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Inequality, democracy, institutional quality, and fiscal redistribution

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Inequality, Democracy, Institutional Quality, and Fiscal Redistribution

by

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Abstract

This paper studies the joint effect of economic and political inequalities on redistributive taxation and institutional quality. The theoretical model suggests that income inequality, coupled with political bias in favor of the rich, decreases redistribution and lowers institutional quality. The effect of the former is to increase productive investment, and the effect of the latter is to decrease it—with resulting ambiguous implications for economic growth. Testing these predictions empirically in a panel of countries, the paper finds that inequality has a negative effect on both institutional quality and redistribution, especially in non-democratic countries.

Keywords: Inequality, institutions, redistribution

JEL classification: D31, D90, E62, H11, O11

1. Introduction

Recent literature has generated an impressive amount of work on the growth effects of democracy, albeit with quite mixed results. Thus, Barro (1996) does not discern a monotonic effect; Tavares and Wacziarg (2001), find that democracy primarily affects human capital accumulation, whereas a direct growth effect is absent; Rodrik and Wacziarg (2005) do not detect adverse growth effects of democratic transitions; Papaioannou and Siourounis (2004) and Persson and Tabellini (2007, argue for significantly positive growth effects of democracy. In contrast, channels through which democracy may affect growth have been less well studied (although see Wacziarg, 2001, and Tavares and Wacziarg, 2001), and this is one of this paper's contributions. In addressing this issue, we draw insights from additional related research.

One such important work has documented substantial differences in various institutional features across countries, noting in particular, that measures of property rights protection and bureaucratic efficiency are significantly correlated with economic development (e.g., Hall and Jones, 1999). Likewise, the size and the composition of public finances differ across countries, and the share of tax revenues and government spending increases with a country's level of economic development—the so-called Wagner's Law—and redistributive programs, such as social security and welfare system, become much more comprehensive.

A common explanation for the correlation between economic development and the extent of redistribution is related to institutional constraints. It is argued, in particular, that weak monitoring and enforcement capabilities prevent developing countries to raise sufficient tax revenues (see Acemoglu, 2005; Besley and Persson, 2007; Chong and Gradstein, 2007b; and Gordon and Li, 2005, for examples of work along these lines). This explanation, therefore, provides a causal link between institutional quality and redistribution. It is, however, incomplete in ignoring the second-order question of the factors determining institutional quality.

This paper, therefore, adopts a different perspective by arguing that the extent of income redistribution, as well as institutional quality, such as the public protection of private property rights, are jointly determined by the economy's fundamentals, specifically, by the distribution of effective political power, which hinges upon the distribution of wealth. In turn, both these ingredients play a role as growth determinants. In particular, the economy is characterized by its prevailing tax policy but also by the degree of public property rights protection; both determine the economy's evolution. Income is a major determinant of political attitudes with respect to

both: richer individuals prefer smaller taxes as well as weaker public protection of property rights. The concept of political bias that we introduce here represents a measure of the departure from democratic decision-making and in favor of the wealthy oligarchy. It generalizes the concept of a voting franchise commonly employed in the literature and, as argued below, can be more useful as well as more accurate. Democratization, or a reduction in the political bias, by increasing the political power of low-income individuals at the expense of rich individuals, does lead to an increase in the tax burden, but also to an improvement in institutional quality—with mixed growth effects.

This framework turns out to be very convenient in studying the nexus of relationship between the distribution of economic and political power on one hand and institutional quality and redistributive taxation on the other hand, thereby also enabling analyses of long-run economic growth and income inequality. We choose to focus the empirical analysis on how inequality shapes institutional quality and the extent of redistribution. The theoretical framework suggest that inequality shapes those outcomes according to the extent to which a country is democratic. In regard to institutional quality, this added consideration complements our earlier work (Chong and Gradstein, 2007a), as well as historical analyses in Sokoloff and Engerman (2000), where income inequality was shown to cause institutional weakness. Our analysis is also consistent with the findings in Cervellati and Sunde (2007), obtained in a cross-country setting.

Some earlier work suggested that income inequality creates fiscal pressures to increase redistributive taxation (see Alesina and Rodrik, 1994; Persson and Tabellini, 1994). Empirical support for this hypothesis, however, was challenged in Perotti (1996), where fiscal effects of inequality were found to be insignificant. Burkett et al., 1999, reinforce these results and find that inequality is negatively related to redistribution in some specifications. Even more recently, a detailed historical analysis in Sokoloff and Zolt (2006), reveals that initial inequality in factor distribution was a decisive factor in the evolution of the tax systems in the New World, those in North America being more redistributive than in South America. We contribute to this literature by analytically deriving and empirically testing the hypothesis that the meaningful concept of inequality for policy choices is mediated through the bias in the political system.

Our empirical analysis reveals patterns consistent with the theory. Specifically, inequality appears to have a detrimental effect on both institutional quality and redistribution; further, this effect is exacerbated the lower the level of democracy is. For example, a marginal

increase of two standard deviations in the Gini coefficient for a country with a medium level of democracy leads to a deterioration in institutional quality 30 percent larger than the one obtained as a result of a similar increase in inequality in a perfect democracy.

While this paper is related to the theoretical and empirical literatures linking inequality, institutions, and redistribution as discussed above, an alternative line of research studies how state capacities in various dimensions are determined by the need to provide public goods, see (Besley and Persson, 2007). In particular, the argument is that such a need, as in cases of military emergencies, triggers government spending that enhances the long run capacity of the state. The two approaches should be viewed as complementary to each other. Another related work, Acemoglu (2007, and references therein) emphasizes reduction of entry barriers as an institutional improvement typical of democracies. The role of income inequality, crucial in this paper, is, however, downplayed there. Finally, also related is work on democracy and its consequences, see Cervellati, Fortunato and Sunde (2005); Gradstein (2007), and Lagunoff (2007), as well as papers cited there; whereas parts of this literature deal with issues of endogenous democratization, here the level of democracy is exogenously given.

We proceed as follows. The next section presents a simple analytical framework, whose analysis is then carried out in Section 3. Section 4 deals with the empirical assessment of some of the model's implications. Finally, Section 5 concludes.

2. Basic Model

The model economy is populated by a measure one of households indexed by i , each consisting of a parent and child, and it operates in discrete time t . The initial level of household i 's income is exogenously given at y_{i0} , and the income level in period t , y_{it} is endogenously determined. F_t denotes the distribution of income in period t .

In each period, the household's income is allocated between consumption, investment in institutional quality, and physical investment. Let Q_t , $0 \leq Q_t \leq 1$, denote the level of institutional quality. We assume that its cost is proportional to the economy's current income, $\phi(Q_t)Y_t$, $0 \leq \phi < 1$, $\phi(0) = 0$, $\phi' > 0$. Moreover, a proportional income tax is used to cover this cost. Individuals allocate resources between investing in institutional quality, consumption, c_{it} , productive investment, k_{it} , and unproductive investment in rent seeking, r_{it} . Normalizing all prices to one, the budget constraint then is

$$y_{it} = \phi(Q_t)y_{it} + c_{it} + k_{it} + r_{it} \quad (1)$$

It is assumed that this constraint is binding and that, because of capital market imperfections, it is impossible to borrow. This assumption will imply that richer individuals are able to invest more, but also to enhance their claims through rent seeking.

