to hold. The country with progressive taxation has more incentives to invest in fiscal capacity because returns to the investment in fiscal capacity, namely the amount of tax revenues raised, is higher than in the country with linear taxation. The expected high tax revenues may also allow the government to cover the costs of this investment.

Consider now a scenario in which the world is in the common interest state at $s = 2$. The conditional revenue curse can be explained by the fact that in the common interest state, nonlinear taxation relaxes the government's constraint by generating additional revenues. More specifically, the increase in tax revenues coming from the nonlinear tax schedule may compensate for the fact that the marginal cost is increasing and the marginal benefit from public good consumption is decreasing. To see this, note that in equation (19), $V_{G_2G_2}$ and $F_{\tau_2\tau_2}$ capture respectively the concavity of $V(\cdot)$ (utility of public good) and the convexity of $F(\cdot)$ (cost of investment in fiscal capacity). Finally, in a scenario where the world is in the redistributive state in $s = 2$, since public goods are not valuable, again, the incumbent governement will redistribute all the avaible revenue to its own group for private consumption. The explanation for the conditional revenue curse comes from the fact that with the progressive tax schedule it is possible for the incumbent group to increase its own group consumption because of the tax collected on high incomes. This incentive to invest in fiscal capacity is obviously increasing in the probability of being in power.

Expected payoff

This Appendix shows the details regarding the calculation of the expected payoff. Assuming that the group I_1 stays in power in $s = 2$, its utility is given by:

$$U_{I2} = \begin{cases} A = \alpha_2 V\left[\tau_2(\theta_I W_I^\sigma + \theta_O W_O^\sigma) + R\right] + W_I - \tau_2 W_I^\sigma \text{ (in the common interest state)} \\ B = W_I - \theta_I t_{I2} W_I^\sigma = W_I + \theta_O \tau_2 W_O^\sigma + R \quad \text{(in the redistributive state)} \end{cases}$$

The second period's payoff can be written as $\eta_{I2} = \phi A + (1-\phi)B$. Where ϕ and $(1-\phi)$ are respectively the probability of being in the common interest state and the redistributive state. If the opposition wins in the process of political transition in the second period, the expected payoff is given by:

$$U_{O2} = \begin{cases} A' = \alpha_2 V\left[\tau_2(\theta_I W_I^\sigma + \theta_O W_O^\sigma) + R\right] + W_O - \tau_2 W_O^\sigma \text{ (in the common interest state)} \\ B' = W_O - \theta_O t_{O2} W_O^\sigma = W_O + \theta_I \tau_2 W_I^\sigma + R \quad \text{(in the redistributive state)} \end{cases}$$

Therefore, the second period's expected payoff when the opposition is in power is given by $\eta_{O2} = \phi A' + (1-\phi)B'$. Finally the second period's payoff (net of the cost of investment in fiscal capacity) can be written as: $\eta = \gamma\eta_{I2} + (1-\gamma)\eta_{O2} - \lambda_1 F(\tau_2 - \tau_1)$. Where γ is the probability of staying in power.

The (ambiguous) direct effect of progressivity on investment in fiscal capacity

By the implicit function theorem,

$$\frac{\partial \tau_2}{\partial \sigma} = -\frac{\partial Q/\partial \sigma}{\partial Q/\partial \tau_2}$$

$$\frac{\partial \tau_2}{\partial \sigma} = -\left\{ \frac{\kappa + W_I^{\sigma} lnW_I(-\gamma\phi + (1-\gamma)(1-\phi)\theta_I) + W_O^{\sigma} lnW_O[\gamma(1-\phi)\theta_O - (1-\gamma)\phi]}{\phi\alpha_2\left(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}\right)^2 V_{G_2G_2} - \lambda_1 F_{\tau_2\tau_2}(\tau_2 - \tau_1)} \right\}$$

$$\text{with } \ \kappa = \phi\alpha_2\left(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma}\right)\left[V_{G_2} + \tau_2(\theta_I W_I^{\sigma} + \theta_O W_O^{\sigma})V_{G_2G_2}\right]$$

The denominator has a negative sign coming from the properties of $F(\cdot)$ and $V(\cdot)$. The sign of the numerator is ambiguous because it depends on the values of the exogenous parameters ($\gamma,\ \phi,\ \theta_0$ and θ_I) and includes also the summation of two terms of opposite sign (in κ).

Appendix B: Empirical Analysis

Countries in the sample

Algeria, Argentina, Bahrain, Bangladesh, Bolivia, Botswana, Cameroon, Chile, China, Rep.of Congo, Costa Rica, Côte d'Ivoire, Dominican Republic, Ecuador, Egypt, El Salvador, Ethiopia, Gabon, Gambia, Ghana, Guatemala, Guyana, Haiti, Honduras, India, Indonesia, Iran, Jamaica, Kenya, Madagascar, Malawi, Malaysia, Mali, Morocco, Mozambique, Niger, Nigeria, Oman, Pakistan, Panama, Papua New Guinea, Paraguay, Peru, Philippines, Senegal, South Africa, Sri Lanka, Syria, Tanzania, Thailand, Togo, Trinidad and Tobago, Tunisia, Uganda, Uruguay, Zambia, Zimbabwe.

