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*Fahad Hassan Khan*

Arndt-Corden Department of Economics

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Arndt-Corden Department of Economics  
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# From Revenues to Democracy?

**Fahad Hassan Khan**

Arndt Corden Department of Economics  
Crawford School of Public Policy  
Australian National University

## Abstract

This paper contributes to the historical political economy literature, which considers the *fiscal imperatives* of the state to be amongst the driving forces behind the emergence of representative systems of government, by examining the impact on democracy of a government's reliance on alternative sources of revenue. 'Taxation' and 'natural resource rent extraction' are considered as alternative sources of revenue within a unified framework. I develop a simple game-theoretic model which postulates that an increase in tax revenues, or a decrease in natural resource rents, enhances democracy. The predictions of the model are empirically tested using a cross-national panel dataset, covering 132 countries over the time period 1990-2009. The evidence is in line with the theoretical model.

*JEL Codes:* B5, C1, C7, H2, O1

**Keywords:** Taxation, Natural Resource Rents, Democratisation

# From Revenues to Democracy?<sup>1</sup>

## 1 Introduction

Why have some countries arrived at mature and well-functioning democratic systems of government while others have not? How can democracy be nurtured in countries where it is absent or not well established? Even outside of academic research, this question is of considerable importance to policymakers, developmental agencies and donors, civil society and the masses at large. The nature of a political regime is not only a matter of fundamental human rights, but also potentially important in understanding economic outcomes (e.g. Barro 1996, Temple 1999, Rigobon and Rodrik 2005, Acemoglu and Robinson 2006a). Even a cursory look at countries around the world reveals that the richer countries are generally more democratic.

In order to identify factors that could foster better political institutions in countries currently lacking them, it is useful to study the historical evolution of successful democracies. One theory of democratisation, based on the ideas of Joseph Schumpeter, postulates fiscal imperatives as the driving force behind the modern nation state and the emergence of representative political institutions in the Western World (Schumpeter 1918, Herb 2003, Moore 2004, Besley and Persson 2013). This school of thought, labeled *fiscal sociology*, points to the historical fact that for the purpose of successfully generating revenues from their people, West European monarchs in the eighteenth and nineteenth centuries had to provide representation in return. Attempts at increasing taxation to meet growing military expenditure led to demands for representation which had to be incrementally fulfilled. Coercive power of the state has its limits, and efficient tax collection relies on a degree of voluntary compliance, especially in the context of weak administrative structures and little documentation of the economy.

Can such a process be replicated in the modern world? Does the necessity to effectively raise revenues force governments to democratize? There are many anecdotal examples which suggest that it does. To quote one such example, the former military dictator of Pakistan, General Musharraf, had to promise parliamentary elections within three years of usurping power through a coup, arguably due to fiscal constraints. These constraints resulted from international sanctions coupled with an inability to implement a tax documentation drive in the face of popular resistance. Even in China increases in

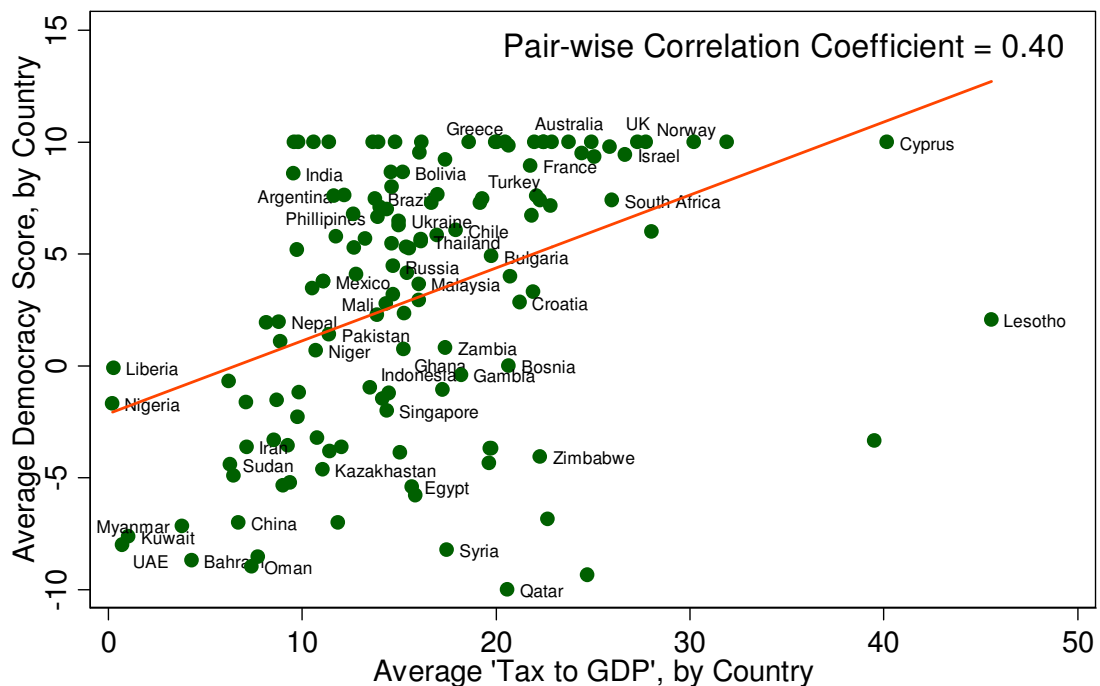
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<sup>1</sup> I wish to thank Professor Prema-chandra Athukorala and Dr Paul Burke for excellent supervision of my PhD dissertation, of which this paper is one of the core papers. Dr Shantayanan Devarajan and Professor Kunal Sen provided excellent comments as external examiners of the dissertation. The paper has also benefitted immensely from comments by Professor Guenther Schulze, Dr Jose Rodriguez Neto, Dr Ronald Stauber and participants of a PhD seminar at the Arndt-Corden Department of Economics.

taxation have caused unrest in the rural areas over the last three decades. The protests have not constituted a challenge to the political regime, but often led to changes in the way local government operates (Bernstein and Lu 2000). Figure 1 demonstrates that the bi-variate relationship between total tax collected by the government as a proportion of GDP and a subjective indicator of democracy is on average positive for a large number of countries over the period 1990-2009.<sup>2</sup>

Conversely it is argued that availability of opportunities for extracting natural resource rents in the so-called 'rentier states' has provided authoritarian regimes the fiscal space to persist over a long period of time (Collier 2007, Ross 1999 and 2001, Besley and Perrson 2010). Figure 2 depicts a negative relationship between total natural resource rents as a proportion of GDP and the subjective indicator of democracy. To the extent that these rents have weakened the dependence of the state on its people for taxation, there is little incentive for the population to organize for collective action to demand representation and accountability, and for the state to accede to the demands of its citizens. If these governments were fiscally constrained and forced to collect more taxes, would there be pressure for democratic change?

**Figure 1. 'Democracy Score' versus 'Tax to GDP', 1990-2009**

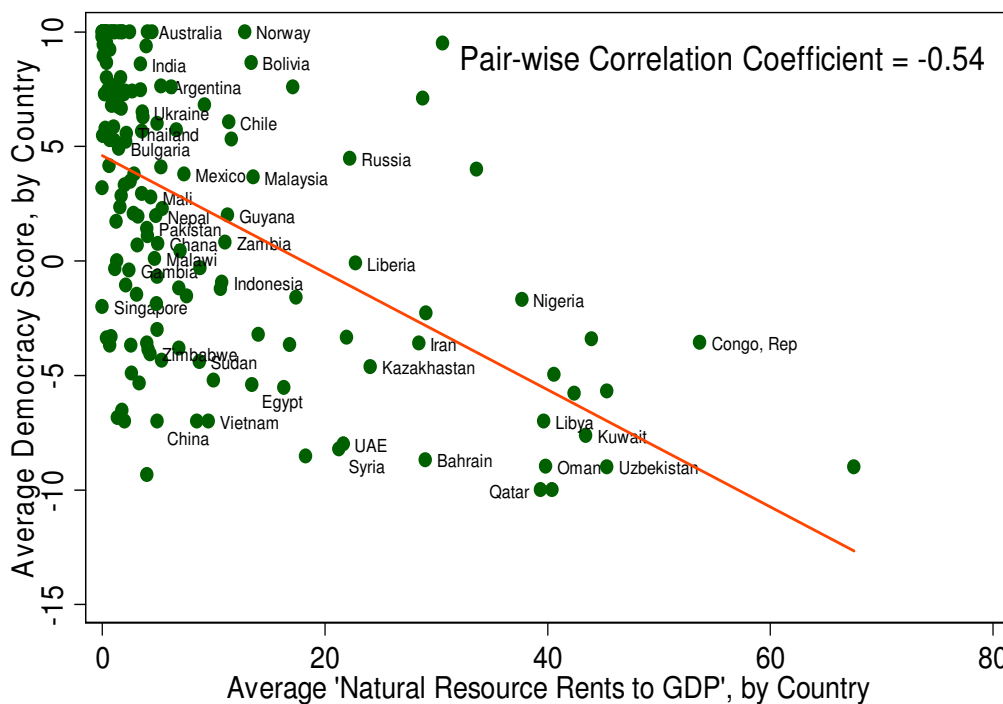


Source: Democracy score is measured by the Polity2 Variable provided by PolityIV project. The measure of Tax to GDP is from World Bank's World Development Indicators.

