ABSTRACT

Title of Dissertation: INEQUALITY, INSTITUTIONS AND REDISTRIBUTION

Ahmet Faruk Aysan, Doctor of Philosophy, 2005

Dissertation Directed by: Professor Roger Betancourt
Department of Economics

This dissertation explores the role of efficiency of redistributive institutions (ERI) on redistribution. The first substantive essay proposes a theoretical model to explain the lack of strong empirical evidence in favor of a positive relationship between income inequality and redistribution. This chapter first shows that even exogenously given ERI affects the relationship between income inequality and redistribution. Then, it 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. Hence, the main conclusion is that one needs consider these conflicting effects in order to account for the puzzling lack of strong empirical evidence for a positive relationship between income inequality and redistribution.

The second substantive essay empirically analyzes the role of efficiency of redistributive institutions on redistribution in the form of social security and welfare spending. When measures of ERI are incorporated into the existing empirical specifications of income inequality and redistribution, cross-sectional and panel data regressions show that the ERI significantly increases redistribution. However, we find weaker evidence for the role of income inequality on redistribution. Income inequality does not appear to be strongly significant in various specifications of the redistribution equation. Based on this evidence, this chapter concludes that ERI plays an important role in redistribution but this effect does not resolve the fiscal policy puzzle that is emphasized in the theoretical chapter. Moreover, this chapter also explores the determinants of ERI. Our empirical results confirm the theoretical model that an increase in GDP per capita and democracy increases ERI. However, there is less convincing evidence for the negative role of income inequality on the ERI. Among the other determinants of ERI, freedom of the press and trade openness improve ERI considerably.

INEQUALITY, INSTITUTIONS AND REDISTRIBUTION

by

Ahmet Faruk Aysan

Dissertation submitted to the Faculty of the Graduate School of the
University of Maryland, College Park in partial fulfillment
of the requirements for the degree of
Doctor of Philosophy
2005

Advisory Committee:
Professor Roger Betancourt, Chair
Professor John Chao
Professor Nuno Limao
Professor Roberto Patricio Korzeniewicz
Professor John Shea

DEDICATION

For my family

ACKNOWLEDGEMENTS

I especially would like to thank my advisor, Roger Betancourt, for his encouragement, guidance, and support. He has given me generously of his time and energy especially over the last two years. Without his help, this dissertation could not come to this stage. I also owe a special thank you to Rodrigo Soares for his precious comments on the various versions of my dissertation. I have also benefited greatly from the suggestions of John Chao for the empirical chapter of my dissertation. I will always remember John Chao's encouraging and constructive attitudes to his students. I would also like to thank John Shea and Nuno Limao for reading and commenting on my dissertation at various stages of my graduate study. Their careful readings and thoughtful comments help this dissertation to improve significantly. I would also like to thank Roberto Patricio Korzeniewicz for serving on my dissertation committee. Finally, I would like to thank the faculty of the Department of Economics, friends in the graduate program, friends in other universities and the World Bank, the secretaries in the Economics department, my undergraduate professors and my family for their constant support.

TABLE OF CONTENTS

List of Tables……vi

List of Figures..……viii

1. Chapter 1: Introduction to the Dissertation……..…1

2. Chapter 2: The Shadowing Role of Redistributive Institutions in the Relationship Between Income Inequality and Redistribution

2.1. Introduction……4
2.2. The Model……..…..7
2.2.1. The Benchmark Model……..….9
2.3. Income Inequality and ERI When ERI is a Positive Function of Average Income……...19
2.4. Income Inequality and Efficiency of Redistributive Institutions in Two Stages..23
2.4.1. Institutional Equilibrium in Two Stages……...….24
2.4.2. Log-Normal Distribution……..26
2.4.3. When Political Power on ERI is Proportional to Income…….……28
2.4.4. When There is Uncertainty about an Individual's Future Income and the Prospect of Upward Mobility……...……..……33
2.4.4.1. Markovian Example…….……...……..36
2.4.4.2. Log-Linear, Log-Normal Specification……..…….…….41
2.5. Conclusion……...…….45

3. Chapter 3: The Role of Efficiency of Redistributive Institutions on Redistribution: An Empirical Assessment

3.1. Introduction……...……..…..47
3.2. Determinants of Redistribution in the Literature……..52
3.3. Bringing the Theory to the Data……...64
3.4. Estimation Specification and Cross-Section Regressions……77
3.4.1. Controlling for Endogeneity of Income Inequality and Efficiency of Redistributive Institutions…..……...86
3.4.2. Two Stage Least Squares Regression Results……..……....93
3.4.2.1. Sensitivity Analysis…….....99
3.4.3. Panel Data Regressions…….…….....107
3.4.3.1. Panel Data Regressions when ERI and Income Inequality are Instrumented…….…...112
3.4.3.2. Sensitivity Analyses of Panel Data Regressions……....115
3.5. Determinants of Efficiency of Redistributive Institutions……..…….....121
3.6. Conclusion……....…….133

A. Appendices

A.2. Appendices for Chapter 2
A.2.1. Derivation of tax rate when efficiency of redistributive institutions is a positive function of average income……...…….134
A.2.2. Proof of Proposition 3……...……...……..135
A.2.3. Why the Wealthy May Have More Political Power……..…140
A.2.4. Why the Wealthy do not Directly Reduce Tax Rate……..……....143
A.2.5. Constitutional Context of Buchanan and Tullock……..145

A.3. Appendices for Chapter 3
A.3.1. Appendix for the Bringing the Theory to the Data……..…….….147
A.3.2. Appendix for the Estimation Specification and Cross-Section Regressions.…….....161
A.3.3. Appendix for the Panel Data Regressions……..... 165
A.3.4. Appendix for the Determinants of Efficiency of Redistributive Institutions…… ..172

References……..…….....173

LIST OF TABLES

3.1. Literature on Income Inequality and Redistribution……..…..62

3.2. Correlation of ICRG Indices…….……..71

3.3. Summary Statistics……...…75

3.4. Correlation Matrix of Variables……..76

3.5. Cross-Sectional Regressions on Redistribution……..84

3.6. Cross-Sectional 2SLS Regressions on Redistribution……...….96

3.7. Alternative Measures of ERI: 2SLS Regressions……..……...…100

3.8. Alternative Measures of Redistribution: 2SLS Regressions……...…..102

3.9. Alternative Measures of Democracy: 2SLS Regressions…….104

3.10. 2SLS Regressions Other Types of Government Expenditures……...106

3.11. Panel Data Estimations……...111

3.12. Panel Data Estimation: 2SLS…….…….114

3.13. Panel Data Estimation, 2SLS: Alternative Measures of Democracy……..116

3.14. Panel Data Estimation, 2SLS: Alternative Measures of Redistribution…….117

3.15. Panel Data Estimation, 2SLS: Alternative Measures of Democracy……..119

3.16. Panel Data Estimations, 2SLS: Other Types of Government Expenditures…..…..120

3.17. Determinants of ERI: Cross-Sectional Regressions…….……..124

3.18. Determinants of ERI: 2SLS Regressions…….…..128

3.19. Determinants of ERI: 2SLS Regressions; Alternative Measures of Democracy...130

3.20. Other Determinants of ERI: 2SLS Regressions……..132

A.1. Variance Inflation Factor…….……161

A.2. Alternative Instrument for Income Inequality…….162

A.3. Correlation Matrix of Instruments……...……163

A.4. Summary Statistics of Instruments in Cross-Section……...……163

A.5. Countries in Regressions……..……164

A.6. Panel Data Estimation: 2SLS without years after independence…….165

A.7. Breusch and Pagan Lagrangian multiplier test for random effects……..166

A.8. Hausman Specification Test……...…..166

A.9. Summary Statistics Panel Data……...….167

A.10. Correlation Matrix of Panel Data……...168

A.11. Data on ERI in Panel……..……168

A.12. Determinants of ERI; Extended Sample of Countries: Cross-Sectional Regressions……..172

LIST OF FIGURES

2.1 Income Inequality and ERI, When Political Influence on ERI is proportional to Income; b=.5, lamda=.5…….31

2.2 Income Inequality and ERI, When Political Influence on ERI is proportional to Income; b=.2, lamda=.1…….32

2.3 Income Inequality and ERI, When Political Influence on ERI is proportional to Income; b=.8, lamda=.5…….33

2.4 Income Inequality and ERI, Prospect of Upward Mobility: Markovian Example; b=.5……39

2.5 Income Inequality and ERI, Prospect of Upward Mobility: Markovian Example; b=.4……40

2.6 Income Inequality and ERI, Prospect of Upward Mobility: Markovian Example; b=.6……41

2.7 Income Inequality and Redistribution, Log-Linear, Log-Normal Specification, Prospect of Upward Mobility, b=.5, p=.5……..44

2.8 Income Inequality and Redistribution, Log-Linear, Log-Normal Specification, Prospect of Upward Mobility, b=.5, p=.8……..45

3.1 OLS Partial Regression Diagram of ERI…….....…85

3.2 WLS Partial Regression Diagram of ERI……..85

3.3 WLS by Number of Observations Partial Regression Diagram of ERI….....86

3.4 Ethnolinguistic Fractionalization and ERI Partial Regression Diagram……..…97

3.5 Oil Export and ERI Partial Regression Diagram……...…97

3.6 Years after independence and ERI Partial Regression Diagram……...…98

3.7 Tropical Climate and Inequality Partial Regression Diagram……...…98

3.8 Ethnolinguistic Fractionalization and Inequality……..…….99

3.9 OLS Partial Regression Diagram Inequality and ERI……..…125

3.10 OLS Partial Regression Diagram Democracy and ERI……...125

3.11 OLS Partial Regression Diagram GDP per capita and ERI…….126

1. Chapter 1: Introduction to the Dissertation

Economists have long been interested in the determinants of redistribution. The main focus in the redistribution literature appears to be the effects of income inequality on aggregate redistribution. In spite of both theoretical and empirical contributions to investigate the determinants of redistribution, an important gap remains in the literature, which is the effect of efficiency of redistributive institutions on redistribution. This dissertation is an attempt to show that the state apparatus with its redistributive institutions plays a major role in determining the size of redistribution.

This dissertation conceptually contributes to the existing literature by first differentiating between two types of inefficiency. One is in the process of taxation and another is in the redistribution stage. The first inefficiency occurs in the process of taxation due to the disincentive effect of taxation on supplying effort and on the accumulation of capital. This type of inefficiency is widely considered in analyzing income inequality and its relationship to redistribution in the literature. However, this dissertation also draws attention to a second type of inefficiency which takes place during the process of redistributing tax revenue back to society. This inefficiency is related to the functioning of redistributive institutions. Since governments implement the redistribution, how efficiently governments are run in the process of redistribution emerges as a second type of inefficiency. Interestingly, this distinction has not been made in the existing literature and the latter type of inefficiency has been omitted in existing studies.

The theoretical chapter of this dissertation 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 theoretical chapter later shows that even an exogenously given efficiency of redistributive institutions (ERI) affects the relationship between income inequality and redistribution. This chapter 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 of the theoretical chapter 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.

The empirical chapter of this dissertation analyzes the role of ERI on redistribution. In this chapter, redistribution is mainly approximated with social security and welfare expenditures by the governments. We utilize the indices of 'Quality of Bureaucracy' and 'Control of Corruption' from the International Country Risk Guide to quantify efficiency of redistributive institutions. When measures of ERI are incorporated into the existing empirical specifications of income inequality and redistribution, cross-sectional and panel data regressions show that ERI significantly increases redistribution.

This result is robust to alternative specifications of the empirical model as well as to alternative data sets. However, we find weaker evidence for the role of income inequality on redistribution. Income inequality does not appear to be strongly significant in various specifications of the redistribution equation. Based on this evidence, this chapter concludes that efficiency of redistributive institutions plays an important role in redistribution but this effect does not resolve the fiscal policy puzzle that is emphasized in the theoretical chapter.

The empirical chapter further explores the determinants of ERI emphasized in the theoretical chapter. Our theoretical model shows that income inequality reduces ERI and ERI is a positive function of the average income. It also implies that more democratic countries reach a higher level of ERI as long as more democracy indicates more political power for the median voter. A section of the empirical chapter focuses on testing these predictions in addition to analyzing some other possible determinants of ERI, such as freedom of the press. Our empirical results in this section confirm the theoretical model that increases in GDP per capita and democracy increase ERI. On the other hand, there is less convincing evidence for the negative role of income inequality on ERI. Among the other determinants of ERI, freedom of the press and trade openness improve ERI substantially.

2. Chapter 2: The Shadowing Role of Redistributive Institutions in the Relationship Between Income Inequality and Redistribution

2.1. 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

[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).

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 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,

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

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 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 chapter is organized as follows. Section 2.2 introduces the benchmark model. Section 2.3 analyzes a model where ERI is a positive function of average national income. Two stage specifications where the political power is proportional to income

[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.

and the prospect of upward mobility hypothesis are investigated in Section 2.4. Finally, Section 2.5 concludes. Detailed proofs, arguments for the political power of the wealthy, and some extensions are relegated to the Appendix.

2.2. 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.

2.2.1. 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 $0 \le T \le 1$ 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

[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,

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

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].

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

---

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.