Investment is taxed at the rate of T_t , $0 \leq T_t \leq 1$, and prevailing institutional quality Q_t determines the marginal productivity of rent seeking in a manner specified below. The aggregate next-period income is

$$Y_{t+1} = A K_t$$

where $A > 0$ is the exogenous productivity parameter, and $K_t = \int_0^1 k_{jt} dj$ is the aggregate investment.¹ This implicitly assumes that labor supply is perfectly inelastic. With elastic labor supply, redistributive taxation results in distortions in the labor market, thus introducing an added dimension into the analysis. This does not, however, change anything substantive.²

The shares of aggregate future income accrued to the households are determined by both productive investment decisions and rent seeking outlays, in conjunction with the prevailing tax rate and institutional quality, as follows:

$$s_{it+1} = \frac{k_{it}^{1-T_t} r_{it}^{1-Q_t}}{\int_0^1 k_{jt}^{1-T_t} r_{jt}^{1-Q_t} dj}, \quad \int_0^1 s_{jt+1} dj = 1 \quad (2)$$

The specification in (3) is an extension of that used in Sonin's (2003), important work; see also González (2005, 2006) for a related specification. Rent seeking can be interpreted as inducing claims for investment shares. In particular, it can manifest itself through relatively peaceful lobbying or be related to more violent appropriative means. As can be seen from (2), higher values of institutional quality reduce the marginal productivity of rent seeking, and higher values of the tax rate reduce the marginal productivity of individual investment.

¹ The AK technology is considered primarily for simplicity; nothing substantive changes when assuming decreasing returns to scale.

² A model extension with an elastic labor supply is available from the authors.

Then the individual next-period income is determined jointly by productive and unproductive individual investments as follows:

$$y_{it+1} = \varepsilon_{it+1} s_{it+1} Y_{t+1} \quad (3)$$

where ε_{it+1} are idiosyncratic shocks, and are i.i.d. in each generation, with the mean of A ; they are assumed to be independent of initial income, hence—as will become clear later—they are also independent of parental income in each period.

Each parent's preferences derive from consumption as well as from the amount of income accrued to the child (and are assumed identical to focus on other issues). This specification greatly simplifies the analysis by making current policy choices independent of future expectations. Assuming for concreteness symmetric logarithmic preferences, we write the individual household's utility:

$$U(c_{it}, y_{it+1}) = \ln(c_{it}) + \ln(y_{it+1}) \quad (4)$$

Collective decisions will be made by a generalized version of a majority rule, which captures the idea of an effective political power. This is defined through the notion of a *political bias*; it is argued below that this notion has both modeling advantages and institutional accuracy. Thus, let w_{it} denote the political weight of individual i in period t and let W_t denote the distribution of weights in period t . Decreases in the political bias will be defined as a transfer of weights from the population in a higher interval $[\zeta_3, \zeta_4]$ to the population in a lower interval $[\zeta_1, \zeta_2]$, $\zeta_2 < \zeta_3$.³ Formally, let W and Z be two weight distributions; then W has a lower political bias than Z if⁴

$$\int_0^{\omega} [W(x) - Z(x)] dx \leq 0 \quad \text{for all } \omega \geq 0 \quad (5)^5$$

A move from Z to W reduces political bias and can be referred to as democratization.

³ This is analogous to Dalton's principle of progressive transfers from the measurement of income inequality.

⁴ We will omit time subscripts for notational brevity.

⁵ This is equivalent to stating that W Lorenz dominates Z .

3. Equilibrium Analysis

In each period, decisions on institutional quality and on the tax rate are first made by a (weighted) majority vote; then each household determines its budget allocation. Equilibrium requires that these decisions are mutually consistent.⁶

3.1. Fixed Tax Rate and Institutional Quality

With T_t and Q_t given, each household allocates its income so as to maximize utility. The logarithmic utility assumption along with the multiplicative production function implies that each individual household will allocate a constant fraction of its income to consumption and another fraction to each type of investment. Specifically, maximization of the individual utility function (4) with respect to consumption, productive investment, and rent seeking outlays subject to the budget constraint (1) and the production function (3) yields the following first-order conditions:

$$-1/c_{it} + (1-T_t)/k_{it} = 0, \quad -1/c_{it} + (1-Q_t)/r_{it} = 0,$$

which, together with the budget constraint, yields the equilibrium choices:

$$\begin{aligned} c_{it} &= y_{it} (1-\phi)/(3-T_t-Q_t), \quad k_{it} = (1-T_t)y_{it} (1-\phi)/(3-T_t-Q_t), \\ r_{it} &= (1-Q_t)y_{it} (1-\phi)/(3-T_t-Q_t) \end{aligned} \quad (6)$$

further substituting which we obtain:

$$K_t = \int_0^1 k_{jt} dj = (1-T_t)Y_t (1-\phi)/(3-T_t-Q_t) \quad (7a)$$

$$s_{it+1} = \frac{y_{it}^{2-T_t-Q_t}}{\int_0^1 y_{jt}^{2-T_t-Q_t} dj} \quad (7b)$$

Equation (7b) already provides some insights into subsequent analysis. Its differentiation with respect to income reveals that, because of credit constraints, richer households are able to secure a larger share of aggregate income. Moreover, differentiation twice reveals that this relationship is strengthened when taxes and institutional quality are low.

⁶ Subsequently we also discuss an extension where a direct commitment to institutional quality cannot be made. This, in turn, leads to a discussion of the potential role of democracy as an indirect commitment mechanism.

Substitution into the production function of individual income yields the future individual and then aggregate income levels:

$$y_{it+1} = \varepsilon_{it+1} \left[\frac{y_{it}^{2-T_t-Q_t}}{\int_0^1 y_{jt}^{2-T_t-Q_t} dj} \right] \left[\frac{(1-T_t)Y_t(1-\phi)}{3-T_t-Q_t} \right] \quad (8a)$$

$$Y_{t+1} = A \left[\frac{(1-T_t)Y_t(1-\phi)}{3-T_t-Q_t} \right] \quad (8b)$$

so that the growth rate is

$$g_t = A \left[\frac{(1-T_t)(1-\phi)}{3-T_t-Q_t} \right] \quad (8c)$$

Differentiation reveals that the growth rate is a decreasing function of the tax rate.

Further substitutions yield indirect utility functions

$$V_{it}(Q_t, T_t) = \ln \left[\frac{y_{it}(1-\phi)}{3-T_t-Q_t} \right] + \ln \left\{ \varepsilon_{it+1} \left[\frac{y_{it}^{2-T_t-Q_t}}{\int_0^1 y_{jt}^{2-T_t-Q_t} dj} \right] \left[\frac{(1-T_t)Y_t(1-\phi)}{3-T_t-Q_t} \right] \right\} \quad (9)$$

For example, suppose that the initial distribution of income, F_0 , is lognormal, with the parameters μ_0 and σ_0^2 , and that the distribution of idiosyncratic shocks in each period is lognormal too, with parameters A and 1; the multiplicative form in (8a) ensures that all future distributions, F_t , are lognormal as well, with parameters μ_t and σ_t^2 , where

$$\mu_{t+1} = \ln A + (2-T_t-Q_t)\mu_t - \ln [(2-T_t-Q_t)\mu_t + (2-T_t-Q_t)^2\sigma_t^2/2] + \ln \left[\frac{(1-T_t)(1-\phi)(\mu_t + \sigma_t^2/2)}{3-T_t-Q_t} \right] \quad (10a)$$

$$\sigma_{t+1}^2 = 1 + (2-T_t-Q_t)^2\sigma_t^2 \quad (10b)$$

and the utility levels in (9) will also be lognormally distributed.