<sup>2</sup> The variables and the data sources are described in detail later in this paper.

There is a rich literature on the impact of tax collection on democracy that has drawn upon both historical and contemporary examples. However this issue has not been widely examined in a cross-national context, despite the availability of data for the relevant variables. A number of studies theoretically and empirically examine the effect of political regime on tax collection capacity (Cheibub 1998; Fauvelle-Aymar 1999; Kenny and Winer 2006; Bird et al 2008; Mahdavi 2008; Besley and Persson 2009, 2010, 2013). To my knowledge, the only cross-country study that investigates the converse question (Ross 2004) finds no impact of taxation on democracy. That study, however, does not control for fixed country characteristics, which is essential to test for the association of taxation with democracy within a given country (Acemoglu 2008 et al, Burke and Leigh 2010). Neither does it establish a causal relation by addressing the potential endogeneity of tax collection to democracy.

**Figure 2. 'Democracy Score' versus 'Natural Resource Rents to GDP', 1990-2009**



Source: Democracy score is measured by the Polity2 Variable provided by PolityIV project.  
The measure of Natural Resource Rents to GDP is from World Bank's World Development Indicators.

Moreover, this paper empirically examines the impact of taxation and natural resource rents on democracy within a unified framework. The negative effect of natural resource rents on democracy has been empirically documented (e.g. Barro 1999, Ross 2001, Collier and Hoeffler 2009). However these studies only look at oil wealth, and furthermore do not consider natural resource rents more broadly as a possible substitute for taxation

(Devarajan et al 2010). As a possible alternative to taxation, natural resource rents can be viewed as a non-tax source of revenue. Therefore, I believe it is informative to systematically compare the relative impacts of both kinds of revenue on the nature of the political regime.

This paper is arranged in nine sections. The next section discusses the analytical context, based on the review of existing literature, to provide the setting for the ensuing analysis. Section 3 presents the theoretical framework and lists the testable propositions that follow from the model. Section 4 presents the econometric model to be estimated. Section 5 describes the variable construction and the data sources, and Section 6 details the estimation strategy. The descriptive statistics are presented in Section 7 and the estimation results are discussed in Section 8. The final section summarizes the key finding and provides the policy implications that follow from the study.

## 2 Analytical Context

The neoclassical theory of the state advanced by Douglass North (1990 and 1991) and others (Bates 1985 and 1991, Grief 2004 and 2005) implies a *fiscal contract* between the state and the people. *Fiscal contract* is a natural extension of the concept of a *social contract* espoused by seventeenth century philosophers such as John Locke. Locke in his *Two Treatises of the Government* (1689) describes the emergence of a formal state from a state of nature for the purpose of protecting property rights and reducing disorder. The state acquires a monopoly over coercive power, but in exchange guarantees the *natural rights* of every individual. The state also acquires a monopoly on taxing its people, in exchange providing representation (North 1990) and an alignment of its policies with the preferences of the people (Bates and Lien 1985).

However, it is not apparent why rulers have to cede any absolute authority because of their need to collect taxes. A state strong enough to prevent disorder can also become a dictatorship (Djankov et al 2003). It should therefore be able to rely on coercion to extract revenues. The answer lies in the fact that collecting taxes is not costless. It requires monitoring, documentation and sanctioning, all of which cannot be carried out without complex administrative structures, thus making coercion costly (e.g. Timmons 2005; Besley and Perrson 2009, 2013a). Moreover, with the rise of capitalism assets acquired greater mobility, making tax collection even harder (Bates and Lien 1985). Capital rather than land possesses a greater taxable capacity, but it is also easier to hide or transfer. In this context, in order to extract taxes and maximise revenues, the state has to bargain with the people rather than use coercive power alone.

The 'tax bargain' between the state and its people is made possible by the emergence of representative assemblies such as the *parliament*. These institutions facilitate both the state and tax-payers in conducting the bargain (Bates and Lien 1985). The state

prefers to bargain with representatives of the people in order to negotiate a collectively binding agreement, rather than having to do so with multiple agents. The tax payers on the other hand also negotiate more effectively, and stand a greater chance to restrict the state's power and get their preferences represented, through collective action. The origin and historical evolution of representative assemblies is consistent with the above narrative (North and Weingast 1989, Ross 2004, Moore 2004). The rising cost of warfare, and the emergence of capitalism which shifted resources away from land, made monarchs in Europe more dependent on taxation. The traditional source of revenue from agriculture was not sufficient to pay for the increased military expenditure. This gave birth to the *Parliament*, the *Estates General*, the *Cortes* etc – in the beginning these were primarily assemblies where the monarchs and their people haggled over taxes.

The 'tax bargain' essentially implies that the state accepts rules limiting its exercise of arbitrary power, and gives importance to the policy preferences of the people. Thus institutions designed to constrain the coercive power of the state, such as representative assemblies, arise endogenously when the economic power – as a source of revenue – rests with the people (Grief 2005, 2008). On the other hand, when the state has access to adequate sources of other revenues, such as natural resource rents and unconditional foreign aid, it does not need to engage in any bargain (Brautigam and Knack 2004, Collier and Hoeffler 2009, Besley and Persson 2013). With lesser scrutiny and pressure from the taxpayers, the restraint on the coercive power of the state is weaker. These natural resource rents, which can be quite large, also enable the state to develop strong repressive mechanisms. It can employ the 'politics of patronage' to weaken political competition through bribery and repression (Ross 2001, Collier 2007). Even historically in the context of Western Europe where large natural resources were found, such as Spanish discovery of silver in Latin America in the sixteenth century, the representative assemblies did not acquire much significance (Drelichman and Voth 2008).

Therefore an empirical investigation of the impact of taxation or natural resource rents on the nature of the political regime should be viewed in terms of the revenue imperative of the state. The state could fulfil its revenue needs through either taxation or other non-tax sources of revenue that it might have access to, such as natural resource rents. This suggests considering both taxation and resource rents, which have opposing impacts on the arbitrary power of the state, in a combined framework. Such a framework would allow us to compare the relative significance of both kinds of revenue on the nature of the political regime. The empirical question would then be that, for a given level of natural resource rents, is increased reliance on taxation associated with democratisation? Next, a model of the 'tax bargain' is presented for formally predicting the effect of changes in taxation and natural resource rents on democracy.



### 3 Theoretical Model

The simple game theoretic model presented here is adapted from Bates and Lien (1985). Their paper only considers taxation as a source of revenue. I introduce the counterbalancing effect of non-tax sources of revenues, and an associated resource constraint into the framework. I assume that non-tax revenues comprise entirely of natural resource rents. Also, unlike the original much more sophisticated model which made a distinction between mobile and immobile factors of production, my analysis does not require two factors of production. Hence I consider only one factor of production in order to simplify the constrained optimization problem.

There are two rational agents, the government and the citizenry, who seek to simultaneously maximise utility. The government maximises utility by choosing the tax rate, the amount of non-tax revenues to extract and a policy position. Its utility is increasing in the tax rate and non-tax revenues but decreasing the farther its chosen policy position is from its most preferred. The chosen tax rate and the policy position affect the utility of the citizens. On the other side, the citizenry, who own the factor of production, optimize by making a production decision. Their utility is increasing in output (net of taxes and production costs). Their production determines the total taxes collected by the government and so affects its utility as well. The utility maximisation problem can be represented as follows,

**Government:**  $\text{Max } U^G [t f(x), N, - (V - V^+)^2]$

$(t, N, V)$

s.t  $t f(x) + N \leq K$

$U^C \geq \underline{U}^C$

**Citizenry:**  $\text{Max } U^C [(1-t) f(x) - w.x, - (V - V^-)^2]$

$(x)$

Where,

$V$  lies in  $[V^-, V^+]$

$t$  lies in  $[0,1]$

$U^G$ : Utility of Government

$U^C$ : Utility of Citizenry

$\underline{U}^C$ : Lower bound of Utility of Citizenry. It represents the minimum tolerable utility of the population, below which there would be a revolution or upheaval

$V$ : Government's chosen policy position

$V^+$ : Government's preferred policy position

$V^-$ : Citizenry's preferred policy position

$V - \bar{V}$ : The level of democracy. The closer the government's chosen policy position is to the preferred policy position of the citizenry (a smaller  $V - \bar{V}$ ), the greater the extent of democracy.

$t$ : Tax rate

$N$ : Non-tax revenues, which in this model are assumed to comprise entirely of natural resource rents.

$K$ : Upper bound of possible revenue.<sup>3</sup> It can be interpreted as the maximum amount of revenues that the state can (and aims to) collect, through a mixture of taxation and natural resource rent extraction.

$f(x)$ : output

$x$ : factor of production

$w$ : average cost of factor of production.