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

[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.

corruption. This represents a decline in α because the needy only benefit as much as the real value of the 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 $\frac{\partial T^*}{\partial b} = -\frac{1}{b^2} \leq 0$. Second, ERI affects the equilibrium tax rate. Whether T^* has an interior solution in [0,1] depends on α and b. The condition $1+b \leq \alpha \bar{y}/y_m \leq \frac{1}{1-b}$ 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 $b \leq 1$, 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

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

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:

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

(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.

2.3. 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,

[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.

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 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

[9] See the Appendix for derivations.

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

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:

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) $\frac{\partial T^*}{\partial \bar{y}} \geq 0$ and (ii) $\frac{\partial \alpha^*}{\partial y_m} \leq 0$.

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

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

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

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.

2.4. 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 chapter. Then, the common underlying motivation in these various specifications can be stated as to constrain the future redistributive pressure that arises with income inequality.

2.4.1. 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

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

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

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

[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.

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.

2.4.2. 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.

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.

[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.

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:

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

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

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

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.

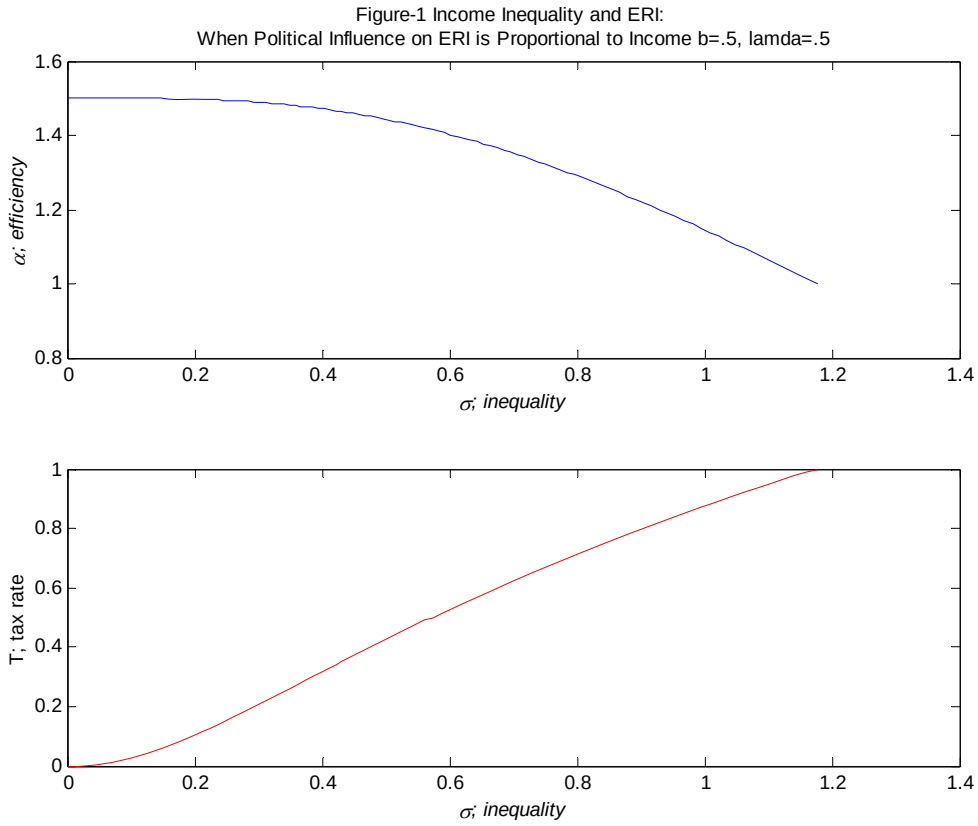
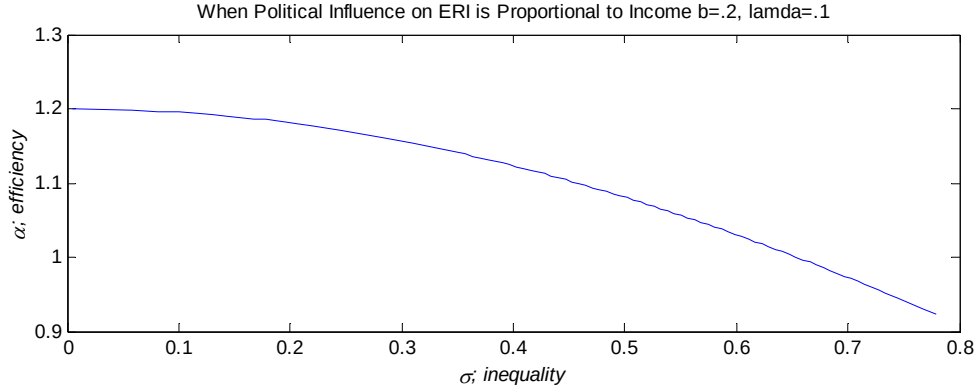
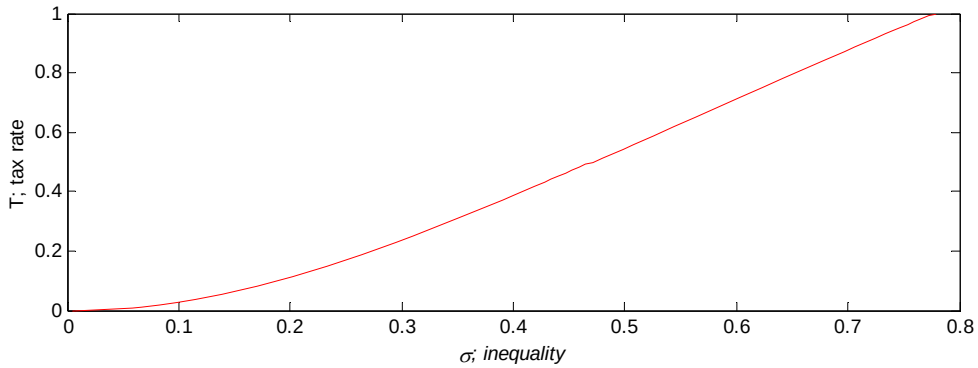
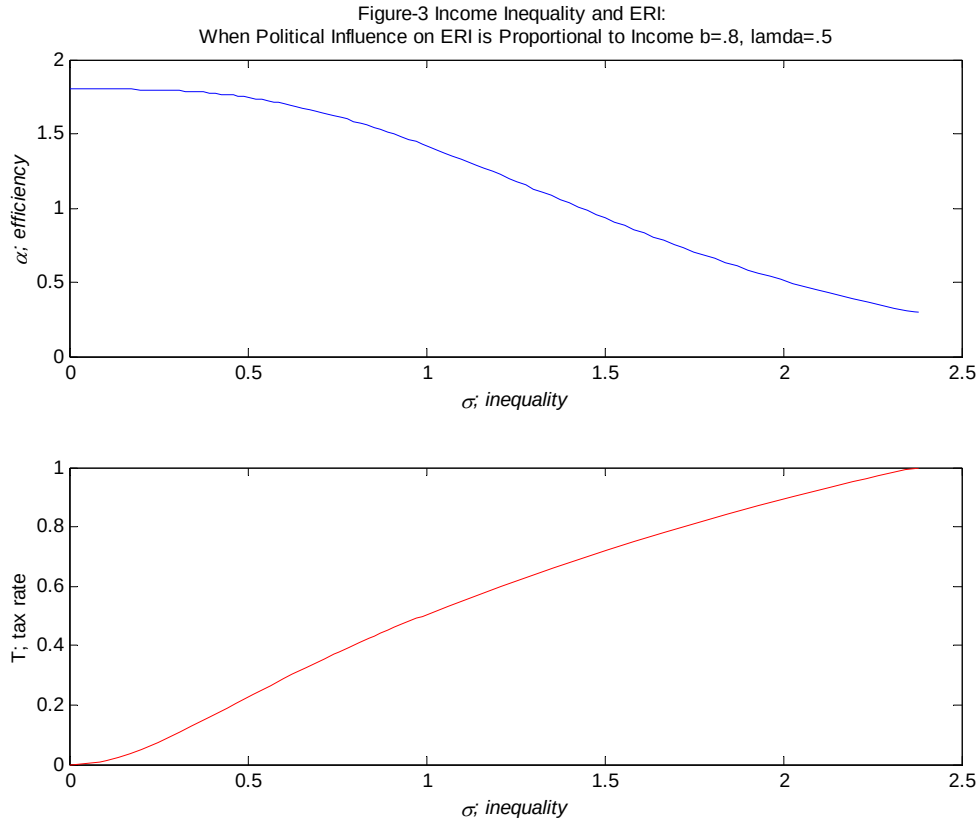


Figure-1 Income Inequality and ERI:
When Political Influence on ERI is Proportional to Income b=.5, lamda=.5
α; efficiency
σ; inequality
T; tax rate
σ; inequality

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







2.4.4. 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.

2.4.4.1. 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

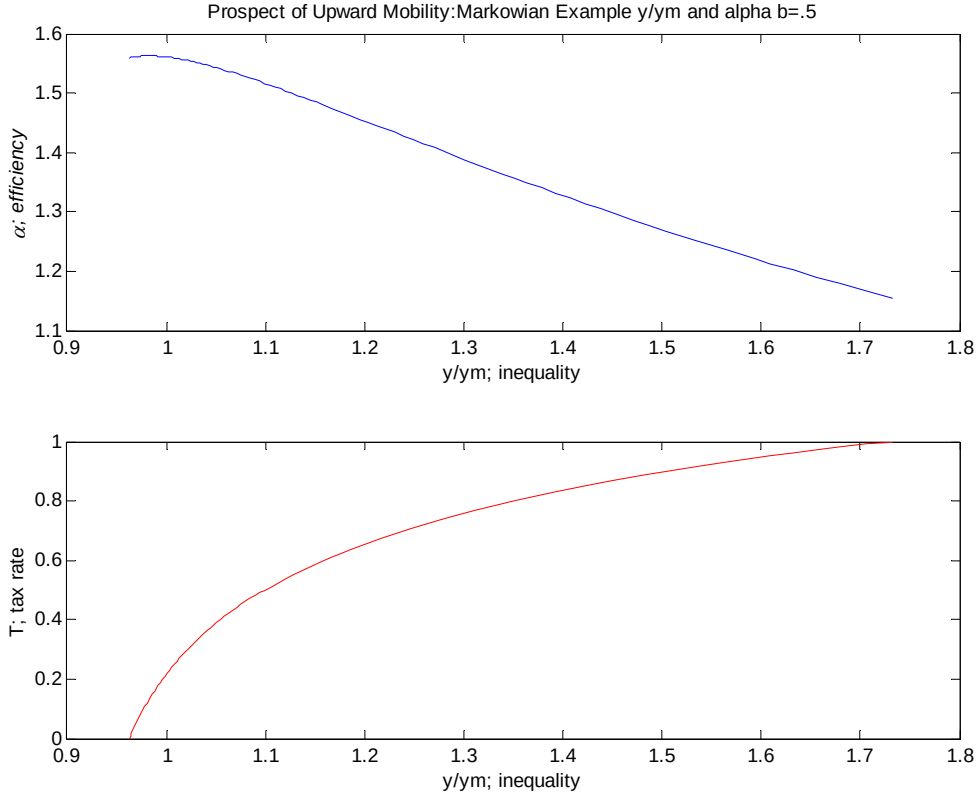
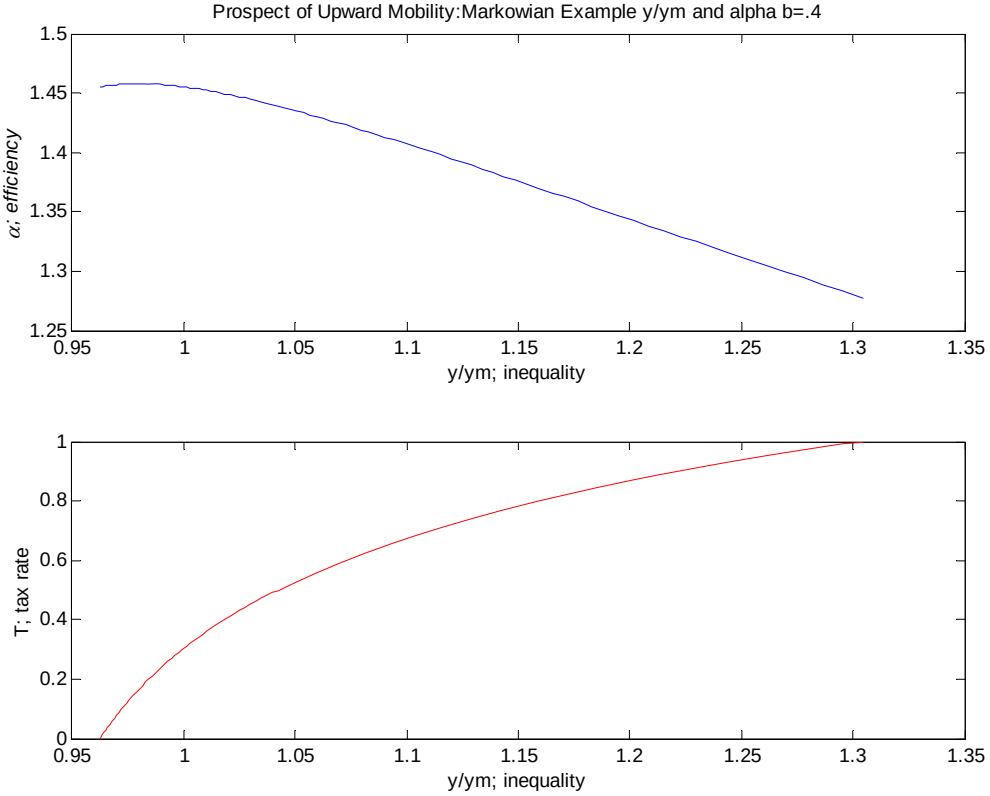
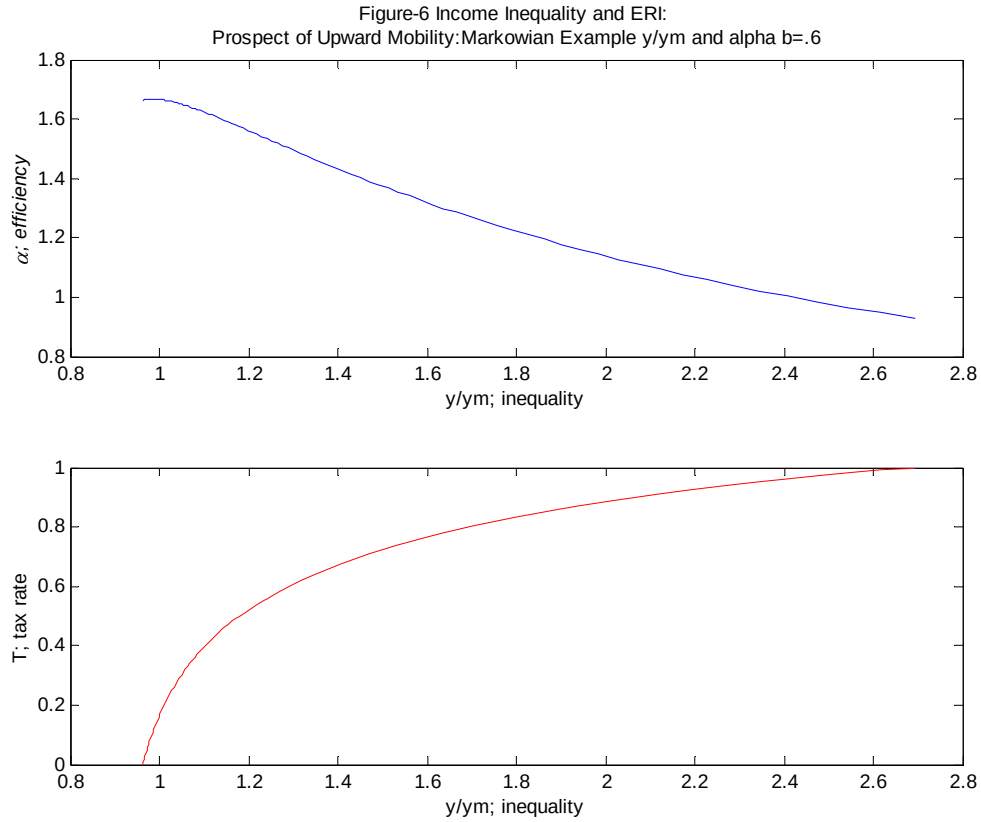