It follows that next-period income inequality, as measured by income dispersion under lognormal distribution, per (10b), is larger the smaller the tax rate and the poorer institutional

quality. Moreover, small values of $T_t + Q_t$ make incomes more likely to diverge over time, whereas large values of $T_t + Q_t$ make incomes more likely to converge.⁷

We can also define a measure of intergenerational income mobility as the complement to one of the intertemporal correlation in (logarithms of) incomes, $\gamma_{t+1} = 1 - \text{Corr}(\ln(y_{it+1}), \ln(y_{it}))$. It is not too difficult to show, then, that γ_{t+1} increases in Q_{t+1} and in T_{t+1} , implying that institutional quality and redistributive taxation both enhance intergenerational income mobility.⁸

Collecting the main results leads to Proposition 1.

Proposition 1. The next-period income equality and intergenerational income mobility are larger the smaller the tax rate and the weaker institutional quality, and income convergence hinges upon the sum of the tax rate and the institutional quality parameter being large.

Taxation here results in a “leaky bucket” type of redistribution from the rich to the poor; see Bénabou (2000) for a similar effect. Better protection of property rights, by restraining rent seeking, channels resources into productive investment, while at the same time effectively redistributing income in favor of the poor. Thus, both taxation and institutional quality have a moderating inequality effect and also promote intergenerational mobility—the former by redistributing income, and the latter by decreasing the marginal productivity of rent seeking, which benefits the rich disproportionately.

3.2. Political Bias and Weighted Voting

Before proceeding with the equilibrium determination of the tax rate and institutional quality, we now pause to examine more closely the concept of a political bias and to define the collective decision-making rule employed. We will consider below a generalized majority voting defined through a weighting function which induces a political bias. While much of the existing work has focused on voting franchise (see, for example, Cervellati, Fortunato and Sunde, 2005), whereby population was regarded as being divided into two classes, franchised and

⁷ Taking the cross derivative in (10b) establishes that the moderating inequality effect of redistributive taxation is more pronounced in cases where institutional quality is low.

⁸ A brief sketch of the argument is as follows. Letting Exp denote the aggregation operator over the households measure and recalling that abilities and incomes are uncorrelated, we obtain:

$$\begin{aligned} \gamma_{t+1} &= 1 - \text{Corr}(\ln(y_{it+1}), \ln(y_{it})) = 1 - \text{Cov}(\ln(y_{it+1}), \ln(y_{it}))/\sigma_{t+1} \sigma_t = 1 - \text{Exp}[(\ln y_{it+1} - \mu_{t+1})(\ln y_{it} - \mu_t)]/\sigma_{t+1} \sigma_t = \\ &= 1 - \text{Exp}[\ln \varepsilon_{it+1} (\ln y_{it} - \mu_t)]/\sigma_{t+1} \sigma_t - (2 - T_t - Q_t) \text{Exp}(\ln y_{it} - \mu_t)^2/\sigma_{t+1} \sigma_t = \\ &= 1 - \text{Exp}(\ln \varepsilon_{it+1}) \text{Exp}(\ln y_{it} - \mu_t)/\sigma_{t+1} \sigma_t - (2 - T_t - Q_t) \sigma_t^2 / [(2 - T_t - Q_t)^2 \sigma_t^2 + 1]^{1/2} \sigma_t = \\ &= 1 - 1/[1 + 1/(2 - T_t - Q_t)^2 \sigma_t^2]^{1/2}, \text{ which increases in } Q_t \text{ and in } T_t. \end{aligned}$$

disfranchised, the notion of a political inequality or bias, which reflects a weighting of votes, makes at least as much sense.

For one, weighted (or, plural) voting was a very common practice in many countries through the nineteenth century.⁹ Moreover, political participation is correlated with income even when the entire population is enfranchised (see Verba, Kim and Nye, 1978). Additionally, this allows us to go beyond elections and vote counting so as to capture features of political influence that include the ability to organize an effective political action, such as political parties, labor and trade unions, and lobbying groups.¹⁰ The notion of a political bias enables us to introduce gradual changes in political participation and influence, which could manifest itself in these other forms rather than solely as the privilege to vote and thus could potentially be applied to more recent episodes of democratization in developing and transition countries, materialized amidst already enfranchised populations. Finally, the commonly used measures of democratization, based on Polity or Freedom House indices, are built from several ingredients, such as political and civil liberties, which again go beyond voting franchise. In this sense, our analysis is more directly linked to the substantial empirical research making use of these indices.

Consider, therefore, an assignment of weights by income for any given income distribution, given by a function $w(y; F)$, $w' \geq 0$. Under simple majority voting, all individual votes have the same weight, $w(y; F) = 1$ or $w' = 0$; more generally, with the family of voting rules characterized by the income-based voting franchise, $w(y_i; F) = 0$ if $y < \underline{y}$, and $w(y_i; F) = 1/[1-F(\underline{y})]$ if $y \geq \underline{y}$, where \underline{y} is the threshold value. In the applications below, a decisive voter with such weights is the median one in the distribution of weights induced through this transformation. Letting w^{-1} denote the inverse of the weight function, $G = F(w^{-1})$ is the weighted distribution of income.

Consider now two weight functions, $w(y)$ and $z(y)$, along with the distributions of weighted incomes, G and H , respectively induced by them, $G = F(w^{-1})$ and $H = F(z^{-1})$. It then follows from the above definition of the political bias that w has less political bias than z if

⁹ Historical details are available on request. Influential liberal thinkers of the time such as John Stuart Mill and Henry Sidgwick, while rejecting limited franchise, advocated plural voting, thus lending considerable intellectual support for the idea, cf., “Though every one ought to have a voice, that every one should have an equal voice is a totally different proposition,” and “Until there shall have been devised some mode of plural voting, which may assign to education as such the degree of superior influence due to it, and sufficient as a counterpoise to the numerical weight of the least educated class, for so long the benefits of completely universal suffrage cannot be obtained without bringing with them, as it appears to me, more than equivalent evils” (Mill, 1861).

$$\int_0^y [H(x) - G(x)]dx = \int_0^y [F(z^{-1}) - F(w^{-1})]dx \leq 0 \text{ for all } y \geq 0 \quad (11)$$

Then, in particular, letting $y_d(w)$ and $y_d(z)$ denote the respective weighted medians under the two weight functions, it follows immediately that $y_d(w) < y_d(z)$, so that a smaller political bias implies that the distribution generates a lower median.

To summarize,

Proposition 2. A smaller political bias in favor of the rich implies that the median of the weighted distribution of income shifts to a poorer individual.