Table A_1
Summary statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Total resource windfall	1054	0.077	3.416	-26.16	23.483
Oil windfall	931	-0.058	3.028	-26.337	22.392
Other resoure windfall	931	0.12	1.509	-8.431	15.758
Domestic tax per capita (Log)	1054	4.617	1.306	1.305	7.859
Total tax per capita (Log)	1054	4.871	1.227	2.158	7.919
Domestic tax (% of GDP)	1054	12.572	5.964	1.708	37.131
Price growth (all resources)	1054	0.002	0.025	-0.148	0.239
Price growth (other resources)	1054	0.001	0.02	-0.108	0.215
Price growth (oil)	1054	0.001	0.015	-0.149	0.114
Agriculture Value Added (Log)	1054	2.87	0.749	-0.161	4.232
Aid (Log)	1054	4.663	0.076	4.6	5.2
GDP per capita (Log)	1054	6.804	1.09	4.523	9.344
Trade Openness(Log)	1054	4.068	0.518	2.513	5.395
Inflation (Log)	1054	4.757	0.33	4.481	9.38
Corruption	1054	2.697	0.945	0	5
$Prog_1$	850	0.024	0.025	0	0.136
$Prog_2$	850	0.025	0.027	0	0.131
Internal conflict	1054	0.208	0.406	0	1
external conflict	1054	0.027	0.161	0	1
Bureaucracy quality	1054	1.714	0.923	0	4
Democratic accountability	1054	3.209	1.188	0	6
Polity2	1054	1.249	6.559	-10	10

Table A_2

The revenue curse: Institutional Controls

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.008***	-0.025**	-0.009***	-0.026**	-0.008***	-0.026**	-0.008***	-0.025**
	(0.002)	(0.010)	(0.002)	(0.011)	(0.002)	(0.011)	(0.002)	(0.010)
GDP per capita (Log)	1.047***	1.022***	1.024***	0.993***	1.061***	1.030***	1.045***	1.017***
	(0.140)	(0.137)	(0.139)	(0.133)	(0.140)	(0.135)	(0.145)	(0.139)
Trade Openness (Log)	0.228**	0.230**	0.212**	0.212**	0.221**	0.222**	0.242**	0.243**
	(0.098)	(0.096)	(0.100)	(0.098)	(0.100)	(0.098)	(0.100)	(0.098)
Inflation (Log)	-0.170***	-0.175***	-0.167***	-0.172***	-0.171***	-0.177***	-0.162***	-0.167***
	(0.037)	(0.035)	(0.034)	(0.032)	(0.037)	(0.035)	(0.037)	(0.034)
Agriculture Value Added (Log)	-0.025	-0.065	-0.015	-0.056	-0.023	-0.063	-0.014	-0.052
	(0.090)	(0.099)	(0.092)	(0.100)	(0.090)	(0.099)	(0.090)	(0.099)
Aid (Log)	-0.308	-0.257	-0.375	-0.316	-0.335	-0.276	-0.223	-0.167
	(0.473)	(0.460)	(0.439)	(0.427)	(0.483)	(0.470)	(0.405)	(0.396)
Internal conflict	-0.076	-0.058						
	(0.051)	(0.046)						
External conflict	0.033	0.040						
	(0.094)	(0.088)						
Bureaucracy quality			0.036	0.037				
			(0.028)	(0.028)				
Democratic_accountability					0.015	0.014		
					(0.017)	(0.017)		
Polity2							-0.009**	-0.009**
							(0.004)	(0.004)
Observations	1054	1054	1054	1054	1054	1054	1054	1054
Countries	57	57	57	57	57	57	57	57
F Stat (first stage)		82.99		90.25		91.31		91.60

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_3
The revenue curse: Excluding countries with market power

Dependent variable: Domestic tax per capita (Log)	(1) OLS	(2) IV	(3) OLS	(4) IV	(5) OLS	(6) IV	(7) OLS	(8) IV
Resource windfall	-0.009***	-0.025*	-0.008***	-0.024**	-0.008***	-0.025**	-0.008***	-0.023**
	(0.003)	(0.014)	(0.002)	(0.011)	(0.002)	(0.011)	(0.002)	(0.010)
GDP per capita (Log)			1.188***	1.174***	1.185***	1.148***	1.174***	1.140***
			(0.151)	(0.147)	(0.160)	(0.153)	(0.160)	(0.154)
Trade Openness (Log)			0.215**	0.217**	0.215**	0.215**	0.201**	0.203**
			(0.104)	(0.102)	(0.104)	(0.102)	(0.102)	(0.101)
Inflation (Log)			-0.165***	-0.171***	-0.165***	-0.171***	-0.159***	-0.164***
			(0.036)	(0.034)	(0.036)	(0.034)	(0.035)	(0.033)
Aid (Log)			-0.259	-0.201	-0.260	-0.208	-0.287	-0.236
			(0.492)	(0.483)	(0.494)	(0.483)	(0.474)	(0.465)
Agriculture Value Added (Log)					-0.005	-0.045	0.008	-0.031
					(0.096)	(0.107)	(0.097)	(0.104)
Corruption (0:Bad 6:Good)							0.054**	0.050**
							(0.023)	(0.022)
Observations	976	976	976	976	976	976	976	976
Countries	53	53	53	53	53	53	53	53
F Stat (first stage)		74.53		72.34		77.85		76.05