The solution to the problem is a Nash equilibrium in which the decision of both the government and citizenry is the best response of one to the other. The solution is derived in Appendix A, and it is shown that in equilibrium the inequality constraints are binding, i.e.

$$U^C = \underline{U}^C, \text{ and}$$

$$t f(x) + N = K$$

In other words, the government chooses  $t$ ,  $N$  and  $V$  such that the utility of the citizens is at the minimum tolerable level below which a revolution or upheaval would occur (implied by the first constraint), and collects as much revenue as it possibly can (implied by the second constraint). Moreover the second constraint also implies that tax and natural resource rents are alternative sources of revenue – higher natural resource rents reduce the taxation required to reach revenue  $K$ . It is then argued in Appendix A that democracy ( $V - \bar{V}$ ) can be expressed as an explicit function of  $t$  and  $N$ . Subsequently, through an exercise in comparative statics, I show that:

$$d(V - \bar{V})/f(x^*)dt = - (U^C)_1 / 2 (U^C)_2 (V - \bar{V}) < 0, \text{ and} \quad (1)$$

$$d(V - \bar{V})/dN = (U^C)_1 / 2 (U^C)_2 (V - \bar{V}) > 0 \quad (2)$$

Additionally, by assuming a specific functional form for the utility of the government and citizens, I derive the optimum  $t$ ,  $V$ ,  $x$  and  $N$ . This confirms that these choice variables lie in the expected range (i.e.  $0 < t < 1$ ,  $\bar{V} < V < V^+$ ,  $x > 0$ ,  $N < K$ ).

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<sup>3</sup> This represents an exogenous resource constraint, and implies that revenues cannot exceed a certain finite limit. A similar resource constraint is used in the theoretical model of patronage in Collier and Hoeffler (2009).

Therefore, the model postulates that democracy can be expressed as a function of taxes and non-tax revenues. The comparative statics results (Equations 1 and 2) are the testable propositions that follow from the model. Equation (1) predicts that an increase in tax revenue will lead to the alignment of the government's chosen policy position with the preferred policy position of the citizenry (i.e. a smaller  $V - V^*$ ), or in other words towards more democratisation. Equation (2) predicts that a reduction in non-tax revenues (natural resource rents) also enhances democracy. Moreover, the change in the level of democracy resulting from an increase in tax revenues will be equal in magnitude to the change due to a similar reduction in natural resource rents. The estimation equation is presented in the next section.<sup>4</sup>

## 4 Estimation Model

Based on the theoretical framework, the estimation equation is specified as follows:

$$\text{Democracy}_{i,t} = \alpha_1 + \alpha_2(\text{Tax})_{i,t} + \alpha_3(\text{NRRents})_{i,t} + \alpha_4 \log(\text{YPC})_{i,t} + \alpha_5(\text{Trade})_{i,t} + \alpha_6(\text{Urbpop})_{i,t} + \alpha_7(\text{Aid})_{i,t} + \beta_t(\text{Debt})_{i,t} + \mu_i + \varepsilon_{i,t} \quad (3)$$

Where,

Subscript 'i,t': country 'i' at time 't'

Democracy: The degree/strength of democracy.

Tax: The percentage of total tax to GDP. NRRents: The percentage of total natural resource rents to GDP. YPC: GDP per capita expressed in Purchasing Power Parity terms in constant year 2005 international dollars.

Trade: The percentage of the sum of exports and imports to GDP.

Urbpop: The percentage of total population living in urban areas as defined by national statistical offices.

Aid: The percentage of official aid and development assistance to GDP.

Debt: The percentage of external public (and publically guaranteed) debt to GDP.

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<sup>4</sup> Before moving on to the next section, I acknowledge that the theoretical model presented above is essentially static. In reality, the choice of both taxation and natural resource rents are likely to be persistent i.e. a function of previous taxation and levels of natural resource rents. Modelling these dynamic processes in a game-theoretic context goes beyond the scope of this paper.

$\mu_i$ : Country-specific and time-invariant factors that might be correlated with both democracy and the explanatory set. These factors include geography, historical experience, legal origin, ethno-linguistic fragmentation and culture

$\beta_t$ : A set of dummies for each year except for the first (1991-2009) to control for time varying common shocks to democracy across all countries in the sample. These reflect global trends.

$\epsilon$ : the idiosyncratic error term, capturing all other determinants of democracy.

*Tax* and *NRRents* are the main explanatory variables based on the theoretical model, and the expected sign of the estimated coefficients are positive and negative respectively, as predicted by the comparative static results (Equations 1 and 2). Furthermore the theoretical model predicts that the magnitudes of the two coefficients will be equal. However, empirically we should expect the estimated coefficient of *Natural Resource Rents* to be smaller, because in reality not all the natural resource rents available in an economy necessarily accrue to the government. Then the ratio of the coefficient of *Natural Resource Rents* to the coefficient of *Tax* gives an estimate for the proportion of rents going to the government if the theoretical model is assumed to be correct. If the coefficient of *Natural Resource Rents* is a fraction  $r$  of *Tax*, this implies that  $100*r$  percent of the rents are appropriated by the government.

The other variables included in Equation (3) are control variables to address possible omitted variable bias. *Aid* and *Debt* represent two other sources of non-tax revenue which reduce the dependence of governments on taxation. Aid and development assistance from donor agencies and advanced countries (*Aid*) is especially relevant for third world countries. The other source of non-tax revenue is external public debt (*Debt*). Even though this cannot be considered a source of rent as it has to be repaid eventually, it could possibly provide governments the fiscal space needed to reduce their dependence on taxes. *Aid* and *Debt* are only included as control variables, rather than as main explanatory variables in the model,<sup>5</sup> because these are available only for a significantly reduced number of countries.<sup>6</sup>

*YPC*, *trade* and *urbpop* are also covariates that could plausibly be correlated with tax-revenue while also being possible determinants of democracy. A vast literature that seeks to explain tax performance across countries identifies the so called 'tax handles' (Tanzi 1989 & 1992, Leuthold 1992, Teera and Hudson 2004, Auriol and Warlters 2005, Mahdevi 2008, etc). 'Tax handles' are the factors that determine the tax base of a country from which revenue can be generated. In this literature a large variety of factors are investigated in

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<sup>5</sup> As sources of non-tax revenue similar to natural resource rents.

<sup>6</sup> Furthermore strictly speaking, *Debt* is a stock unlike the other sources of revenue which are a flow, and this might create an inconsistency in the model specification. However as noted above *Debt* is only included as a control variable, and the empirical specification including *Debt* is only meant as a robustness check. Therefore I do not investigate this issue more thoroughly in this paper.

order to assess their impact on tax performance, but all studies consider per capita income, the level of international trade and the degree of urbanisation amongst the primary tax handles. At the same time these variables are also likely to be associated with democracy. Income per capita influences democracy – based on the ‘modernization hypothesis’ which conjectures that political development accompanies economic development (Acemoglu et al 2008, Moral-Benito and Bartolucci 2013, Benhabib et al 2013). Similarly, international trade has been investigated as an influence on democracy (Rigobon and Rodrik 2005). Lastly a higher level of urbanisation is associated with economic and political development as well.

## 5 Variables Description and Data Sources

The empirical investigation is carried out using a panel dataset covering 132 countries over the period 1990-2009. It is an unbalanced panel with data for several variables missing for some years. Data for the main explanatory variable, tax revenue, are not available before 1990 for most countries. The relatively short time coverage fits in well with the purpose of this paper, which is to investigate whether the historical process generating democracy in the Western world could be replicated in the contemporary period.

The dependent variable in Equation (3) is measured by an indicator called *Polity2* developed by Marshall et al (2010) who run the *Polity IV* project. This indicator measures the degree to which democracy is present in a country. It is based on a conceptual scheme which measures the characteristics of different regimes. The data release used for this paper contains data from 1800 to 2009.

The construction of *Polity2* is based on two different variables, *democracy* and *autocracy*. These variables measure the degree of democracy and autocracy in a country on separate eleven point scales of 0 to 10 and 0 to -10 respectively. The variables *democracy* and *authority* can be combined into a composite *polity* variable which ranges from -10 (absolute autocracy) to +10 (perfect democracy). A modified variable *Polity2* provides a score on the same scale for periods where there was transition, interruption or anarchy. This is the dependent variable that is used in my regressions.

The conceptual scheme underlying these variables assigns a score based on distinct elements or characteristics of the regime, which are then combined. These broadly translate into the presence of institutions that allow citizens to express preferences about leaders and policies, the existence of institutionalized constraints on the power of executive, and the degree of opportunity provided to every citizen to participate in the political process. The score based on these elements can be interpreted as essentially measuring the existence of truly representative institutions (representative in the sense that they are accessible to the entire citizenry) that can check the power of the executive and influence its policy preferences.

As a robustness check, I also use a measure for the dependent variable from a different source. This variable is *Voice and Accountability* from the *World Governance Indicators* released by the World Bank. The data release I use contains data running from 1996 to 2009 with a few missing years in between. This variable is one of the six dimensions of institutional quality defined by the authors of these indicators (Kaufmann, Kraay and Mastruzzi 2010). *Voice and Accountability* measures not just “the extent to which a country’s citizens are able to participate in selecting their government”, but also civil liberties such as media freedom. In this sense it is broader than *Polity2*.