3.3. Determination of the Tax Rate and Institutional Quality

Anticipating the individual decisions given in Section 3.1, the voters choose T_t and Q_t . These optimal choices maximize the utility in (9). Assuming for simplicity an internal solution, the first order conditions are:

$$T_t: \quad \frac{2}{3-T_t-Q_t} - \ln(y_{it}) - \frac{1}{1-T_t} + \frac{\int_0^1 y_{jt}^{2-T_t-Q_t} \ln(y_{jt}) dj}{\int_0^1 y_{jt}^{2-T_t-Q_t} dj} = 0 \quad (12)$$

$$Q_t: \quad -\frac{2\phi'}{1-\phi} + \frac{2}{3-T_t-Q_t} - \ln(y_{it}) + \frac{\int_0^1 y_{jt}^{2-T_t-Q_t} \ln(y_{jt}) dj}{\int_0^1 y_{jt}^{2-T_t-Q_t} dj} = 0 \quad (13)$$

and we assume that the second-order conditions hold. Differentiation of (12) and (13) reveals, then, that T_t and Q_t both decrease in individual income. Moreover, viewed as functions of individual income, the utility function (9) satisfies the property of intermediate preferences as defined in Grandmont (1978); see Persson and Tabellini (2002, Chapter 2) for a simple exposition.¹¹ This implies that a majority voting equilibrium exists and, in particular, under one-man-one-vote system

¹⁰ Mobilization for political action is an important factor in political participation as documented in Rosenstone and Hansen (1993).

¹¹ Please note that the indirect utilities can be written as follows (the time subscript is omitted): $V_i = f(T, Q) + \chi(y_i)h(T, Q)$, where $\chi' > 0$, thus satisfying the property.

is given by equations (12) and (13) with the income of the median voter, y_{mt} , replacing y_{it} there.¹² More generally, it is not difficult to see that, for any weighting function w , the intermediate preferences property holds, implying that a properly weighted majority voting equilibrium exists; so that the decisive voter's identity is given by $G(y_d) = 1/2$. But then Proposition 2 applies with the resulting implications for the equilibrium outcome.

To summarize these implications,

Proposition 3. Preferences on the tax rate and institutional quality are a decreasing function of individual income. A (weighted) majority voting equilibrium determining these parameters exists; when it is a simple majority voting, the median income voter is decisive, whereas in the presence of a political bias the decisive voter's income is larger than the median. As the political bias changes in favor of the poor, a poorer voter becomes decisive, causing an increase in the levels of institutional quality and taxes.

The implication that democracy is associated with a higher level of institutional quality is strongly supported by the data. For example, the correlations between a measure of democracy based on the Polity IV dataset and measures of institutional quality based on the International Country Risk Guide (ICRG) or on the World Bank data hover above 0.70. The effects of democracy on taxation and redistribution appear somewhat more nuanced. Thus, Mulligan, Gil and Sala-i-Martin (2004), examining the fiscal impact of democracies over 1960-1990 for a large sample of countries, conclude that fiscal policy components look similar across democracies and non-democracies; in contrast, they find significant differences between democracies and non-democracies with regard to issues pertaining to human rights and civil liberties. Boix (2001) finds that, while democracy is overall mildly associated with the size of the public sector, the relationship is robust among more developed countries. Husted and Kenny (1997), examining the effect of the removal of franchise restrictions in the context of the states in the US, find that they led to an increase in welfare spending and transfers, although the relationship is moderate; Aidt, Dutta and Loukianova (2006), in a similar study of 12 European countries also discover a moderate effect of franchise extension, especially for women, on welfare spending. Also note

¹² Note that, under the assumption of lognormal income distribution the median voter's preferred outcome coincides with aggregate welfare maximization. This is because in such a case, $y_{mt} = \mu_t = \int \ln(y_{jt})dj$; then aggregate utility,

that, because of the countervailing effect of taxes and institutional quality, the effect of democracy on growth is ambiguous: the tax effect acts to slow growth, whereas the institutions effect enhances it.

To proceed further, suppose that income distributions are lognormal as in (10). Also, suppose that the political weight of an individual household is a properly normalized exponential function of its income; the exponent, b , $b \geq 0$, represents the extent of the political bias, whereby the case of $b = 0$ corresponds to full democracy. It is not difficult to show that the identity of the decisive voter is then given by: $\ln(y_{di}) = \mu_t + b\sigma_t^2$; for example, under full democracy, $b = 0$, the median income voter, y_{mt} , is decisive. Further, the first order conditions determining the policy parameters can be written as follows:¹³

$$T_t: \quad \frac{2}{3-T_t-Q_t} - \ln(y_{di}) - \frac{1}{1-T_t} + \frac{\mu_t + (2-T_t-Q_t)\sigma_t^2}{(2-T_t-Q_t)\mu_t + (2-T_t-Q_t)^2\sigma_t^2/2} = 0 \quad (12')$$

$$Q_t: \quad -\frac{2\phi'}{1-\phi} + \frac{2}{3-T_t-Q_t} - \ln(y_{di}) + \frac{\mu_t + (2-T_t-Q_t)\sigma_t^2}{(2-T_t-Q_t)\mu_t + (2-T_t-Q_t)^2\sigma_t^2/2} = 0 \quad (13')$$

Given the above characterization of the decisive voter and using Proposition 3, the political equilibrium is then characterized as follows:

$$\frac{2}{3-T_t-Q_t} - (\mu_t + b\sigma_t^2) - \frac{1}{1-T_t} + \frac{\mu_t + (2-T_t-Q_t)\sigma_t^2}{(2-T_t-Q_t)\mu_t + (2-T_t-Q_t)^2\sigma_t^2/2} = 0 \quad (14)$$

$$-\frac{2\phi'}{1-\phi} + \frac{2}{3-T_t-Q_t} - (\mu_t + b\sigma_t^2) + \frac{\mu_t + (2-T_t-Q_t)\sigma_t^2}{(2-T_t-Q_t)\mu_t + (2-T_t-Q_t)^2\sigma_t^2/2} = 0 \quad (15)$$

Differentiation of the left-hand sides in (14) and (15) with respect to b reveals that they decrease in the political bias, implying that oligarchic regimes will choose lower values for the policy parameters of institutional quality and redistribution than democratic regimes.

Twice differentiating with respect to b and σ_t^2 reveals that the effect of inequality works in conjunction with the political bias; simple yet tedious derivations establish that $d^2T_t/db d\sigma_t^2$, $d^2Q_t/db d\sigma_t^2 > 0$. This then is summarized in

$\int V_{jt} dj$, is equivalent to that of the median income voter.

¹³ Derivational details are available on request.

Proposition 4. The adverse effect of inequality on institutional quality and redistribution is stronger the larger is the political bias, and when the latter is large enough, an increase in inequality causes the politically powerful elite to choose smaller levels of both.

We now proceed to empirically assess this implication.