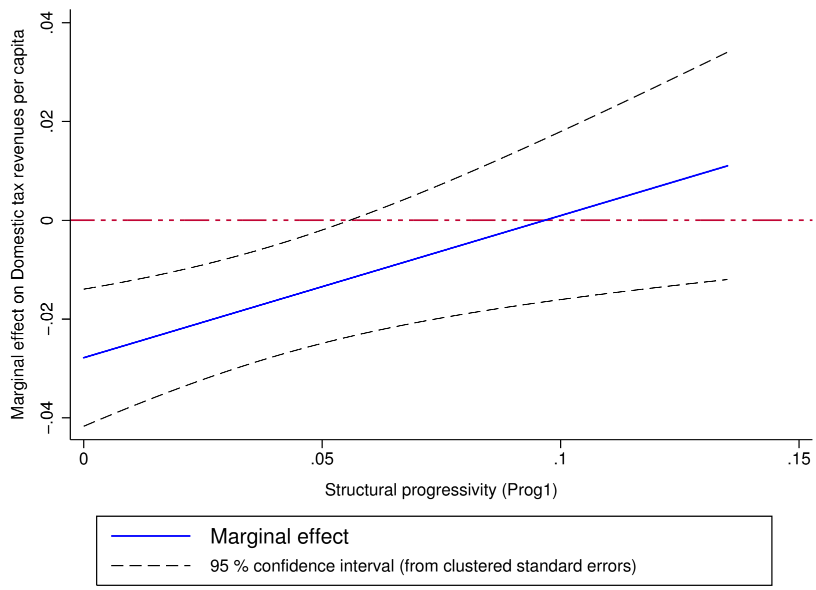
Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. The countries dropped are Chile (Copper), China (Coal), Indonesia (Coal,Tin) and Morocco (Phosphate).
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_4
The Conditional revenue curse: Total tax per capita

Dependent variable: Total tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.007***	-0.019***	-0.007***	-0.022***	-0.007***	-0.022***	-0.007***	-0.022***
	(0.003)	(0.007)	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
Resource windfall $\times$ $Prog_1$	0.122**	0.146**	0.108**	0.195***	0.109**	0.192***	0.109**	0.181***
	(0.062)	(0.072)	(0.049)	(0.066)	(0.050)	(0.066)	(0.051)	(0.064)
Prog˙1	0.208	0.164	0.053	0.004	0.053	0.003	0.006	-0.040
	(1.291)	(1.301)	(0.899)	(0.893)	(0.899)	(0.894)	(0.900)	(0.896)
GDP per capita (Log)			0.896***	0.893***	0.900***	0.879***	0.907***	0.886***
			(0.113)	(0.115)	(0.128)	(0.128)	(0.127)	(0.127)
Trade Openness (Log)			0.306***	0.316***	0.306***	0.315***	0.301***	0.311***
			(0.094)	(0.090)	(0.094)	(0.090)	(0.093)	(0.089)
Inflation (Log)			-0.123	-0.126	-0.123	-0.125	-0.111	-0.114
			(0.081)	(0.079)	(0.081)	(0.079)	(0.083)	(0.081)
Aid (Log)			-0.260	-0.206	-0.258	-0.214	-0.271	-0.226
			(0.339)	(0.328)	(0.340)	(0.328)	(0.332)	(0.322)
Agriculture Value Added					0.007	-0.027	0.014	-0.021
					(0.078)	(0.082)	(0.079)	(0.083)
Corruption (0: Bad 6: Good)							0.025	0.022
							(0.016)	(0.016)
Observations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		33.66		33.74		36.26		36.41
F Stat (first stage): equation (14)		66.38		64.36		71.78		70.84

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A1
Marginal effect of resource windfalls on Domestic tax in % of GDP as the level of structural progressivity increases



Notes: This figure shows the marginal effect of resource windfalls on domestic tax revenues in % of GDP from equation (12). The marginal effect is computed for each increment of 0.001 in structural progressivity using estimation (8) from Table A_5. I compute the confidence interval using the standard error of the marginal effect which is: $\sqrt{var(\theta_1) + prog^2 * var(\theta_2) + 2 * prog * cov(\theta_1, \theta_2)}$.