The methodology for the construction of *Voice* is also different from *Polity2*. It involves aggregation and standardization of data from 31 different sources. The distribution of the resulting variable is standard normal with a range from -2.5 to 2.5. I rescale the variable so that it ranges from 0 to 100. The sources include “surveys of individuals and domestic firms, perceptions of country analysts at multilateral development, nongovernmental organizations and commercial business information providers”. Crucially the *Polity IV Project* is not one of the underlying sources. This means that *Polity2* and *Voice and Accountability* are independent, and thus using both allows a suitable check on the robustness of results.

In addition, one of the potential drawbacks of the *Polity2* variable is that it is censored at 10 for most democratic and -10 for most autocratic countries. Moreover the variable follows a discrete scale.<sup>7</sup> On the other hand, whereas *Voice and Accountability* is constructed as a standard normal variable, none of the observations are bounded at the top or the bottom of the scale (Table B.1). Moreover, this variable is continuous rather than discrete. The use of *Voice and Accountability* as an alternate dependent variable allows me to check whether the results are sensitive to the bounded and discrete nature of the *Polity2* variables.

The first main explanatory variable (*Tax*) measures the central governments’ tax collection. I use *Total Tax to GDP percentage* from *World Development Indicators* (WDI) provided by the World Bank. This data is based on the IMF’s *Government Finance Statistics*. Total tax includes taxes on income, profits and capital gains; taxes on goods and services; taxes on international trade;<sup>8</sup> and a residual called ‘other taxes’ which comprises of taxes not allocable to the previous three categories such as property taxes, employer payroll taxes, penalties for non-payment of taxes etc. Total tax does not include most social security contributions and other sources of government revenues such as fines, fees, rents, profits of

<sup>7</sup> For this reason, the use of Least Square Dummy Variable (LSDV) estimation used in this paper might be problematic.

<sup>8</sup> It could be argued that taxes on international trade should be removed as these are administratively less costly to collect compared to other kinds of taxes. However, disaggregated tax data is available only for a reduced number of countries. Moreover, the theoretical model on which Equation (2.3) is based only makes a distinction between revenue collected from the economic activity of citizens and those from other sources. In this context taxes on international trade are also collected from the economic activity of citizens, even if these are easier to collect.

public enterprises etc. It also does not include grants. I am interested in total tax rather than total revenue, because it is generated solely from the economic activity of the citizens.

The other main explanatory variable is a measure of rents from natural resources. World Bank's *WDI* provides a relevant variable called exactly that. *Total natural resource rents* are the sum of rents from oil, natural gas, coal, mineral deposits and forests. Rents are defined as the difference between the world market value of these resources and their total cost of production. The calculation of this data is done by the World Bank staff using the *Comtrade* database maintained by the United Nations Statistics Division. It should be noted that this variable is a measure of the total rents available in a country, not all of which go to the government.

The data source for all the other variables included as covariates in Equation 3 (*YPC*, *Trade*, *Urbpop*, *Aid* and *Debt*) is also the World Bank's *WDI*.

## 6 Estimation Methodology

The equation is estimated using three different regression techniques – pooled OLS, fixed effects and system Generalized Method of Moments (system GMM). Fixed effects is superior to pooled OLS, while system GMM addresses additional endogeneity issues compared to fixed effects. A comparison of the estimation results reveals different perspectives into the relationship of democracy with Tax and NRRents, based on the differing assumptions underlying each technique.

The equation is first estimated through pooled OLS — this technique estimates Equation (3) excluding the country-specific fixed effects ( $\mu_i$ ). However, ignoring country-specific fixed effects could cause omitted variable bias, because the  $\mu_i$  are country-specific and time-invariant factors that might be correlated with both democracy and the explanatory set. These factors include geography, historical experience, legal origin, ethno-linguistic fragmentation and culture, which the literature considers to be important determinants of economic and political development. Thus the estimated coefficients from Pooled OLS regressions represent only the statistical association between the explanatory variables and the dependent variable across countries (over the time period under study), indicating for example whether countries with higher taxation are also more democratic. The estimated coefficients from pooled OLS do not capture the within-country relationship, for example whether a given country on average becomes more democratic as it collects more taxes (Acemoglu et al 2008). Thus the  $\mu_i$  are subsequently included in the equation, which is then re-estimated using the fixed effects regression technique. This technique involves estimating the equation after demeaning it to purge the  $\mu_i$ .

While the fixed effects estimation technique mitigates omitted variable bias by removing the influence of long run determinants of both revenues and democracy, it does

not address another source of endogeneity — potential reverse causality from the dependent variable to the explanatory variables. Therefore we still need to be cautious about inferring causality based on the estimated coefficients from fixed effects regressions (Acemoglu et al 2008). Strictly speaking, in order to establish a causal impact the explanatory variables need to be statistically shown as exogenous (uncorrelated with the error term).

Moreover, there is also reason to believe that democracy is a persistent variable, with the present nature of the political regime dictating its future quality (Acemoglu et al 2005b, 2006a, 2006c, 2008). Hence there is a rationale for including lagged democracy as an explanatory variable in the econometric equation. Then the fixed effects regression technique also does not consistently estimate an equation containing the lagged dependent variable, because the lagged dependent variable is correlated with the error term after the equation is demeaned to purge the country-specific fixed effects.

Because of the concerns discussed above I subsequently re-estimate the equation after also including lagged democracy in the specification through the system Generalized Method of Moments (GMM) regression technique developed by Arellano and Bover (1995) and Blundell and Bond (1998).<sup>9</sup> The modified equation to be estimated is as follows,

$$\text{Democracy}_{i,t} = \alpha_1 + \alpha_2 \text{Democracy}_{i,t-1} + \alpha_3 (\text{Tax})_{i,t-1} + \alpha_4 (\text{NRRents})_{i,t-1} + \alpha_5 \log(\text{YPC})_{i,t-1} + \beta_t + \mu_i + \varepsilon_{i,t} \quad (4)$$

The explanatory variables now enter the equation with a lag, so that I am in effect estimating the impact of *Tax* and *NRRents* on the change in democracy from the current to the next period. Neither does the equation include the complete set of control variables, the reason for which will be explained shortly.

The system GMM estimation procedure involves differencing the equation through either subtracting the previous observations of the variables, or alternatively subtracting from it the average of all future available observations of the variables. The second method of differencing, known as ‘forward orthogonal deviations’, is preferable when dealing with an unbalanced panel (Roodman 2009a). Then the differenced  $\text{Democracy}_{i,t-1}$ , can be instrumented by  $\text{Democracy}_{i,t-2}$  (and previous lags) as these are uncorrelated with the differenced error term. The difference GMM technique uses this set of instruments only. However, lagged levels of the variables are weak instruments for the first differences if the variable is persistent (Bond et al 2001). The system GMM technique derives additional moment conditions by instrumenting  $\text{Democracy}_{i,t-1}$  in the original levels equation by its contemporaneous and lagged first differences, as these are uncorrelated with the level of the error term.

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<sup>9</sup> System GMM augments the difference GMM technique suggested by Arellano and Bond (1991)



System GMM estimation has an important advantage in addition to allowing consistent estimation of an equation that controls for the lagged dependent variable.<sup>10</sup> It allows the explanatory variables to be either endogenous or weakly exogenous (predetermined), and thus deals with the problem of likely reverse causality from taxation to democracy establishing a causal impact. In order to estimate the model, I impose the restriction that the explanatory variables *Tax*, *NRRents* and per capita income are predetermined. This means that they can be correlated with the past error terms as long as they are not correlated with the current error term. In other words the exclusion restriction is that for a given predetermined variable ( $x$ ),  $E(x_{i,t}, \varepsilon_{i,s}) = 0$  for  $s \geq t$ , but  $E(x_{i,t}, \varepsilon_{i,s}) \neq 0$  for  $s < t$ . Because our explanatory variables are specified in the equation with a lag, this effectively means that they are endogenous. So for example  $Tax_{i,t-1}$  can be correlated with  $\varepsilon_{i,t-1}$ . The predetermined variables are then instrumented in the same way as the lagged dependent variable. The System GMM estimation technique provides us with a set of internal instruments, rather than having to look for external instruments which are highly correlated with tax collection, but do not impact democracy through any other channel — this would be a really difficult task, and the validity of such an instrument can always be argued against.

For estimation of (4) through system GMM I take observations occurring every second year from 1991-2009 as this technique works best for small  $T$  (time interval) and large  $N$  (countries) (Roodman 2009a, Jayasuriya and Burke 2013). I also restrict the number of lags used for instrumenting the right-hand side variables to one. This is because a large instrument set relative to the number of observations causes an over-fitting bias for the estimates (Roodman 2009b). Increasing the number of lags used to instrument the right-hand side variables beyond one does not substantially change the estimated coefficients while improving the efficiency in terms of standard errors and diagnostics.<sup>11</sup>

It is for the same reason (to avoid instrument proliferation), that the complete set of control variables is not included in the specification. In any case, because system GMM provides consistent estimates for the coefficients even when the explanatory variables are correlated with the error term, we do not need to worry about omitted variables. A standard Sargan or Hansen test of over-identifying restrictions allows us to check for the validity of the instrument set; the instrument set is exogenous if it is not correlated with the error term. Thus an inappropriate exclusion of the control variables would lead to the rejection of the null hypothesis (under the test of over-identifying restrictions) that the instrument set is valid.