4. Empirical Analysis

While the above framework generates quite a few testable hypotheses, for the purposes of the empirical analysis we focus on the determination of the policy parameters, the level of institutional quality and the extent of redistributive taxation. Consistent with the model above, we estimate the following specifications:

$$Inst_{it} = \alpha + \beta_1 X_{it} + \beta_2 Democ_{it} + \beta_3 Ineq_{it} + \beta_4 Democ_{it} * Ineq_{it} + \mu_i + \varepsilon_{it} \quad (16a)$$

$$Tax_{it} = \alpha + \beta_1 X_{it} + \beta_2 Democ_{it} + \beta_3 Ineq_{it} + \beta_4 Democ_{it} * Ineq_{it} + \mu_i + \varepsilon_{it} \quad (16b)$$

where $Inst_{it}$ represent our first dependent variables, namely, the institutional quality; Tax_{it} is the tax burden of country i in period t ; and X_{it} is a vector of basic controls, which we take from the previous literature on the subject (Chong and Gradstein, 2007a).

The key Proposition 4 states that both the institutional quality and the tax burden are determined by the level of income inequality as mediated by the political bias in the society; specifically, the adverse effect of inequality is moderated in the context of a more democratic society. To assess this issue, we include in our empirical specification an interactive term between the democracy index, and the income inequality measure. Hence (denoting z_{it} the left-hand side variables there) we can compute the marginal effect of the latter by taking derivatives in equations (16), as follows:

$$\frac{\partial z_{it}}{\partial Ineq_{it}} = \beta_3 + \beta_4 Democ_{it} \quad (17)$$

Equation (17) shows that the marginal effect of income inequality hinges not only on the coefficients obtained for the inequality variable and the interactive term, but also on the empirical value of the democracy proxy, so we can obtain an estimate of the marginal effect of income inequality at any point of the empirical distribution of the democracy proxy.

We employ the well known institutional quality measure from the International Country Risk Guide (ICRG, 2006), which provides an aggregate assessment of the overall institutional quality of over 120 countries from 1970 to 2004.¹⁴ For the tax burden we use the Global Development Finance dataset, which contains information about the total revenues, income taxes, total revenues and grants, and tax revenues; we express all these variables as a percentage of the GDP. The inequality measure comes from the United Nations (2005).¹⁵ This extensive dataset, which updates the Gini coefficients reported by Deininger and Squire (1997) and World Bank (2005), is comprised of comparable Gini coefficients from several sources; these include previous calculations by other authors as well as UN calculations based on household surveys; furthermore, different criteria from different sources are homogenized in order to avoid definition problems.¹⁶ Data on income inequality is available for 133 countries from 1960 to 2001. The data on democracy is taken from the Polity IV dataset, which contains coded annual information on regime and authority characteristics for all independent states (with a total population greater than 500,000) in the global state system and covers the years 1800-2004. These objective measures of income inequality and of the degree of authoritarianism and democracy allow us to accurately generate empirical results that provide empirical support of the predictions of the theoretical model above.

Finally, following previous work on the determinants of the tax burden and the institutional quality, we use a parsimonious specification with basic controls, such as the logarithm of the per capita GDP as a measure of the wealth of the country, the inflation rate, which proxies for the volatility of the economy. Also, for the determinants of the tax burden, we use general government final consumption expenditure; in the case of the determinants of institutional quality we also control for the average years of education of the population, which has been proved to be a very accurate predictor of the quality of the institutional framework. All of these variables, except the average years of education, were taken from the World

¹⁴ The institutional quality index is built using information coming from the perceived risk of corruption, law and order, and bureaucratic quality of the country.

¹⁵ Obviously, the Gini coefficient and similar indices also pose some problems. One is that the general coverage tends to be sparse and unbalanced. To minimize this problem, the data from the World Bank (2005) combines different sources. Still, the question is whether there is any better proxy than these indices for making broad cross-country comparisons on inequality, and the answer is no.

¹⁶ The definition problems that can arise include whether the data is taken at the individual or household level; whether it correspond to income or expenditures; in the former case, whether it is net of taxes or not; or if it representative at the national or sub national levels. We only take into account data that is representative at the national level, based on income data and weighted to the individual level.

Development Indicators (World Bank, 2005). The education variable comes from Barro and Lee (1993). Detailed definitions of the variables used in this paper are provided in the Appendix, whereas Tables 1 and 2 present the descriptive statistics and the correlation matrix, respectively.

As mentioned before, we use a panel data approach, using country-level fixed effects. Nevertheless, due to the fact that both the institutional quality and the tax burden may be considered as persistent series over time, we apply a method that deals with the problem of the serial correlation in the error terms. Also, there may be some concerns on the simultaneity and reverse causation between democracy and income inequality and our dependent variables. To minimize these problems, we also use the fixed-effects dynamic panel data GMM-IV method suggested by Arellano and Bover (1995). The advantage of this method is that we used the lagged value of the dependent variable as a regressor, which is included in a simultaneous regression in levels and a regression in differences, with each equation using its own specific set of instrumental variables.

The consistency of the GMM estimator depends on whether lagged values of the explanatory variables are valid instruments in the regression. We address this issue by considering two specification tests suggested by Arellano and Bond (1991) and Arellano and Bover (1995). The first is a Sargan test of over-identifying restrictions, which tests the overall validity of the instruments by analyzing the sample analog of the moment conditions used in the estimation process. Failure to reject the null hypothesis lends support to the model. The second test examines the hypothesis that the error term ε_{it} is not serially correlated. We test whether the differenced error term (that is, the residual of the regression in differences) is first and second-order serially correlated. A first-order serial correlation of the differenced error term is expected even if the original error term (in levels) is uncorrelated, unless the latter follows a random path. A second-order serial correlation of the differenced residual indicates that the original error term is serially correlated and follows a moving average process of at least an order of one. If the test fails to reject the null hypothesis of absence of second-order serial correlation, we conclude that the original error term is serially uncorrelated and use the corresponding moment conditions.¹⁷ Because the lagged values of each variable serve as instruments, and in order to balance the data

¹⁷ A detailed explanation of these methods is available in a technical appendix, which will be happily provided by the authors upon request of the interested reader.

as much as possible to avoid possible biases towards countries with more data availability, we use five-year averages.

Whereas the emphasis of the theoretical model is on the relationship between income inequality and institutions and tax burden being mediated by the level of democracy, as a prelude for its exploration we first examine a simpler linear model. Table 3 shows the basic results of the regressions, using the fixed effects and GMM-IV methods. The first two columns show the results for the institutional quality index, while the remaining ones correspond to the total revenues of the government as a percentage of the GDP. We observe that the institutional quality is negatively affected by income inequality, as measured by the Gini coefficient, and is positively affected by the level of democracy, implying that more equal and democratic societies tend to have better institutions. These results hold even after controlling for potential endogeneity and serial correlation using the GMM-IV method. As can be seen from the statistics shown at the bottom of the table, the consistency of the GMM estimator is ensured, since we fail to reject the null hypothesis of first order serial correlation, and we do reject the hypothesis that the error term of the differenced equation follows a second order auto regressive process. The value obtained in Hansen test of over-identification of restrictions confirms that the instruments are consistent.

For the tax burden, we find evidence consistent with Wagner's Law, that richer countries are also those that are able to collect a higher share of taxes. We do find consistent estimates that confirm the negative and linear association between the country's income inequality and the tax revenues, as predicted by the model. Nevertheless, we do not obtain a statistically significant relationship for the democracy proxy and the tax burden, which leads us to think that the political bias in fact does affect the tax burden, but its effect is driven through the inequality level in the country. Also, these results raise the question of whether the effect of income inequality on either institutional quality or the tax burden has some sort of non-linearities throughout the empirical values of our democracy proxy.

