The Role of Redistributive Institutions in the Fiscal Policy Channel of Redistribution

Abstract

This paper first points out the lack of consensus between empirical and theoretical studies of income inequality and redistribution. While theoretical papers show that income inequality increases redistribution, empirical studies fail to confirm the same result. The paper later shows that even an exogenously given efficiency of redistributive institutions (ERI) affects the relationship between income inequality and redistribution. This paper also introduces three specifications to endogenize ERI. In these various specifications, increasing inequality reduces the ERI when (1) ERI is an increasing function of average income or (2) political influence on ERI is positively associated with income or (3) the median voter has some prospect of upward mobility. There is one common element in these various specifications. While income inequality increases the pressure for redistribution, it also increases the incentive to reduce the efficiency of redistribution in order to constrain aggregate redistribution. Thus, the main conclusion is that one needs to consider these conflicting effects in order to account for the lack of strong empirical evidence of a positive relationship between income inequality and redistribution.

Keywords: Income Inequality, Redistribution, Institutions, Prospect of Upward Mobility

JEL classification: D7**,** D31, H40, H5

Ahmet Faruk Aysan

Bogazici University, Dept. of Economics

34342 Bebek, Istanbul, Turkey

Phone: 90-212-359 76 39

Fax: 90-212-287 24 53

ahmet.aysan@boun.edu.tr

The Role of Redistributive Institutions in the Fiscal Policy Channel of Redistribution

1. Introduction

Italy has a more equal income distribution than the Dominican Republic. However, Italy has redistributed 14 percent of its GDP for social security and welfare expenditure over the last thirty years, whereas the corresponding figure for Dominican Republic is only 0.8 percent. This observation is quite contrary the predictions of economic models. Existing theoretical models suggest that higher income inequality generates more redistribution in favor of the poor. While a positive relationship between income inequality and redistribution has been suggested much earlier (Meltzer and Richard 1981), with the advent of endogenous growth models[1], a resurgence of interest in income inequality and redistribution took place in 1990s. The main purpose of the related endogenous growth papers was to explain the casual relationship between income distribution and growth. In addition, these studies have also implications for income inequality and redistribution, given that redistribution typically emerges as the main channel from income inequality to growth. The common theme in these political economy models is that higher income inequality leads to higher redistributive pressure and redistributive pressure affects growth.

Even though there exists a strong theoretical presumption in favor of a positive relationship between income inequality and redistribution, empirical studies fail to confirm this positive relationship (Benabou 1996, Perotti 1996, Milanovic 2000). This lack of empirical evidence motivates this study to analyze income inequality and redistribution relation by considering the efficiency of redistributive institutions (ERI). Existing

[1] See, for instance, Bertola (1993, 1998), Banarjee and Newman (1993), Saint-Paul and Verdier (1993), Perotti (1993), Perrson and Tabellini (1994), Galor and Zeira (1993), Alesina and Rodrik (1994), Aghion and Bolton (1997), Chiu (1998), Benabou (2000), Rigolini (2003).

explanations[2] for this failure overlook the role of ERI on the relationship between income inequality and redistribution.

This study shows that inefficiency of redistributive institutions can limit the aggregate redistribution in the economy. Furthermore, the current study provides a model where income inequality reduces the ERI while increasing the pressure for redistribution and thereby presents an explanation for the aforementioned empirical puzzle.

This study also contributes to the literature by distinguishing two types of inefficiencies. The first one occurs at the taxation stage. Taxing income reduces agent's incentive to supply effort or factors of production and hence generates deadweight losses. This case is the main form of inefficiency emphasized in existing studies like McGuire and Olson (1996) and Harms and Zink (2003). This study draws attention to the second type of inefficiency, which has been overlooked so far in analyzing the income inequality and redistribution relationship. This type of inefficiency emerges in the process of redistributing the tax revenue back to society. Existing political economy models ignore the redistributive institutions in the redistribution process and simply assume that all tax revenues are redistributed back to society without any change in the total value. However, in reality, governments play an active role in the redistribution process. Hence, how governments run their redistributive institutions emerges as another form of inefficiency and needs to be taken into account.

Anecdotal evidence from Latin America by De Ferranti et al. (2004)[3] also confirms our idea that income inequality reduces government effectiveness by generating political inequality, clientelism, and state capture by the elite. Moreover, inefficiency in redistributive

[2] See Harms and Zink (2003) for the detailed literature review.

[3] The World Bank Publication, "Inequality in Latin America Breaking with History?" provides an extensive analysis of the role of income inequality on governance and redistribution especially in chapter 5.

institutions in turn adversely affects aggregate redistribution, for instance in the Dominican Republic (Keefer 2002).

The literature on inefficient redistribution is also related here. The central issue in this literature is to explain why most redistribution in practice takes an inefficient form. Coate and Morris (1995) attribute inefficient transfers to imperfect information. Politicians exploit the voters' imperfect information to make transfers to their favorite groups. Acemoglu and Robinson (2001-a) assert that inefficient redistribution is employed in order to maintain future political power. Drazen and Limao (2004) emphasize that inefficient transfers increase the bargaining power of the government. Finally, the commitment to inefficient forms of redistribution emerges as a way to constrain redistribution (Becker and Mulligan 2003). Similarly, in this current study, the inefficiency in redistributive institutions generates inefficient redistribution and thereby constrains the redistributive pressure of the poor.

This paper is organized as follows. Section 2 introduces the benchmark model. Section 3 analyzes a model where ERI is a positive function of average national income. Two stage specifications where the political power is proportional to income and the prospect of upward mobility hypothesis are investigated in Section 4. Finally, Section 5 concludes. Detailed proofs, arguments for the political power of the wealthy, and some extensions are relegated to the Appendix.

2. The Model

In this section, we explain the model in two steps. First, we take the ERI as exogenously given and show that ERI plays an important role in determining aggregate redistribution in the economy. Next, we endogenize ERI in several ways. First, we use the assumption of Azariadis and Lahiri (2002) that ERI is a positive function of average income.

In this specification, income inequality increases the prevailing tax rate in the economy. Then, the higher tax rate reduces the average income due to the disincentive effect of taxation, and the decline in average income reduces ERI. This section shows that income inequality determines not only the equilibrium tax rate but also the ERI.

Other explanations of how income inequality can influence the ERI rely on a common assumption that ERI are determined prior to the effective tax rate in the economy. We emphasize the same theme across various alternatives. The common element in these alternative explanations is that the decisive voter in determining ERI is wealthier or expects to be wealthier than the median voter who chooses the tax rate in the second stage. Moreover, all these explanations share a common motivation: since the wealthy disproportionately bear the burden of taxation, they have incentives to constrain redistribution by reducing the benefits of redistribution for the poor.

Among these various mechanisms, we first follow Benabou (1996 and 2000) in the first stage, we deviate from standard median voter hypothesis and analyze the possibility that the political power in determining the ERI is proportional to income. When political influence in changing institutions is proportional to income, the wealthy become more powerful in designing the redistributive institutions. Since the wealthy disproportionately bear the burden of redistributive income tax in the second stage, they attempt to manipulate the redistributive institutions in the first stage in order to constrain the redistributive taxation in the second stage.

In other explanations, we do not deviate from the median voter hypothesis but we introduce uncertainty about individual’s future income. Due to this uncertainty, even though the aggregate income distribution does not change over time, the median voter in the first stage becomes willing to set up a lower ERI. The median voter in the first stage expects to be wealthier in the second stage. Since income distribution stays the same, the median voter of the first stage actually expects not to be the median voter in the second stage. Hence, he/she manipulates ERI in his/her self-interest when he/she has the power in the first stage.

The results here are also established without deviating from median voter hypothesis. The prospect of upward mobility (POUM) offers an alternative. In the POUM hypothesis, when individuals' expected future income is a concave function of their current income, the current median voter expects to be wealthier than the future median voter and hence attempts to reduce ERI to constrain future redistribution.

In all of these different explanations, income inequality also increases the incentive to reduce ERI in order to constrain the redistributive pressure that rises with income inequality. In the model, while higher income inequality increases the redistributive pressure, it also increases the incentive of the decisive voter to reduce the ERI. Therefore, the final effect of income inequality on redistribution depends on the relative magnitude of these two opposite effects.

2.1. The Benchmark Model

The economy is populated by a large number of individuals. Population size is normalized to one. All individuals have identical preferences, and they obtain utility only from their own consumption. The utility function of individual i is given by

$$U_i = (1-T)y_i(T) + \alpha T\bar{y}(T) \quad (1)$$

where $0 \leq T \leq 1$ and $\alpha > 0$ denote the income tax rate and ERI respectively. Each individual is assumed to be endowed with a different skill level. When individuals work, they receive income, y_i proportional to their skill before taxation. The individuals pay a flat tax rate T and receive $\alpha T\bar{y}(T)$ from redistribution.

In terms of notation, $y_i(T)$ differs from y_i and indicates the post tax level of income of individual i. The model incorporates the disincentive effect of taxation as a decline in individual income[4]. In the model, this disincentive effect of taxation for individual i is characterized as

$$\frac{\partial y_i(T)}{\partial T} \leq 0 \qquad (2)$$

Following Benabou (2000), we adopt the following functional relationship between tax rates and income to account for the disincentive effect of taxation.

$$y_i(T) = y_i e^{-bT} \qquad (3)$$

Equation 3 indicates that with the introduction of taxation, each individual's income changes in proportion to e^{-bT} where $b \in [0,1]$ represents the extent of the disincentive effect in the model[5].

[4] The disincentive effect of taxation is already widely accepted in the literature. Therefore, in the model, we do not attempt to endogenize this assumption. However, without going into the details, one can think of the most apparent reason why the higher tax rate reduces the taxable income in the economy. People will have less incentive to work if they know that some of their earnings are going to be taxed away anyway. Hence, they will substitute working with leisure and their post tax income, which is $y_i(T)$ will be less than their income before taxation, which is y_i [Meltzer and Richard (1981)]. One can also think of alternative explanations such as in Perrson and Tabellini (1994)'s model of the distortionary effects of taxation on capital accumulation.

[5] The restriction which is $b \leq 1$ is required to find an interior solution for $T^* \in [0,1]$. Note that when $b = 0$ there is no disincentive effect and when $b = 1$ the disincentive effect reaches its highest level in the model.

Since our main objective is not to explore the adverse effects of taxation on individuals' income, we do not attempt to endogenize disincentive effect in the model. Actually, this issue has been already explored by the previous studies as labor-leisure trade off by Meltzer and Richard (1981) and consumption-capital accumulation trade off by Perrson and Tabellini (1994). In this study, we prefer to be more general in defining the disincentive effects of taxation in order to incorporate these various reasons for disincentive effect of taxation. Hence, our formulation of disincentive effect, for example, implicitly incorporates labor-leisure trade off in the following manner. Increase in taxation reduces benefit of working due to decline in net income and subsequently reduces the utility of an individual. On the other hand, increasing leisure due to working less increases the utility of the individual. However, as a final outcome, adverse effect of working less and making less income dominates the positive effect of increasing labor. Moreover, the disincentive effect of taxation has to be in the model. Otherwise, the median voter always chooses an equilibrium tax rate of one as long as he/she has lower than mean income (Harms and Zink, 2003).

Similarly, $\bar{y}$ and $\bar{y}(T)$ denote the average income of the economy before and after taxation respectively. Average post-tax income also changes in proportion to e^{-bT} and can be written as

$$\bar{y}(T) = \int_{i=0}^{1} y_i e^{-bT} di = \bar{y} e^{-bT} \qquad (4)$$

A higher tax rate reduces the tax base, $\bar{y}(T)$ in the economy. Average income in the economy without taxation is denoted as $\bar{y}$ and represents the aggregate tax base.

In Equation 1, each individual's income is taxed at the same rate T. Aggregate tax revenue is then redistributed back to the society equally. Since the tax burden is proportional to income but redistribution is the same for each individual, the wealthy disproportionately bear the burden of taxation while the poor benefit from this taxation and redistribution process.

Unlike the existing literature, redistribution in equation 1, $R = \alpha T\bar{y}(T)$ also depends on the efficiency of redistributive institutions, which is characterized by the parameter α. Hence, Equation 1 incorporates two types of inefficiency from the taxation and redistribution process. The first occurs in the taxation stage, as a positive tax rate generates inefficiency by creating a disincentive to work. The reduction in α emerges as a second type of inefficiency that occurs during the process of redistribution. In the current model, we first want to distinguish these two types of inefficiencies in taxation and redistribution stages, and secondly we want to show that inefficiencies in the redistribution stage, represented as a reduction in α, also play a role in constraining aggregate redistribution[6].

One can think of the following example to motivate variations in the parameter α. Suppose that to redistribute tax revenues, a government establishes a social security and welfare administration. This branch of government hires new employees to run the redistributive programs. But due to lack of competency of civil servants or due to corruption, suppose the social security and welfare administration wastes some of the government revenue in redistributing it back to the society. For instance, suppose that the program constructs a new building to carry out redistribution to the needy, but pays more than necessary for the construction of the building due to their incompetence or corruption. This represents a decline in α because the needy only benefit as much as the real value of the

---

[6] Existing political economy models ignore efficiency of redistributive institutions and assume that all the tax revenue is redistributed back to society. Therefore, they analyze the special case of equation (1) when α is equal to one. However, we only require $\alpha > 0$. When $\alpha > 1$, there are economies of scale or positive externalities in redistribution. For example, one can think of health care expenditure for the poor as a form of redistribution. There can be gains from providing health care facilities at the aggregate level, and hence α can exceed one.

building. The ERI also declines when government officers receive their salaries without generating a corresponding benefit to the recipients of redistribution. Actually, the parameter α can be very broadly considered to capture various forms of inefficiencies in redistribution stage.