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<sup>10</sup> System GMM is primarily employed in the literature to consistently estimate an equation containing the lagged dependent variable (Bond et al 2001).

<sup>11</sup> Moreover, using the minimum possible lag length allows the least reduction in the number of observations available for estimation given the availability of tax data over relatively short time duration.

## 7 Descriptive Statistics

Before presenting the regression results I report (in Table B.1 of Appendix B) the descriptive statistics, including the means, standard deviations, minimums, maximums, as well as the number of observations and countries, for all the variables in the econometric model. More interesting are the statistics in Tables (1) and (2). These tables show the mean of Democracy, *Tax* and *NRREnts* for countries grouped by the *Polity2* quartiles (Table 1) and the *Voice* quartiles (Table 2). The mean of the proportion of tax to GDP progressively rises from around twelve to over twenty from the bottom to the top quartile of both *Polity2* and *Voice*. On the other hand, the mean of the proportion of natural resource rents to GDP falls from around fourteen for the bottom quartile to two for the top quartile. The means of *Tax* and *NRREnts* for each *Polity2* quartile are roughly similar to the corresponding *Voice* quartile. These tables present initial yet clear-cut evidence in favor of the hypothesis of a positive linear relation between democracy and *Tax*, and an inverse linear relation between democracy and *NRREnts*.

**Table 1. Means by Polity2 Quartiles**

Variable	1 <sup>st</sup> Quartile (Polity2 < -1)	2 <sup>nd</sup> Quartile (-1<Polity2<7)	3 <sup>rd</sup> Quartile (7<Polity2<10)	4 <sup>th</sup> Quartile (Polity2=10)
Polity2	-5.83 (2.36)	3.70 (2.37)	8.06 (0.72)	10 (0.00)
Tax	12.24 (7.11)	14.02 (7.17)	16.45 (7.05)	20.81 (7.12)
NRREnts	14.75 (16.52)	9.62 (11.70)	4.01 (6.07)	2.93 (8.15)
Countries	46	49	56	34

Note: Standard deviation are reported in parenthesis

**Table 2. Means by Voice Quartiles**

Variable	1 <sup>st</sup> Quartile (Voice < 39.39)	2 <sup>nd</sup> Quartile (39.39<Voice<52.42)	3 <sup>rd</sup> Quartile (52.42<Voice<70.71)	4 <sup>th</sup> Quartile (Voice> 70.71)
Voice	28.92 (7.53)	45.80 (3.80)	62.44 (5.67)	76.88 (3.92)
Tax	12.39 (6.54)	15.28 (7.45)	18.73 (6.95)	21.48 (6.44)
NRREnts	13.90 (15.86)	6.65 (11.58)	3.85 (9.19)	1.57 (3.51)
Countries	58	57	60	37

Note: Standard deviation are reported in parenthesis

Finally, the pair-wise partial correlation reported in Appendix Table B.2 lend further credence to my hypothesis. Even though from different sources, both measures of democracy (*Polity2* and *Voice*) are highly correlated with each other (the correlation coefficient is 0.8). Moreover, both the measures display a clear positive correlation with *Tax* and an equally clear negative correlation with natural resource rents.

## 8 Estimation Results

### 8.1 Estimation Results for *Polity2*

Table 3 reports the pooled OLS and Table 4 reports the fixed effects regression results. In both these tables the first two columns show results from a regression of the dependent variable on each of the main explanatory variables separately. In Column (3), both the explanatory variables are included together. In Column (4), the first set of control variables — *L(YPC)*, *Trade* and *Urbpop* — are then added. Finally Column (5) also includes *Aid* and *Debt* — this is done last because the sample of countries is curtailed a great deal, which is why this is my least preferred specification. It is only reported as a comparison to check for the robustness of estimated coefficients. Columns (3) and (4) are the preferred specifications.

In the regressions reported in Table 3 both *Tax* and *NRREnts* are highly significant (at the one percent level) in explaining the *Polity2* score across countries over this time period — countries that tax more, and sustain themselves on smaller natural resource rents as a percentage of GDP, are more democratic. The estimated coefficients of both the variables in Column (3) confirm the prediction of the model — these are statistically significant (at the one percent level) with opposite signs. The null hypothesis that the magnitudes of the coefficients are exactly the same (as predicted by the theoretical model) cannot be rejected at any reasonable level of significance based on the F-test for equality of the coefficients. The coefficient of *Tax* indicates that a percentage point increase in *Tax* is on average associated with a 1.1 percentage point ( $=0.21/20*100$ ) higher *Polity2* score.<sup>12</sup> To put it differently, a one standard deviation increase in *Tax* is associated with a 0.25 of a standard deviation improvement in the *Polity2* score.<sup>13</sup> By contrast a percentage point rise in *NRREnts* is on average associated with 0.9 of a percentage point lower *Polity2* score. In terms of standard deviations: a one standard deviation increase in *NRREnts* is associated with a 0.33 of a standard deviation lower *Polity2* score. Adding the control variables in Column (4) does not change the estimated coefficients substantially.<sup>14</sup>

<sup>12</sup> Here and henceforth a percentage point is meant to indicate the change as a proportion of the total range of the variable.

<sup>13</sup> This calculation (and all other similar calculations henceforth) is based on the estimated coefficient, and the standard deviations reported as descriptive statistics (i.e. Table B.1).

<sup>14</sup> Note that the coefficient of *Tax* (as well as *NRREnts*) in columns 3 and 4 overlap within one standard error band.

An interesting finding is that higher *Trade* is associated with a lower democracy score, confirming a similar result reported by Rigobon and Rodrik (2005). The magnitude of this partial correlation is not very high — only 0.15 of a percentage point lower *Polity2* score. Finally for the reduced sample of countries that results from adding *Aid* and *Debt* in Column (5), only the coefficient of *NRREnts* is estimated precisely at a high level of statistical significance.

**Table 3. Determinants of Polity2<sub>t</sub>: Pooled OLS Estimation Results**

Variable	(1)	(2)	(3)	(4)	(5)
Tax <sub>t</sub>	0.285*** (0.072)		0.214*** (0.066)	0.170*** (0.053)	0.099 (0.066)
NRREnts <sub>t</sub>			-0.177*** (0.042)	-0.177*** (0.045)	-0.120*** (0.042)
L(YPC) <sub>t</sub>				1.188* (0.613)	-0.478 (1.172)
Trade <sub>t</sub>				-0.025*** (0.008)	-0.007 (0.014)
UrbPop <sub>t</sub>				0.025 (0.036)	0.096 (0.052)
Aid <sub>t</sub>					0.016 (0.048)
Debt <sub>t</sub>					-0.001 (0.008)
Observations	1540	1540	1540	1516	963
Countries	130	130	130	129	91
TE included	Yes	Yes	Yes	Yes	Yes
Tax=- NRREnts			0.685	0.924	0.811
R <sup>2</sup>	0.189	0.230	0.294	0.373	0.198
Adjusted R <sup>2</sup>	0.178	0.220	0.284	0.363	0.176

Notes: A constant is included in all regressions but not reported. Annual observations of the dependent variable are used from 1990-2009. Robust standard errors clustered by countries reported in parentheses. TE refers to the set of time dummies. The statistic reported for '*Tax - NRREnts = 0*' is the p-value of the F-statistic testing for equality of the magnitudes of the coefficients.

\*Significant at the 10% level

\*\*Significant at the 5% level

\*\*\*Significant at the 1% level

An interesting finding is that higher *Trade* is associated with a lower democracy score, confirming a similar result reported by Rigobon and Rodrik (2005). The magnitude of this partial correlation is not very high — only 0.15 of a percentage point lower *Polity2* score. Finally for the reduced sample of countries that results from adding *Aid* and *Debt* in Column (5), only the coefficient of *NRREnts* is estimated precisely at a high level of statistical significance.

The fixed effects estimation results reported in Table 4 indicate that the within-country association of tax and natural resource rents with democracy remains statistically significant at the ten percent level.<sup>15</sup> The overall explanatory power of these regressions (indicated by the  $R^2$  from regression of the equivalent LSDV Model) is much higher than the corresponding pooled OLS regressions, suggesting that fixed country characteristics explain most of the variation in the extent of democracy. This is exactly as expected because institutional quality, such as the nature of political regimes, is determined to a great extent by historical experience, geography, culture and other long-run determinants (Acemoglu et al 2001, Rodrik et al 2004, Shirley 2005 etc).