Figure-5 Income Inequality and ERI:
Prospect of Upward Mobility:Markowian Example y/ym and alpha b=.4





2.4.4.2. 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

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

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 $\sigma^2 = \frac{s^2}{1-p^2}$ and $\mu = \frac{-s^2}{2(1-p)} = \frac{-\sigma^2(1-p^2)}{2(1-p)} = \frac{-\sigma_2(1+p)}{2}$.

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

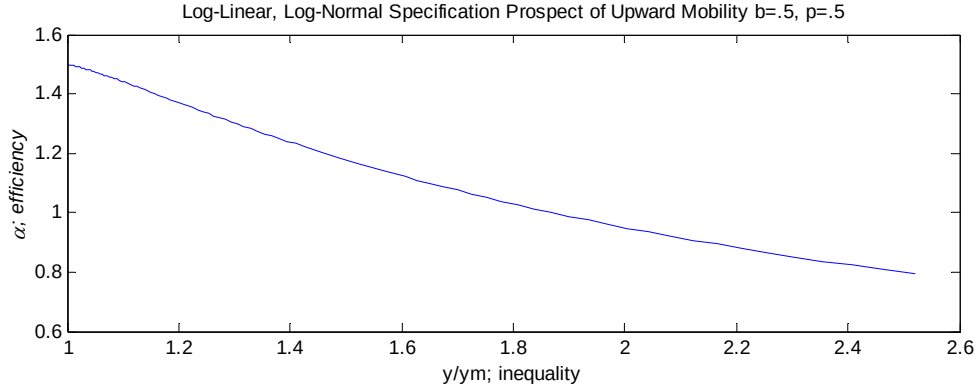
$E(f(y_{m_t};\theta_{m_{t+1}})) = E(\theta_{m_{t+1}} y_{m_t}^p) = y_{m_t}^p E(\theta_{m_{t+1}}) = y_{m_t}^p$ because $E(\theta_{m_{t+1}}) = 1$.

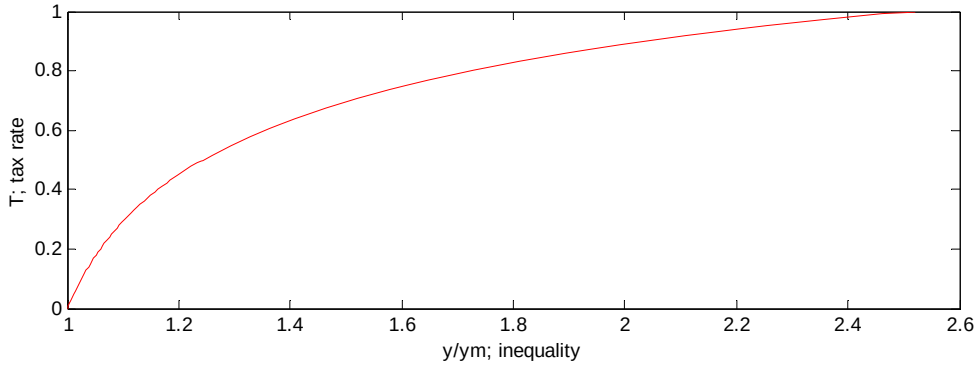
The decisive voter again maximizes Equation 1 with respect to α and finds a variant of Equation 7;

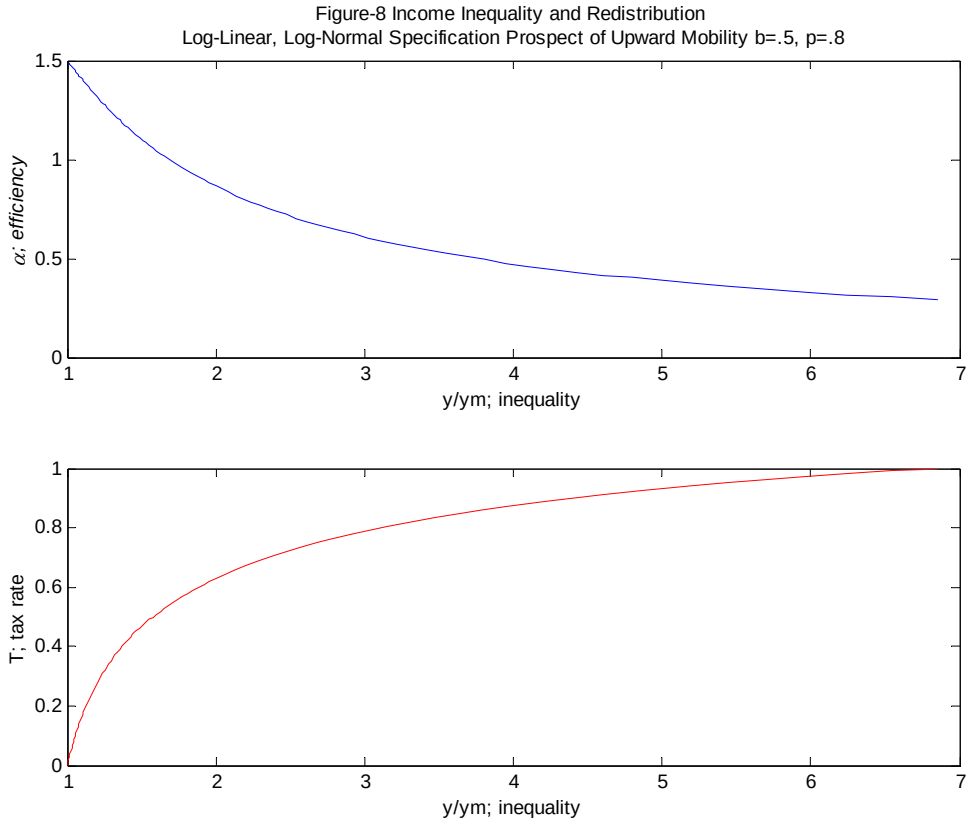
$$\alpha^* = \frac{T*}{Z(1-bT^*)(y_d/y_m - 1)} = \frac{T^*}{Z(1-bT^*)(E(y_m)/y_m - 1)} = \frac{(b+1-\alpha e^{\frac{1}{2}\sigma^2})(1-\alpha e^{\frac{1}{2}\sigma^2})^2}{b^2 e^{\frac{1}{2}\sigma^2}(1-e^{\frac{-\sigma^2(1+p)}{2}})^{p-1}} \quad (7\text{-}2)$$

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







2.5. Conclusion

This chapter 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.

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

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 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 chapter 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.

3. Chapter 3: The Role of Efficiency of Redistributive Institutions on Redistribution: An Empirical Assessment

3.1. Introduction

Countries with better bureaucratic quality and lower corruption[14] also tend to have more redistributive government spending. According to ICRG, Sweden has the highest possible scores both in bureaucratic quality (4) and control of corruption (6). In addition to its high institutional quality, Sweden has redistributed almost 18 percent of its GDP in the form of social security and welfare expenditure over the last thirty years. While, the Dominican Republic has only redistributed 0.8 percent of its GDP. Indonesia has been even worse, redistributing just 0.27 percent during the same period. The Dominican Republic and Indonesia have been also characterized by low institutional quality. Dominican Republic has only reached a score of 1.8 in bureaucratic quality and a score of 3.3 in control of corruption. Indonesia has displayed an even worse record in these institutional aspects and has only received a 1.2 in bureaucratic quality and a 1.5 in control of corruption. Bureaucratic quality and control of corruption are the main indicators of how efficiently governments are run in these countries. These institutional

[14] Several private companies and non-profit organizations issue evaluations of various dimensions of institutional quality for the countries. The scores reported in this section of the paper are obtained from the International Country Risk Guide. Later in the paper, we give detailed descriptions of these institutional indicators, which are commonly used in the literature, and discuss them in more depth.

scores support the conventional understanding that Sweden has been ruled by better governments as compared to the Dominican Republic and Indonesia.

Based on these observations, a natural question follows: whether there is a casual link from quality of institutions to aggregate redistribution in the economy. Our theoretical model shows that the answer is YES. The theoretical model confirms that a decline in the efficiency of redistributive institutions also restrains aggregate redistribution and suggests that the efficiency of redistributive institutions needs to be taken into account in analyzing the determinants of redistribution.

Income inequality emerges as the main focus of attention in analyzing the determinants of redistribution in the political economy literature[15]. However, our theoretical model points out that in addition to income inequality, the efficiency of redistributive institutions (ERI) plays an important role in determining the size of aggregate redistribution. To this end, our model first differentiates two types of inefficiencies that take place in the process of taxation and redistribution stages, respectively. The disincentive to work or accumulate factors of production in the taxation stage emerges as a first type of inefficiency and is already widely discussed in the existing studies of redistribution[16]. Nonetheless, the second type of inefficiency appears to have received less attention in existing research. This latter type of inefficiency takes place in the process of redistributing tax revenue back to society.

[15] 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).

[16] For an illustration of this form of inefficiency in existing studies, one can refer to McGuire and Olson (1996) and Harms and Zink (2003).

Contrary to existing theoretical models, it is self-evident that redistribution of tax revenue in practice is implemented by means of certain redistributive institutions. Then, how efficiently these institutions are run emerges as a second type of potential inefficiency in redistribution.

Our theoretical model incorporates this second type of inefficiency into existing models of income inequality and redistribution and shows that inefficiencies in redistributive institutions constrain the demand for redistribution. Since a fraction of tax revenue is lost during the redistribution process, the median voter's return from the redistribution declines. Consequently, inefficiencies in redistributive institutions limit the redistributive pressure in the economy.

Since existing econometric studies ignore the effect of efficiency of redistributive institutions on the size of aggregate redistribution, they suffer from an omitted variable bias. Therefore, one of the major empirical implications of our theoretical model requires that in addition to income inequality and other control variables, ERI needs to be included in any econometric specifications of the redistribution equation. In this chapter, we proceed in this direction and empirically analyze the role of ERI for redistributive spending.