We first assume that individuals take α as given and then they aim to maximize their utility with respect to tax rates. Each individual has a preferred tax rate, depending on their level of income. Then, the question is who determines the equilibrium tax rate in the economy. In the model here, the median voter is assumed to have decisive power in determining equilibrium tax rate. Hence, the median voter maximizes Equation 1 with respect to T by setting

$$\frac{\partial U_m}{\partial T} = \frac{\partial y_m(T)}{\partial T}(1-T) - y_m(T) + \alpha\bar{y}(T) + \alpha T\frac{\partial\bar{y}(T)}{\partial T} = 0$$

where

$$\frac{\partial y_m(T)}{\partial T} = \frac{\partial(y_m e^{-bT})}{\partial T} = -by_m e^{-bT} = -by_m(T)$$

and

$$\frac{\partial\bar{y}(T)}{\partial T} = \frac{\partial(\bar{y}e^{-bT})}{\partial T} = -b\bar{y}e^{-bT} = -b\bar{y}(T)$$

and finds his/her preferred tax rate as

$$T^* = \frac{1}{1-\alpha\,\bar{y}/y_m} + \frac{1}{b} \qquad (5)\ \text{ where } 0 \le b \le 1$$

One may also notice that the equilibrium tax rate decided by the median voter depends on the aforementioned two types of inefficiency. First, when the disincentive effect of taxation is high, the median voter reduces his or her preferred tax rate, as $\frac{\partial T^*}{\partial b} = -\frac{1}{b^2} \le 0$.

Second, ERI affects the equilibrium tax rate. Whether T^* has an interior solution in [0,1] depends on α and b. The condition $1+b \le \alpha\,\bar{y}/y_m \le \frac{1}{1-b}$ is enough to obtain an interior solution for $T^* \in [0,1]$. When b is low and/or α is high, there is a corner solution at $T^* = 1$. In this case, the disincentive effect is not big enough to deter radical redistribution and/or efficiency of redistribution is so high that the median voter benefits from radical redistribution.

The income inequality in this study is defined as the ratio of mean income to median income. Definitely, this definition has its limitations. However, it is the most common measure of income inequality in existing income inequality and redistribution studies. For example, pioneering work of Meltzer and Richard (1981) uses this definition for income inequality. Other influential papers in this topic such as Saint-Paul and Verdier (1993), Perrson and Tabellini (1994) Benabou (2000) also follow Meltzer and Richard in their definitions of income inequality. In spite of this common use of income inequality measure, one may define the income inequality in different ways. Hence, in discussing the definition of income inequality, Ray (1998) points out that "it is difficult to have complete unanimity in this subject" (p. 174). However, mean to median income ratio satisfy at least three of the four common assumptions which need to be satisfied in constructing Kuznet's curve. Our definition of income inequality always satisfies the unanimity, population and relative income principles. However, Dalton principle is not always satisfied. For example, even though a regressive transfer worsens the income distribution, it may not change the mean and median incomes. Given the widespread use of this definition, we decide to adopt the mean to median ratio as our measure of income inequality in the theoretical model.

Now we can state a widely accepted conclusion of the political economy literature on the income inequality and redistribution relationship.

Proposition 1:

Income inequality increases both the equilibrium tax rate and the aggregate level of redistribution $R = \alpha T^{*} y(T^{*})$. In other words: (i) $\frac{\partial T^{*}}{\partial(\bar{y}/y_m)} > 0$ and (ii) $\frac{\partial R}{\partial(\bar{y}/y_m)} > 0$.

Proof:

(i) $\frac{\partial T^{*}}{\partial(\bar{y}/y_m)} > 0$***;*** We only consider the case when we have an interior solution where $T^{*} \in [0,1]$. In Equation 5, one can think of income inequality as the difference between mean income and median income. When the median voter's income is further away from the mean income, income inequality, $\bar{y}/y_m$ increases. When we take the derivative of equilibrium tax rate with respect to income inequality, we find the following expression:

$\frac{\partial T^{*}}{\partial(\bar{y}/y_m)} = \frac{\alpha}{(1-\alpha\,\bar{y}/y_m)^2} > 0$. Hence, income inequality increases the equilibrium tax rate

QED.

(ii) $\frac{\partial R}{\partial(\bar{y}/y_m)} > 0$***;*** given that $R = \alpha T^{*} \bar{y}(T^{*})$, one may think that because of the disincentive effect, aggregate redistribution may not always increase with higher income inequality, while equilibrium tax rate increases. In other words, T^{*} increases with $\bar{y}/y_m$ while $\bar{y}(T^{*})$ can be declining with higher T^{*}. So redistribution may even decline with higher income inequality or there might be some Laffer curve relation between income inequality and redistribution. However, when $b \le 1$, the increase in T^{*} always dominates the decline in $\bar{y}(T^{*})$, and hence aggregate redistribution always increases with income inequality. This can be seen with the following expression

$\frac{\partial R}{\partial(\bar{y}/y_m)} = \alpha\bar{y}(T)\frac{\partial T}{\partial(\bar{y}/y_m)} + \alpha T\frac{\partial\bar{y}(T)}{\partial T}\frac{\partial T}{\partial\,\bar{y}/y_m} = \alpha\bar{y}(T)\frac{\partial T}{\partial(\bar{y}/y_m)}[1-bT] > 0$ ***QED.***

Now, we concentrate on how α affects the median voter's preferred tax rate and aggregate redistribution for a given level of income inequality. In this section, we do not attempt to endogenize α but analyze the effect of exogenously given α on T^*, which has been ignored in the literature. Then, our second proposition follows as

Proposition 2:

An increase in the efficiency of redistributive institutions, α ***, increases both the equilibrium tax rate and the aggregate redistribution; that is, (i)*** $\frac{\partial T^*}{\partial \alpha} \geq 0$ ***and (ii)*** $\frac{\partial R}{\partial \alpha} \geq 0$.

Proof:

(i) $\frac{\partial T^*}{\partial \alpha} \geq 0$***;*** when one takes the derivative of T^* with respect to α in Equation 5, the following expression, which is always positive, is obtained:

$$\frac{\partial T^*}{\partial \alpha} = \frac{\bar{y}/y_m}{(1-\alpha\,\bar{y}/y_m)^2} \geq 0.$$ ***QED.***

(ii) $\frac{\partial R}{\partial \alpha} \geq 0$***;*** when one takes the derivative of $R = \alpha T \bar{y}(T)$ with respect to α, the following expression is obtained:

$$\frac{\partial R}{\partial \alpha} = T\bar{y}(T) + \alpha \frac{\partial T}{\partial \alpha}\bar{y}(T) + \alpha T \frac{\partial \bar{y}(T)}{\partial T}\frac{\partial T}{\partial \alpha} = \bar{y}(T)T + \alpha\bar{y}(T)\frac{\bar{y}/y_m}{(1-\alpha\,\bar{y}/y_m)^2}(1-Tb)$$

This expression is always positive given that $b \in [0,1]$ and $T^* \in [0,1]$ ***QED.***

Both the equilibrium tax rate and aggregate redistribution decrease for lower values of α. Therefore, one can conclude that ERI plays a role in limiting the amount of redistribution, and should be taken into account when considering relationship between inequality and redistribution.

One can think of the following example to see the hazard of ignoring the ERI in analyzing the income inequality and redistribution relationship. Consider two countries with the same average tax rates and average incomes but different levels of income inequality. If one ignores the possibility that α may differ in these two countries, one would conclude that redistribution does not have a robust relationship with income inequality. Suppose, however, α is lower for the country with higher income inequality, let's say for Country 1. This difference implies lower aggregate redistribution for Country 1. Although tax rates and average incomes are same in the two countries, Country 1 will have less aggregate redistribution due to lower values of α, which can be seen as $R_1 = \alpha_1 T^* \bar{y}(T^*) \leq \alpha_2 T^* \bar{y}(T^*) = R_2$ because $\alpha_1 \leq \alpha_2$.

This example carries important insights as to why existing literature cannot find a robust positive relationship between income inequality and average tax rates. For example, Perotti (1996) attempts to test the implications of political economy models directly by regressing income inequality on average and marginal tax rates. In this paper, the optimal tax rate emerges from Equation 5 as a function of the interaction term of α and a measure of income inequality. This interaction term is ignored to in existing econometric studies and thereby constitutes a potential reason for the failure to confirm the prediction that higher inequality should increase redistribution.

3. Income Inequality and ERI When ERI is a Positive Function of Average Income

So far, the main purpose here has been to show that exogenously given efficiency of redistributive institutions plays a significant role in determining the equilibrium tax rate and aggregate redistribution. In this section, we endogenize α by following Azariadis and Lahiri (2002) and assuming that α increases with average income[7]. Under this assumption, income inequality determines both T^* and α^*, simultaneously[8]. Higher income inequality increases taxation and hence reduces average income due to the disincentive effect of taxation, and this reduction in average income also reduces α^*.

This assumption appears to be quite reasonable considering that higher income countries appear to have better governance in general. Azariadis and Lahiri (2002) also draw attention to this issue. They provide a model explaining why wealthy countries choose better governance. In Azariadis' and Lahiri's model, high ability bureaucrats have to be paid a higher wage than their less able counterparts. However, high ability bureaucrats generate better governance, which translates to a higher α^* in our context. The wages paid to bureaucrats constitute the cost of government. Azariadis and Lahiri show that as long as the cost of government rises less than proportionately with income, then as national income rises, government operations become less expensive and high income countries find better governance to be more affordable.

With this assumption, one can see that income inequality has a direct positive effect on equilibrium tax rate. But the loop does not end there. Since higher income inequality leads to

---

[7] North (1981) also states that "as the scale of economic activity expands, better institutions become affordable, and hence government performance should improve" (p. 224). In addition, see La Porta et al. (1999).

[8] T^* and α^* denote the equilibrium tax rate and equilibrium efficiency of redistributive institutions prevailing in the economy.

higher T^* and higher T^* simultaneously reduces the average income due to a disincentive effect, one expects to see lower α^* in more unequal countries. Under this framework, income inequality does not directly reduce α^* but does so indirectly by increasing taxes and simultaneously reducing average income in the economy.

To model this idea, we assume that the disincentive effects holds as in the original model, hence $y_i(T) = y_i e^{-bT}$ and $\bar{y}(T) = \bar{y}e^{-bT}$. We further assume that the functional relationship between $\bar{y}(T)$ and α has the following form:

$$\alpha(a, \bar{y}, T) = a\bar{y}(T) = a\bar{y}e^{-bT} \text{ where } a > 0$$

In other words, we assume that α is an increasing function of the average income. First, the equilibrium tax rate must be found under this assumption. Again the median voter maximizes his/her utility given in Equation 1 with respect to tax rate, impliying:

$$\frac{\partial U_m}{\partial T} = -y_m(T) + (1-T)\frac{\partial y_m(T)}{\partial T} + \alpha\bar{y}(T) + \alpha T\frac{\partial \bar{y}(T)}{\partial T} + \frac{\partial \alpha}{\partial \bar{y}(T)}\frac{\partial \bar{y}(T)}{\partial T}\bar{y}(T)T = 0$$

and finds the equilibrium tax rate[9] as

$$T^* = \frac{1 + b - \alpha^* \bar{y}/y_m}{b(1 - 2\alpha^* \bar{y}/y_m)} \qquad (6)$$

With this background, we can state our third proposition.

Proposition 3:

When efficiency of redistributive institutions is a positive function of average income, an increase in income inequality reduces equilibrium efficiency of redistributive institutions.

Proof:

[9] See the Appendix for derivations.

The equilibrium tax rate in Equation 6 depends on α^*, and α^* in turn depends on T^*. Hence, one needs to perform comparative static analysis in order to analyze the effects of income inequality on T^* and α^*. Moreover, given that α^* is a function of $\bar{y}$ and y_m, either $\bar{y}$ or y_m needs to be kept constant, while the other one changes in order to represent income inequality.

1-When $\bar{y}$ is Constant

When $\bar{y}$ remains constant, a decline in y_m increases income inequality given that $\bar{y} > y_m$. Hence, in order to show that income inequality increases T^* and reduces α^*, we need to show that the following expressions hold: (i) $\frac{\partial T^*}{\partial y_m} \leq 0$ and (ii) $\frac{\partial \alpha^*}{\partial y_m} \geq 0$.

The first order condition above can be rewritten as

$$F(\alpha^*, T^*; a, b, \bar{y}, y_m) = -1 - b + bT^* + \alpha^* \bar{y}/y_m - 2\alpha^* bT^* \bar{y}/y_m = 0$$

Using $\frac{\partial T^*}{\partial y_m} = -\frac{\frac{\partial F}{\partial y_m}}{\frac{\partial F}{\partial T^*}}$, we show in the appendix that

$$\frac{\partial T^*}{\partial y_m} = \frac{-\alpha^* \frac{\bar{y}}{y_m^2}(1+2b)}{b[(1-2\alpha^* \bar{y}/y_m)^2 + \alpha^* \bar{y}/y_m + 2\alpha^* b \bar{y}/y_m]} \leq 0 \qquad \text{and}$$

$$\frac{\partial \alpha^*}{\partial y_m} = \frac{(\alpha^*)^2 \frac{\bar{y}}{y_m^2}(1+2b)}{[(1-2\alpha^* \bar{y}/y_m)^2 + \alpha^* \bar{y}/y_m + 2\alpha^* b \bar{y}/y_m]} \geq 0 .$$

2-When y_m is Constant

When y_m is kept constant, an increase in $\bar{y}$ increases income inequality, given that $\bar{y} > y_m$. Hence, in order to show that income inequality increases T^* and reduces α^*, we need to show that the following expressions hold: (i) $\dfrac{\partial T^*}{\partial \bar{y}} \geq 0$ and (ii) $\dfrac{\partial \alpha^*}{\partial y_m} \leq 0$.