Table A_5
The Conditional revenue curse: Domestic tax in % GDP

Dependent variable: Domestic tax in % of GDP	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.076** (0.032)	-0.283*** (0.098)	-0.085*** (0.032)	-0.293*** (0.096)	-0.086** (0.034)	-0.294*** (0.096)	-0.084** (0.034)	-0.288*** (0.096)
Resource windfall × $Prog_1$	1.399 (0.988)	3.084* (1.578)	1.540 (0.942)	3.096** (1.541)	1.547 (0.944)	3.116** (1.531)	1.542 (0.961)	3.012** (1.506)
Prog˙1	11.849 (14.912)	11.628 (14.994)	9.173 (14.638)	8.713 (14.617)	9.207 (14.535)	8.814 (14.493)	8.766 (14.598)	8.416 (14.541)
GDP per capita (Log)			-0.454 (1.648)	-0.493 (1.663)	-0.499 (1.598)	-0.627 (1.596)	-0.467 (1.572)	-0.596 (1.573)
Trade Openness			0.030** (0.014)	0.032** (0.014)	0.030** (0.014)	0.031** (0.014)	0.030** (0.014)	0.031** (0.014)
Inflation			-0.002 (0.005)	-0.003 (0.005)	-0.002 (0.005)	-0.003 (0.005)	-0.002 (0.005)	-0.002 (0.005)
Aid (Log)			-0.000 (0.029)	0.006 (0.028)	-0.001 (0.027)	0.004 (0.026)	-0.002 (0.026)	0.003 (0.025)
Agriculture Value Added					-0.007 (0.066)	-0.021 (0.064)	-0.006 (0.067)	-0.020 (0.064)
Corruption (0:Bad 6:Good)							0.242 (0.225)	0.208 (0.226)
Obervations	850	850	850	850	850	850	850	850
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		33.66		33.34		32.00		32.08
F Stat (first stage): equation (14)		66.38		64.35		62.30		61.50

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_6
The Conditional revenue curse: Middle Income Countries

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.008**	-0.020***	-0.007*	-0.019***	-0.006*	-0.019***	-0.006*	-0.018***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.003)	(0.005)	(0.003)	(0.005)
Resource windfall × $Prog_1$	0.080	0.130***	0.055	0.131***	0.058	0.137**	0.048	0.114**
	(0.059)	(0.038)	(0.054)	(0.048)	(0.061)	(0.056)	(0.057)	(0.056)
Prog˙1	1.130	1.027	0.395	0.232	0.420	0.250	0.074	-0.073
	(1.347)	(1.396)	(1.226)	(1.257)	(1.242)	(1.284)	(1.262)	(1.301)
GDP per capita (Log)			0.728***	0.718***	0.754***	0.733***	0.816***	0.792***
			(0.210)	(0.211)	(0.222)	(0.222)	(0.224)	(0.226)
Trade Openness (Log)			0.194	0.210	0.191	0.209	0.183	0.201
			(0.168)	(0.165)	(0.170)	(0.168)	(0.171)	(0.169)
Inflation (Log)			-0.010	-0.008	-0.013	-0.010	-0.017	-0.013
			(0.094)	(0.096)	(0.093)	(0.095)	(0.098)	(0.100)
Aid (Log)			0.172	0.270	0.174	0.271	0.361	0.441
			(0.696)	(0.685)	(0.704)	(0.691)	(0.712)	(0.695)
Agricuture Value Added (Log)					0.054	0.031	0.055	0.033
					(0.132)	(0.131)	(0.129)	(0.128)
Corruption (0: Bad 6: Good)							0.040*	0.037
							(0.023)	(0.024)
Observations	490	490	490	490	490	490	490	490
Countries	32	32	32	32	32	32	32	32
F Stat (first stage): equation (13)		41.51		44.31		48.96		48.26
F Stat (first stage): equation (14)		348.85		354.74		405.07		380.13

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_7
The Conditional revenue curse : Low Income Countries

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.014**	-0.051	-0.010***	-0.063**	-0.010***	-0.065**	-0.010***	-0.064**
	(0.006)	(0.034)	(0.003)	(0.030)	(0.003)	(0.031)	(0.003)	(0.031)
Resource windfall × $Prog_1$	0.386**	0.833	0.259**	0.927*	0.261**	0.942*	0.267**	0.937*
	(0.172)	(0.561)	(0.105)	(0.516)	(0.104)	(0.522)	(0.105)	(0.520)
Prog˙1	-0.695	-0.670	-0.574	-0.587	-0.571	-0.595	-0.574	-0.596
	(2.313)	(2.349)	(1.605)	(1.634)	(1.600)	(1.637)	(1.609)	(1.642)
GDP per capita (Log)			1.139***	1.109***	1.148***	1.083***	1.137***	1.077***
			(0.289)	(0.271)	(0.286)	(0.267)	(0.298)	(0.277)
Trade Openness (Log)			0.277*	0.315**	0.282*	0.304**	0.281*	0.303**
			(0.159)	(0.141)	(0.164)	(0.149)	(0.162)	(0.148)
Onflation (Log)			-0.300	-0.276	-0.302	-0.270	-0.285	-0.262
			(0.210)	(0.206)	(0.207)	(0.198)	(0.214)	(0.200)
Aid (Log)			-0.134	-0.006	-0.128	-0.020	-0.153	-0.034
			(0.383)	(0.379)	(0.380)	(0.368)	(0.385)	(0.375)
Agriculture Value Added(Log)					0.031	-0.083	0.041	-0.078
					(0.126)	(0.187)	(0.128)	(0.185)
Corruption (0: Bad 6:Good)							0.023	0.013
							(0.027)	(0.025)
Observations	360	360	360	360	360	360	360	360
Countries	25	25	25	25	25	25	25	25
F Stat (first stage): equation (13)		6.13		6.45		6.36		6.62
F Stat (first stage): equation (14)		10.87		11.36		11.36		11.73