We then test more specifically the predictions of Proposition 4, which states that the effect of income inequality on the tax burden and institutional quality hinges on the level of political bias. We include in the specification presented in Table 3 the interactive term between these variables, and then evaluate the estimated coefficients for a wide range of values of the

democracy proxy, following equation (17).¹⁸ Table 4 shows selected marginal coefficients after running our preferred specification (GMM-IV) and computing equation (17); also see Figure 1. We find that income inequality generally has a negative effect on institutional quality and taxation, and more so in low-democracy countries: as can be seen in Figure 1, the negative effect of inequality on both has a positive slope over the distribution of the democracy proxy. While in a country with a median level of democracy (0.5), a marginal increase of two standard deviations in the Gini coefficient (about the difference between Chile and Portugal in the 1995-1999 period) leads to a decrease of about 8.2 percent in the institutional quality, a similar increase in the countries inequality in a perfect democracy (1.0) will imply a decline in the institutional quality index of about 6.1 percent. The tax burden effect follows a similar pattern to the one for institutional quality. Moreover, this effect has a steeper slope, meaning that the same two standard-error increase on our income inequality measure will lead to a decrease in total revenues of about 10.4 percent, while the same increase in a perfect democracy will only mean that the revenues will fall by about 8 percent.

In Tables 5 and 6 we perform the same exercise as above but use different proxies for democracy and inequality, respectively. In Table 5, we alternate the Polity IV Democracy index with the Freedom House aggregated index and the civil liberties measure from the same source; also, we use the democratic accountability index from the International Country Risk Guide. As can be seen in the table, our results hold with all these proxies. Table 6 uses alternative measures of income inequality, based on income shares held by various portions of the population. Specifically, we use the income share held by the top and bottom 40 percent of the population (ranked by the household expenditures), as well as the ratio of those shares. The results confirm our previous findings. Finally, in Table 7 we run similar regressions, but now proxy our dependent variable with some alternative measures such as the level of corruption or the taxes on income and profits, the results being very similar to those above.¹⁹

¹⁸ For the sake of economy we do not present the full regressions but only our variables of interest.

¹⁹ Additionally, we have used a difference-in-difference approach, using as a “treatment” variable a dummy that indicates whether a country has changed from a democratic regime to an authoritarian one. While the findings are consistent with the above, they are not always significant, probably due to the small sample size. We would be happy to provide this analysis upon request.

5. Concluding Remarks

This paper examines how economic and political inequities shape institutional quality and redistribution in the economy. The simple theoretical model suggests that income inequality, in conjunction with political bias, has an adverse effect on both—thereby generating an overall ambiguous effect on growth. While the model is quite rich in producing a number of interesting implications, we then take to the data the prediction that the adverse effect of income inequality is exacerbated in economies with a high degree of political bias. Our panel data analysis is consistent with theory in confirming that income inequality “works through” political bias. The effect is both statistically significant and economically meaningful, suggesting that the synergy of economic and political inequalities has large detrimental consequences for institutional quality and redistribution.

Many issues are left for future work. Endogenization of the political bias is an important avenue of research, and some recent literature has started tackling it analytically, see e.g., Cervellati, Fortunato and Sunde (2005), Gradstein (2007), and Lagunoff (2007, and references therein). This line of research can also shed light on the link between income and political inequalities—assumed to be exogenous in this paper. Another, more empirical issue, is contrasting this paper’s view whereby both institutional quality and redistribution are simultaneously determined by the economy’s fundamentals, with an alternative where, for example, the former has a causal effect on the latter. Finally, further work could build on the analysis presented to focus more thoroughly on the channels through which the fundamentals affect economic growth. While existing literature contains suggestions that inequalities may affect growth via human capital accumulation (Wacziarg, 2001; Tavares and Wacziarg, 2001), examination of the alternative channels is an important complementary research program.

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Appendix. Variable description

| Variable | Description |
|---|--|
| <i>Institutional quality</i> | |
| Index of the quality of institutions | Index of the overall quality of the institutions in the country. It comprises data from the sub indices related to corruption, law and order and bureaucratic quality. It takes values between 1 and 18. Source: ICRG (2006) . |
| Corruption | Assessment of the corruption within the political system. The most common form of corruption met directly by business is financial corruption in the form of demands for special payments and bribes connected with import and export licenses, exchange controls, tax assessments, police protection, or loans. It is also more concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, 'favor-for-favors', secret party funding, and suspiciously close ties between politics and business. It takes values between 1 and 6. Source: ICRG (2006). |
| <i>Taxes</i> | |
| Total revenue (% of GDP) | Total revenues of the central government, including taxes on income, profits, and capital gains, social security contributions, taxes on payroll of the workforce, taxes on property, domestic taxes on goods and services, taxes on international trade, and transactions, and other taxes, grants, expressed as a percentage of the GDP. Source: IMF: Government Financial Statistics |
| Taxes on income, profits, & capital gains (% of GDP) | All taxes collected by the central government on income, profits, & capital gains, expressed as a percentage of the GDP. Source: IMF: Government Financial Statistics |
| <i>Inequality measures</i> | |
| Gini coef. | The Gini index measures the extent to which the distribution of income among individuals or households within an economy deviates from a perfectly equal distribution. A Gini index of 0 represents perfect equality, while an index of 100 implies perfect inequality. Source: UN (2004). |
| Top 40 | Share of the national income concentrated on the richest 40 percent of the population. Source: UN (2004) |
| Bottom 40 | Share of the national income concentrated on the poorest 40 percent of the population. Source: UN (2004) |
| Top 40/Bot 40 | Ratio of the two measures above. Source: UN (2004). |
| <i>Democracy indices</i> | |
| Polity 4 Index | Index of democracy and autocracy calculated by the Polity project. This index ranges between -10 and 10, where highest values represent a more democratic regime as lower levels, a more autocratic regime. Data are available for the whole 20 th century. We normalize the data so it takes values between 0 and 1. Source: Polity 4 project. |
| Freedom house index | <i>Freedom in the World</i> is an annual comparative assessment of political rights and civil liberties that covers 192 countries and 14 related and disputed territories. It ranges from 0 to 1. Source: Freedom House (2006). |
| Civil liberties | Comparative assessment of civil liberties that covers 192 countries and 14 related and disputed territories. It ranges from 0 to 1. Source: Freedom House (2006). |
| Democratic accountability | This is a measure of how responsive government is to its people, on the basis that the less responsive it is, the more likely it is that the government will fall, peacefully in a democratic society, but possibly violently in a non-democratic one. The points in this component are awarded on the basis of the type of governance enjoyed by the country in question. For this purpose, we have defined the following types of governance: Alternating Democracy, Dominated Democracy, De-Facto One-Party State, De-Jure One-Party State, Autarchy. Takes values between 1 and 6, but we normalize the index so it is between 0 and 1. Source: ICRG (2006). |
| <i>Basic controls</i> | |
| Log (GDP pc) | GDP per capita is gross domestic product divided by midyear population. Data are in constant 2000 US dollars. Source: WDI (2005) |
| GDP Growth | GDP annual growth rate (%). Source: WDI (2005). |
| Inflation Rate | Annual growth rate of the consumer price index (%). Source: WDI (2005). |
| General government final consumption expenditure (%GDP) | General government final consumption expenditure, expressed as a percentage of the GDP. Source: WDI (2005). |
| Average years of education | Average years of schooling of the population. 5-year averages are available for the period 1960-2000 (the data from the original paper was actualized by the authors to include recent data). Source: Barro, and Lee (1993). |