Using $\dfrac{\partial T^*}{\partial \bar{y}} = -\dfrac{\frac{\partial F}{\partial \bar{y}}}{\frac{\partial F}{\partial T^*}}$, we find in the Appendix that

$$\frac{\partial T^*}{\partial \bar{y}} = \frac{2\alpha^* \dfrac{1}{y_m}(1+2b)}{b[(1-2\alpha^* \,\bar{y}/y_m)^2 + \alpha^* \,\bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]} \geq 0 \qquad \text{and}$$

$$\frac{\partial \alpha^*}{\partial \bar{y}} = \frac{-2(\alpha^*)^2 \dfrac{1}{y_m}(1+2b)}{[(1-2\alpha^* \,\bar{y}/y_m)^2 + \alpha^* \,\bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]} \leq 0\,.$$

Proposition 3 has an interesting implication. An increase in average income improves ERI unless the income distribution becomes more unequal. This result suggests that growth at the expense of increasing inequality can indeed reduce the ERI due to the increasing redistributive pressure.

4. Income Inequality and Efficiency of Redistributive Institutions in Two Stages

Considering that institutions are persistent, it seems reasonable to examine two-stage models in which redistributive institutions are determined prior to taxation. Hence, the second type of explanations rely on the assumption that α^* is determined prior to T^*. A common element in this type of models is that the decisive voter in the first stage attempts to reduce α^* to constrain redistributive taxation in the second stage. Under this alternative setting, we endogenize α^* in several ways.

First, the wealthy may have more political power in the first stage than in the second stage. We follow Benabou (1996 and 2000) in modeling this idea. Political power is assumed to be proportional to income in the first stage, so that the wealthy have disproportionate influence over α^*. Since the tax rate will be decided by the median voter in the second stage, the decisive voter, being wealthier than the median voter, tends to reduce α^* in order to constrain redistributive pressure in the second stage. Hence, higher income inequality also implies higher political inequality, and leads to lower ERI.

An alternative two-stage model relies on the uncertainty about an individual's own income but complete certainty about the income distribution. We show that income inequality can reduce α^* when the median voter's expected future income is a concave function of his/her current income. Benabou and Ok (2001) explain the lack of redistribution by referring to the median voter's prospect of upward mobility (POUM). In Benabou's and Ok's model, the only policy variable that affects redistribution is the tax rate. Similar to their model, our model carries the same idea of POUM but with an alternative mechanism. In our model, the POUM affects redistribution through influencing the determination of α^*. The median voter chooses a lower α^* due to his POUM in the second stage. Moreover, income inequality again exaggerates the POUM effect and leads to further reduction in α^*.

Before exploring these various explanations in detail, we want to draw attention to a common motivation of these alternative explanations so that one will not be diverted in the remainder of this paper. Then, the common underlying motivation in these various specifications can be stated as to constrain the future redistributive pressure that arises with income inequality.

4.1. Institutional Equilibrium in Two Stages

Each individual has a preferred level of α and T depending on his/her income. Therefore, in each stage, individuals maximize their utility with respect to choice parameter of that stage. It is quite reasonable to assume that α^* is determined prior to T^*, given that it is harder to change institutions as compared to tax rates. Since α^* is chosen in the first stage, the only choice variable left to the individuals in the second stage is the tax rate. Moreover, in the second stage, we assume that median voter hypothesis holds. Therefore, in the second stage, the median voter's problem is exactly the same as before when α is given exogenously.

Determination of α^* is more interesting because the decisive voter in the first stage knows that his/her choice of α in the first stage persists in the second stage and affects the median voter's choice of T^*. Being aware of this influence, the decisive voter maximize his/her utility with respect to α, while considering the effects of his/her choice of α on T^*. Hence, the decisive voter maximizes his/her utility given in Equation 1[10] with respect to α:

$$\frac{\partial U_d}{\partial \alpha} = -\frac{\partial y_d(T)}{\partial T}\frac{\partial T}{\partial \alpha}(1-T) - y_d(T)\frac{\partial T}{\partial \alpha} + \frac{\partial T}{\partial \alpha}\alpha\bar{y}(T) + T\bar{y}(T) + \alpha T\frac{\partial \bar{y}(T)}{\partial T}\frac{\partial T}{\partial \alpha} = 0$$

and finds the following expression for α^* as

$$\alpha^* = \frac{T^*}{Z(1-bT^*)(y_d/y_m - 1)} \qquad (7)$$

where

$$Z = \frac{\partial T}{\partial \alpha} = \frac{\bar{y}/y_m}{(1-\alpha\,\bar{y}/y_m)^2}$$

$$T^* = \frac{1}{1-\alpha\,\bar{y}/y_m} + \frac{1}{b}$$

---

[10] The choice of α^* becomes enacted in the second stage. Hence, we can just concentrate on the individual's utility function in the second stage.

Given that T^* and z also contain α^* in their expression, Equation 7 denotes the implicit solution for α^*. The model becomes interesting when the decisive voter's actual or expected income in the first stage differs from the median voter's income. Since it is certain that the median voter is decisive in the second stage, the only question is the actual or expected income of the decisive voter in the first stage.

Next, we explore two scenarios in which the decisive voter's expected or actual income may differ from the median income and show that income inequality exaggerates the motive to constrain taxation. However, before explaining these models in detail, we introduce a log-normal income distribution to make our results analytically tractable. We conjecture that the implications of the model would be valid for other types of income distributions.

4.2. Log-Normal Distribution

Let a continuum of agents $i \in [0,1]$ have log-normally distributed income y_i, so that $\ln(y_i)$ is normally distributed with mean $\mu \geq 0$ and variance $\sigma^2 \geq 0$, $y_i \approx \log n(\mu, \sigma^2)$ or $\ln(y_i) \approx N(\mu, \sigma^2)$.

The log-normal distribution of income is a good approximation for the empirical income distribution and will lead to analytically tractable results (Benabou and Ok, 2001). The log-normal distribution has also nice properties. First, the log-normal distribution has a non-negative range $0 \leq y_i \leq +\infty$. It also allows for an unambiguous definition of inequality as increases in σ^2 shifts the Lorenz curve outward. This variance also measures the distance between median income and mean income. The mean and median levels of a log-normal distribution are given by $e^{\mu+\frac{1}{2}\sigma^2}$ and e^{μ}, respectively and thus $\frac{\bar{y}}{y_m} = e^{\frac{1}{2}\sigma^2}$. A mean preserving spread in a log-normal distribution can be characterized when $\bar{y} = e^m$ is kept constant and $y_m = e^{m - \frac{1}{2}\sigma^2}$ is declining, due to increasing σ^2.

4.3. When Political Power on ERI is Proportional to Income

When the efficiency of redistributive institutions is determined in the first stage, we model the political process by following Benabou (1996 and 2000) and analyze the case when political power is proportional to income. Similar to Benabou (1996 and 2000), we do not seek to explain the source of wealth biases in political institutions but only to model them in a convenient manner[11]. Therefore, the model explicitly formalizes departures from the one-person, one-vote ideal.

Instead of assuming that the voter at the 50th percentile of the income distribution is decisive, let the agent located at the p^{th} percentile be the decisive voter. The most likely case is when $p \geq 1/2$ and corresponds to a system biased against the poor due to, for instance, wealth restricted franchise or unequal lobbying power. In the model, each agent has political weight in proportion to their income $w_i(y_i)$. When an agent's weight depends on the absolute level of his/her income, the pivotal voter corresponds to the income level y_d defined by $\phi(\frac{\ln(y_d)-\mu}{\sigma^2}) = p$, where ϕ is the cumulative distribution function of a standard normal distribution. Equivalently, one can define $\phi^{-1}(p) = \lambda = \frac{\ln(y_d)-\mu}{\sigma^2}$ and write $y_d = e^{\mu+\lambda\sigma^2}$. A positive value of λ corresponds to a positive wealth bias in the political institutions. For example, the case $\lambda = 0.5$ corresponds to a one-dollar, one-vote rule.

Having identified the decisive voter in the second stage, we can now solve for the institutional equilibrium by putting the decisive voter's income into Equation 7 as follows:

[11] In the Appendix, we first put forward some arguments and examples for why the wealthy may have more political power. Then, we explain why the wealthy may not be able to reduce tax rate directly.

$$z = \frac{\partial T}{\partial \alpha} = \frac{\bar{y}/y_m}{(1-\alpha\,\bar{y}/y_m)^2} = \frac{e^{\frac{1}{2}\sigma^2}}{(1-\alpha e^{\frac{1}{2}\sigma^2})^2}$$

$$T^* = \frac{1}{1-\alpha\,\bar{y}/y_m} + \frac{1}{b} = \frac{1}{1-\alpha e^{\frac{1}{2}\sigma^2}} + \frac{1}{b}$$

$$\frac{y_d}{y_m} = \frac{e^{\mu+\lambda\sigma^2}}{e^{\mu}} = e^{\lambda\sigma^2}$$

Combining, we have

$$\alpha = \frac{T}{Z(1-bT)(y_d/y_m-1)} = \frac{(b+1-\alpha e^{\frac{1}{2}\sigma^2})(1-\alpha e^{\frac{1}{2}\sigma^2})^2}{b^2 e^{\frac{1}{2}\sigma^2}(1-e^{\lambda\sigma^2})} \qquad (7\text{-}1)$$

Equation 7-1 implicitly defines α^* as a function of income inequality. We simulate the model assuming an interior solution of $T^* \in [0,1]$. Based on simulation results, we can state our next proposition as

Proposition 4:

For positive values of λ, higher income inequality makes the decisive voter in the first stage wealthier and reduces the equilibrium efficiency of redistributive institutions α^*

One can think of the following intuition to explain the simulation results. The decisive voter in the first stage weighs the marginal cost and benefit of reducing α^*. The cost of reducing α^* comes from the redistribution side. Since aggregate redistribution is divided equally among the whole population, by reducing α^* the decisive voter also reduces what he/she receives from redistribution. The benefit of reducing α^* comes from the taxation side. Since the median voter in the second stage is now faced with a lower α^*, the benefit of redistribution for the median voter declines and he/she tends to choose a lower tax rate by considering the disincentive effect of taxation.

In the simulation analysis below, an increase in income inequality is measured as a rise in σ^2. We also perform simulations experimenting with various values of parameters in the model. In all these various specifications, income inequality reduces the efficiency of redistributive institutions by increasing the gap between the decisive voter's income and median income. This result confirms our main idea that efficiency of redistributive institutions needs to be taken into account in analyzing income inequality and redistribution relationship.

Figure-1 Income Inequality and ERI:
When Political Influence on ERI is Proportional to Income b=.5, lamda=.5

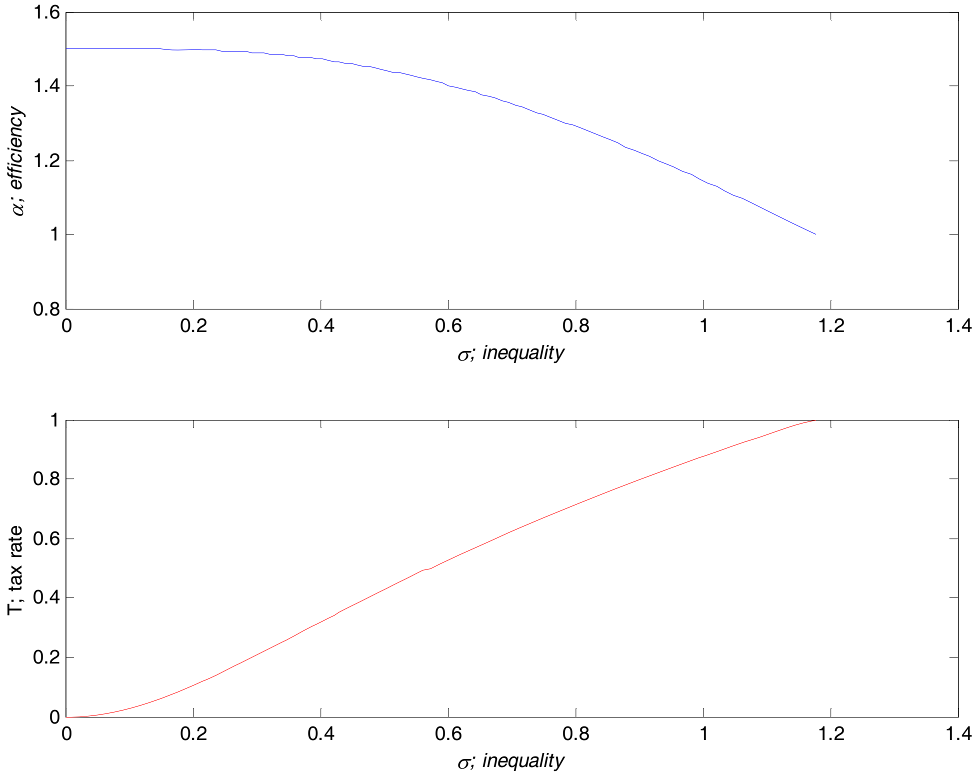


Figure-2 Income Inequality and ERI:
When Political Influence on ERI is Proportional to Income b=.2, lamda=.1