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_8
The Conditional revenue curse: Dropping countries with no (zero) rent over the period

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.009***	-0.027***	-0.008***	-0.030***	-0.008***	-0.030***	-0.008***	-0.029***
	(0.003)	(0.008)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)	(0.007)
Resource windfall × $Prog_1$	0.155**	0.259**	0.124**	0.299***	0.130**	0.307***	0.129**	0.289***
	(0.067)	(0.113)	(0.055)	(0.111)	(0.054)	(0.109)	(0.056)	(0.109)
Prog˙1	-0.023	-0.066	-0.038	-0.094	-0.035	-0.091	-0.111	-0.161
	(1.623)	(1.638)	(1.291)	(1.282)	(1.282)	(1.276)	(1.282)	(1.276)
GDP per capita (Log)			0.925***	0.919***	0.981***	0.951***	0.991***	0.961***
			(0.137)	(0.138)	(0.156)	(0.153)	(0.152)	(0.150)
Trade Openness (Log)			0.252**	0.266**	0.255**	0.268**	0.245**	0.258**
			(0.121)	(0.114)	(0.121)	(0.114)	(0.119)	(0.113)
Inflation (Log)			-0.194	-0.195	-0.197	-0.197	-0.177	-0.180
			(0.140)	(0.137)	(0.138)	(0.135)	(0.141)	(0.138)
Aid (Log)			-0.089	-0.018	-0.057	0.001	-0.073	-0.014
			(0.414)	(0.402)	(0.417)	(0.404)	(0.396)	(0.385)
Agriculture Value Added (Log)					0.106	0.062	0.116	0.071
					(0.085)	(0.094)	(0.086)	(0.093)
Corruption (0:Bad 6:Good)							0.040**	0.036*
							(0.019)	(0.019)
Observations	814	814	814	814	814	814	814	814
Countries	54	54	54	54	54	54	54	54
F Stat (first stage): equation (13)		33.07		33.20		35.49		35.69
F Stat (first stage): equation (14)		67.35		65.42		72.78		71.85

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. The countries dropped are: Panama, Mali and Paraguay.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_9
The Conditional revenue curse: Dropping Oman and Iran

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.007**	-0.026***	-0.007***	-0.031***	-0.007***	-0.031***	-0.006**	-0.030***
	(0.003)	(0.008)	(0.003)	(0.007)	(0.003)	(0.007)	(0.003)	(0.007)
Resource windfall × Prog1	0.125**	0.269**	0.115*	0.315***	0.117**	0.316***	0.116*	0.302***
	(0.063)	(0.112)	(0.060)	(0.112)	(0.058)	(0.111)	(0.059)	(0.110)
Prog˙1	-0.119	-0.139	-0.279	-0.318	-0.288	-0.319	-0.327	-0.354
	(1.745)	(1.769)	(1.300)	(1.305)	(1.293)	(1.305)	(1.302)	(1.312)
GDP per capita (Log)			0.946***	0.943***	0.973***	0.946***	0.982***	0.954***
			(0.138)	(0.140)	(0.153)	(0.152)	(0.150)	(0.149)
Trade Openness(Log)			0.332***	0.343***	0.334***	0.344***	0.326***	0.336***
			(0.106)	(0.099)	(0.106)	(0.099)	(0.105)	(0.099)
Inflation (Log)			-0.212	-0.212	-0.214	-0.212	-0.198	-0.198
			(0.142)	(0.139)	(0.141)	(0.138)	(0.143)	(0.140)
Aid (Log)			-0.171	-0.089	-0.155	-0.087	-0.170	-0.102
			(0.393)	(0.385)	(0.394)	(0.383)	(0.379)	(0.370)
Agriculture Value Added (Log)					0.054	0.006	0.062	0.015
					(0.083)	(0.090)	(0.083)	(0.089)
Corruption (0:Bad 6:Good)							0.032*	0.028
							(0.018)	(0.018)
Observations	831	831	831	831	831	831	831	831
Countries	55	55	55	55	55	55	55	55
F Stat (first stage): equation (13)		36.27		36.36		39.23		39.35
F Stat (first stage): equation (14)		64.04		62.07		68.99		68.30

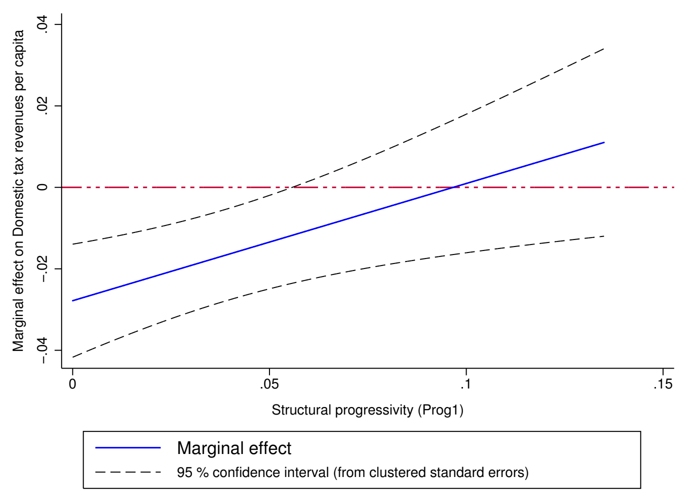
Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_{10}
The Conditional revenue curse: Dynamic panel specification