The literature on institutions and redistribution is scarce. Empirical papers mainly concentrate on the role of income inequality for aggregate redistribution (e.g., Perotti, 1996; Dalgaard et al., 2003). This concerted interest partly stems from the motivation to test the existing theoretical models of income inequality and redistribution. However, there is very little research analyzing the effects of institutions on redistribution. Ther are few papers that address the role of institutions on redistribution (such as Mauro, 1998 and

Betancourt and Gleason, 2000). These papers, however, do not explore the effect of ERI on relationship between income inequality and redistribution. Hence, this current paper attempts to integrate these separate strands of research and empirically investigate the impact of both ERI and income inequality on redistribution. This empirical specification is also necessary considering the possible omitted variable bias suggested in our theoretical model.

In this chapter, redistribution is mainly measured with social security and welfare expenditures by the governments. This measure of redistribution is widely used in exiting studies of redistribution (Perotti, 1996; Dalgaard et al., 2003; Lindert, 1996). Social security and welfare expenditure also better satisfies the assumption in theoretical papers that the poor are the principal beneficiaries of redistribution. We mainly utilize the indices of 'Quality of Bureaucracy' and 'Control of Corruption' of the International Country Risk Guide to quantify efficiency of redistributive institutions. These indicators provide a better proxy for ERI than data that measure other dimensions of institutions[17]. The underlying assumption in this selection of these institutional variables is that countries with high corruption and low bureaucratic quality are also characterized by less efficient functioning of redistributive institutions[18].

Our measures of ERI are incorporated into existing empirical specifications of income inequality and redistribution. Cross-sectional and panel data regressions show that ERI significantly increases redistribution. This result is robust to alternative specifications of the empirical model as well as to alternative data sets. However, we

[17] We extensively discuss this issue later in the paper.

[18] The detailed discussion of variables used in this research is covered later in the paper.

find weaker evidence concerning the role of income inequality for redistribution. Income inequality does not appear to be strongly significant in various specifications of the redistribution equation. This result is similar to existing empirical results. When the measures of ERI are included in the empirical models, the coefficient of income inequality tends to get closer to the predictions of theoretical models of income inequality and redistribution. Nonetheless, the coefficients of income inequality measures remain insignificant. Based on this evidence, this chapter concludes that efficiency of redistributive institutions plays an important role in redistribution, but this effect does not seem to resolve the fiscal policy puzzle, which is emphasized in the theoretical chapter. In this regard, this chapter contributes the literature by confirming the existing findings on the effects of income inequality on redistribution and more importantly, it vigorously elucidates the importance of redistributive institutions to the size of redistribution.

The plan of this chapter is the following: In the next section, existing empirical models for redistribution and ERI are investigated to guide our empirical specification. Existing empirical studies reveal other determinants of redistribution and ERI, that need to be controlled for empirical estimations. They also provide various alternative econometric specifications to test the effects of income inequality on ERI and redistribution. Section 3 introduces the data used in this chapter. Specially, data on the measures of redistribution and ERI are discussed in detail, and the reasons for using these data sets are given in this section. Section 4 presents the cross-sectional and panel data empirical specifications and results. Section 5 analyzes the determinants of efficiency of redistributive institutions and Section 6 concludes.

3.2. Determinants of Redistribution in the Literature

Initial papers addressing the income inequality and growth relationship base their theoretical explanations on redistributive pressure, emanating from higher income inequality. This redistributive pressure explanation has been categorized by subsequent work as a fiscal policy approach. Structural models of the fiscal policy approach require a redistribution equation to be estimated in addition to a growth equation. However, empirical estimations typically adopt reduced form estimations to uncover the relationship between income inequality and growth (Perrson and Tabellini, 1994; Alesina and Rodrik, 1994).

Perotti (1996) appears to be the first researcher to address the fiscal policy channel with a structural empirical model. Hence, his paper is taken to be the benchmark for later studies. In Perotti's empirical specifications, growth and redistribution arise as two endogenous variables. In line with the theoretical models of the fiscal policy approach, a measure of income distribution enters into the redistribution equation along with other control variables. Various measures of redistribution are treated as exogenous variables in the growth equation. This type of estimation definitely represents a more precise test of existing fiscal policy models. Perotti employs several different variables to measure the redistribution formulated by the theoretical models. His measures include types of government expenditures that are explicitly redistributive in nature. Hence, Perotti uses data on social security and welfare, health, housing, and education expenditures, compiled by Easterly and Rebello (1993). He also includes various measures of taxation, such as average and marginal tax rates, and average shares of labor

and income taxation in GDP to account for the distortionary effects redistributive pressure on growth.

On the right hand side of the redistribution equation, the share of income accruing to the middle-class income enters into the equation. Perotti uses the share in income of the third and fourth quintiles as a proxy for a more equal distribution of income. Per capita GDP in 1960 is included to control for the conventional notion suggested by Wagner's Law that government expenditure is a luxury good. Hence, countries with higher GDP per capita are expected to spend more for redistribution. The share of population over 65 years of age, POP65, is also an important demographic variable in affecting the size of redistribution. The older the population, the higher the demand for social security. Hence, Perotti controls for the age structure of population which is especially important considering that the correlation between income inequality and POP65 is high in practice. Since the theoretical models are based on the assumption that the median voter decides on the tax rate and the corresponding redistribution, Perotti controls for the degree of democracy in the society. Democracy is expected to enter into the redistribution equation with a positive sign. Moreover, in several specifications, an interaction term between the middle-class share, and democracy is employed to test the predictions of the fiscal policy models that income inequality has a larger impact on redistribution in democracies.

Perotti's empirical estimations are based on cross-sectional data comprising at most 54 countries. His results show that income distribution plays essentially no role in the average marginal tax rate equation. However, this finding in itself is not sufficient to invalidate the fiscal policy approach. Given that the impact of income distribution on

government expenditure and taxation sould be felt more strongly in democracies, Perotti includes an interaction term, MID*DEM as well as the dummy for democracy. The theory predicts that the coefficient of MID*DEM should be negative and that the sum of coefficients of MID and MID*DEM should be negative, too. The point estimates of his specifications confirm both of these predictions. In democracies, inequality has a large effect on redistribution, while in non-democracies this effect is essentially zero. However, the relevant coefficients are not even close to being significant. POP65 has a positive and significant coefficient as expected, while initial GDP per capita appears to have a negative and insignificant coefficient. These patterns persist when various other measures of redistribution are used, such as the average share of labor and income taxation in GDP, social security and welfare expenditure, housing and health care expenditure, and finally education expenditure. Given these empirical findings, Perotti concludes that there seems to be weak empirical support for standard models of the effect of income distribution on fiscal policy.

Dalgaard et al. (2001, 2003), in a series of papers, attribute the weak relationship between income inequality and redistribution to the nature of cross-sectional regressions. They claim that weak correlations between income inequality and redistribution may emerge in a cross-section of countries, while within any one economy greater inequality leads to more redistribution. Hence, they present the following explanation for what they call the "fiscal policy puzzle". They first demonstrate that countries differ with respect to their level of productivity. In the original fiscal policy models, income shares of capital and labor are constant. In contrast, they use a more general formulation, which allows factor shares to vary with the level of productivity. Dalgaard et al. also present evidence

that the labor share of total income is higher in countries with a higher level of productivity. This analysis indicates that as countries improve their productivity, their labor share in production increases, and in turn the income distribution becomes more equal. Therefore, when high productivity countries tend to have more equal distribution of income, the correlation between income inequality and redistribution, across countries may not be conclusive, because the marginal cost of public spending tends to be low in countries with a relatively high level of productivity. It is then possible that a majority in the electorate would prefer a relatively high level of government activity in spite of a more equal distribution of income, while public expenditure is less desired in countries with low productivity[19]. Given these considerations, a more precise relationship between income inequality and redistribution can be derived with panel data estimations.

The empirical sections of these papers attempt to provide a test of this explanation. Invoking panel data techniques, they disentangle the time series variation in income inequality and measures of redistribution from the cross-section variation. As in Perotti (1996), Dalgaard et al. (2001) use social security, health, and housing expenditures as dependent variables in addition to the share of income and property taxes in GDP. GDP per capita, the share of population over 65 years of age and the income share of the middle class appear as exogenous variables in their panel data regressions. Moreover, they augment Perotti's specification by adding trade openness to account for the idea that more open countries redistribute more to protect against external shocks (Rodrik, 1998).

[19] Our theoretical paper shares the same result that public expenditures are desired more by the electorate when it is more productive due to the efficiency of redistributive institutions prevailing in the economy.

In Dalgaard et al. (2003), the authors conduct similar estimations just for 19 OECD countries over a period of 1971-1995 by averaging the data over five years. Unlike the previous study, they control for the size of population and the dependency ratio instead of trade openness and POP65. In this paper, they only use the share of income and property taxes as their dependent variables. They find that the impact of the middle class income share on taxes is positive and significant across countries. However, the estimated "time series effect" is negative and significant in accordance with their theory. As a result, they conclude that there is still evidence in favor of the traditional fiscal policy approach when time series information is examined; whereas, the puzzling weak relationship only emerges due to the cross-country dimension of the data. Their within-country estimates are also broadly consistent with the independent findings of Milanovic (2000), who brings evidence from the Luxemburg Income Study (LIS) that redistribution does indeed benefit the poor at least for the countries covered in the LIS. As one moves upward among the income deciles, net income transfers appear to be decreasing in these surveys.

Another piece of supportive evidence for a positive relationship between inequality and redistribution comes from Sylwester (2000). Using pure cross-section regression analysis, Sylwester finds that more inequality in 1970 is associated with a higher level of educational expenditures. Lindert (1996), however, provides evidence against the Metzler-Richard hypothesis of a positive relationship between income inequality and redistribution. His estimation relies on panel data of social spending in OECD countries between 1960-1981. Lindert finds that the greater the distance between

the middle class and the poor (higher inequality), the lower the political tendency to spend on any major type of social program.

Borge and Rattso (2004) emphasize that the Metzler-Richard hypothesis should be investigated in a more homogenous setting with comparable institutions. To this end, they exploit a new data set on poll taxes and property taxes at the local government level in Norway. They assume that the tax structure is the main instrument of redistributive politics. Given that property tax liability is highly positively correlated with income, an increase in property taxes relative to poll taxes is indicative of more redistributive pressure. They find that more equal income distribution leads to less redistribution by shifting local financing from property taxes to the poll tax. Their estimated model confirms the conventional understanding of fiscal theory that higher income inequality shifts the tax structure from poll tax to property taxes and thereby leads to more redistribution in Norway.

Corcoran and Evans (2004) also provide evidence in favor of a median voter hypothesis in a more homogeneous setting. They point out that income inequality in school districts has risen 16 percent in the US since 1969. They analyze the effects of this rising inequality trend on school financing. Local per-pupil public education spending increases with rising income inequality within districts in their panel data regressions.

Rigolini (2003) suggests that the mechanisms underlying redistribution vary significantly between democratic and non-democratic regimes. He first illustrates that there seems to be a weak and inexistent relationship between inequality and redistribution in democratic countries. However, redistribution under autocratic regimes displays an inverted-U shape relationship with respect to overall income inequality. He attributes

this relationship in autocratic countries to the idea that redistribution in autocratic regimes is often exercised to avoid social conflict. Then, Rigolini develops a theoretical model to justify this inverted-U relationship in autocratic countries. His model considers redistribution as an outcome of three forces in the society: the degree of inequality, the degree of poverty, and the degree of state repression of political activity, which depends on the type of political regime. In accordance with the simple observations, Rigolini's model generates an inverted-U relationship between inequality and redistribution in autocracies; whereas, an ambiguous relationship is derived for democracies. In the empirical sections of his papers, Rigolini uses the shares of government expenditure and education expenditure in GDP as proxies for redistribution and finds evidence in line with his theoretical model. Income inequality seems to be insignificant for the entire sample, especially for democratic countries in affecting redistribution. However, income inequality has a positive but declining role in the redistribution spending of autocratic countries.

Bassett et al. (1999) retest existing studies on the income distribution and redistribution relationship using several alternative definitions and an income inequality dataset compiled by Deininger and Squire (1996). Their results resemble the findings of Perotti (1996). More interestingly, they also introduce the possibility that political influence is a positive function of income. Their results indicate that for certain parameters of their model, when the income share of the decisive voter (not the median voter) rises, various measures of redistribution decline.

The central variable of interest in the redistribution literature is income inequality. Some existing papers attempt to account for the possible endogeneity of the income

distribution by instrumental variable estimation. Papers analyzing the redistribution equation in more homogeneous settings are more successful in finding plausible instruments for income inequality. Corcoran and Evans (2004) instrument for within-district inequality with a measure of income distribution from another nearby school district. Borge and Rattso (2004), on the other hand, choose regional industrial structure in 1990 as an instrument for income inequality. They argue that the industrial structure plays a role for income distribution but not for the particular choice of tax structure (more reliance on poll or property taxes).

Papers addressing the income inequality and redistribution relationship in more heterogeneous settings with cross-country data have more difficulty in solving the potential endogeneity of income distribution measures. Dalgaard et al. (2003) attempt to instrument for income inequality with initial GDP per capita and time dummies in their panel data regressions. However, they do not explain their arguments for the choice of these instruments. In their earlier paper, Dalgaard et al. do not even mention the possible endogeneity issues. This approach seems to be a general tendency in earlier papers as well. Perotti (1996), Lindert (1996) and Bassett et al. (1999), for example, do not even discuss instrumenting their income inequality measures.