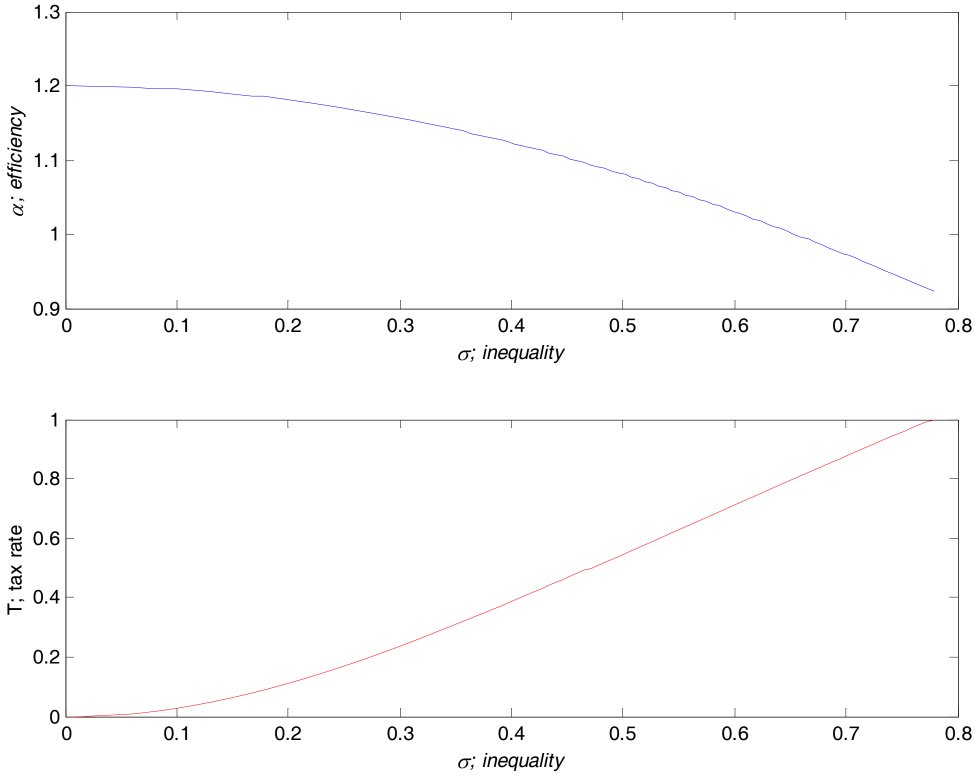
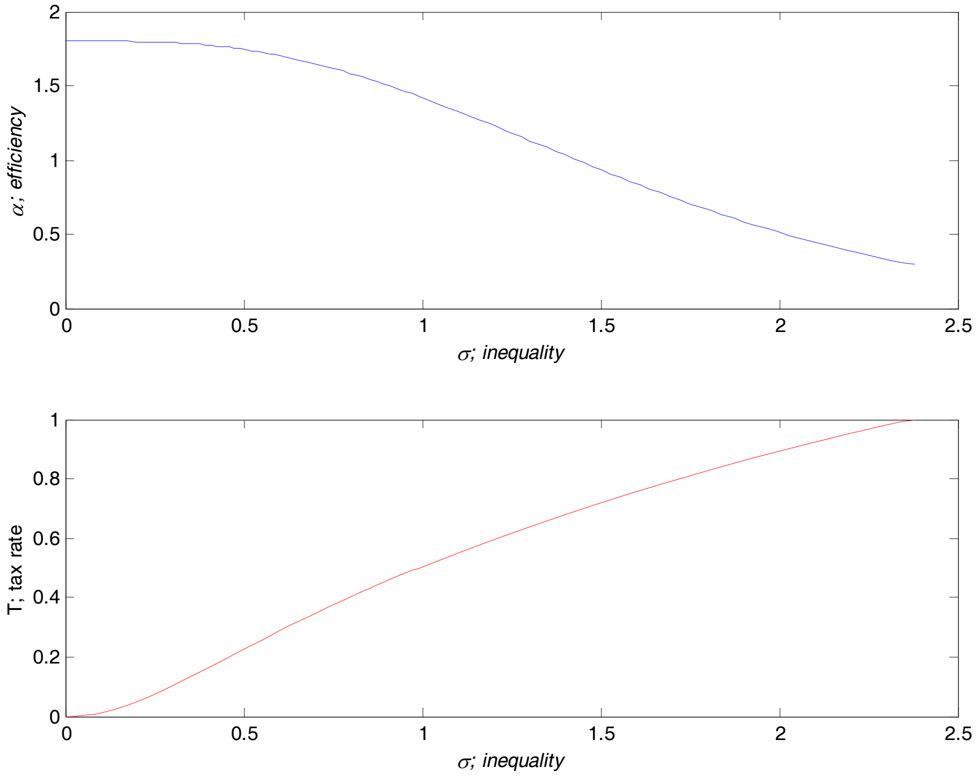


Figure-3 Income Inequality and ERI:
When Political Influence on ERI is Proportional to Income b=.8, lamda=.5



4.4. When There is Uncertainty about an Individual's Future Income and the Prospect of Upward Mobility

The prospect of upward mobility hypothesis enables us to analyze the negative effect of income inequality on ERI without deviating from the median-voter hypothesis. Benabou and Ok (2001) have shown that the POUM hypothesis is totally consistent with rational expectations under certain premises. In order for the POUM effect to influence redistribution, the authors first require some degree of persistence in redistributive policies. In our context, this implies that α^* chosen in the first stage will not be changed in the second stage. In this regard, our model is an improvement on Benabou's and Ok's model to the extent that ERI are expected to be more persistent than a particular choice of tax rate. Benabou's and Ok's second assumption requires that individuals are not too risk averse. Since they also show that for a moderate degree of risk aversion, POUM hypothesis still holds, we abstract from risk aversion and assume a linear utility function in Equation 1. The third and key premise is that tomorrow's expected income is an increasing and concave function of today's income.

Concavity of the expected transition function that links today's income to expected future income is a rather natural property of decreasing returns: as current income rises, the odds for future income improve, but at a decreasing rate. Concave transition functions are common in economic models and econometric specifications. Credit constraints and decreasing returns to capital accumulation, for instance, give rise to concave transition functions. A log-linear AR(1) process of income dynamics, which is widely used in theoretical and empirical studies, has this concave transition property.

In order to keep the aggregate income distribution constant while assuming concavity of expected income, Benabou and Ok (2001) add idiosyncratic shocks to the model. Idiosyncratic shocks play a role in offsetting the skewness-reducing effect of a concave expected transition functions so as to maintain a positively skewed distribution of income realization. In contrast to concavity of the transition function, skewness of idiosyncratic shocks in itself does nothing to reduce the demand for redistribution. In particular, it does not affect the distribution of expected incomes. The balance between concavity of the transition function and skewness of idiosyncratic shocks leads to over-optimism of the poor about their income prospects.

In our model, concavity of expected income with respect to current income leads the median voter of the first stage to expect to be wealthier than the median voter of the second stage while idiosyncratic shocks keep the aggregate income distribution to remain invariant. Hence, the tax rate chosen in the second stage will be greater than what is desired by the median voter of the first stage. This result can be seen from Equation 5

$$T^* = \frac{1}{1-\alpha\,\bar{y}/y_m} + \frac{1}{b} \geq \frac{1}{1-\alpha\,\bar{y}/E(y_m)} + \frac{1}{b} \quad \text{because} \quad E(y_m) \geq y_m$$

In the first stage, the median voter takes this effect into account and chooses a lower α^* to reduce the tax rate that will be chosen by a future median voter.

The more interesting question is whether this tendency of the median voter of the first stage to reduce α^* increases with income inequality. The answer is affirmative. Next, we follow Benabou and Ok (1998) to analyze the effects of income inequality on α^* under the POUM framework[12]. First, we use a Markov process example to explore the effects of income inequality on ERI. Then, we introduce a log-linear log-normal specification.

---

[12]In terms of motivations, there is similarity between the prospect for upward mobility hypothesis and constitutional context of Buchanan and Tullock (1962). We explain their relevance of Buchanan and Tullock's idea to our model extensively in the Appendix. But, we state here that uncertainty about future income leads the decisive voter to expect to have mean income when deciding on α^* in the first stage (constitutional stage). Therefore, in Buchanan and Tullock's context, even the median voter wants to reduce α^* with increasing inequality in order to constrain redistribution in the second stage.

4.4.1. Markovian Example

We want to find income processes in which stationary distributions are positively skewed, but where the median voter nonetheless chooses to reduce ERI in response to increasing inequality. We can demonstrate this result through a simple Markovian example. We use the same Markov process that Benabou and Ok (2001) use in order to be compatible with earlier literature. As an addition to their example, we introduce income inequality into the stochastic process by shifting income from the middle class to the wealthy and the poor. This is rather stylized characterization of income inequality, and follows existing studies that positively associate the income share of middle class with a more equal income distribution (Perotti 1996, Benabou 1996, Milanovic 2000).

Income takes one of three values: $X = \{a_{1,} a_2, a_3\}$ with $a_1 < a_2 < a_3$. The transition probabilities between those states are independent across agents and given by the Markov matrix:

$$M = \begin{bmatrix} 1-r & r & 0 \\ ps & 1-s & (1-p)s \\ 0 & q & 1-q \end{bmatrix}$$

where $(p,q,r,s) \in (0,1)^4$. The unique probability vector π that solves $\pi M = \pi$ gives the invariant distribution induced by M over $\{a_{1,} a_2, a_3\}$ with mean

$\bar{y} = \pi_1 a_1 + \pi_2 a_2 + (1 - \pi_1 - \pi_2) a_3$

Benabou and Ok (2001) aim to show that the median voter's expected income can exceed the mean income so that the median voter would be against redistribution. They derive conditions on the mobility process and the associated steady state such that this is true. Our model does not require that the median voter's income exceeds the mean income. The key condition for these results to hold is that the median voter in the first stage expects to be wealthier than the median voter of the second stage. Thus, we can relax some of Benabou and Ok's assumptions. But, in order to be compatible with their example, we adopt their Markovian process. For the detailed discussion of sufficient conditions on $(p,q,r,s;a_1,a_2,a_3)$, one can refer to Benabou and Ok (1998). When we modify their Markovian example and change income inequality, their conditions are always satisfied and the current median voter expects to be wealthier than the future median voter.

Benabou and Ok (2001, 1998) choose their specifications to match broad facts of the United States income distribution and intergenerational persistence. Hence, they let $p=.55$, $q=.6$, $r=.5$ and $s=.7$ leading to the transition matrix:

$$M=\begin{bmatrix} .5 & .5 & 0 \\ .385 & .3 & .315 \\ 0 & .6 & .4 \end{bmatrix}$$

and stationary distribution: $(\pi_1,\pi_2,\pi_3)=(.33,.44,23)$. Thus, 77 percent of the population is always poorer than average. They choose $(a_{1,}a_2,a_3)=(16000,36000,91000)$ and obtain a rather good fit with the data. This income process also has more persistence for lower and upper income groups than the middle class, which is consistent with the findings of Cooper, Durlauf, and Johnson (1998). Given that our results primarily depend on the prospect of upward mobility for the median voter, note that this is rather nice characteristic in favor of our model. In this example, the median voter expects to have \$45,625 which is greater than the median income \$36,000.

Income inequality is increased by spreading the income to the tails. Thus, a_1 and a_3 are each increased by an amount of d. In order to keep the mean income constant, middle class income is reduced by $\frac{14}{11}d$. The new income distribution then, is characterized as $(a_{1,}a_2,a_3)=(16000+d,36000-\frac{14}{11}d,91000+d)$. Note that when $d=0$ the example is exactly the same as that of Benabou and Ok (2001). When $d > 0$ existing income inequality is further exaggerated and middle class income evaporates for higher values of d.

One can also note that
$$E(y_{m_{t+1}}) = .385*(16000+d) + .3*(36000 - \frac{14}{11}d) + .315*(91000+d) =$$
$$45625 + .32d > a_2 = 36000 - \frac{14}{11}d$$

for all $d > -6$.

Thus, even as we increase income inequality by increasing $\bar{y}/y_m$, the median voter still expects to be wealthier than the future median voter. The following simulation results for this specification show that this increase in income inequality, further reduces the equilibrium ERI. This conclusion is our next proposition:

Proposition 5:

When individuals have some prospect of upward mobility, an increase in income inequality reduces the equilibrium efficiency of redistributive institutions α^*.