**Table 4. Determinants of Polity2<sub>t</sub>: Fixed Effects Estimations Results**

Variable	(1)	(2)	(3)	(4)	(5)
Tax <sub>t</sub>	0.115* (0.063)		0.120* (0.062)	0.121** (0.061)	0.167** (0.074)
NRRents <sub>t</sub>		-0.052 (0.036)	-0.056* (0.032)	-0.061* (0.034)	-0.118*** (0.044)
L(YPC) <sub>t</sub>				-2.486* (1.394)	-4.872*** (1.420)
Trade <sub>t</sub>				0.010 (0.010)	0.025* (0.016)
UrbPop <sub>t</sub>				0.198 (0.156)	0.228 (0.183)
Aid <sub>t</sub>					-0.007 (0.023)
Debt <sub>t</sub>					-0.002 (0.003)
Observations	1540	1540	1540	1516	963
Countries	130	130	130	129	91
TE included	Yes	Yes	Yes	Yes	Yes
Tax= -NRRents			0.329	0.308	0.484
R <sup>2</sup>	0.868	0.868	0.869	0.870	0.813
Adjusted R <sup>2</sup>	0.854	0.853	0.855	0.855	0.787
R <sup>2</sup> (within)	0.090	0.085	0.096	0.126	0.184
R <sup>2</sup> (between)	0.94	0.263	0.326	0.105	0.114

Notes: A constant is included in all regressions but not reported. Annual observations of the dependent variable are used from 1990-2009. Robust standard errors clustered by countries are reported in parentheses. TE refers to the set of time dummies. The statistic reported for 'Tax = - NRRents' is the p-value of the F-statistic testing for equality of the magnitudes of the coefficients. The  $R^2$  refers to the coefficient of determination from estimation of the equivalent Least Squares Dummy Variable Model (LSDV).

\*Significant at the 10% level

\*\*Significant at the 5% level

\*\*\*Significant at the 1% level

<sup>15</sup> The reduction in statistical significance and magnitude of the estimated coefficients is expected due to the inclusion of fixed country characteristics that are correlated with democracy as well as Tax and NRRents.

Comparing the impact of the two types of revenue in Table 4, the coefficient for *Tax* is more significant and higher in magnitude than *NRREnts*. Columns (3) and (4) indicate that a one percentage point rise in *Tax* is associated with 0.6 of a percentage point better *Polity2* score.<sup>16</sup> In other words, a one standard deviation increase in *Tax* is associated with a 0.15 of a standard deviation reduction in the *Polity2* score. For *NRREnts* the negative association is 0.3 of a percentage point. In terms of standard deviation this partial correlation is -0.11. The point estimates imply that within any given country, higher taxation is more strongly associated with democracy compared to the adverse association of higher natural resource rents with democracy. However in line with the theoretical model, the null hypothesis that the coefficients are equal in magnitude cannot be rejected at the ten percent level of significance.

The negative association between *Trade* and democracy witnessed in the pooled OLS regression results also disappears within countries. An interesting result is the sign of the coefficient of *L(YPC)*. One percent higher real per capita income within a given country is associated with a *Polity2* score that is lower by 0.12 of a percentage point. This surprising result could be due to a potentially non-linear relation between income per capita and democracy (shown in Table 1) that I have ignored. As income per capita is not the main explanatory variable, I do not explore this issue in detail.

Unlike the pooled OLS results, the within-country association of *Tax* and *NRREnts* with *Polity2* for the reduced sample of countries (following the addition of *Aid* and *Debt* in Column (5) of Table 4) is even stronger. The coefficients are higher in magnitude and more statistically significant. The coefficients for *L(YPC)* and *Trade* are also estimated more precisely in this specification. The coefficient of *Aid* and *Debt* are not statistically significant at a reasonable level, but have the expected negative sign.

The system GMM regression results are presented in Table 5. The first three columns are specifications similar to Tables 3 and 4. However Column (4) only includes log of income per capita as the control variable because of reasons discussed in Section 6. The diagnostics indicate that the model has been adequately estimated. The p-value of the Hansen test for over-identifying restrictions shows that we cannot reject the null hypothesis that the instrument set is valid. At the same time the estimation does not likely suffer from an over-fitting bias caused by over instrumentation, as the Hansen p-value is not unrealistically high (Roodman 2009b, Jayasuriya and Burke 2013). Also, the p-value of the AR(2) test indicates that we cannot reject the null of no second order serial correlation at the ten percent level of significance, which is a necessary assumption for consistent estimation using system GMM.

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<sup>16</sup> The coefficients of *Tax* and *NRREnts* in column (4) after the addition of the control variables are practically unchanged compared to column (3).

**Table 5. Determinants of Polity2<sub>t</sub>: System GMM Estimations Results**

Variable	(1)	(2)	(3)	(4)
Polity2 <sub>t-1</sub>	0.944*** (0.027)	0.959*** (0.017)	0.938*** (0.022)	0.926*** (0.023)
Tax <sub>t-1</sub>	0.026* (0.015)		0.027** (0.013)	0.028* (0.015)
NRREnts <sub>t-1</sub>		-0.010** (0.004)	-0.013** (0.006)	-0.015** (0.006)
L(YPC) <sub>t-1</sub>				0.043 (0.068)
Observations	771	1480	761	754
Countries	131	156	130	129
TE included	Yes	Yes	Yes	Yes
Tax= -NRREnts			0.337	0.429
Instruments	64	66	92	111
Hansen J test p-value	0.395	0.444	0.169	0.105
AR(2) test p-value	0.340	0.938	0.359	0.371
Wald chi-sq statistic	5135.97	7185.90	16170.03	13480.71
Wald chi-sq p-value	0.00	0.00	0.00	0.00

Notes: A constant is included in all regressions but not reported. Observations of the dependent variable at 2 year intervals are used from 1993-2009. Windmeijer-Corrected Robust standard errors from the two-step GMM estimation are reported in parenthesis. TE refers to the set of time dummies. The statistic reported for 'Tax = - NRREnts' is the p-value of the chi-squared statistic testing for equality of the magnitudes of the coefficients. Orthogonal forward deviations used to purge fixed effects. All explanatory variables are treated as endogenous and instrumented by 1 lag.

\*Significant at the 10% level

\*\*Significant at the 5% level

\*\*\*Significant at the 1% level

The system GMM results provide the strongest evidence for my hypothesis. The positive impact of higher taxation and the adverse effect of higher natural resource rents on democracy within countries are quite substantial. Moreover, the coefficients for *Tax* and *NRREnts* are statistically significant (at the five percent level). Although the point estimate of the impact of taxation is higher as expected, we still cannot reject the null hypothesis that the magnitudes of the coefficients are equal. Column (3), for example, tells us that a percentage point higher tax to GDP ratio cumulatively increases the *Polity2* score to rise by 0.44 points.<sup>17</sup> This is an increase of more than 2 percentage points. On the other hand a percentage point lower natural resource rents to GDP ratio, cumulatively decreases the democracy score to fall by 0.21 points (or 1 percentage point). As suspected, democracy is a highly persistent variable as indicated by the magnitude and statistical significance of the coefficient for lagged *Polity2*. Addition of the control variable in Column (4) does not change

<sup>17</sup> The cumulative impact equals  $0.027/(1-0.938)$

the results to any noticeable degree, although the coefficient for *Tax* becomes slightly less statistically significant.<sup>18</sup>

The relative magnitudes of the impact of *Tax* and *NRREnts* on democracy, as indicated by the point estimates are similar in both the fixed effects and the system GMM regressions. The coefficient of *Tax* is approximately twice as large as the coefficient of *NRREnts*. According to the prediction of the theoretical model the coefficients should have been of the same magnitude. This was based on the assumption that the entire natural resource rents available in an economy go to the government. In terms of the interval estimates, we cannot reject that the coefficients are equal in magnitude at the ten percent level of significance. However if we consider the point estimates, the relative magnitudes of the coefficients give an approximation of the total resource rents accruing to the government. If the theoretical model is correct, then based on the point estimates, on average around half of the rents in a country belong to the government.

## 8.2 Estimation Results for *Voice* as an alternative measure of democracy

For the alternative measure of democracy (*Voice*), I only report the pooled OLS and the fixed effects regression results in Tables B.3 and B.4 respectively. Due to the shorter time period over which this data is available with various missing years in between, the system GMM regression results are not estimated consistently (as indicated by the diagnostics) nor with precision. The pooled OLS and the fixed effects regression results for *Voice* are qualitatively similar to the results for *Polity2*, but quantitatively different.

The explanatory power of the pooled OLS regressions in explaining *Voice* is very similar to that for *Polity2* in the specifications that do not include the control variables. However, for the specifications with the control variables included (Columns 4 and 5) the  $R^2$  for the regression of *Voice* is substantially higher. Column (4) of Table B.3 indicates that a percentage point higher *Tax* is associated with a *Voice* score that is higher by 0.44 percentage points. Whereas an additional percentage point of natural resource rents is associated with a 0.47 percentage point decrease in the score. This association is lower than the corresponding one for *Polity2*. The estimated coefficients of both *L(YPC)* and *Trade* are highly significant (at the one percent level) as well. Similar to the pooled OLS regression results for *Polity2*, the association of real income per capita with *Voice* remains positive, while for *Trade* it is negative. The estimated coefficients retain their statistical significance even for the reduced sample of countries (Column 5). More interestingly the coefficient for *Aid* is also estimated with a high level of precision (one percent level of statistical significance). However, it has the unexpected sign. Countries that receive more aid are more

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<sup>18</sup> The coefficients of *Tax* (and *NRREnts*) in columns (3) and (4) overlap within one standard error band.



democratic over the time period 1996-2009. As discussed previously, this is yet another illustration of the shortcoming of the pooled OLS regression technique. It is plausible that fixed-country characteristics simultaneously affected both the nature of the political regime and the amount of aid it receive over this time period; or it could be that countries which are more democratic receive more aid rather than the other way round.