The inability of existing literature to account for the endogeneity of income inequality stems from the lack of consensus on the right instruments for income inequality across countries. Rigolini (2003) acknowledges potential problems with the endogeneity of income distribution but fails to find a proper instrument for it. Following Engerman and Sokoloff (1997, 2000), Rigolini employs dummies for oil and non-oil commodity exporters as well as tropical location as an instrument for income inequality.

However, he finds that none of the explanatory variables in his estimations is consistently significant. Hence, he chooses not to report these results.

It is apparent from the aforementioned research[20] that the role of redistributive institutions in determining the size and the composition of public spending has not really been investigated in analyzing the income inequality and redistribution relationship. However, a separate branch of the redistribution literature shows the importance of the quality of existing institutions in redistribution. Mauro (1998), for example, studies the effects of corruption as an indicator of quality of institutions on the size and composition of government expenditure. His empirical results reveal that corruption alters the composition of government expenditure, especially by reducing government spending on education. He interprets this result as evidence that more corrupt countries choose to spend less on education, because education provides less lucrative opportunities for government officials to rent seek[21].

Betancourt and Gleason (2000) provide further evidence for the importance of institutional structure in the size and allocation of publicly provided goods to rural households in India. Their empirical findings lead them to conclude that district characteristics in rural India that capture the bureaucratic aspects of redistribution play a robust and systematic role in determining the allocation of medical inputs to rural areas of districts.

---

[20] See Table 1 for the summary of results of papers on income inequality and redistribution.

[21] Moreover, Evrenk (2003), in a theoretical paper, shows that corruption increases the size of government. In his model, even the low income non-evaders prefer to live under a large government with corruption, rather than a small and clean one given that they disproportionately benefit from higher government spending.

This class of papers does not analyze the relationship between redistribution and income inequality. However, they shed light on the key role of efficiency of redistributive institutions in affecting the aggregate redistribution, consistent with our theoretical model. Hence, in our empirical estimations we account for the efficiency of redistributive institutions in addition to measures of income inequality and other control variables used in the literature.

Table 3.1. Literature on Income Inequality and Redistribution	***Measure of Redistribution***	***Inequality to Redistribution***	***Strength of Results***
Authors			
Persson & Tabellini (1992)	Transfers	pos.	consistent sign but generally insignificant
Easterly and Rebelo (1993)	Education	pos.	consistent sign, sometimes significant
Keefer & Knack (1995)	Transfers and tax rates	neg.	consistent sign but generally insignificant
Lindert (1996)	All government expenditure	neg.	insig.
	Nonsocial exp.	neg.	sig.
	All social expenditure	pos.	insign.
	Pensions	neg.	insign.
	Welfare	pos.	sign.
	Unemployment compensation	pos.	sign.
	Education	pos.	insign.
	Health care	neg.	insign.
Perotti (1996)	Marginal tax rate	pos.	insign.
	Average labor income tax rate	pos.	insign.
	Average personal income tax rate	pos.	insign.
	Social Security and Welfare Exp.	pos.	insign.
	Housing Exp.	pos.	insign.
	Education Exp.	pos.	insign.
Sylwester (2000)	Education Exp.	pos.	sign.

Table 3.1. (cont) Authors	***Measure of Redistribution***	***Inequality to Redistribution***	***Strength of Results***
Dalgaard, Hansen & Larsen (2001)	Social Security and Welfare Exp.	neg.	insign.
	Health Care Exp.	pos.	insign.
	Housing Exp.	pos.	insign.
	Education Exp.	pos.	sign.
	Income taxes	neg.	insign.
	Property taxes	pos.	insign.
Dalgaard, Hansen & Larsen (2003)	Income taxes	neg.	sign.
	Property taxes	neg.	sign.
	Education Exp.	pos.	sign.
Rigolini (2003)	Total Government Expenditure minus military spending	neg. pos.	insign.
	Education exp.	neg. pos.	insign.
Milanovic (2000)	Transfer	pos.	sign.
Bassett, Burkett & Putterman (1999)	Social Security and welfare exp.	pos. neg.	sign. insign.
	Education Exp.	pos. neg.	sign. insign.
Borge & Rattso (2004)	Poll Tax	neg.	sign.
	Property Tax	pos.	sign.
Corcoran & Evans (2004)	Education Exp.	pos.	sign.

3.3. Bringing the Theory to the Data

Our theoretical model relies on two fundamental variables. The first is aggregate redistribution and the second is the efficiency of redistributive institutions (ERI). In this section, we explain how one can find data that correspond to these variables in practice. Since the models are highly stylized, it is somewhat easier to define these concepts in theory. For example in the model, aggregate revenue from a flat income tax rate is considered to be redistributed back to the society. In this regard, governments in our theoretical model exist only to redistribute income. However, this type of characterization of governments in practice is definitely incomplete. Even in most democratic countries, governments are not established solely for the sake of transferring income to the poor. For instance, governments spend for safety and protection in the form of military and police expenditure. Some government expenditure is intended to promote growth and development. In this regard, government spending for research and innovation or investment for infrastructure cannot be solely characterized as redistributive expenses. Hence, it would be a mistake to consider total government outlays as redistributive spending in empirical testing of the theoretical model.

Given these considerations, we must find types of government expenditures that are redistributive in their nature in order to better test the role of efficiency of redistributive institutions in redistribution. IMF Government Financial Statistics (GFS) provides disaggregated data on government expenditure. GFS classifies the aggregate expenses according to the functions of government. Among others, this classification includes spending for defense, economic affairs, transportation, energy, education, health

care and social security and welfare expenditures. Existing literature typically categorizes expenditures on education, heath care, housing and social security and welfare as redistribution expenditures (Perotti, 1996; Dalgaard et al., 2001; Rigolini, 2003). In this empirical chapter, social security and welfare expenditures are also used to proxy redistribution[22]. In the theoretical model, redistribution is intended to benefit the poor more than the wealthy. Social security and welfare expenditures satisfy this assumption better. The poor are more likely to receive funds allocated for social protection. Education expenditure, health expenditures and, to a certain extent, housing expenditures also tend to benefit the poor. However, these expenditures may also arise from other motivations as well. For example, investment on education has growth enhancing effects and contains supplementary positive externalities for the entire economy. Therefore, in the empirical analysis, we mainly rely on social security and welfare expenditures to measure redistribution for the poor.

The second vital parameter in our theoretical model is the efficiency of redistributive institutions. Any type of redistribution requires some institutions or government branches. For example, in order to carry out redistribution to the poor, social security and welfare administrations, or other branches of government, need to be established. Then, the question is how efficiently these institutions are operated. Our theoretical model indicates that when these redistributive institutions fail to operate

[22] In the theoretical model, the tax revenue is redistributed back to the society equally. In this respect, it may be better to represent the redistribution only with social security expenditure because the median voter may not benefit from the government's welfare spending and hence opposes to any welfare expenditure but not to the social security expenditure. However, in the data set social security and welfare expenditure is not provided separately.

efficiently, the poor benefit less from taxation and the redistribution process and hence demand less redistribution in light of the deadweight losses from redistributive taxation.

The main issue then is to quantify the efficiency of redistributive institutions in practice. The ideal data would provide an index of quality of redistributive institutions for various countries. Unfortunately, there is no such data for most of the countries. However, there exist certain governance indicators that provide proxy for the ERI in our theoretical model. Having said that, however, this does not exactly match our definition of ERI. Distinguishing various aspects of governance is crucial because governance and institutions concepts are sometimes used such a general manner that it becomes hard to pinpoint their different dimensions. Existing governance indicators actually capture different aspects of governance and institutions. For example, some widely used indicators capture democratic accountability and inclusiveness of governance such as the Political Rights and Civil Liberties indices of Gastil / Freedom House or the Polity IV variables. On the other hand, measures of the rule of law, political stability, and regulatory quality provide information on other aspects of governance. Our theoretical model draws attention to a particular feature of governance namely, the 'efficiency of redistributive institutions'. Therefore, in order to appropriately test the implication of the model, we utilize existing governance indices that come closest to our definition of ERI.

The international Country Risk Guide (ICRG) provides precious information on the different aspects of governance starting in 1984. In order to find a good proxy for ERI, it is important to realize the distinction among these various indicators of governance. Table 3.2 reports the different governance indicators of ICRG and their

correlations. Among these indices, 'quality of bureaucracy' and 'control of corruption' arguably represent the ERI better than the other indices.

Countries where bureaucracy has the strength and expertise to govern without drastic changes or interruptions in policy receive higher points for this index. Countries with a higher score in quality of bureaucracy score tend to have bureaucracies that are autonomous from political pressure. An established mechanism for recruitment and training increases the quality of bureaucracy score. Civil servants tend to have more competence when they are less subject to political pressure in their daily operations as well as in the process of their recruitment. Countries with higher scores are also expected to provide better quality of public service in their day-to-day administrative function. In our context, efficiency of institutions is very much related to the quality of bureaucracy, given that the latter indicates not only more qualified employees but also better administrative structure of these institutions in delivering redistribution. The ICRG's quality of bureaucracy index ranges between 0 and 4 where a higher point represents better bureaucratic quality.

Corruption, on the other hand, is conventionally defined as the exercise of public power for private gain. It reduces the efficiency of government by enabling people to assume positions of power through patronage rather than ability and increases instability in public administration. This index is concerned with actual or potential corruption in the form of excessive patronage, nepotism, job reservations, reciprocal favors, and suspiciously close ties between politics and business. In the ICRG data set, this index ranges between 0 and 6, where higher scores indicate more control over corruption. In our model, corruption is associated with lower ERI. In more corrupt countries, a higher

fraction of government revenue would be lost during the process of redistribution. Redistributive institutions would invest more in wasteful projects, which benefit the poor less but provide high returns for corrupt officers.

Other ICRG indicators of governance are likely to affect aggregate redistribution as well. However, as it is apparent from their definitions[23], these indices of governance do not primarily capture redistributive efficiency. Even though they are widely used in the literature, the Government Stability, Military in Politics, Religious Tensions, External and Internal Conflict indicators, for example, do not really match our definition of ERI. The investment Profile index measures contract viability and expropriation, profit repatriation and payment delays and hence is more related to investment climate and less related to redistribution.

Beside the ICRG indices, other organizations such as the Heritage Foundation and the Fraser institute also report indicator of the quality of governance. Kaufmann et al. (2003) construct six governance indicators based on several hundred variables measuring perceptions of governance. These indicators are drawn from 25 separate data sources from 18 different organizations. Among their governance indicators, 'government effectiveness' and 'control of corruption' come closest to representing our ERI[24]. In the construction of these indicators, they also use quality of bureaucracy variable from ICRG to construct their 'government effectiveness' cluster. Similarly, Kaufmann et al. also use the corruption index from ICRG to form their "control of corruption" cluster. However,

[23] Formal descriptions of these variables by ICRG are given in the Appendix.

[24] Their other governance indicators also include 'Voice and Accountability', 'Political Stability and Absence of Violence', 'Regulatory Quality', and 'Rule of Law'.

since they attempt to use some other sources as well to construct these indices, their governance data only span four data points after 1996 with two-year intervals. Kaufmann et al. also incorporate the government stability variable of ICRG in constructing government effectiveness. We prefer to use the original sources in constructing our measure of ERI. For example, the government stability index of ICRG is also included in constructing the 'government effectiveness variable. This index is likely to be influential in affecting redistribution but it does not directly capture our idea of ERI. Hence, we exclude this index in constructing our measure of ERI.

In this study, we primarily resort to 'Quality of Bureaucracy' and 'Corruption' indices from ICRG to represent ERI. These two variables share a high correlation coefficient (0.73) as is seen in Table 3.2. Since they capture somewhat different but highly related aspect of redistributive institutions, we construct an index from these two indicators using principal component analysis and call it our 'efficiency of redistributive institutions' variable.

At a first glance, the 'quality of bureaucracy' index seems to fit better our definition of ERI. The index of 'control of corruption' seems to be redundant due to the quite reasonable understanding that better quality of bureaucracy has to incorporate less corruption by its nature. However, ICRG constructs these indices to capture different aspects of quality of governance. To grasp this idea better, one may think of a country with a high bureaucratic quality. Let's say that this high quality of bureaucracy is achieved because of the reasons given in the definition of 'quality of bureaucracy' index. Officers are recruited on the basis of meritocracy. They have high competence and education as it is in the case for bureaucrats in many developing countries. Moreover,

they are autonomous from political pressure. These are the aspects of governance that are covered by 'quality of bureaucracy' index of ICRG. However, it is possible that in spite of these characteristics, the bureaucracy can be still corrupt, for various reasons for this outcome. For example, inadequate economic incentives given to the bureaucrats may induce them to indulge in corrupt conduct. Weak enforcement of laws reduces the opportunity cost of corruption even for high quality bureaucrats.

Given these considerations, we generate our index of ERI by combining the 'quality of bureaucracy' and 'control of corruption' indices from ICRG. However, in testing the sensitivity of our results, the arithmetic average of these variables are employed in addition to using these variables separately.