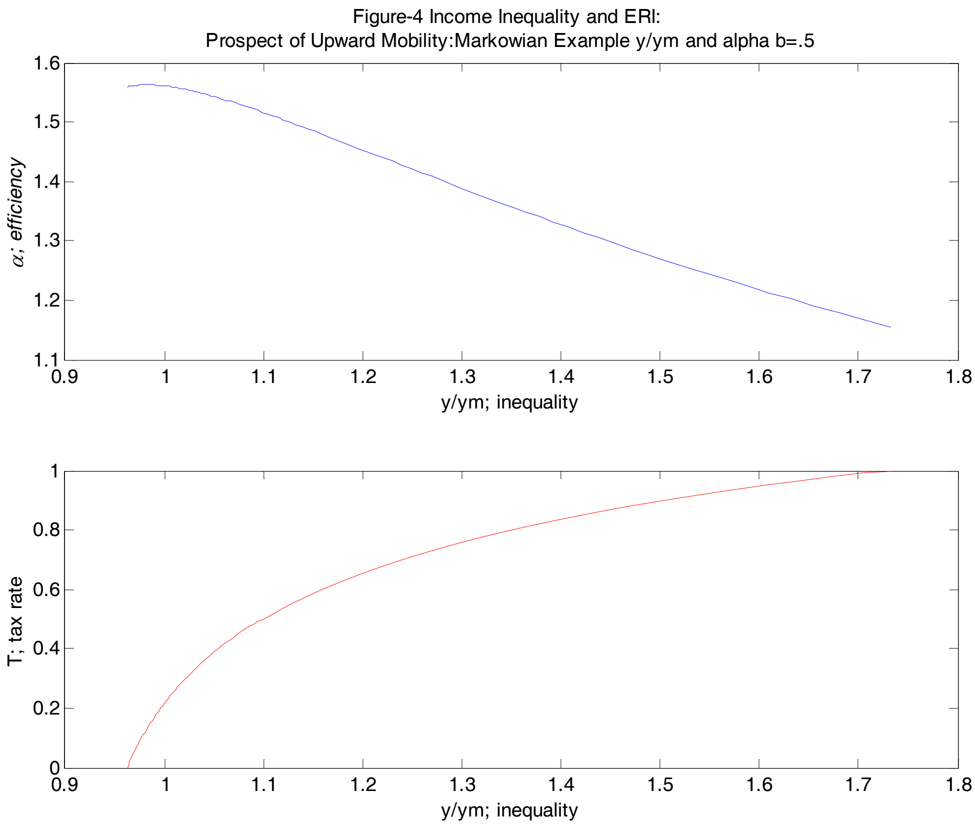


Figure-4 Income Inequality and ERI:
Prospect of Upward Mobility:Markowian Example y/ym and alpha b=.5
α; efficiency
1.6
1.5
1.4
1.3
1.2
1.1
0.9
1
1.1
1.2
1.3
1.4
1.5
1.6
1.7
1.8
y/ym; inequality
T; tax rate
1
0.8
0.6
0.4
0.2
0
y/ym; inequality

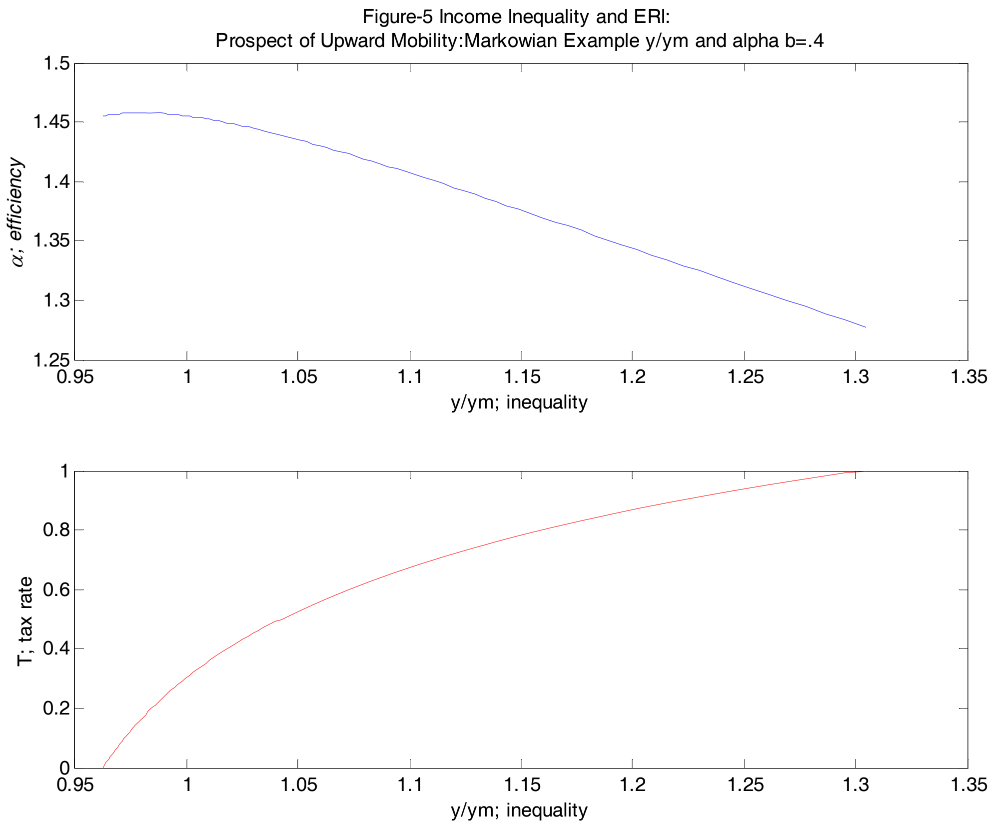
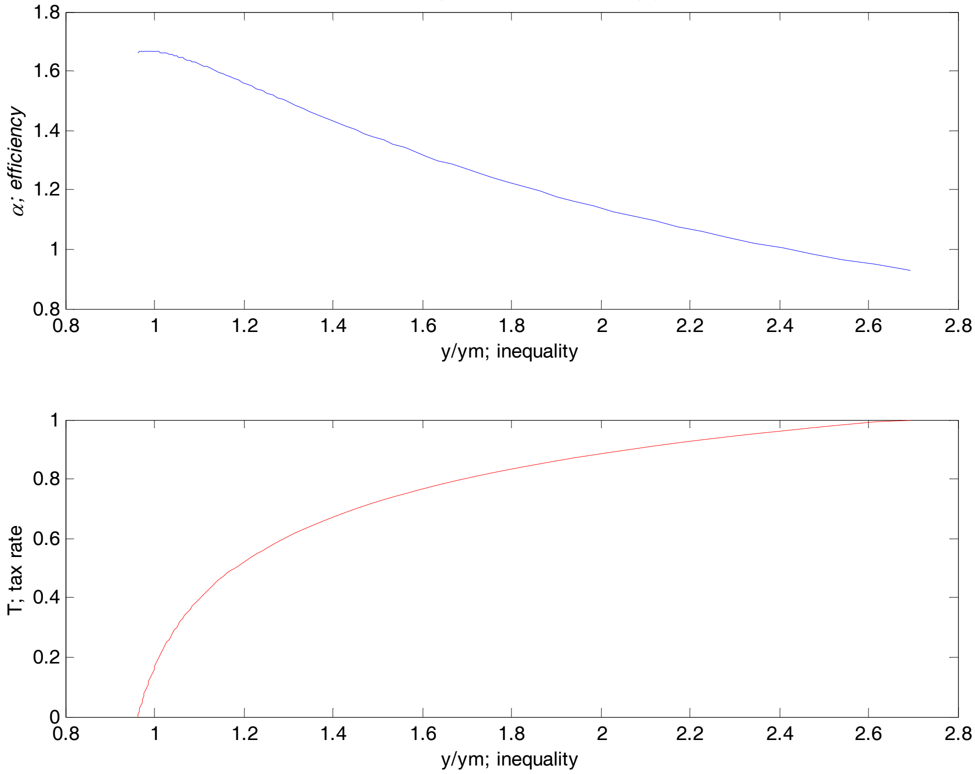


Figure-5 Income Inequality and ERI:
Prospect of Upward Mobility:Markowian Example y/ym and alpha b=.4
α; efficiency
y/ym; inequality
T; tax rate
y/ym; inequality

Figure-6 Income Inequality and ERI:
Prospect of Upward Mobility:Markowian Example y/ym and alpha b=.6



4.4.2. Log-Linear, Log-Normal Specification

Now, Let the transition function be log-linear: $f(y;\theta)=\theta y^{p}$ for all values of $y \geq 0$ and with $p \in (0,1)$ ensuring strict concavity in y. The log-linear specification is very common in the empirical literature on income or wage dynamics over the life cycle or across generations. Individual incomes thus evolve according to the stochastic process:

$$\ln y_{i_{t+1}} = p \ln y_{i_t} + \ln \theta_{i_{t+1}}$$

t, $t+1$ are the first and second stages, respectively.

Both the initial income levels and the shocks are assumed to be log-normally distributed.

$\ln y_{i_t} \approx N(\mu_t, {\sigma_t}^2)$ and $\ln \theta_{i_t} \approx N(-s^2/2, s^2)$

Notice that $E(\theta_{i_{t+1}})$ is normalized to 1 because $E(\theta_{i_{t+1}}) = e^{-s^2/2+1/2s^2} = 1$. Everybody faces the same uncertain environment. In other words, the current income is the only individual level state variable that helps predict future income. With a log-linear specification of shocks, the cross-sectional distribution also remains log-normal over time and this is a good approximation to the actual income distribution. Under this specification, the distribution of income has the following recursive equations for mean and variance:

$$E(\ln y_{i_{t+1}}) = pE(\ln y_{i_t}) + E(\ln\theta_{i_{t+1}})$$

which is equal to

$$\mu_{t+1} = p\mu_t - s^2/2$$

and

$$\mathrm{var}(\ln y_{i_{t+1}}) = p^2\,\mathrm{var}(\ln y_{i_t}) + \mathrm{var}(\ln\theta_{i_{t+1}})$$

or equivalently:

$$\sigma^2_{t+1} = p^2\sigma^2_t + s^2 .$$

Note that μ_t is the logarithm of median income $(y_{m_t} = e^{\mu_t})$, whereas mean per capita income is given by $\bar{y}_t = e^{\mu_t+\sigma_t^2/2}$.

We analyze the case where the income distribution does not change over time, so that $\mu_t = \mu_{t+1} = \mu$ and $\sigma^2{}_t = \sigma^2{}_{t+1} = \sigma^2$. From above equations, we obtain $\sigma^2 = \dfrac{s^2}{1-p^2}$ and $\mu = \dfrac{-s^2}{2(1-p)} = \dfrac{-\sigma^2(1-p^2)}{2(1-p)} = \dfrac{-\sigma_2(1+p)}{2}$.

Given this specification, notice that $\bar{y} = e^{\mu_t+\sigma_t^2/2} = e^{\frac{-\sigma^2(1+p)}{2}+\frac{\sigma^2}{2}} = e^{\frac{-\sigma^2 p}{2}}$, while

$y_m = e^{\mu_t} = e^{\frac{-\sigma^2(1+p)}{2}}$ and $\bar{y}/y_m = e^{\frac{\sigma^2}{2}}$.

The next question is what is the income level expected by the median voter in the first stage. The median voter's expected income is equal to

$E(f(y_{m_t};\theta_{m_{t+1}})) = E(\theta_{m_{t+1}} y^p_{m_t}) = y^p_{m_t} E(\theta_{m_{t+1}}) = y^p_{m_t}$ because $E(\theta_{m_{t+1}}) = 1$.

The decisive voter again maximizes Equation 1 with respect to α and finds a variant of Equation 7;

$$\alpha^* = \frac{T*}{Z(1-bT^*)(y_d/y_m-1)} = \frac{T^*}{Z(1-bT^*)(E(y_m)/y_m-1)} = \frac{(b+1-\alpha e^{\frac{1}{2}\sigma^2})(1-\alpha e^{\frac{1}{2}\sigma^2})^2}{b^2 e^{\frac{1}{2}\sigma^2}(1-e^{\frac{-\sigma^2(1+p)}{2}})^{p-1}} \quad (7\text{-}2)$$

Note that the median voter maximizes his utility by considering his/her expected future income, inequality and median income of the second stage. Simulation results below show that α^* declines with increasing inequality.

Figure-7 Income Inequality and Redistribution
Log-Linear, Log-Normal Specification Prospect of Upward Mobility b=.5, p=.5

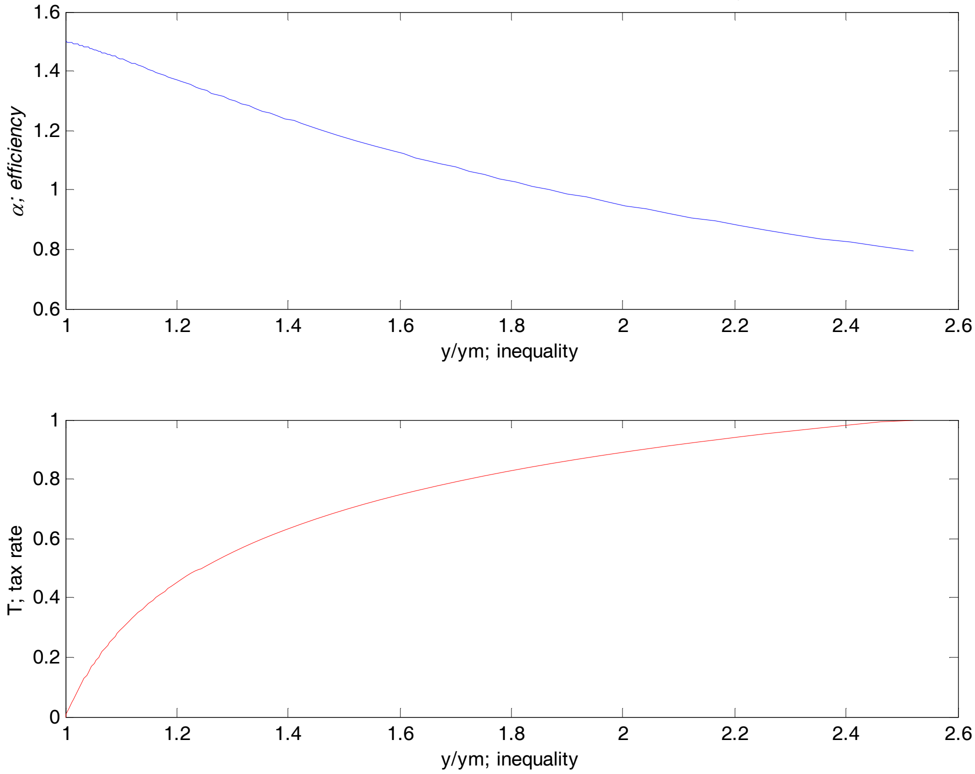
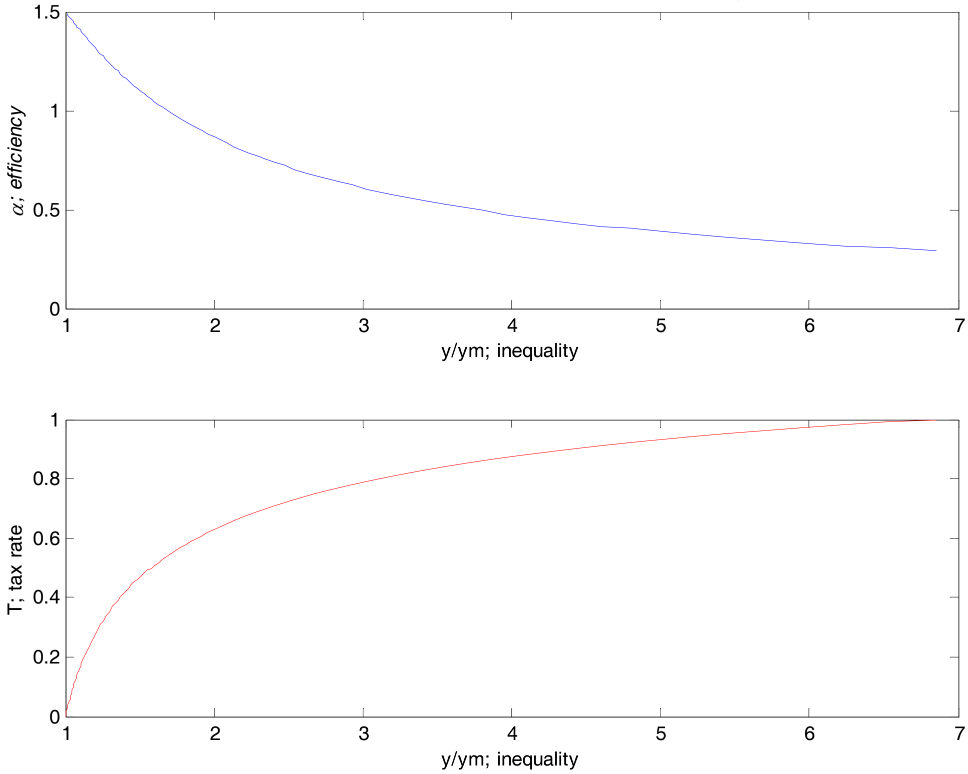