Table 1. Descriptive Statistics

| Variable | Obs. | Mean | Std. Dev. | Min | Max |
|---|------|-------|-----------|--------|---------|
| <i>Institutional quality</i> | | | | | |
| Index of the quality of institutions | 881 | 8.56 | 3.97 | 0.00 | 16.00 |
| Corruption | 881 | 3.17 | 1.43 | 0.00 | 6.00 |
| <i>Taxes</i> | | | | | |
| Total revenue (% of GDP) | 545 | 25.58 | 10.94 | 0.04 | 76.52 |
| Taxes on income, profits, & capital gains (% of GDP) | 544 | 27.00 | 11.32 | 0.04 | 76.52 |
| <i>Inequality measures</i> | | | | | |
| Gini coef. | 495 | 39.95 | 10.82 | 16.63 | 74.61 |
| Top 40/Bot 40 | 237 | 4.59 | 2.46 | 2.04 | 28.10 |
| Top 40 | 238 | 67.87 | 6.50 | 54.47 | 87.10 |
| Bottom 40 | 237 | 16.83 | 4.52 | 3.10 | 26.73 |
| <i>Democracy indices</i> | | | | | |
| Polity 4 Index | 980 | 0.52 | 0.37 | 0.00 | 1.00 |
| Freedom house index | 1130 | 0.50 | 0.36 | 0.00 | 1.00 |
| Civil liberties | 1137 | 0.49 | 0.32 | 0.00 | 1.00 |
| Democratic Accountability | 881 | 0.60 | 0.31 | 0.00 | 1.00 |
| <i>Basic controls</i> | | | | | |
| Log (GDP pc) | 1045 | 7.43 | 1.53 | 4.43 | 10.72 |
| Inflation Rate | 925 | 52.57 | 373.52 | -38.15 | 8010.91 |
| GDP growth | 1045 | 3.40 | 4.83 | -42.45 | 35.59 |
| General government final consumption expenditure (%GDP) | 1013 | 16.64 | 7.16 | 2.34 | 59.18 |
| Average years of education | 604 | 4.56 | 2.88 | 0.04 | 12.18 |

Table 2. Pairwise Correlation Matrix

| | Index of the quality of institutions | Total revenue (% of GDP) | Gini coef. | Polity 4 Index | Log (GDP pc) | GDP growth | Inflation Rate | General government final consumption expenditure (% GDP) |
|--|---|-----------------------------|---------------|-------------------|-----------------|---------------|-------------------|---|
| Total revenue (% of GDP) | 0.419 | | | | | | | |
| Gini coef. | 0.000 | -0.446 | | | | | | |
| Polity 4 Index | 0.567 | 0.211 | -0.195 | | | | | |
| Log (GDP pc) | 0.000 | 0.000 | 0.000 | 0.543 | | | | |
| GDP growth | 0.045 | -0.049 | 0.174 | -0.091 | 0.001 | | | |
| Inflation Rate | 0.215 | 0.265 | 0.000 | 0.007 | 0.985 | | | |
| General government final consumption expenditure (%GDP) | -0.102 | -0.010 | -0.038 | -0.022 | -0.081 | -0.304 | | |
| Average years of education | 0.006 | 0.820 | 0.428 | 0.544 | 0.017 | 0.000 | | |
| | 0.325 | 0.517 | -0.327 | 0.037 | 0.256 | -0.085 | 0.023 | |
| | 0.000 | 0.000 | 0.000 | 0.279 | 0.000 | 0.008 | 0.497 | |
| | 0.743 | 0.414 | -0.493 | 0.625 | 0.842 | -0.044 | -0.052 | 0.324 |
| | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.300 | 0.231 | 0.000 |

p-values shown below the correlation coefficients

Table 3. Inequality, Democracy, Institutional Quality, and Taxation

| | Index of the Quality of institutions | | Total revenue (% of GDP) | |
|-------------------------------------|--------------------------------------|---------------------|--------------------------|--------------------|
| | Country Fixed effects | GMM-IV | Country Fixed effects | GMM-IV |
| Gini | -0.040 (1.97)* | -0.039 (2.63)*** | -0.124 (2.27)** | -0.148 (2.57)** |
| Polity IV index | 3.403 (6.62)*** | 1.296 (1.63)* | -2.992 (1.59) | -1.079 (0.60) |
| Constant | 7.519 (1.46) | 3.828 (3.60)*** | -25.149 (2.02)** | 11.247 (2.01)** |
| Observations | 289 | 250 | 265 | 215 |
| Number of countries | 73 | 72 | 79 | 73 |
| R-sq within | 0.36 | | 0.38 | |
| R-sq between | 0.37 | | 0.30 | |
| R-sq overall | 0.39 | | 0.38 | |
| Rho | 0.89 | | 0.93 | |
| Hansen test of overid. restrictions | | 55.21 | | 37.64 |
| P-value | | 0.35 | | 0.43 |
| Test for AR(1) | | -2.70 | | -2.48 |
| P-value | | 0.01 | | 0.01 |
| Test for AR(2) | | -1.12 | | 0.79 |
| P-value | | 0.26 | | 0.74 |

Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%. In all the regressions we include time dummies. Full specification are not presented but are available upon request (see text). Also, in the GMM-IV specifications we use legal origin dummies as regressors, our strictly exogenous instruments for the system are the legal origin dummies, the number of years under a colonial regime in the 20th century, and the absolute value of the latitude of the capital city.

Table 4. Marginal effect of Inequality on Institutional Quality and Total Revenues for Various Levels of Democracy, GMM-IV Estimator.

| Democracy | Effect of income inequality on: | |
|-------------------------------------|---------------------------------|--------------------|
| | Institutional quality | Total revenues |
| 0 | -0.052 (1.35) | -0.157 (0.95) |
| 0.1 | -0.050 (1.55)* | -0.151 (1.05) |
| 0.2 | -0.048 (1.57)* | -0.145 (1.18) |
| 0.3 | -0.045 (1.72)* | -0.140 (1.36) |
| 0.4 | -0.043 (1.90)* | -0.134 (1.60) |
| 0.5 | -0.041 (2.10)** | -0.128 (1.94)* |
| 0.6 | -0.039 (2.31)** | -0.122 (2.34)** |
| 0.7 | -0.037 (2.43)** | -0.117 (2.57)** |
| 0.8 | -0.034 (2.37)** | -0.111 (2.28)** |
| 0.9 | -0.032 (2.10)** | -0.106 (1.74)* |
| 1.0 | -0.030 (1.72)* | -0.100 (1.30) |
| Observations | 250 | 215 |
| Number of countries | 72 | 73 |
| Hansen test of overid. restrictions | 58.31 | 39.24 |
| P-value | 0.36 | 0.44 |
| Test for AR(1) | -2.68 | -2.49 |
| P-value | 0.01 | 0.01 |
| Test for AR(2) | -1.11 | 0.78 |
| P-value | 0.25 | 0.72 |