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Lagged dependent	0.771***	0.771***	0.686***	0.686***	0.686***	0.686***	0.682***	0.682***
	(0.030)	(0.030)	(0.035)	(0.035)	(0.034)	(0.034)	(0.034)	(0.034)
Resource windfall	-0.008***	-0.015***	-0.008***	-0.017***	-0.008***	-0.017***	-0.008***	-0.016***
	(0.002)	(0.006)	(0.002)	(0.005)	(0.002)	(0.005)	(0.002)	(0.005)
Resource windfall× $Prog_1$	0.152***	0.239**	0.141***	0.249***	0.141***	0.249***	0.141***	0.244***
	(0.058)	(0.094)	(0.050)	(0.086)	(0.051)	(0.085)	(0.050)	(0.084)
Prog˙1	1.263***	1.270***	1.101**	1.093**	1.100**	1.093**	1.068**	1.063**
	(0.368)	(0.375)	(0.519)	(0.526)	(0.520)	(0.525)	(0.520)	(0.524)
GDP per capita (Log)			0.302***	0.299***	0.308***	0.297***	0.315***	0.304***
			(0.050)	(0.051)	(0.055)	(0.056)	(0.057)	(0.057)
Trade Openness (Log)			0.115**	0.122**	0.115**	0.122**	0.114**	0.120**
			(0.054)	(0.053)	(0.054)	(0.052)	(0.053)	(0.052)
Inlation (Log)			-0.092	-0.091	-0.092	-0.091	-0.087	-0.086
			(0.091)	(0.090)	(0.091)	(0.090)	(0.090)	(0.089)
Aid (Log)			-0.098	-0.077	-0.095	-0.078	-0.102	-0.084
			(0.198)	(0.194)	(0.203)	(0.200)	(0.200)	(0.197)
Agriculture Value Added (Log)					0.010	-0.004	0.014	-.0003
					(0.040)	(0.042)	(0.040)	(0.042)
Corruption (0: Bad 6: Good)							0.013	0.011
							(0.009)	(0.009)
Observations	846	846	846	846	846	846	846	846
Countries	57	57	57	57	57	57	57	57
F Stat (first stage): equation (13)		32.48		32.63		34.97		35.02
F Stat (first stage): equation (14)		64.70		63.84		70.13		68.63

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Figure A_2
Marginal effect of resource windfalls on Domestic tax per capita as the level of structural progressivity increases



Notes: This figure shows the marginal effect of resource windfalls on domestic tax revenues per capita from equation (12). The marginal effect is computed for each increment of 0.001 in structural progressivity using estimation (8) from Table A_{13}. I compute the confidence interval using the standard error of the marginal effect which is: $\sqrt{var(\theta_1) + prog^2 * var(\theta_2) + 2 * prog * cov(\theta_1, \theta_2)}$.

Table A_{11}
Market power

Natural resource & Top exporters	
Coal	Over the period (2003-2005), three countries have the highest shares of global exports. Australia (31%) Indonesia (15.82%) and China (9.95%) Source: `http://www.sourcewatch.org/index.php/Coal_exports`
Copper	Chile is the greatest exporter of copper in the world. Over the period (1999-2005), Chile's share of copper exports is 39.63% .
Phosphates	Morocco is the largest exporter of phosphastes in the world and accounts for 30% of global exports. Source: `http://www.reuters.com/article/2010/09/02/fertiliser-japan-idUKTOE67N04020100902`
Tin	Indonesia is the leading exporter of Tin. Source: `http://www.bloomberg.com/news/articles/2015-04-22/world-s-biggest-tin-exporter-cuts-output-after-price-rout`

Note: The table is focused on natural resources for which the countries in the sample may have a market power.