Figure-8 Income Inequality and Redistribution
Log-Linear, Log-Normal Specification Prospect of Upward Mobility b=.5, p=.8



5. Conclusion

This paper investigates the relationship between income inequality and redistribution by addressing the role of income inequality on redistributive institutions. Existing literature analyzes the effects of income inequality on fiscal policy, sociopolitical instability and human capital[13]. However, the effects of income inequality on institutions and in turn on redistribution have been overlooked so far in the existing studies.

We first take ERI as exogenously given and illustrate that ERI needs to be taken into account in analyzing the income inequality and redistribution relationship. The model here shows that inefficiency in redistributive institutions reduces the incentive for redistribution

[13] For detailed account of these explanations, see, for instance, Alesina, Ozler, Roubini, and Swagel (1996), Drazen (2000), and Persson and Tabellini (2002).

that arises with income inequality. Then, we address the question of how income inequality influences ERI. We present a model with several specifications to analyze the effects of income inequality on redistributive institutions. The results show that increasing inequality reduces the ERI (1) when ERI is a positive function of average income or (2) political influence on ERI is positively associated with income or (3) the median voter has some prospect of upward mobility. The common element in these specifications is that income inequality not only increases the redistributive pressure and but also exaggerates the incentive to constrain the redistribution. Hence, these two conflicting effects need to be considered in analyzing the income inequality and redistribution relationship. Moreover, this approach can provide an explanation for the lack of strong empirical evidence in favor of a positive relationship between income inequality and redistribution, as implied by fiscal policy theories. This paper concludes that income inequality emerges as an important determinant of redistributive institutions and hence points out the need for exploring the income inequality issues from this perspective.

A.1. Derivation of tax rate when efficiency of redistributive institutions is a positive function of average income

$$\frac{\partial U_m}{\partial T} = -y_m(T) + (1-T)\frac{\partial y_m(T)}{\partial T} + \alpha\bar{y}(T) + \alpha T\frac{\partial\bar{y}(T)}{\partial T} + \frac{\partial\alpha}{\partial\bar{y}(T)}\frac{\partial\bar{y}(T)}{\partial T}\bar{y}(T)T = 0$$

$$\frac{\partial y_m(T)}{\partial T} = -by_m(T)$$

$$\frac{\partial\bar{y}(T)}{\partial T} = -b\bar{y}(T)$$

$$\frac{\partial\alpha}{\partial\bar{y}(T)} = a$$

$$\frac{\partial\alpha}{\partial T} = \frac{\partial\alpha}{\partial\bar{y}(T)}\frac{\partial\bar{y}(T)}{\partial T} = -ab\bar{y}(T) = -b\alpha$$

$$\frac{\partial U_m}{\partial T} = -y_m(T) + (1-T)(-by_m(T)) + \alpha\bar{y}(T) + \alpha T(-by(T)) + a(-by(T))\bar{y}(T)T = 0$$

To simplify the expression we divide this expression by $y_m(T) \geq 0$ and get

$$\frac{\partial U_m}{\partial T} = -1 - b + bT + \alpha\,\bar{y}/y_m - 2\alpha bT\,\bar{y}/y_m = 0$$

By arranging T on one side, we get

$$bT(1-2\alpha b\,\bar{y}/y_m) = (1+b-\alpha\,\bar{y}/y_m)$$

$$T^* = \frac{1+b-\alpha^*\,\bar{y}/y_m}{b(1-2\alpha^*\,\bar{y}/y_m)}$$ ***QED.***

A.2.Proof of Proposition 3

The equilibrium tax rate in Equation 6 depends on α^* and α^*, in turn, depends on T^*. Hence, one needs to do a comparative analysis in order to analyze the effects of income inequality on T^* and α^*. Moreover, given that α^* is a function of $\bar{y}$ and y_m, either $\bar{y}$ or y_m needs to be kept constant while the other one changes in order to represent income inequality.

1-When $\bar{y}$ is Constant

When $\bar{y}$ is kept constant, a decline in y_m increases income inequality given that $\bar{y} > y_m$. Hence, in order to show that income inequality increases T^* and reduces α^*, we need to show that following expressions hold: (i) $\frac{\partial T^*}{\partial y_m} \leq 0$ and (ii) $\frac{\partial \alpha^*}{\partial y_m} \geq 0$**.**

(i) $\frac{\partial T^*}{\partial y_m} \leq 0$***;*** The first order condition above can be rewritten as

$$F(\alpha^*, T^*; a, b, \bar{y}, y_m) = -1 - b + bT^* + \alpha^* \, \bar{y}/y_m - 2\alpha^* bT^* \, \bar{y}/y_m = 0$$

Moreover, $\frac{\partial T^*}{\partial y_m} = -\frac{\frac{\partial F}{\partial y_m}}{\frac{\partial F}{\partial T^*}}$.

We find them in parts.

$$\frac{\partial F}{\partial y_m} = -\alpha^* \frac{\bar{y}}{y_m^2} + 2\alpha^* \frac{\bar{y}}{y_m^2} bT^* = -\alpha^* \frac{\bar{y}}{y_m^2}(1 - 2bT^*)$$

$$\frac{\partial F}{\partial T^*} = b + \frac{\partial \alpha^*}{\partial T^*} \bar{y}/y_m - 2\alpha^* b \, \bar{y}/y_m - 2bT^* \, \bar{y}/y_m \frac{\partial \alpha^*}{\partial T^*}.$$

Given that $\frac{\partial \alpha^*}{\partial T^*} = -b\alpha^*$

$$\frac{\partial F}{\partial T^*} = b + (-b\alpha^*) \, \bar{y}/y_m - 2\alpha^* b \, \bar{y}/y_m - 2bT^* \, \bar{y}/y_m (-b\alpha^*)$$

$$\frac{\partial F}{\partial T^*} = b - 3\alpha^* b \, \bar{y}/y_m + 2\alpha^* b^2 T^* \, \bar{y}/y_m$$

$$\frac{\partial F}{\partial T^*} = b[1 - 2\alpha^* \bar{y}/y_m - \alpha^* \bar{y}/y_m (1 - 2bT^*)].$$

By substituting T^* from Equation 6, one can find

$$1 - 2bT^* = \frac{(-1-2b)}{(1 - 2\alpha^* \bar{y}/y_m)}.$$

Then we can rewrite $\frac{\partial T^*}{\partial y_m} = -\frac{\frac{\partial F}{\partial y_m}}{\frac{\partial F}{\partial T^*}} = -\frac{-\alpha^* \frac{\bar{y}}{y_m^2}[\frac{(-1-2b)}{(1-2\alpha^* \bar{y}/y_m)}]}{b[(1-2\alpha^* \bar{y}/y_m) - (\alpha^* \bar{y}/y_m)(\frac{(-1-2b)}{(1-2\alpha^* \bar{y}/y_m)})]}$

$$\frac{\partial T^*}{\partial y_m} = -\frac{-\alpha^* \frac{\bar{y}}{y_m^2}[\frac{(-1-2b)}{(1-2\alpha^* \bar{y}/y_m)}]}{b\{\frac{[(1-2\alpha^* \bar{y}/y_m)^2 + \alpha^* \bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]}{(1-2\alpha^* \bar{y}/y_m)}\}}$$

$$\frac{\partial T^*}{\partial y_m} = \frac{-\alpha^* \frac{\bar{y}}{y_m^2}(1+2b)}{b[(1-2\alpha^* \bar{y}/y_m)^2 + \alpha^* \bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]}.$$

Given that $b \in [0,1]$, $T \in [0,1]$ and $(1-2\alpha^* \bar{y}/y_m)^2 \geq 0$, it is clear that $\frac{\partial T^*}{\partial y_m} \leq 0$ ***QED.***

(ii) $\frac{\partial \alpha^*}{\partial y_m} \geq 0$***;*** This is equivalent to show $\frac{\partial \alpha^*}{\partial y_m} = -\frac{\frac{\partial F}{\partial y_m}}{\frac{\partial F}{\partial \alpha^*}} \geq 0$.

Let’s find them in parts.

$$\frac{\partial F}{\partial y_m} = -\alpha^* \frac{\bar{y}}{y_m^2} + 2\alpha^* \frac{\bar{y}}{y_m^2} bT^* = -\alpha^* \frac{\bar{y}}{y_m^2}(1-2bT^*)$$

$$\frac{\partial F}{\partial \alpha^*} = b\frac{\partial T^*}{\partial \alpha^*} + \bar{y}/y_m - 2bT^* \bar{y}/y_m - 2b\alpha^* \bar{y}/y_m \frac{\partial T^*}{\partial \alpha^*}.$$

Given that $\frac{\partial T^*}{\partial \alpha^*} = \frac{1}{-b\alpha^*}$

$$\frac{\partial F}{\partial \alpha^*} = b(\frac{1}{-b\alpha^*}) + \bar{y}/y_m - 2bT^* \bar{y}/y_m - 2b\alpha^* \bar{y}/y_m (\frac{1}{-b\alpha^*})$$

$$\frac{\partial F}{\partial \alpha^*} = -\frac{1}{\alpha^*} + \bar{y}/y_m - 2bT^*\,\bar{y}/y_m + 2\,\bar{y}/y_m$$

$$\frac{\partial F}{\partial \alpha^*} = -\frac{1}{\alpha^*} + 3\bar{y}/y_m - 2bT^*\,\bar{y}/y_m$$

$$\frac{\partial F}{\partial \alpha^*} = -\frac{1}{\alpha^*}(1 - 3\alpha^*\bar{y}/y_m + 2b\alpha^* T^*\,\bar{y}/y_m)$$

$$\frac{\partial F}{\partial \alpha^*} = -\frac{1}{\alpha^*}[1 - 2\alpha^*\bar{y}/y_m - \alpha^*\,\bar{y}/y_m(1 - 2bT^*)]$$

by substituting T^* from Equation 6, one can find

$$1 - 2bT^* = \frac{(-1-2b)}{(1 - 2\alpha^*\,\bar{y}/y_m)}.$$

Then, we can rewrite $\frac{\partial \alpha^*}{\partial y_m} = -\frac{\frac{\partial F}{\partial y_m}}{\frac{\partial F}{\partial \alpha^*}} = -\frac{-\alpha^*\,\frac{\bar{y}}{y_m^2}[\frac{(-1-2b)}{(1-2\alpha^*\,\bar{y}/y_m)}]}{-\frac{1}{\alpha}[(1-2\alpha^*\,\bar{y}/y_m) - (\alpha^*\,\bar{y}/y_m)(\frac{(-1-2b)}{(1-2\alpha^*\,\bar{y}/y_m)})]}$

$$\frac{\partial \alpha^*}{\partial y_m} = -\frac{(\alpha^*)^2\,\frac{\bar{y}}{y_m^2}[\frac{(-1-2b)}{(1-2\alpha^*\,\bar{y}/y_m)}]}{\{\frac{[(1-2\alpha^*\,\bar{y}/y_m)^2 + \alpha^*\,\bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]}{(1-2\alpha^*\,\bar{y}/y_m)}\}}$$

$$\frac{\partial \alpha^*}{\partial y_m} = \frac{(\alpha^*)^2\,\frac{\bar{y}}{y_m^2}(1+2b)}{[(1-2\alpha^*\,\bar{y}/y_m)^2 + \alpha^*\,\bar{y}/y_m + 2\alpha^* b\,\bar{y}/y_m]}.$$

Given that $b \in [0,1]$, $T \in [0,1]$ and $(1-2\alpha^*\,\bar{y}/y_m)^2 \geq 0$, it is clear that $\frac{\partial \alpha^*}{\partial y_m} \geq 0$ ***QED.***

2-When y_m is Constant

When y_m is kept constant, an increase in $\bar{y}$ increases income inequality, given that $\bar{y} > y_m$.

Hence, in order to show that income inequality increases T^* and reduces α^* we need to show

that following expressions hold: (i) $\frac{\partial T^*}{\partial \bar{y}} \geq 0$ and (ii) $\frac{\partial \alpha^*}{\partial y} \leq 0$.