Table 3.2. Correlation of ICRG Indices	***Quality of Bureaucracy***	***Corruption***	***Socioeconomic Conditions***	***Religious Tensions***	***Military in Politics***	***Law and Order***	***Investment Profile***	***Internal Conflict***	***Government Stability***	***External Conflict***	***Ethnic Tensions***	***Democratic Accountability***
Quality of Bureaucracy	1.00											
Corruption	0.73	1.00										
Socioeconomic Conditions	0.55	0.40	1.00									
Religious Tensions	0.34	0.40	0.15	1.00								
Military in Politics	0.62	0.65	0.34	0.50	1.00							
Law and Order	0.68	0.69	0.43	0.47	0.61	1.00						
Investment Profile	0.43	0.29	0.55	0.19	0.39	0.38	1.00					
Internal Conflict	0.50	0.54	0.35	0.53	0.64	0.77	0.35	1.00				
Government Stability	0.31	0.24	0.24	0.16	0.32	0.44	0.67	0.41	1.00			
External Conflict	0.29	0.34	0.21	0.53	0.44	0.49	0.26	0.60	0.27	1.00		
Ethnic Tensions	0.34	0.41	0.23	0.51	0.46	0.54	0.25	0.65	0.31	0.43	1.00	
Democratic Accountability	0.66	0.68	0.33	0.42	0.67	0.62	0.41	0.56	0.31	0.42	0.40	1.00

Source: International Country Risk Guide 2004

The income distribution data in this chapter needs special mentioning. Most of the recent papers use the Deininger and Squire (1996) data set for income inequality (Rigolini, 2003; Dalgaard et al. 2001, 2003; Forbes, 2000; and many others). Studies prior to the release of this data set contained data of arguably dubious quality. Persson and Tabellini (1994), for example, make use of the income distribution data compiled by Paukert (1973). On the other hand, Perotti (1996) obtains his data mostly from Jain (1975) and Lecaillon et al. (1984). Many of the observations in these studies, however, fail to meet the 'high quality' criteria of Deininger and Squire. In order to be included in

Deininger and Squire's 'high quality' data set, the data derived from the existing surveys of income and expenditure distribution have to satisfy three main criteria. The data must come from household surveys, rather than being derived from national account statistics. The population covered in the surveys must be representative of the whole population rather than covering a certain segment of population like the urban population or wage earners only. Moreover, the measure of income or expenditure must include income from self employment, nonwage earnings and nonmonetary income.

Deininger and Squire's data set cover income distribution data up to 1996. Recently, the United Nations University/World Institute for Development Economics Research has compiled the World Income Inequality Database (WIID). This database is available online and is planned to be published in summer 2005, and contains robust data that are measured consistently. It extends the Deininger and Squire data set and is more comprehensive, including almost twice as many observations.

In this chapter, we use primarily the income inequality data, compiled by the research department of the World Bank. Dollar and Kraay (2002) describe this data set as the most reliable source of data on income inequality. When multiple observations are reported in existing data sets, this data set only includes the better quality data. Moreover, it also includes current estimates of income distribution based on the consistent World Bank surveys in recent years. In addition to this data set, we extend our sample of observations by using the World Income Inequality Database of the United Nations. In extending our sample of countries, we have been extremely vigilant so that our final income inequality data set has only includes 'high quality' data according to criteria of Deininger and Squire (1996).

Other key control variables in the regressions come from various sources. The degree of democracy is derived from the Gastil/Freedom House and Polity IV. Real GDP per capita in purchasing power parity terms is obtained from Version 6 of the Penn World Tables. The percentage of population above 65 years old is provided by the World Development Indicators of the World Bank.

Since political economy models of income inequality and redistribution are mainly based on the median voter hypothesis, existing empirical models account for the degree of democracy in the country. In more democratic counties, the median voter is assumed to have more political power as compared to autocratic regimes. Hence, existing political economy models predict a positive relationship between the measures of democracy and redistribution. However, empirical studies fail to find strong evidence that democratic countries redistribute more (Perotti, 1996; Rigolini, 2003). This study employs two primary sources to control for the degree of democracy across countries and time. The Polity variable from Polity IV measures the extent of democracy, based on the institutional characteristics of politics in countries. Countries are first given points based on various criteria that capture different requirements for democracy. Later, these points are aggregated to determine the overall democracy score of the country[25].

We also use the Gastil/Freedom House data set to control for democracy in the sensitivity analysis of our empirical results. This democracy indicator is composed of two subcomponents Political Rights and Civil Liberties. Each year, countries are rated

[25] See the Appendix for the definition of Polity variable given by Polity IV.

based on these somewhat subjective criteria. Then, the arithmetic average of these two variables is reported as a proxy for the level of democracy in the country[26].

The percentage of the population above 65 years old captures the idea that many of the primary recipients of social security and welfare expenditures are the people above a certain age. Hence, all the previous empirical studies account for this variable. The correlation between income inequality and the share of population above 65 is (-0.47). Perotti (1996) states that age structure of the population is likely to be correlated with income distribution for two reasons: First, inequality is lower among people above 65 years old. Secondly, their average income is low as well. As a result, their demand for social security is high in spite of low income inequality. Hence, omitting this age structure variable would bias the coefficient of income distribution downward.

GDP per capita in purchasing power parity terms is included as a control variable to capture "Wagner's law" that redistribution is a luxury good. On the other hand, when average income increases, the number of people dependent on the government's income assistance declines. When social security and welfare expenditures are used as a proxy for redistribution, the latter effect is likely to dominate. Summary statistics and the correlation matrix of cross-section averages of variables in our sample are reported in Tables 3.3 and 3.4, respectively.

[26] The Appendix provides the formal descriptions of these variables given by Gastil/Freedom House.

Table 3.3. *Summary Statistics*

Variable	# of Coun.	Mean	Std. Dev.	Min	Max
Social Security and Welfare Expenditure	63	6.26	5.50	0.05	19.92
ERI	63	-0.22	1.11	-2.60	2.12
Inequality	63	42.09	8.38	24.16	63.65
Democracy/ Polity IV	63	3.37	6.14	-9.00	10.00
Democracy/ Gastil	63	1.66	0.59	1.00	3.00
Real GDP per capita PPP	63	8.59	0.82	6.33	10.10
% of pop. above 65	63	7.55	4.44	2.48	16.61
Bureaucratic Quality	63	2.28	1.01	0.29	4.00
Control of Corruption	63	3.41	1.18	0.90	6.00
Education, Heath Care and Social Security & Welfare Expenditure	62	10.50	6.62	0.44	27.20

Correlation Matrix of Variables

Table 3.4.

Variable	***Social Security and Welfare Expenditure***	***ERI***	***Inequality***	***Democracy/ Polity IV***	***Democracy/ Gastil***	***Real GDP per capita PPP***	***% of pop. above 65***	***Bureaucratic Quality***	***Control of Corruption***	***Education, Heath Care and Social Security & Welfare Expenditure***
Social Security and Welfare Expenditure	1.00									
ERI	0.42	1.00								
Inequality	-0.43	-0.13	1.00							
Democracy/ Polity IV	0.44	0.55	-0.10	1.00						
Democracy/ Gastil	-0.40	-0.57	0.07	-0.87	1.00					
Real GDP per capita PPP	0.55	0.68	-0.18	0.57	-0.56	1.00				
% of pop. above 65	0.90	0.46	-0.47	0.56	-0.48	0.65	1.00			
Bureaucratic Quality	0.35	0.93	-0.14	0.51	-0.53	0.68	0.41	1.00		
Control of Corruption	0.44	0.92	-0.10	0.50	-0.53	0.57	0.44	0.71	1.00	
Education, Heath Care and Social Security & Welfare Expenditure	0.91	0.40	-0.41	0.41	-0.42	0.53	0.80	0.35	0.39	1.00

3.4. Estimation Specification and Cross-Section Regressions

Redistribution is our main endogenous variable in the model. Other central variables in the model are income inequality and ERI. Hence, in all variants, we regress the ratio of redistributive transfers to GDP on the measures of income inequality, the proxy for ERI and additional control variables. Hence, the following equation is the basic form underlying the estimation:

$$RD_i = \alpha_0 + \alpha_1 ERI_i + \alpha_2 inequality_i + \alpha_3 X_{1i} + \varepsilon_i \qquad (1)$$

Where i corresponds to countries and ε_i represents a country error term. As explained in the previous section, social security and welfare expenditures as a fraction of aggregate GDP is the dependent variable, RD. ERI stands for the efficiency of redistributive institutions and is a combined index of 'quality of bureaucracy' and 'control of corruption' variables from ICRG. Income inequality is measured by the Gini coefficient, $inequality$. The vector of control variables, X_1 includes log real GDP per capita in purchasing power parity terms, $\ln rgdpch$, the degree of democracy, $polity$ and the percentage of population over 65 years old, $pop65$. Regional dummies are also included in order to account for unobservable regional characteristics. These are the standard control variables that are commonly used in existing empirical studies as explained in the previous two sections.

To begin, we run cross-section OLS regressions to uncover the effects of efficiency of redistributive institutions on social security and welfare expenditure. Strong

arguments exist that quality of institutions evolves slowly and short-term changes in institutional indices may not reflect actual changes in institutions. Moreover, other right-hand side variables like the income distribution measures and the age structure of population also change slowly over time. These considerations justify the cross-country analysis of existing data.

Hauk and Wacziarg (2004) also acknowledge that when omitted variables are correlated with the explanatory variables, a fixed effect panel data estimator unambiguously dominates the cross-section OLS estimator. However, in the presence of measurement error, fixed effects estimators tend to exaggerate measurement error bias. In this regard, they analyze whether the gains from reducing omitted variables bias are offset by an increase in the measurement error bias under fixed effects. They assert that "when potential for omitted variables bias coexists with measurement error, a cure for the first problem can be worse than the disease, as it may exacerbate the second"[27]. Their simulation results confirm that cross-sectional estimators perform much better than the more state-of-art panel alternatives. Hence, they conclude that the use of panel data estimation methods leads to unreliable estimates when measurement error is present and OLS on cross-sectional averages is a better choice.

Given these considerations, the average values of all the variables are employed in cross-sectional regressions. This sample averaging reduces possible measurement problems by smoothing out the observations. Western European countries are widely known to have strong welfare states. This region is the reference category for regional

[27] Hauk and Wacziarg (2004) p. 4.

dummies in the regression specifications and it constitutes the basis of comparison for other regions.

In averaging the explanatory variables, we have been extremely careful. Social security and welfare expenditure data are available starting from 1970. However, because of our concern for the quality of earlier data, we do not use all the available data after 1970. Instead, we concentrate on years after 1983. There are two reasons for this choice. First, data quality is expected to be better in more recent years as compared to much earlier periods. For example, real GDP per capita data from Penn World Tables are less reliable in the 1970s. Secondly, ICRG starts reporting institutional variables in on annual basis only in 1984. For the data to be comparable in time, we average ERI and democracy starting in 1984. As a result, democracy variables and ERI variables are averaged for the years after 1983[28].

Countries in the sample also vary in terms of availability of data on social security and welfare expenditures. Since the share of population over 65 years old and real GDP per capita may have a direct effect on that specific year's social security and welfare expenditures, we only take the average of these variables for years in which there is corresponding data for social security and welfare expenditure[29]. Since the income distribution is likely to evolve slowly, we take the mean of all the available high quality

[28] Relatively long period of averaging for democracy and institutional variables is reasonable considering the fact that these variables are subject to drastic shifts in data as a result of regime changes. For instance, in these data sets, just in one year, democracy can change to a dictatorship or vice versa. In this regard, averaging over a longer period of time makes these variables more reliable.

[29] In other words, the share of population over 65 years old and real GDP per capita data for a given year are dropped if social security and welfare expenditure data are missing in that year.

data on income inequality. We also split the income inequality data before and after 1985 and name them as gini_past and gini_pres. Average income inequality data over the whole sample has a high correlation with these alternative averages of income inequality (0.9049 with gini_past and 0.9633 with gini_pres,). Hence, we have decided to use the average of all available income inequality data[30].

Table 3.5 reports the estimation results of cross-country regressions of 63 countries. The first column shows the OLS regression specification without ERI. In the second column, ERI enters into redistribution equation as an additional control variable in OLS regression. The main result of this cross-country regression shows that ERI plays a significant role in redistribution. It has a positive coefficient and it is almost significant at one percent even in two-sided statistics[31] (student's t statistics is 2.31). This strong result shows that ERI needs to be taken into account in analyzing the determinants of redistribution. This result is highly robust to alternative regression specifications as well. Later, we will explore the robustness of this result in more detail. But, before doing that, we first summarize the other major results.

Income inequality appears to have a negative coefficient. However, it is not significant at conventional levels. This result is not surprising considering the existing literature on the effects of income inequality on redistribution that also fails to find a robust positive relationship as well. For example, Dalgaard et al. (2001) and Rigolini

[30] We also run all the regressions in this section with these alternative income inequality data, the results are not altered at all.

[31] Since we have prior expectation that ERI enters into the redistribution equation with a positive sign. One sided test actually better represents the significance level of coefficient of ERI.

(2003) find negative and insignificant coefficients for income inequality measures in the redistribution equations.

Democratic countries seem to redistribute less in the form of social security and welfare expenditure. The democracy coefficient is, however, insignificant at the conventional levels. This negative relationship is consistent with the results of most previous literature that does not find a strong link between inequality and redistribution in democracies (Perotti, 1996; Benabou, 2000; Dalgaard et al., 2003).