Coefficients shown are obtained from regressions similar to the ones in columns 2 and 4 of Table 3, but including the interactive term between our democracy index, and the Gini coefficient. The marginal effects shown correspond to the effect of inequality on each dependent variable, evaluated at different levels of our democracy index. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

**Table 5. Marginal Effect of Inequality on Institutional Quality
and Total Revenues for Various Levels of Democracy,
GMM-IV Estimator Using Different Proxies for Democracy**

| Values for Democracy | Effect of income inequality on: | |
|--|---------------------------------|----------------------|
| | Institutional quality | Total revenues |
| Polity IV index | | |
| 0.25 | -0.047 (-1.64)* | -0.143 (-1.26) |
| 0.5 | -0.041 (-2.10)** | -0.128 (-1.94)* |
| 0.75 | -0.036 (-2.43)*** | -0.114 (-2.49)*** |
| Freedom House index | | |
| 0.25 | -0.055 (-2.57)*** | -0.175 (-1.68)* |
| 0.5 | -0.047 (-2.67)*** | -0.124 (-2.11)** |
| 0.75 | -0.038 (-2.11)** | -0.072 (-1.50) |
| Civil liberties (0-1) | | |
| 0.25 | -0.050 (-2.65)*** | -0.027 (-0.42) |
| 0.5 | -0.036 (-2.08)** | -0.083 (-1.44) |
| 0.75 | -0.022 (-0.88) | -0.139 (-1.21) |
| Democratic Accountability (0-1) | | |
| 0.25 | -0.053 (-1.37) | -0.071 (-0.46) |
| 0.5 | -0.042 (-1.84)* | -0.109 (-1.28) |
| 0.75 | -0.031 (-2.12)** | -0.147 (-2.40)** |

Coefficients shown are obtained from regressions similar to the ones in columns 2 and 4 of Table 3, but including the interactive term between our democracy index, and the Gini coefficient. The marginal effects shown correspond to the effect of inequality on each dependent variable, evaluated at different levels of our democracy index. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table 6. Marginal Effect of Inequality on Institutional Quality and Total Revenues for Various Levels of Democracy, GMM-IV Estimator Using Different Proxies for Inequality

| Values for Democracy | Effect of income inequality on: | |
|-------------------------|---------------------------------|----------------------|
| | Institutional quality | Total revenues |
| Gini | | |
| 0.25 | -0.047 (-1.64)* | -0.143 (-1.26) |
| 0.5 | -0.041 (-2.10)** | -0.128 (-1.94)* |
| 0.75 | -0.036 (-2.43)** | -0.114 (-2.49)** |
| Top 40/Bottom 40 | | |
| 0.25 | -0.156 (-0.74) | -1.537 (-2.85)*** |
| 0.5 | -0.239 (-2.16)** | -1.268 (-3.83)*** |
| 0.75 | -0.322 (-2.30)** | -0.999 (-3.42)*** |
| Top 40 | | |
| 0.25 | -0.077 (-1.32) | -0.424 (-3.28)*** |
| 0.5 | -0.087 (-2.67)*** | -0.361 (-3.25)*** |
| 0.75 | -0.098 (-2.29)** | -0.298 (-2.52)** |
| Bottom 40 | | |
| 0.25 | 0.145 (1.44) | 0.427 (1.59) |
| 0.5 | 0.121 (1.93)* | 0.419 (2.42)** |
| 0.75 | 0.096 (1.84)* | 0.412 (2.95)*** |

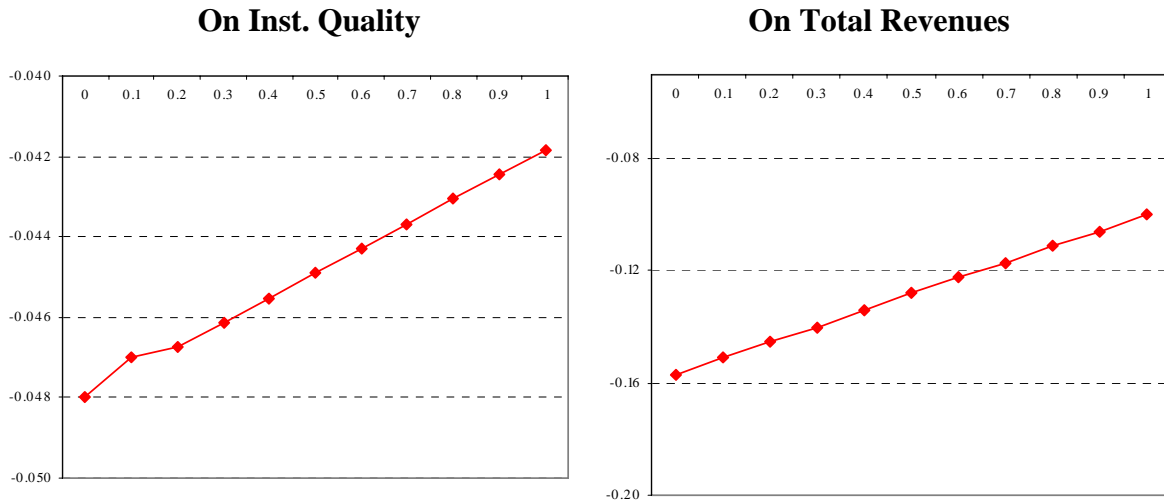
Coefficients shown are obtained from regressions similar to the ones in columns 2 and 4 of Table 3, but including the interactive term between our democracy index, and the Gini coefficient. The marginal effects shown correspond to the effect of inequality on each dependent variable, evaluated at different levels of our democracy index. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

**Table 7. Marginal Effect of Inequality on Institutional Quality
and Total Revenues for Various Levels of Democracy,
GMM-IV Estimator Using Different Proxies for our Dependent Variables**

| Values for Democracy | Index of the quality of institutions | Total Revenue (% of GDP) |
|----------------------|--------------------------------------|--|
| 0.25 | -0.047 (-1.64)* | -0.143 (-1.26) |
| 0.5 | -0.041 (-2.10)** | -0.128 (-1.94)* |
| 0.75 | -0.036 (-2.43)** | -0.114 (-2.49)** |
| | Corruption | Taxes on income, profits, & capital gains (% of GDP) |
| 0.25 | -0.019 (-1.34) | -0.124 (-1.37) |
| 0.5 | -0.021 (-2.47)** | -0.111 (-1.83)* |
| 0.75 | -0.023 (-2.46)** | -0.099 (-2.22)** |

Coefficients shown are obtained from regressions similar to the ones in columns 2 and 4 of Table 3, but including the interactive term between our democracy index, and the Gini coefficient. The marginal effects shown correspond to the effect of inequality on each dependent variable, evaluated at different levels of our democracy index. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Figure 1. Marginal Effects of GMM-IV Regressions



Note: The figures show the coefficients obtained from regressions similar to the ones in columns 2 and 4 of Table 3, but including the interactive term between our democracy index, and the Gini coefficient. The marginal effects shown correspond to the effect of inequality on each dependent variable, evaluated at different levels of our democracy index. Robust t statistics in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.