(i) $\frac{\partial T^*}{\partial \bar{y}} \geq 0$***;*** The first order condition above can also be rewritten as

$$F(\alpha^*, T^*; a, b, \bar{y}, y_m) = -1 - b + bT^* + ae^{-bT}\, \bar{y}^2 / y_m - 2bT^* ae^{-bT}\, \bar{y}^2 / y_m = 0\,.$$

Moreover, $\frac{\partial T^*}{\partial \bar{y}} = -\frac{\frac{\partial F}{\partial \bar{y}}}{\frac{\partial F}{\partial T^*}}$.

Let's find them in parts.

$$\frac{\partial F}{\partial \bar{y}} = 2ae^{-bT}\, \bar{y}/y_m - 4bT^* ae^{-bT}\, \bar{y}/y_m = 2\alpha^* \frac{1}{y_m} - 4bT\alpha^* \frac{1}{y_m} = 2\alpha^* \frac{1}{y_m}(1 - 2bT^*)$$

We have solved $\frac{\partial F}{\partial T^*}$ above as

$$\frac{\partial F}{\partial T^*} = b[1 - 2\alpha^*\, \bar{y}/y_m - \alpha^*\, \bar{y}/y_m (1 - 2bT^*)]$$

By substituting T^* from Equation 6, one can find

$$1 - 2bT^* = \frac{(-1-2b)}{(1 - 2\alpha^*\, \bar{y}/y_m)}\,.$$

Then, we can rewrite $\frac{\partial T^*}{\partial \bar{y}} = -\frac{\frac{\partial F}{\partial \bar{y}}}{\frac{\partial F}{\partial T^*}} = -\frac{2\alpha^* \frac{1}{y_m}[\frac{(-1-2b)}{(1-2\alpha^*\, \bar{y}/y_m)}]}{b[(1 - 2\alpha^*\, \bar{y}/y_m) - (\alpha^*\, \bar{y}/y_m)(\frac{(-1-2b)}{(1-2\alpha^*\, \bar{y}/y_m)})]}$

$$\frac{\partial T^*}{\partial \bar{y}} = -\frac{2\alpha^* \frac{1}{y_m}[\frac{(-1-2b)}{(1-2\alpha^*\, \bar{y}/y_m)}]}{b\{\frac{[(1-2\alpha^*\, \bar{y}/y_m)^2 + \alpha^*\, \bar{y}/y_m + 2\alpha^* b\, \bar{y}/y_m]}{(1-2\alpha^*\, \bar{y}/y_m)}\}}$$

$$\frac{\partial T^*}{\partial \bar{y}} = \frac{2\alpha^* \frac{1}{y_m}(1+2b)}{b[(1-2\alpha^*\, \bar{y}/y_m)^2 + \alpha^*\, \bar{y}/y_m + 2\alpha^* b\, \bar{y}/y_m]}\,.$$

Given that $b \in [0,1]$, $T \in [0,1]$ and $(1 - 2\alpha^*\, \bar{y}/y_m)^2 \geq 0$, it is clear that $\frac{\partial T^*}{\partial \bar{y}} \geq 0$ ***QED.***

(ii) $\frac{\partial\alpha^*}{\partial\bar{y}} \leq 0$***;*** This is equivalent to show $\frac{\partial\alpha^*}{\partial\bar{y}} = -\frac{\frac{\partial F}{\partial\bar{y}}}{\frac{\partial F}{\partial\alpha^*}} \leq 0$.

We find $\frac{\partial F}{\partial\bar{y}}$ and $\frac{\partial F}{\partial\alpha^*}$ above as:

$$\frac{\partial F}{\partial\bar{y}} = 2\alpha^* \frac{1}{y_m}(1-2bT^*)$$

$$\frac{\partial F}{\partial\alpha^*} = -\frac{1}{\alpha^*}[1-2\alpha^*\bar{y}/y_m - \alpha^*\bar{y}/y_m(1-2bT^*)].$$

By substituting T^* from Equation 6, one can find

$$1-2bT^* = \frac{(-1-2b)}{(1-2\alpha^*\bar{y}/y_m)}.$$

Then we can rewrite $\frac{\partial\alpha^*}{\partial\bar{y}} = -\frac{\frac{\partial F}{\partial\bar{y}}}{\frac{\partial F}{\partial\alpha^*}} = -\frac{2\alpha^*\frac{1}{y_m}[\frac{(-1-2b)}{(1-2\alpha^*\bar{y}/y_m)}]}{-\frac{1}{\alpha}[(1-2\alpha^*\bar{y}/y_m)-(\alpha^*\bar{y}/y_m)(\frac{(-1-2b)}{(1-2\alpha^*\bar{y}/y_m)})]}$

$$\frac{\partial\alpha^*}{\partial\bar{y}} = -\frac{-2(\alpha^*)^2\frac{1}{y_m}[\frac{(-1-2b)}{(1-2\alpha^*\bar{y}/y_m)}]}{\{\frac{[(1-2\alpha^*\bar{y}/y_m)^2+\alpha^*\bar{y}/y_m+2\alpha^* b\bar{y}/y_m]}{(1-2\alpha^*\bar{y}/y_m)}\}}$$

$$\frac{\partial\alpha^*}{\partial\bar{y}} = \frac{-2(\alpha^*)^2\frac{1}{y_m}(1+2b)}{[(1-2\alpha^*\bar{y}/y_m)^2+\alpha^*\bar{y}/y_m+2\alpha^* b\bar{y}/y_m]}.$$

Given that $b\in[0,1]$, $T\in[0,1]$ and $(1-2\alpha^*\bar{y}/y_m)^2 \geq 0$, it is clear that $\frac{\partial\alpha^*}{\partial\bar{y}} \leq 0$ **QED.**

A. Appendices

A.3. Why the Wealthy May Have More Political Power

Generally, political economy models of income inequality and redistribution assume equal political power for each individual, regardless of his/her income. But, in practice, the belief that the wealthy minority, not the poor majority, controls the political process is widespread. Our model takes unequal political power into account in determining the redistributive institutions.

Our model is not the first in loosening the perfect democracy assumption. Verdier and Ades (1992) deviate from perfect democracy assumption and analyze the case when only a fraction of population is enfranchised to vote. They assume that belonging to the ruling class is costly. Membership in ruling elite requires some fixed investment expenditure. When capital markets are imperfect, mean preserving increase in inequality pushes a greater fraction of the population into a situation of political disenfranchisement, thereby concentrating political power on the wealthy. One can find some historical evidence that voting franchises are restricted to citizens owning a minimum amount of property in Saint-Paul and Verdier (1993), Pearson and Tabellini (1994) and Jack and Lagunoff (2004); for example, Jack and Lagunoff state:

> *In the 19th century, England partially expanded along lines of wealth or property ownership as well. However, in Italy, the franchise was granted to citizens who passed certain educational as well as financial criteria in 1849. 19th century Prussia presents an interesting case: in 1849 voting rights were extended to most citizens, but these rights were accorded proportional to percentage of taxes paid. The electorate was divided into three groups, each group given equal weight in the voting. The wealthiest individuals who accounted for the first third of taxes paid accounted for 3.5 % of the population. The next wealthiest group-the 'middle class'-accounted for 10-12 % of population. The rest of the population (about 85 %) accounted for the remaining third of the power.* (2004 p.3)

In our model, instead of assuming that there is a fixed cost for political participation, we follow Benabou (1996, 2000) in formulating the unequal political power in shaping the redistributive institutions. Benabou (1996, 2000) attributes the political power of individuals proportionally to their income. Hence, higher income inequality also leads to greater inequality in the political arena.

Having said that we adopt Benabou's method in formulating political power, Prussian experience provides a valid historical example, revealing the political power of the wealthy. In our model, the taxation is proportional to income, and therefore the wealthy disproportionately bear the burden of taxation. Similar to our model, in the Prussian experience, the wealthy, 3.5% of the population, pay more per capita than the other groups for taxation. But at the same time, their political power per person is also much higher than the citizens in other groups.

One may have definite doubts in extending these historical episodes to the present, considering that it is rare to encounter with the cases that officially only the wealthy are enfranchised with certain political rights. However, there is less contention for the idea that the wealthy have other means to express their political influence today, and most of the time, these means are very much proportional to income. Similar to Benabou (1996, 2000), in this study, we do not attempt to model why the wealthy emerge to be more powerful to influence government's decision. Nonetheless one can think of several reasons. For example, there is an extensive literature on how the wealthy can exert more political power in affecting government's policies through lobbying activity, like in Estaban and Ray (2004), Bassett, Burkett and Putterman (1999).

Another reason for greater political power of the wealthy can be related to the collective action problem originally formulated by Olson (1965). For example, Rodriguez (2004) analyzes the political power of the wealthy in the context of income inequality and redistribution. He shows that once the wealthy have lobbying power under uncertainty, standard positive relationship between income inequality and redistribution dissolves. The most interesting aspect of his work is that Rodriguez incorporates collective action issues in his analysis. The wealthy are not just more powerful because of their income, but at the same time they are more immune to collective action problems. Hence, they can form coalitions or lobbies much more easily than the poor. Moreover, considering their number and greater interest at stake as factors reducing collective action problem, collective action issues emerge as another plausible reason for the wealthy to be more powerful in influencing redistributive institutions.

A.4.Why the Wealthy do not Directly Reduce Tax Rate

The question why the wealthy do not directly reduce the tax rate but attempt to exaggerate inefficiency in redistributive institutions is very much related to the literature on inefficient redistribution. In the inefficient redistribution literature, the central issue is exactly the same that why redistribution takes inefficient forms even if more efficient alternatives exist. In our model, reducing the tax rates is definitely better than reducing the efficiency of redistributive institutions, given that disincentive effect of taxation will be reduced in addition to not aggravating the inefficiency in redistributive institutions. Then, why do the wealthy tend to reduce ERI instead of reducing tax rates directly?

Asymmetric information and commitment problems constitute strong candidates for this behavior. First, the wealthy prefer to play with ERI when people imperfectly observe identity of individuals in designing the ERI, but they are perfectly informed about the identity of the wealthy, when they attempt to reduce the tax rate. For example, the wealthy may not dare to offer a cut in taxes channeled for social security spending for the poor directly. Instead they prefer to make the poor think that social security spending does not bring much benefit to them because of the low ERI. Hence, by reducing ERI, the wealthy leave the decision to the poor to reduce the tax rate and redistribution. As long as their attempts to reduce ERI are observed with more imperfection than their attempts to reduce taxes, the wealthy prefer to manipulate ERI instead of trying to reduce tax rates. Keefer and Khemani (2003) support this idea by stating

> *It is especially difficult for voters to assess the quality and efficiency of service provision and to evaluate the responsibility of specific political actors for service breakdowns.* (p.2)

The second reason for this inefficient policy stems from the commitment problem. It is not time consistent to set the equilibrium taxes at a lower rate in the first stage. Even though in the first stage the wealthy and the poor agree to lower the tax rates, there is no guarantee that this agreement will last in the second stage. In other words, there is no reason for the median voter to comply with any agreement to reduce tax rates in the second stage, once the ERI is already determined.

There are definitely certain escape routes to overcome the commitment problem, especially when the game is repeated over time. However, it is not easy at all to reverse institutions as a punishment strategy, considering the literature on the persistence of institutions (like in Acemoglu and Robinson 2001-a, Sokoloff and Engerman 2000). In short, it is much more difficult to alter redistributive institutions in the future. Therefore, in spite of the cost of increasing inefficiencies, the wealthy prefer to establish less efficient redistributive institutions to force the poor to commit to a lower aggregate redistribution scheme.

A.5. Constitutional Context of Buchanan and Tullock

Buchanan and Tullock (1962) develop a theory of constitutional government. Their constitutional stage closely resembles the first stage in our analysis in determining α^*. In their context, individuals are uncertain about their future positions and thus are led out of self-interest to select rules that weigh the positions of all other individuals.

Similar to their constitutional context, in our model, individuals in the first stage can be assumed to have information about the future income distribution with certainty but have no information about their own future income. Individuals learn their income in the second stage. Then, each individual in the first stage -constitutional stage- has an expected income equal to average income in the economy. The existence of uncertainty about the individual's own income ensures that unanimity is obtained in the first stage. Hence, the decisive voter in the first stage expects to have average income, which is greater than the median income that will be realized in the second stage. Again, due to the same reason that the decisive voter expecting mean income will not be the decisive voter in the second stage, each individual in the first stage agrees to set α^* lower than the median voter of the second period in order to constrain redistributive taxation desired by the future median voter. Similar to the first explanation, income inequality aggravates the reduction in α^*, while it increases the redistributive pressure.

The decisive voter's expected income in the first period is equal to the mean income[14] $E(y_d) = \vec{y}$. Therefore, Equation 7 becomes

$$\alpha^* = \frac{T^*}{Z(1-bT^*)(\bar{y}/y_m - 1)}$$

[14] In order to convey the main message, we abstract from risk-aversion and assume linear utility function. The risk-aversion does not abruptly change the results as long as expected income sufficiently exceeds the median income in the second period.

Now, we can show how α^* changes with income inequality. This change corresponds to the simulations above when $\lambda = 0.5$ because the decisive voter's expected income becomes mean income when $\lambda = 0.5$ [$E(y_d) = e^{\mu + \frac{1}{2}\sigma^2} = \bar{y}$]. Hence, one can also consider the above simulations when $\lambda = 0.5$ as an example in this case and note that α^* declines with income inequality.

Proposition A-1:

Income inequality reduces the ERI when there is uncertainty about the individuals' future income but has no uncertainty about the future distribution of aggregate income.

References

Acemoglu, D. and Robinson, J. (2001-a), 'A Theory of Political Transition', *The American Economic Review*, 91, 938-963.