The fixed effects regressions explain the within-country variation in *Voice* to a lesser degree than *Polity2* (as indicated by the within  $R^2$ ). This is expected given the shorter time period being investigated. Also, the coefficients are estimated with less precision, and magnitudes of the association of the explanatory variables with *Voice* are smaller than with *Polity2*. Compared to *Tax*, the coefficient for *NRREnts* is more statistically significant. Moreover the point estimate for the coefficient for *NRREnts* is much closer in magnitude to the coefficient for *Tax*, indicating that from 1996 onwards the proportion of natural resource rents accruing to the government is smaller. Column (3) for example indicates that a percentage point increase in *Tax* is associated with a 0.13 percentage point higher *Voice* score within countries, whereas a similar increase in *NRREnts* is associated with a 0.09 percentage point lower score. For the reduced sample of countries in Column (5), the only control variable that is associated at a reasonable level of statistical significance with *Voice* is *Debt*. An increase of one percentage point in the external debt to GDP ratio within a given country is associated with a 0.35 percentage point reduction in the *Voice* score.

In summary, the regression results for *Voice* are broadly similar to *Polity2* — the signs of estimated coefficients for the main explanatory variables remain the same. It can be concluded that the positive association of taxation with democracy and the negative association of natural resource rents is not a peculiarity of the *Polity2* variable.

## 9 Conclusion

The possible impact of a government's effort to collect more taxes from its population on the characteristics of the political regime has a basis in history, as well as episodes in the modern world. When a government is forced to collect more taxes because of fiscal imperatives, it may have to accede to the policy preferences of the people. Higher taxation often leads to pressure for changes in the political regime. Despite the existence of a rich literature to provide a historical and theoretical basis, this link has not been systematically investigated in a cross-national context. Most studies focus on the causality from political regime to tax collection. This paper investigates the other direction, while also incorporating natural resource rents as a source of non-tax revenues into the framework. In this sense the study attempts to also add to the resource rent literature, by framing the question of its effect on the political regime within the broader issue of a State's revenue needs. This paper is also related to literature on the income-democracy nexus — in particular the suggestion by Burke and Leigh (2010) that commodity price shocks that cause output contractions could increase the likelihood of democratic change.

The empirical evidence presented in this paper using a sample of 132 countries for the time period 1990-2009 is consistent with the hypothesis that higher taxation leads to better democracy, even when the state has access to natural resource rents. On the other hand, natural resource rents are detrimental for democracy even in the presence of taxation. The relationship of taxation and natural resource rents with democracy is established using two different and unrelated measures of democracy. The statistical relationship is also robust to the addition of control variables in the econometric specification as well as estimation through different regression techniques. The potential endogeneity of tax revenues and natural resource rents to democracy is addressed through estimation by the system GMM, a regression technique which employs a set of exogenous internal instruments in order to establish a causal impact. It is found that the impact of a percentage point increase in the ratio of tax to GDP is equivalent to more than a two percentage point improvement in the democracy score. On the other hand, a similar increase in the ratio of natural resource rents to GDP reduces the democracy score by one percentage point.

The findings of this paper have a critical policy implication for countries that possess well developed and functional systems for tax collection, but have recently also discovered natural resources. These new resource producers, especially certain African countries such as Ghana, Tanzania, Mozambique and Kenya, now face the choice of continuing to rely on taxation as their main source of revenue, or shifting to natural resource rents to fulfil their fiscal needs.<sup>19</sup> While exploitation of natural resources will undoubtedly be carried out, these countries would be well advised to invest these rents into trust funds, or perhaps distribute these to the citizens followed by subsequent taxation along the lines of a proposal by Devarajan et al (2010). Given the nascent state of democracy in many of these countries, the decision to use natural resource rents as a direct source of government revenue could hamper prospects for democratic progress.

The estimates presented here are very aggregate in nature. Further research could perhaps identify with more clarity the exact channels through which tax collection impacts political institutions. For this purpose it could be informative to identify a variable that is highly correlated with taxation, but not with democracy. Such an external instrument, if more malleable than fiscal policy, could guide us towards a more practical theory of how to promote democracy.<sup>20</sup>

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<sup>19</sup> I want to thank Shantayanan Devarajan for pointing out these new resource producers.

<sup>20</sup> Identifying an exogenous external instrument is very difficult in practice, even harder is to argue convincingly for its validity. However, a convincing external instrument potentially provides a greater insight into the mechanism at work. It helps develop the broad contours of a theory. For example the theory of institutional change proposed by Acemoglu et al (2005d, 2012) is based on the instrument for institutional quality they identified in an earlier paper (2001).

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## Appendix A

Before solving the problem of the government and citizenry described in Section 3 of the paper, the following assumptions are imposed.<sup>21</sup>

- (1)  $U^G$  and  $U^C$  are continuously differentiable. Furthermore,  $(U^G)_1$ ,  $(U^G)_2$ ,  $(U^G)_3$ ,  $(U^C)_1$ ,  $(U^C)_2$  are all  $> 0$ . Here subscripts 1, 2 and 3 refer to the partial derivative of the function with respect to the first, second and third argument of the function respectively.
- (2)  $U^G$  and  $U^C$  are both quasiconcave functions, while  $f(x)$  is a concave function. This ensures that the first order conditions are sufficient conditions as well.
- (3)  $\text{Max } U^C [(1-t) f(x) - w.x, - (V^+ - V)^2] < \underline{U}^C$ , for all  $t$  between 0 and 1. This states that Government will never be able to choose its exact preferred policy position i.e.  $V \neq V^+$ . If  $V = V^+$ , the utility of the citizens would fall below the minimum tolerable level.

The solution to the problem of both agents is a simultaneous move Nash Equilibrium. The citizenry, given  $t$  and  $V$ , chooses how much factor of production to hire, which is a best response to what the government does. The first order condition is:  $(1-t) f'(x) = w$ , and the solution is given by  $x^*(t, V)$ . The government, knowing  $x^*(t, V)$ , optimizes subject to constraints, which is a best response to the production decision of the citizenry. Therefore the government's maximisation problem can be written as,

$$\text{Max } U^G [t f(x), N, - (V-V^+)^2] + \lambda_1 [(1-t) f'(x) - w] + \lambda_2 (U^C - \underline{U}^C) + \lambda_3 (K - t f(x) - N)$$

$(t, N, V, x)$

The first order conditions are listed below:

$$\text{w.r.t 't': } (U^G)_1 f(x) - \lambda_1 f'(x) - \lambda_2 (U^C)_1 f(x) - \lambda_3 f(x) = 0 \quad (\text{A.1})$$

$$\text{w.r.t 'N': } (U^G)_2 - \lambda_3 = 0 \quad (\text{A.2})$$

$$\text{w.r.t 'V': } -2 (U^G)_3 (V-V^+) - 2 \lambda_2 (U^C)_2 (V-V) = 0 \quad (\text{A.3})$$

$$\text{w.r.t 'x': } (U^G)_1 t f'(x) + \lambda_1 (1-t) f''(x) + \lambda_2 (U^C)_1 [(1-t) f'(x) - w] - \lambda_3 t f'(x) = 0 \quad (\text{A.4})$$

$$\text{w.r.t '}\lambda_1\text{' : } (1-t) f'(x) = w \quad (\text{A.5})$$

$$\text{w.r.t '}\lambda_2\text{' : } \lambda_2 (U^C - \underline{U}^C) = 0, \quad U^C - \underline{U}^C \geq 0, \quad \lambda_2 \geq 0 \quad (\text{A.6})$$

$$\text{w.r.t '}\lambda_3\text{' : } \lambda_3 (K - t f(x) - N) = 0, \quad K - t f(x) - N \geq 0, \quad \lambda_3 \geq 0 \quad (\text{A.7})$$

where (A.6) and (A.7) follow from Kuhn-Tucker condition for inequality constraints

From (A.2),

$$\lambda_3 = (U^G)_2 > 0 \quad (\text{A.8})$$

From (A.3),

$$\lambda_2 = - [(U^G)_3 (V - V^+)] / [(U^C)_2 (V - V)] > 0, \quad (\text{A.9})$$

as  $(V - V^+) < 0$  by Assumption (3).

Then (A.8) and (A.9) imply that in equilibrium the inequality constraints are binding by (A.6) and (A.7) i.e.