The log GDP per capita emerges with a negative sign, and its coefficient is significant at five percent. This result may stem from the type of redistribution used in this study. Wealthier countries may have a smaller fraction of population that depends on the redistribution of income by the government[32]. Similarly, Bassett et al. (1999) and Lindert (1996) find negative and significant coefficients for GDP per capita in explaining social security and welfare expenditure. Perotti (1996) also finds that higher GDP per capita reduces redistributive pressure in the form of marginal and average tax rates.

The share of population over 65 years old is always highly significant and positive in all specifications at the one percent level. This result is also in line with earlier empirical research and indicates the importance of the age-structure of population in the redistribution decision (Perotti, 1996; Bassett et al., 1999; Lindert, 1996).

[32] We also include the log of square of GDP per capita to analyze the non-linear relationship between income per capita and redistribution. However, we find out that GDP per capita and its square are highly collinear. Variance inflation factor is much more than 10. Hence, in order to avoid a multi-collinearity problem, we continue with the existing specification of the model. Moreover, just a side note, other variables do not suffer from the multi-collinearity problem given that they have much lower variance inflation factor than 10. The results of variance Inflation Factor analysis is provided in the Appendix.

Although we rely on the best available compilation of each variable, measurement error might be driving our results. In Column 3, we account for one source of potential measurement error, weighting the data by the log GDP per capita. It is often claimed that in richer countries data quality is better. Summers and Heston (1991), for example, report that the margin of error in estimating gross domestic product is much lower for richer countries. This weighted least squares (WLS) estimation gives results that are very similar to OLS results. The coefficient of ERI appears to be slightly higher but its significance level almost remains almost the same. The same result applies to the coefficients of democracy, log GDP per capita and the share of population over 65 years old.

In Column 4, we attempt to ensure that the results are not a product of few influential observations. Hence, we employ a robust regression method in which observations with higher residuals are down-weighted. In this case, the initial OLS results are strengthened. ERI is now significant at a one percent level. The significance level of log GDP per capita now appears to be one percent instead of five percent. The share of the population over 65 years old variable is still significant at its initial level as in column 2.

In the Column 5, we report the heteroskedasticity consistent robust estimation results. The Huber/White/sandwich estimator of variance is used in place of the traditional calculation in this regression. Again the primary OLS results are not altered much. ERI is still significant at a five percent level. Other significant variables are also still significant at their initial levels in this heteroskedasticity robust estimation specification.

Finally, we run one more weighted regression. The weighting variable now is a function of the number of observations over which the average social security and welfare expenditure is calculated. ERI is still significant but now at a ten percent level and other results are not altered at all.

In all these regressions, dummy variables for region do not appear to be significant individually. However, these dummy variables are jointly significant in all regressions. The significance level varies between regression specifications. For example, in the OLS regressions, the dummy variables are jointly significant at ten percent while in the robust regression, they are significant at one percent level. Hence, all the other regions together appear to be different from Western Europe.

Table 3. 5. Cross-Sectional Regressions on Redistribution

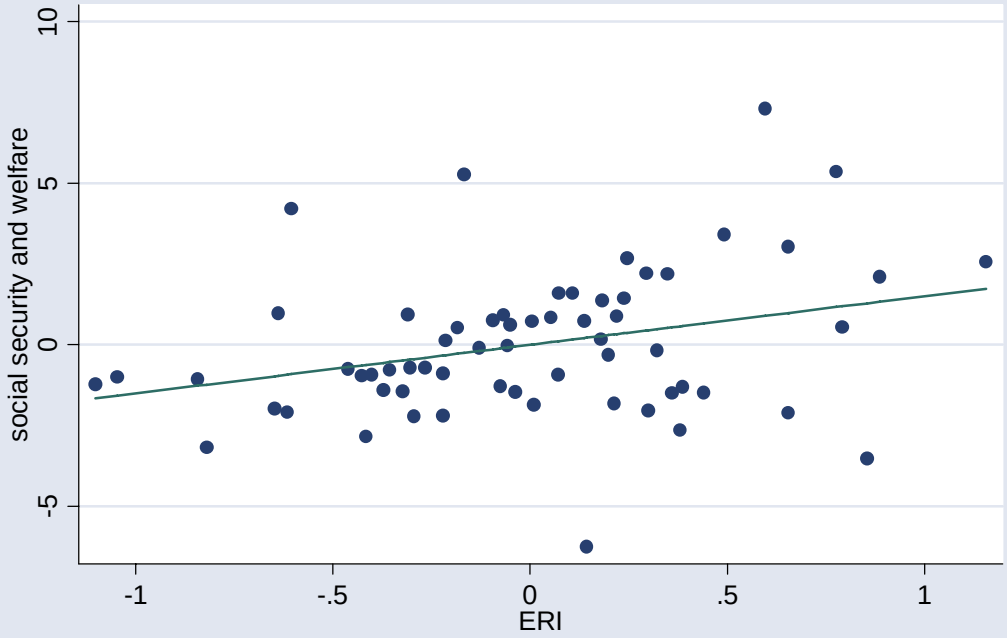
Dependent Variable

Social Security and Welfare Expenditure

	OLS without ERI	*OLS with ERI*	*Weighted Least Squares*	*Robust*	*heteroskedasticity consistent robust*	*Weighted by Number of Observations for SSW*
ERI		1.5029	1.5108	1.5102	1.5029	1.2177
		****2.31**	****2.29**	*****2.68**	****2.14**	***1.81**
Inequality	-0.0316	-0.0041	-0.0080	-0.0246	-0.0041	-0.0001
	-0.55	-0.07	-0.14	-0.5	-0.07	0
Democracy	-0.0312	-0.1369	-0.1292	-0.1419	-0.1369	-0.1204
	-0.29	-1.22	-1.15	-1.46	-1.17	-1.06
Log of Real GDP per capita PPP	-0.5967	-1.7704	-1.7742	-2.3096	-1.7704	-1.7810
	-0.9	****-2.17**	****-2.1**	*****-3.26**	****-2.19**	****-2.03**
% of pop. above 65	1.0946	1.1352	1.1393	1.1413	1.1352	1.2608
	*****6.14**	*****6.6**	*****6.59**	*****7.65**	*****6.1**	*****7.26**
East Asia & Pacific	-1.8526	-1.1309	-1.1872	-1.5146	-1.1309	-0.7183
	-0.91	-0.57	-0.61	-0.88	-0.64	-0.38
Eastern Europe & Central Asia	-0.2508	1.4261	1.4884	0.2017	1.4261	1.0427
	-0.17	0.89	0.95	0.14	0.83	0.67
Middle East & North Africa	0.0075	0.6403	0.8309	0.0057	0.6403	1.5872
	0	0.27	0.35	0	0.32	0.67
South Asia	-2.0766	-1.0816	-0.9738	-2.1103	-1.0816	-0.1260
	-0.78	-0.42	-0.37	-0.94	-0.59	-0.05
North America	-2.3779	-2.0880	-2.0755	-1.7462	-2.0880	-1.7438
	-1.08	-0.98	-1.04	-0.95	-1.22	-0.98
Sub-Saharan Africa	-1.3734	-1.6585	-1.4326	-2.6307	-1.6585	-0.9936
	-0.57	-0.72	-0.62	-1.31	-0.78	-0.41
Latin America & Caribbean	0.2019	2.2405	2.3616	1.9834	2.2405	2.8926
	0.11	1.1	1.18	1.12	1.03	1.55
cons.	5.1721	13.0895	13.1294	19.0847	13.0895	11.5815
	0.85	***1.93**	***1.85**	*****3.24**	***1.97**	1.59
# of coun.	63	63	63	63	63	63
F Test (p-value)	0.00	0.00	0.00	0.00	0.00	0.00
R-squared	0.82	0.84	0.84		0.84	0.85

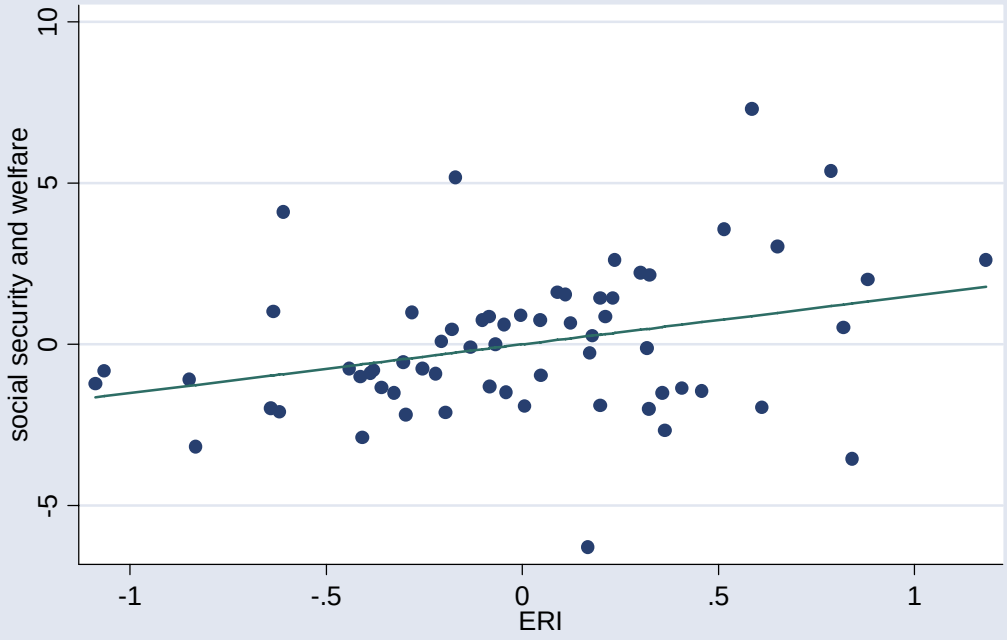
Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Figure 3.1: OLS Partial Regression Diagram of ERI

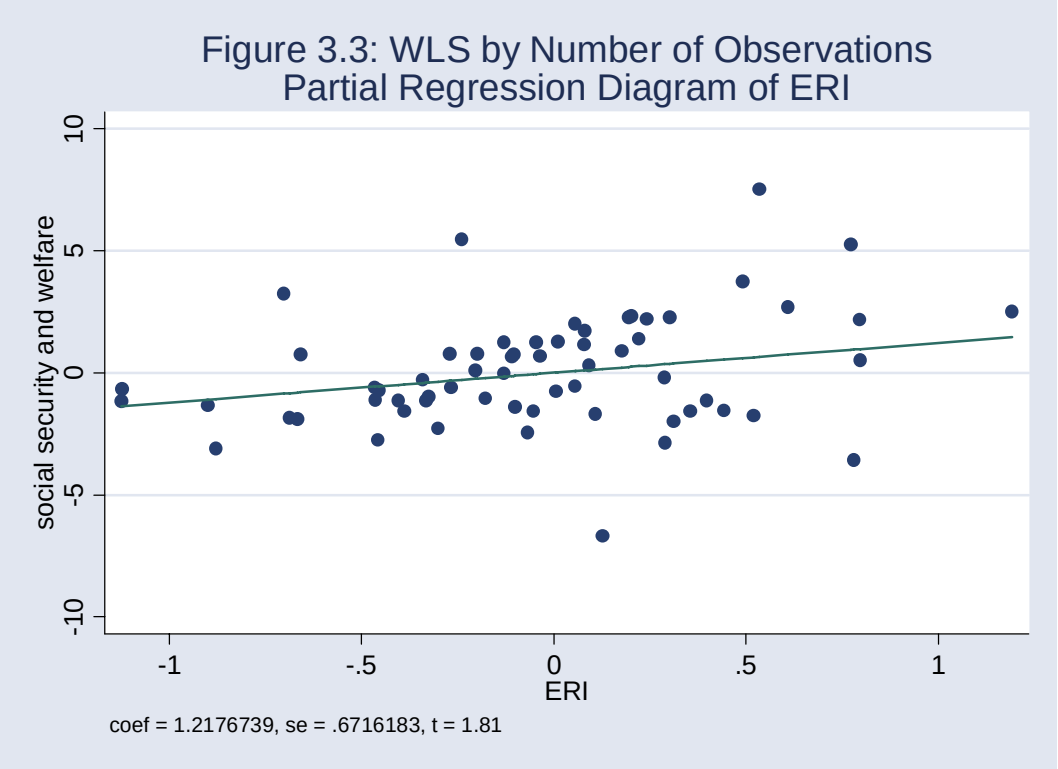


coef = 1.5029425, se = .65019647, t = 2.31

Figure 3.2: WLS Partial Regression Diagram of ERI



coef = 1.5108162, se = .65938699, t = 2.29



3.4.1. Controlling for Endogeneity of Income Inequality and Efficiency of Redistributive Institutions

In estimating the roles of ERI and income inequality in redistribution, the issue of causality needs to be addressed, when one suspects that redistribution in turn alters income inequality and ERI. It is, for example, quite possible to expect that redistribution changes the income distribution. Existing income inequality data sets are often derived from post-transfer income distributions. However, in the theoretical models, actual income inequality measures are given for the pre-transfer income distributions. This reason also justifies why income inequality variable needs to be instrumented in the regressions.