Table A_{12}
The Conditional revenue curse : Other resource rents

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.005	-0.027	-0.010	-0.036*	-0.010	-0.036*	-0.008	-0.033*
	(0.010)	(0.020)	(0.009)	(0.019)	(0.009)	(0.019)	(0.009)	(0.020)
Resource windfall × $Prog_1$	0.097	0.521	0.127	0.581*	0.147	0.590*	0.116	0.532
	(0.157)	(0.386)	(0.160)	(0.331)	(0.159)	(0.331)	(0.167)	(0.343)
Prog˙1	0.812	0.840	0.202	0.222	0.207	0.225	-0.011	0.013
	(1.736)	(1.719)	(1.448)	(1.438)	(1.443)	(1.434)	(1.422)	(1.416)
GDP per capita (Log)			0.917***	0.920***	0.954***	0.960***	0.974***	0.979***
			(0.128)	(0.129)	(0.146)	(0.147)	(0.141)	(0.142)
Trade Openness (Log)			0.266**	0.268**	0.268**	0.270**	0.258**	0.261**
			(0.125)	(0.125)	(0.124)	(0.124)	(0.122)	(0.122)
Inflation (Log)			-0.067	-0.062	-0.071	-0.067	-0.047	-0.044
			(0.069)	(0.070)	(0.069)	(0.070)	(0.078)	(0.079)
Aid (Log)			-0.454	-0.444	-0.429	-0.416	-0.467	-0.453
			(0.474)	(0.477)	(0.481)	(0.485)	(0.446)	(0.449)
Agriculture Value Added (Log)					0.074	0.078	0.087	0.090
					(0.089)	(0.089)	(0.089)	(0.089)
Corruption (0: Bad 6:Good)							0.047**	0.046**
							(0.019)	(0.019)
Observations	777	777	777	777	777	777	777	777
Countries	50	50	50	50	50	50	50	50
F Stat (first stage): equation (13)		35.80		34.94		34.44		34.84
F Stat (first stage): equation (14)		43.71		45.87		44.50		45.18

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. Resource windfall refers in this case to other natural resource windfall excluding oil. The instrument used is the country-specific price index growth of the other natural resources. Again, following the literature on the "resource curse" (Ross, 2001 ; Sala-i-Martin and Subramanian, 2003 ; Tsui, 2011) I distinguish oil rents from the other natural resource rents (See also Table A_{13}) . Unfortunately in the robustness check I lose 7 countries that do not have data on oil rents. The countries are: Gambia, Guyana, Niger, Madagascar, Mali, Malawi and Uganda. The same number of countries is used in the two tables. In another robustness check, I separate oil rent from other resource rents to test for a potential heterogenous effect of natural resources. Column (4) shows that at a level of structural progressivity of 0.05, 1 percentage point increase in other rent windfall generates a reduction in domestic tax revenues per capita by 0.7%. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_{13}
The Conditional revenue curse: Oil rent

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Oil windfall	-0.006*	-0.030***	-0.006**	-0.026***	-0.005*	-0.026***	-0.005*	-0.025***
	(0.003)	(0.010)	(0.003)	(0.006)	(0.003)	(0.006)	(0.003)	(0.006)
Oil windfall × $Prog_1$	0.118	0.127	0.119*	0.212**	0.118*	0.222**	0.112*	0.210**
	(0.095)	(0.097)	(0.068)	(0.099)	(0.069)	(0.104)	(0.068)	(0.106)
Prog˙1	0.848	0.803	0.236	0.203	0.239	0.210	0.020	0.003
	(1.759)	(1.785)	(1.459)	(1.455)	(1.457)	(1.453)	(1.435)	(1.437)
GDP per capita (Log)			0.912***	0.904***	0.948***	0.925***	0.970***	0.945***
			(0.128)	(0.130)	(0.146)	(0.148)	(0.142)	(0.143)
Trade Openness (Log)			0.269**	0.283**	0.271**	0.284**	0.261**	0.274**
			(0.124)	(0.118)	(0.123)	(0.118)	(0.121)	(0.115)
Inflation (Log)			-0.066	-0.068	-0.070	-0.070	-0.047	-0.048
			(0.068)	(0.067)	(0.068)	(0.066)	(0.078)	(0.075)
Aid (Log)			-0.461	-0.386	-0.438	-0.375	-0.475	-0.411
			(0.475)	(0.457)	(0.481)	(0.462)	(0.445)	(0.430)
Agriculture Value Added (Log)					0.070	0.040	0.084	0.054
					(0.089)	(0.098)	(0.090)	(0.097)
Corruption (0: Bad 6:Good)							0.048**	0.045**
							(0.019)	(0.018)
Observations	777	777	777	777	777	777	777	777
Countries	50	50	50	50	50	50	50	50
F Stat (first stage): equation (13)		10.68		10.83		11.14		11.13
F Stat (first stage): equation (14)		32.32		33.14		30.99		30.58

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. Resource windfall refers in this case to oil rent windfall. The instrument used is the country specific oil price index growth . Column (8) shows that at the maximum level of structural progressivity in the sample, 1 percentage point increase in oil rent windfall causes a reduction in domestic tax revenues per capita by 1.45%. The conditional effect in this case is higher than the one in the baseline result using all 14 natural resources (reduction by 1.21%) and it is consistent with the particularly detrimental effect of oil. Overall Table 11 and Table 12 suggest that progressive taxation may dampen the revenue curse. This result is depicted in Figure A_2 (Appendix B) showing a flatter curve of the marginal effect in the case of oil rent than in the baseline result (Figure 4). Table A_{12} and Table A_{13} together show that the type of natural resource rent does not seem to matter except for the fact that the outcome of progressive taxation may be less in the case of oil rents than in the case of other resource rents.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_{14}
The Conditional revenue curse: Excluding OPEC members