<sup>21</sup> I follow the set of assumptions listed by Bates and Lien (1985).

$$U^C = \underline{U}^C, \text{ and} \quad (\text{A.10})$$

$$t f(x) + N = K \quad (\text{A.11})$$

Equations (A.10) and (A.11), which characterize the equilibrium, allow  $V$  to be written as an explicit general function of  $t$  and  $N$ . As  $U^C$  is continuously differentiable by Assumption (1) and the partial derivative of  $U^C$  with respect to  $V-V$  is not zero for all  $V \neq V$ , by the implicit function theorem,

$$V-V = g(t) \text{ such that } U^C [(1-t^*)f(x^*) - w \cdot x^*, (V^*-V)^2] = \underline{U}^C, \text{ and } V \neq V \quad (\text{A.12})$$

$$V-V = h(N) \text{ such that } U^C [f(x^*) + N^* - K - w \cdot x^*, (V^*-V)^2] = \underline{U}^C, \text{ and } V \neq V \quad (\text{A.13})$$

Therefore taking any linear combination of (A.12) and (A.13),

$$\mathbf{V-V} = \mathbf{F(t, N)} \text{ such that } U^C = \underline{U}^C, t f(x) + N = K \text{ and } V \neq V. \quad (\text{A.14})$$

We can then derive the comparative static results for the change in democracy resulting from changes in tax and non-tax revenues along the optimal solution path. Taking the total derivative of (2.A10) and setting  $dx = 0$ ,

$$\begin{aligned} & - (U^C)_1 f(x^*) dt - 2 (U^C)_2 (V - V) d(V - V) = 0 \\ \Rightarrow & d(V - V)/dt = - (U^C)_1 f(x^*) / 2 (U^C)_2 (V - V) < 0 \\ \Rightarrow & \mathbf{d(V - V)/f(x^*)dt = - (U^C)_1 / 2 (U^C)_2 (V - V) < 0} \end{aligned} \quad (\text{A.15})$$

Similarly, substituting (2.A11) into (2.A10) and then taking the total derivative, and setting  $dx = 0$ ,

$$\begin{aligned} & (U^C)_1 dN - 2 (U^C)_2 (V - V) d(V - V) = 0 \\ \Rightarrow & \mathbf{d(V - V)/dN = (U^C)_1 / 2 (U^C)_2 (V - V) > 0} \end{aligned} \quad (\text{A.16})$$

Finally, consider the following specific functional form for the utility of the government and citizens, this allows us to verify whether the choice variables of the optimization problem lie in the expected range.

$$U^G = t x^\alpha + N - \log (V-V^+)^2$$

$$U^C = (1-t) x^\alpha - wx - \log (V-V)^2$$

where  $\alpha < 1$ .

Then, by FOC (A.4),

$$t^* = [\lambda_2 \alpha x^{(\alpha-1)} - \lambda_1 \alpha (1-\alpha) x^{(\alpha-2)} - \lambda_2 w] / [(\lambda_2 + \lambda_3) \alpha x^{(\alpha-1)} - \lambda_1 (1-\alpha) x^{(\alpha-2)} - \alpha x^{(\alpha-1)}],$$

where the numerator is positive as  $\lambda_1 < 0$  by definition, and  $\alpha x^{(\alpha-1)} > w$  by (A.5). The denominator is also positive as  $\lambda_2 + \lambda_3 > 1$  by (A.2), (A.8) and (A.9). Also the denominator is greater than the numerator as  $\lambda_2 + \lambda_3 > \lambda_2$ . Therefore,  $0 < t^* < 1$  as we expect.

By FOC (A.3),

$$V^* = (\lambda_2 V^+ + V) / (\lambda_2 + 1). \text{ Thus, } V^- < V^* < V^+ \text{ as we expect.}$$

By FOC (A.1),

$$x^* = -\alpha \lambda_1 / \lambda_2 > 0 \text{ as we expect.}$$

Finally by (A.10),

$$N^* = K - t^* f(x^*)$$

## Appendix B

**Table B.1. Descriptive Statistics (Entire Sample)**

Variable	Mean	Minimum	Maximum	Observations	Countries
Polity2	4.45 (6.22)	-10	10	1540	130
Voice	53.71 (18.51)	11.93	86.53	1117	143
Tax	16.63 (7.53)	0.12	61.02	1802	149
NRREnts	6.52 (11.27)	0	74.67	1802	149
L(YPC)	8.82 (1.28)	5.51	11.25	1802	149
YPC (1000)	13.16 (13.85)	0.25	77.11	1802	149
Trade	91.52 (55.98)	10.83	445.91	1775	148
UrbPop	57.15 (23.48)	5.4	100	1802	149
Aid	5.19 (8.98)	-0.66	148.50	1365	126
Debt	46.69 (52.80)	1.44	824.09	1157	102

Note: Standard deviations are reported in parentheses

**Table B.2. Pair-wise Correlation Matrix**

	1	2	3	4	5	6	7	8	9
Polity	1.00								
Voice	0.80	1.00							
Tax	0.38	0.44	1.00						
NRREnts	-0.41	-0.37	-0.26	1.00					
YPC	0.21	0.61	0.18	0.01	1.00				
Trade	-0.06	0.02	0.20	-0.02	0.24	1.00			
UrbPop	0.26	0.48	0.13	-0.03	0.65	0.24	1.00		
Aid	-0.07	-0.17	-0.11	0.03	-0.34	-0.01	-0.34	1.00	
Debt	-0.11	-0.22	-0.04	0.14	-0.31	-0.01	-0.14	0.46	1.00



**Table B.3. Determinants of Voice<sub>t</sub>: Pooled OLS Estimation Results**

Variable	(1)	(2)	(3)	(4)	(5)
Tax <sub>t</sub>	1.127*** (0.258)		0.960*** (0.253)	0.438*** (0.120)	0.519*** (0.165)
NRRents <sub>t</sub>		-0.595** (0.114)	-0.445*** (0.104)	-0.468*** (0.088)	-0.331*** (0.101)
L(YPC) <sub>t</sub>				9.911*** (1.281)	5.611*** (2.473)
Trade <sub>t</sub>				-0.052*** (0.014)	-0.063** (0.029)
UrbPop <sub>t</sub>				-0.028 (0.069)	0.064 (0.097)
Aid <sub>t</sub>					0.265*** (0.090)
Debt <sub>t</sub>					-0.013 (0.041)
Observations	1117	1117	1117	1101	657
Countries	143	143	143	142	97
TE included	Yes	Yes	Yes	Yes	Yes
Tax = - NRRents			0.094	0.856	0.379
R <sup>2</sup>	0.214	0.144	0.288	0.633	0.312
Adj R <sup>2</sup>	0.206	0.136	0.281	0.626	0.294

Notes: A constant is included in all regressions but not reported. Annual observations of the dependent variable are used from 1996-2009. Robust standard errors clustered by countries are reported in parenthesis. TE refers to the set of time dummies. The statistic reported for 'Tax = - NRRents' is the p-value of the F-statistic testing for equality of the magnitudes of the coefficients.

\*Significant at the 10% level

\*\*Significant at the 5% level

\*\*\*Significant at the 1% level

**Table B.4. Determinants of Voice<sub>t</sub>: Fixed Effects Estimation Results**

<b>Variable</b>	<b>(1)</b>	<b>(2)</b>	<b>(3)</b>	<b>(4)</b>	<b>(5)</b>
Tax <sub>t</sub>	0.122 (0.084)		0.132* (0.812)	0.120 (0.079)	0.217*** (0.072)
NRRents <sub>t</sub>		-0.088* (0.047)	-0.094** (0.047)	-0.096* (0.049)	-0.206*** (0.060)
L(YPC) <sub>t</sub>				1.584 (2.760)	0.383 (3.969)
Trade <sub>t</sub>				0.014 (0.016)	0.019 (0.021)
UrbPop <sub>t</sub>				0.278 (0.248)	0.466 (0.297)
Aid <sub>t</sub>					0.031 (0.039)
Debt <sub>t</sub>					-0.050** (0.022)
Observations	1117	1117	1117	1101	657
Countries	143	143	143	142	97
TE included	Yes	Yes	Yes	Yes	Yes
Tax - NRRents = 0			0.670	0.787	0.908
R <sup>2</sup>	0.971	0.971	0.972	0.972	0.940
Adj R <sup>2</sup>	0.967	0.967	0.967	0.967	0.927
R <sup>2</sup> (within)	0.024	0.026	0.033	0.045	0.109
R <sup>2</sup> (between)	0.219	0.163	0.304	0.394	0.239
R <sup>2</sup> (overall)	0.180	0.125	0.265	0.385	0.175

Notes: A constant is included in all regression but not reported. Annual observations of the dependent variable are used from 1990-2009. Robust standard errors clustered by countries reported in parentheses. TE refers to the set of time dummies. The statistic reported for 'Tax - NRRents = 0' is the p-value of the F-statistic testing for equality of the magnitudes of the coefficients. The R<sup>2</sup> refers to the coefficient of determination from estimation of the equivalent Least Squares Dummy Variable Model (LSDV).

\*Significant at the 10% level

\*\*Significant at the 5% level

\*\*\*Significant at the 1% level

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