Acemoglu, D. and Robinson, J. (2001-b), 'Inefficient Redistribution', *American Political Science Review*, 95, 649-661.

Ades, A., and Di Tella, R.,. (1999), 'Rents, Competition, and Corruption', *American Economic Review*, 89 (4), pp. 982-993.

Aghion, P. and Bolton, P. (1997), 'A Theory of Trickle-Down Growth and Development', *Review of Economic Studies*, 64, 151-172.

Alesina, A. and Rodrik, D. (1994), 'Distributive Politics and Economic Growth', *The Quarterly Journal of Economics*, 109, 465-489.

Alesina, A. and Perotti, R. (1996), ‘Income Distribution, Political Instability, and Investment’, *European Economic Review*, 40(6), 1203-1228.

Alesina, A., Ozler, S., Roubini N. and Swagel P. (1996), ‘Political Instability and Economic Growth’, *Journal of Economic Growth*, 1, 189-211.

Alberto A., Baqir, R., and Easterly, W., (1999), 'Public Goods and Ethnic Divisions', *The Quarterly Journal of Economics*, MIT Press, vol. 114(4), pages 1243-1284.

Alesina, A., Devleeschauwer, A., Easterly, W., Kurlat, S., and Wacziarg, R., (2003), 'Fractionalization', *NBER Working Papers* 9411.

Azariadis, C. and Lahiri, A. (2002), ‘Do Rich Countries Choose Better Governments?’ University of California, Los Angeles, mimeographed

Banerjee, A.V. and Newman, A.F. (1993), ‘Occupational Choice and the Process of Development’, *Journal of Political Economy*, 101(2), 274-298.

Bassett, W.F., Burkett, J.P. and Putterman, L. (1999), ‘Income Distribution, Government Transfers and the Problem of Unequal Influence’, *European Journal of Political Economy*, 15, 207-228.

Becker, G. S. and Mulligan, C. B. (2003), 'Deadweight Costs and the Size of Government.' *Journal of Law and Economics*, 46(2), 293-340.

Benabou, R. (1996), Inequality and Growth, in Bernanke, B. and J. Rotemberg eds, 'NBER Macro Annual 1996', MIT Press, Cambridge, MA, 11-76.

Benabou, R. and Ok, E.A. (1998), 'Social Mobility and the Demand for Redistribution: the POUM Hypothesis', *NBER Working Paper* No. 6795.

Benabou, R. (2000), 'Unequal Societies: Income Distribution and the Social Contract' *American Economic Review*, 90(1), 96-129.

Benabou, R. and Ok, E.A. (2001), 'Social Mobility and the Demand for Redistribution: the POUM Hypothesis', *Quarterly Journal of Economics* 116, 447-487.

Bertola, G. (1993), 'Factor Shares and Savings in Endogenous Growth', *American Economic Review*¸ 83(5), 1184-1198.

Bertola, G. (1998), Macroeconomics of Distribution and Growth in Atkinson, A. B. and F. Bourguignon eds, 'Handbook of Income Distribution' New York, Amsterdam, North Holland-Elsevier.

Betancourt, R. and S. Gleason, (2000), 'The Allocation of Publicly-Provided Goods to Rural Households in India: On Some Consequences of Caste, Religion and Democracy', *World Development*, Vol. 28, No. 12, December.

Borge, L.-E. and J. Rattsø (2004), 'Income Distribution and Tax Structure: Empirical Test of the Meltzer-Richard Hypothesis', *European Economic Review*, vol. 48(4), pages 805-826.

Buchanan, J. M. and Tullock G. (1962), *'Calculus of Consent: Logical Foundations of Constitutional Democracy'* University of Michigan Press Ann Arbor, Michigan.

Chiu, W. H. (1998), 'Income Inequality, Human Capital Accumulation and Economic Performance', *Economic Journal*, 108(446), 44-59.

Chong, A., and Calderon, C., (2000), 'Institutional Quality and Income Distribution' *Economic Development and Cultural Change*, vol. 48(4), pages 761-86.

Coate, S. T. and Morris S. E. (1995), 'On the Form of Transfers to Special Interests', *Journal of Political Economy*, 103, 1210-1235.

Corcoran, Sean, and William N. Evans. 2004, 'Income Inequality, the Median Voter, and the Support for Public Education' Unpublished manuscript. Department of Economics. College Park, MD: University of Maryland. March.

Cooper, S., Durlauf S., and Johnson P. (1998), 'On the Evolution of Economic Status across Generations', American Statistical Association (Business and Economics Section), Papers and Proceedings, 50-58.

Dalgaard, C.H., Hansen H., and Larsen T., (2001), 'On the Fiscal Policy Approach to Income Distribution and Growth', Economic Policy Research Unit (EPRU), University of Copenhagen. Institute of Economics.

Dalgaard, C.H., Hansen H., and Larsen T., (2003), 'Income Skewness, Redistribution and Growth: A Reconciliation', Economic Policy Research Unit (EPRU), University of Copenhagen. Institute of Economics.

De Ferranti, D., Perry, G.E., Ferreira, F.H.G. and Walton M. (2004), *'Inequality in Latin America Breaking with History?'*, World Bank Latin American and Caribbean Studies, The World Bank, Washington, D.C.

Deininger, K., Squire, L., 1996, 'A New Data Set Measuring Income Inequality', *World Bank Economic Review* 10(3), 565-591.

Drazen, A., Limao, N. (2004), 'Government Gains from Self-Restraint: A Bargaining Theory of Inefficient Redistribution', *NBER Working Papers* No. 10375.

Drazen, A. (2000), *'Political Economy in Macroeconomics'*, Princeton University Press, Princeton, NJ.

Dollar, D., and Kraay, A., (2002), 'Growth Is Good for the Poor,' *Journal of Economic Growth*, vol. 7(3), pages 195-225.

Easterly, W. and S. Rebello (1993), 'Fiscal Policy and Economic Growth: An Empirical Investigation', *Journal of Monetary Economics*, 32, 417-458.

Easterly, W., and Levine, R., (1997), 'Africa's Growth Tragedy: Policies and Ethnic Divisions', *The Quarterly Journal of Economics*, MIT Press, vol. 112(4), pages 1203-50.

Easterly, W., and Ross, L., (2003), 'Tropics, germs, and crops: how endowments influence economic development', Journal *of Monetary Economics*, vol. 50(1), pages 3-39.

Engerman, S. and Sokoloff, K., 1997. 'Factor Endowments, Institutions, and Differential Paths of Growth Among New World Economies', in: Haber, S.H., ed., How Latin America Fell Behind, (Stanford University Press, Stanford CA) 260-304.

Estaban, J. and Ray, D. (2004), 'Inequality, Lobbying and Resource Allocation', Mimeograph.

Evrenk, H., (2003) 'Are Honest Citizens to Blame for Corruption? An Exercise in Political Economy of Tax Evasion', Boston University.

Forbes, K. J., (2000), 'A Reassessment of the Relationship Between Inequality and Growth', *American Economic Review*, 90:4, September, 869-887.

Galor, O. and Zeira, J. (1993), 'Income Distribution and Macroeconomics', *Review of Economic Studies*, 60, 35-52.

Gylfason, T., (2001), ‘Natural Resources, Education, and Economic Development’, *European Economic Review* 45 (May): 847-859.

Hauk, W. R. and Wacziarg, R., (2004), 'A Monte Carlo Study of Growth Regressions' *NBER Technical Working Papers* 0296.

Harms, P. and Zink, S. (2003), ‘The Limits of Redistribution in a Democracy: a Survey’, *European Journal of Political Economy*, 19, 651-668.

Hayashi, F. (2000), Econometrics. Princeton: Princeton University Press.

Jack, W. and Lagunoff, R. (2004), ‘Dynamic Enfranchisement’, mimeograph, Georgetown University.

International Country Risk Guide (2004).

Isham, J., Woolcock, M., Pritchett L, and Busby, G., (2002), 'The Varieties of Rentier Experience: How Natural Resource Export Structures Affect the Political Economy of Economic Growth', mimeo.

Kaufmann, D., A. Kraay, and M. Mastruzzi. (2003), 'Governance Matters III: Governance Indicators for 1996–2002', World Bank, *World Bank Policy Research Working Paper* 3106.

Keefer P. and Khemani, S. (2003), 'The Political Economy of Public Expenditures', Background Paper for WDR 2004, Making Services Work for Poor People, The World Bank.

Keefer, P. and Knack, S. (2002) 'Polarization, Property Rights and the Links Between Inequality and Growth', Public Choice. 111:1-2, 127-154 (March).

Keefer, P. (2002), 'Clientelism, Credibility and Democracy', World Bank Economy Research Group Paper, Washington, D.C.

La Porta, Lopez-de-Silanes, R., F., Shleifer, A. and Vishny, R. (1999), 'Quality of Government', *The Journal of Law, Economics, and Organization*, 15, 222-279.

LeCaillon, J., Paukert, F., Morrisson, C. and Germidis D., (1984), 'Income Distribution and Economic Development', An Analytical Survey. International Labor Office. Geneva.

Lederman D., Loayza, N.V., and Soares, R.R., (2005), 'Accountability And Corruption: Political Institutions Matter', Economics *& Politics*, vol. 17, pages 1-35.

Lindert, Peter H., (1996). 'What Limits Social Spending?', *Explorations in Economic History*, vol. 33(1), 1-34.

Mauro, P. (1995), 'Corruption and Growth', *Quarterly Journal of Economics* 110: 681 712.

Mauro, P., (1998), ‘Corruption and the Composition of Government Expenditure’, *Journal of Public Economics*, 69, 263–279.

McGuire, M. C. and Olson, M. (1996), ‘The Economics of Autocracy and Majority Rule: The Invisible Hand and the Use of Force’, *Journal of Economic Literature*, 34(1), 72-96.

Meltzer, A.H. and Richard, S.F. (1981), ‘A Rational Theory of the Size of Government’ *Journal of Political Economy*, 89, 914-927.

Milanovic, B. (2000), ‘The Median-Voter Hypothesis, Income Inequality, and Income Redistribution; an Empirical Test with the Required Data’, *European Journal of Political Economy*, 16, 367-410.

North, D. (1981), ‘Growth and Structural Change’, W.W. Norton, New York.

Paldam, M. (2002) `The Cross-Country Pattern of Corruption. Economics, Culture and the Seesaw Dynamics', *European Journal of Political Economy* 18(2): 215-240.

Paukert, F., (1973), ‘Income distribution at different levels of development: a survey of the evidence’, *International Labor Review* 108, 97-125. 29.

Perotti, R. (1993), ‘Political Equilibrium, Income Distribution, and Growth’ *Review of Economic Studies*, 60,755-76.

Perotti, R. (1996), ‘Growth, Income Distribution, and Democracy: What the Data Say’, *Journal of Economic Growth*, 1, 149-187.

Persson T. and Tabellini, G. (1994), ‘Is Inequality harmful for Growth? Theory and Evidence’, *American Economic Review*, 84(3), 600-621.

Persson, T, and Tabellini, G. (1992) 'Growth, Distribution, and Politics' in A, Cuckierman, Z. Hercowitz and L. Lederman, eds., Political Economy Growth, and Business Cycles. MIT Press, Cambridge, MA.

Persson T. and Tabellini, G. (2002), ‘Political Economics Explaining Economic Policy’, The MIT Press, Cambridge, M.A.

Ray, D., (1998), *‘Development Economics’*, Princeton University Press, Princeton, NJ.

Rigolini, J. (2003), ‘Inequality, Transfers and Social Conflicts under Autocratic Regimes’, Mimeograph, New York University.

Rodriguez, F. (2004), ‘Inequality, Redistribution and Rent Seeking’, *Economics & Politics*, 16(3), 287-320.

Rodrik, D. (1998). ‘Why Do More Open Economies Have Bigger Governments?,’ *Journal of Political Economy*, University of Chicago Press, vol. 106(5), pages 997-1032.

Saint-Paul, G., and Verdier, T. (1991), 'Education, Democracy, and Growth' *Journal of Development Economics*, 42(2), 399-407.

Sokoloff, K.L. and Engerman, S. (2000), 'Institutions, Factor Endowments, and Paths of Development in the New World', *Journal of Economic Perspectives*, 3, 217-232.

Shleifer, A., and Vishny, R. W., (1993), 'Corruption', The *Quarterly Journal of Economics,* MIT Press, vol. 108(3), pages 599-617.

Sylwester, K. (2000), 'Income inequality, education expenditures, and growth', *Journal of Development Economics*, 63: 379-98.

Summers, R. and Heston, A. (1991), 'The Penn World Table (Mark 5): an expanded set of international comparisons, 1950-1988', *Quarterly Journal of Economics*, 106 (2), May, pp. 327-368

Taylor, C. L., and Hudson, M.C., (1972), World Handbook of Political and Social Indicators. 2nd. Ed. New Haven: Yale University Press.

Thorsten B., Clarke, G., Groff, A., Keefer, P., and Walsh, P., (2001), 'New tools in comparative political economy: The Database of Political Institutions' 15: 1, 165-176 (September), *World Bank Economic Review*.

Treisman, D., (2000), 'The Causes of Corruption: A Cross-National Study', *Journal of Public Economics*, 76, pp. 399-457.

Olson, M. (1965), *‘The logic of collective Action’*, Harvard University Press, Cambridge, M.A.

Verdier, T. and Ades, A. (1993), ‘The Rise and Fall of Elites: Economic Development and Social Polarization in Rent-Seeking Societies’, Harvard University, Mimeograph.

Wei, S., (2000), 'Natural Openness and Good Government', *NBER Working Papers* 7765, National Bureau of Economic Research.

Woolbridge, J., M., (2002), ‘*Econometric Analysis of Cross Section and Panel Data’,* The MIT Press, Cambridge, M.A.