Dependent variable: Domestic tax per capita (Log)	OLS (1)	IV (2)	OLS (3)	IV (4)	OLS (5)	IV (6)	OLS (7)	IV (8)
Resource windfall	-0.009**	-0.025***	-0.008**	-0.027***	-0.008**	-0.027***	-0.008*	-0.026***
	(0.004)	(0.009)	(0.004)	(0.006)	(0.004)	(0.007)	(0.004)	(0.006)
Resource windfall × $Prog_1$	0.130**	0.249**	0.131*	0.298**	0.144**	0.315***	0.139**	0.301***
	(0.066)	(0.118)	(0.067)	(0.118)	(0.064)	(0.114)	(0.065)	(0.111)
Prog˙1	-0.539	-0.586	-0.538	-0.584	-0.589	-0.625	-0.622	-0.653
	(1.838)	(1.852)	(1.184)	(1.195)	(1.161)	(1.176)	(1.174)	(1.185)
GDP per capita (Log)			0.941***	0.937***	1.008***	0.993***	1.021***	1.005***
			(0.138)	(0.138)	(0.158)	(0.157)	(0.155)	(0.154)
Trade Openness (Log)			0.418***	0.416***	0.421***	0.419***	0.412***	0.411***
			(0.090)	(0.090)	(0.090)	(0.090)	(0.090)	(0.090)
Inflation (Log)			-0.192	-0.198	-0.196	-0.200	-0.182	-0.188
			(0.146)	(0.144)	(0.145)	(0.143)	(0.146)	(0.144)
Aid (Log)			-0.168	-0.105	-0.128	-0.072	-0.140	-0.085
			(0.395)	(0.390)	(0.398)	(0.393)	(0.388)	(0.385)
Agriculture Value Added (Log)					0.128	0.108	0.134	0.114
					(0.082)	(0.078)	(0.083)	(0.079)
Corruption (0: Bad 6:Good)							0.024	0.021
							(0.017)	(0.018)
Observations	765	765	765	765	765	765	765	765
Countries	52	52	52	52	52	52	52	52
F Stat (first stage): equation (13)		23.043		21.994		22.659		22.509
F Stat (first stage): equation (14)		39.374		37.213		39.869		39.306

Notes: All specifications include year dummies and the within estimator is used to eliminate country fixed effects. Clustered standard errors at country level in parentheses. These estimates exclude OPEC members in the sample: Algeria, Ecuador, Indonesia, Iran and Nigeria.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table A_{15}
Average level of structural progressivity

Country	$Prog_1$	$Prog_2$
Argentina	0.011871	0.0147779
Bahrain	0	0
Bangladesh	0.0020087	90.07e-06
Bolivia	0.0246074	0.0313945
Botswana	0.0201442	0.0240705
Cameroon	0.0435893	0.0501218
Congo Rep.of	0.0396989	0.0368522
Chile	0.00768	0.0096888
China	0.0069782	0.0088429
Costa Rica	0.0132486	0.0122779
Dominican Rep	0.0056501	0.0049128
Algeria	0.0613635	0.0612446
Ecuador	0.0063728	0.0067045
Egypt	0.0104927	0.0112837
El Salvador	0.0090466	0.0092273
Ethiopia	0.0216277	0.0308418
Gabon	0.0539698	0.0541778
Ghana	0.0371842	0.0338202
Gambia	0.0242184	0.0277125
Guatemala	0.0028875	0.0038915
Guyana	0.0627141	0.0888907
Haiti	0.0030792	0.0033245
Honduras	0.0005184	-10.58e-12
India	0.0030165	0.0003588
Indonesia	0.0237508	0.0248152
Iran	0.026385	0.0266588
Ivory Coast	0.0181821	0.0219129
Jamaica	0.0626497	0.0731689
Kenya	0.0811155	0.0666759
Morocco	0.0380368	0.0451587
Madagascar	0.0022594	0.0023257

Source: Andrew Young School World Tax Indicators (Volume 1). Average over 1981-2005 (Authors' calculation)

Table A_{15}
Average level of structural progressivity (ctd)

Country	$Prog_1$	$Prog_2$
Malawi	0.0163536	0.0185787
Malaysia	0.023684	0.0292171
Mali	0.0268613	0.026245
Mozambique	0.0152985	0.0207357
Niger	0.0023013	0.0021524
Nigeria	0.0236224	0.0212379
Oman	0	0
Pakistan	0.0038914	0.0021709
Papua New Guinea	0.0182544	0.0218736
Panama	0.0211205	0.0239066
Paraguay	0	0
Peru	0.0076439	0.0085928
Philippines	0.0295322	0.0318852
Senegal	0.0473125	0.0531587
South Africa	0.0562829	0.0659814
Sri Lanka	0.0158956	0.0176549
Syria	0.0135252	0.0102853
Tanzania	0.0217854	0.0218389
Thailand	0.0132811	0.0135176
Togo	0.0330261	0.044024
Trinidad and Tobago	0.0859563	0.0798458
Tunisia	0.0346408	0.038034
Uganda	0.0154877	0.0154107
Uruguay	0	0
Zambia	0.0498101	0.0577688
Zimbabwe	0.0377898	0.0468478

Source: Andrew Young School World Tax Indicators (Volume 1). Average over 1981-2005 (Authors' calculation)