It is clear that redistribution could affect the income distribution though it is less obvious how redistribution in the form of social security and welfare expenditure could affect ERI. Nonetheless, more comprehensive redistribution schemes, such as redistribution in the form of education, can change the redistributive institutions in the long run. A more educated public may demand better quality of redistributive institutions with less corruption and higher bureaucratic quality. Moreover, higher education spending is also likely to increase the supply of better qualified bureaucrats. Given these considerations, a number of instrumental variables are employed to examine a potential endogeneity bias.

It is a great challenge to find appropriate instruments for income inequality and ERI. Hence, as mentioned earlier, existing studies of income inequality and redistribution either avoid using instrumental variables or merely discuss this endogeneity issue (Rigolini, 2003). On the other hand, recent studies on the determinants of institutions provide a broader scope to find instruments for ERI (Acemoglu, Johnson and Robinson; 2001; Easterly and Levine, 2002). In this study, we follow the arguments that have been developed in the literature to justify our instruments for income inequality and ERI. We have tried to choose instruments for income inequality and ERI in accordance with the following criteria: First, they have to have a high explanatory power in explaining the endogenous variables. Moreover, instrumental variables have to be uncorrelated with the disturbance term of redistribution equation. In other words, their effects on redistribution need to appear only indirectly through their effect on the endogenous variables for which they serve as instruments. Given these considerations, we focus on the following variables to instrument income inequality and ERI.

1-Ethnolinguistic fractionalization (for inequality and ERI)

2-Dummy for tropical climate (for inequality)

3-Natural resource abundance in the form of oil exports as a percentage of total merchandise export in GDP (for ERI)

4-Number of years after independence (for ERI)

Ethnolinguistic fractionalization is drawn from Taylor and Hudson (1972), Easterly and Levine (1997) and Alesina et al. (2003). It measures the probability that two randomly selected individuals from a given country will belong to different ethnolinguistic groups. Shleifer and Vishny (1993) argue that more fractionalized countries tend to have more dishonest bureaucracies. La Porta et al. (1999) provide empirical evidence that ethnolinguistic fractionalization explains the quality of governments. In their study, ethnolinguistic fractionalization is associated with negative institutional outcomes like corruption, and low bureaucratic quality. Mauro (1995 and 1998) also use ethnolinguistic fractionalization as an instrument for corruption. Similarly, in our context, ethnolinguistic fractionalization is expected to reduce ERI. Furthermore, any fractionalization is also associated with higher income inequality (Alesina et al., 1999). This index is likely to be a good instrument because it is definitely exogenous and is most likely determined as a result of the long historical process. Moreover, its effect on redistribution has to be indirect through either affecting ERI or income inequality or both.

The dummy for tropical climate is essentially used as an instrument for income inequality. The motivation for this instrument comes from the highly influential papers

by Engerman and Sokoloff (1997, 2000), who argue that tropical commodity endowments that had significant scale economies led to the concentration of wealth in the hands of a small elite, especially in Latin American countries. In their analysis, the chain of causation starts with the tropical climate. A tropical climate enables countries to be primary commodity exporters. Primary commodities, such as sugar cane, rice, and silver are characterized by economies of scale and hence enjoy high returns from using slave and indigenous labor in mass production. Hence, this production structure is historically associated with concentration of power in the hands of the plantation and mining elite. In contrast, non-tropical land in North America led to more equal distribution of income with family farms and a more equal distribution of land. To give an example, even in the early twentieth century, only 2.4 percent of household heads in Mexico owned land, while the corresponding number in the US was 75 percent.

Over a long period of time, these income distribution characteristics persist due to path-dependence. In Latin America, for example, the entrenched elite opposed democracy and other institutions promoting equality before the law. They were afraid of losing power to the poor. Hence, they restricted the voting franchise by imposing literacy and wealth requirements. In the 1940s, the proportions of the population voting in the U.S. and Canada were five to ten times higher than Bolivia, Brazil, Chile and Ecuador. These historically shaped institutional limitations on the poor led to enduring high income inequality[33]. Hence, tropical climate is used as an instrument for the income distribution. This variable is definitely exogenous. Even the type of production can be

[33] A similar point is also emphasized for the high income inequality in Latin America by the World Bank's publication in 2004, "Inequality in Latin America Breaking with History?".

changed over time in these tropical regions; it is hard to claim that climate has been changed radically over time. It has a high correlation with income inequality (0.52) and the correlation coefficient is significant at less than one percent. Moreover, it is difficult to think of any conceivable direct effect of this variable on redistribution.

Mauro (1998) uses an oil dummy to instrument corruption. We adopt a similar variable as an instrument for ERI namely; the percentage of oil exports in total merchandise exports. We check the robustness of our results by using similar variable that is the share of the mining exports in GDP. The motivation behind these variables is to capture the 'rentier effect'. Oil, diamonds, and other minerals are characterized as 'point source' resources (Isham et al., 2002). It is easier for the elite to control and capture the rents from 'point source' resources. Resource rents are generally high in oil production. Around 80 percent of oil income is considered to be resource rent (Gylfason, 2001), while such rents are much lower for other types of products in industry or in agriculture. A small work force is required to extract oil resources. Most of the time, oil is extracted by foreign firms with sophisticated technical skills (Isham et al., 2002). As a result, the ruling elite can exclude the majority of population in extracting oil reserves. In other words, there exists no incentive on the part of the elite to incorporate the society into increasing aggregate production. Given the lack of economic preconditions, the citizens cannot generate pressure for increased literacy and political influence. This lack of political influence further feeds the vicious cycle by not effectively and peacefully revealing public interest and preferences. This process also restricts the society's ability to monitor officials and more importantly limits the public's ability to penalize corrupt conduct.

There are numerous examples for the positive connection between oil rents and less efficient institutions. Nigeria, for example, is the most widely cited case for high corruption due to its oil resources. Nigeria's suddenly rising oil revenue after the oil shocks of the 1970s have generated extraordinary opportunities for corruption. Ades and Di Tella (1999) quotes the following clause from the Economist of August 4, 1984:

> *"Oil and corruption go together. Nigeria's oil accounts for about 80 percent of government revenue. The official price of crude oil increased 17-fold in eight years from about $2 a barrel in 1973-4 to $34 by the end of 1981. Nigeria went on a construction and improving spree. Parties and party officials grew rich."*

Alesina et al. (2003) further notes the following:

> *"Nigeria has produced $280 billion in oil revenues since the discovery of oil in 1950s, but the average Nigerian is no further out of poverty today than 4 decades ago. Such egregious failures as the $8 billion state-owned Ajaokuta steel complex, which has yet to produce a bar of steel, give a hint of the breakdown of state institutions."* (p.18)

In addition to anecdotal evidence, empirical evidence on the negative role of resource abundance on governance abound. For instance, Ades and Di Tella (1999) reveal that oil rents determine the level of corruption in the economy. Treisman (2000)

and Gylfason (2001) also provide empirical evidence along the same line. Oil resources or any mineral resources are natural endowments and in this sense this variable is definitely exogenous[34]. Moreover, its effect on redistribution has to be trough its effect on institutions.

The number of years after independence is also used as an instrument. Our choice of this instrument is based on the assumption that strong institutions develop over a long period of time by learning by doing and with accumulating various experiences[35]. Hence, it is expected that countries which achieved their independence earlier had more chances to establish better institutions. This variable is widely used as an instrument for institutions. For example, Mauro (1998) employs similar dummies in his instrumental variable regressions. The correlation matrix and summary statistics of instruments are also presented in the Appendix.

[34] Given that actual resource extraction is endogenous, one may argue that potential extraction of oil is more appropriate measure for rentier effect than its actual extraction. Even though there is a merit in this argument, potential resources only materialize as rent for the elite after their extraction. Moreover, in practice, there will be high correlation between potential and actual extraction of natural resources.

[35] We restrict the maximum number of the years after independence to 200 years considering that the relationship between institutions and years of independence cannot be linear after some range. For example, Denmark has been independent since 920. Hence, Denmark receives maximum 200 years instead of the actual number of the years after independence.

3.4.2. Two Stage Least Squares Regression Results

Table 3.6 reports 2SLS results with heteroskedasticity consistent standard errors[36]. Since El Salvador does not have data on ethnolinguistic fractionalization, the number of countries declines to 62. Hence, the first column presents the OLS regression for 62 observations. The third and fourth columns in Table 3.6 report the first stage regressions. Ethnolinguistic fractionalization, oil exports as a fraction of total merchandise exports and the number of the years after independence are all highly significant in ERI equation (p values = 0.009, 0.060 and 0.048 respectively). These results are in accordance with the arguments discussed above. Ethnolinguistic fractionalization and oil exports reduce ERI, while countries that achieved their independence earlier reach higher level of ERI. On the other hand, the dummy for tropical climate and ethnolinguistic fractionalization emerge as significant instrumental variables in the income inequality regression in Column 4. Both tropical climate and ethnolinguistic fractionalization increase the income inequality and their coefficients are almost significant at a five percent. Test of excluded instruments indicates that instruments are also jointly significant at the conventional levels in the first stage regressions[37].

[36] Heteroskedasticity test reject the null hypothesis that disturbance is homoskedastic. Hence, we proceed with heteroskedasticity consistent 2SLS estimations.

[37] P-value of test of excluded restriction for ERI is equal to 0.0024.

When both ERI and income inequality are instrumented, the OLS results are strengthened. ERI is now significant below one percent (t=3.08)[38]. These 2SLS regression results also confirm the proposition that ERI plays an important role in determining redistribution.

The 2SLS results are consistent with the OLS results for the other control variables as well. Optimistically, the coefficient of income inequality is now positive, but it is still insignificant. All the previously significant variables are still significant. The democracy variable appears to be significant at five percent, while the significance level of log GDP per capita reaches below one percent. Similarly, regional dummies are jointly significant at less than one percent level.

Finally, an overidentifying restrictions test supports the empirical specification of the model. The Hansen's J statistic test is a test of overidentifying restrictions in heteroskedasticity consistent IV regressions (Hayashi 2000). The joint null hypothesis is that the instruments are valid, in that they are uncorrelated with the error term, and are correctly excluded from the estimated equation. Under the null, the test statistic is distributed as chi-squared with degrees equal to the number of overidentifying restrictions. A rejection would shed doubt on the validity of the instruments. Hansen's J statistics gives a p value of 0.66430 and consequently we fail to reject the null hypothesis that the instruments are exogenous. Hence, we conclude that our instruments are appropriate by passing Hansen's overidentification test.

[38] In terms of economic significance, one standard deviation increase in ERI increases the share of social security and welfare expenditure by 3.4 percent. However, one needs to keep in mind that magnitude of coefficients for changes in ERI may not be a good indicator for economic significance.

In the Appendix, we also provide the results of an alternative instrument when income inequality is instrumented with its past values instead of the tropical dummy. In order to obtain the past inequality measure, we consider the Gini coefficient measured using data before 1985 (or closest year available to 1985) as our past income inequality measure and the average of Gini coefficient after this date as the present income inequality measure. The main results of the 2SLS estimation in Table 3.6 stay the same. The only difference is that ethnolinguistic fractionalization loses its significance in the first stage regression for income inequality, while ethnolinguistic fractionalization is still highly significant in the first stage regression for ERI.

Table 3.6. Cross-Sectional 2SLS Regressions on Redistribution

Dependent Variable

Social Security and Welfare Expenditure

	OLS	*2SLS*	*ERI First Stage*	*Inequality First Stage*
ERI	1.4927	3.2223		
	****2.26**	*****3.08**		
Inequality	-0.0033	0.1823		
	-0.06	1.06		
Democracy	-0.1367	-0.3492	0.0428	0.6112
	-1.21	****-2.17**	*****2.72**	*****2.83**
Log of Real GDP per capita PPP	-1.7687	-3.3856	0.8293	1.7025
	****-2.15**	*****-3.11**	*****7.19**	1.03
% of pop. above 65	1.1359	1.3422	-0.0235	-0.9255
	*****6.54**	*****4.94**	-0.61	*****-2.99**
East Asia & Pacific	-1.1397	-0.1500	-0.0990	-5.2916
	-0.57	-0.07	-0.23	-1.11
Eastern Europe & Central Asia	1.4123	3.7315	-0.7180	-2.1949
	0.87	***1.89**	****-2.45**	-0.64
Middle East & North Africa	0.6275	1.0261	-0.2393	3.4959
	0.26	0.44	-0.52	0.73
South Asia	-1.0946	0.5956	-0.1532	-5.2387
	-0.42	0.27	-0.35	-0.77
North America	-2.0911	-2.1181	0.1308	1.2590
	-0.98	-1.32	0.27	0.28
Sub-Saharan Africa	-1.6753	-3.2790	0.5664	3.1351
	-0.72	-1.24	1.11	0.56
Latin America & Caribbean	2.2389	4.1366	-1.4055	1.2437
	1.09	1.5	*****-3.57**	0.39
Tropical			-0.0433	4.5514
			-0.25	***1.93**
Ethnolinguistic Fractionalization			-0.8357	7.5930
			*****-2.73**	***1.85**
Oil export			-0.0060	-0.0216
			***-1.93**	-0.48
Years after independence			0.0030	0.0174
			****2.03**	0.95
cons.	13.0505	17.3319	-6.4118	27.4143
	***1.9**	****2.05**	*****-6.72**	****2.01**
# of coun.	62	62	62	62
F Test (p-value)	0.00	0.00	0.00	0.00
R-squared	0.84	0.79	0.84	0.61

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

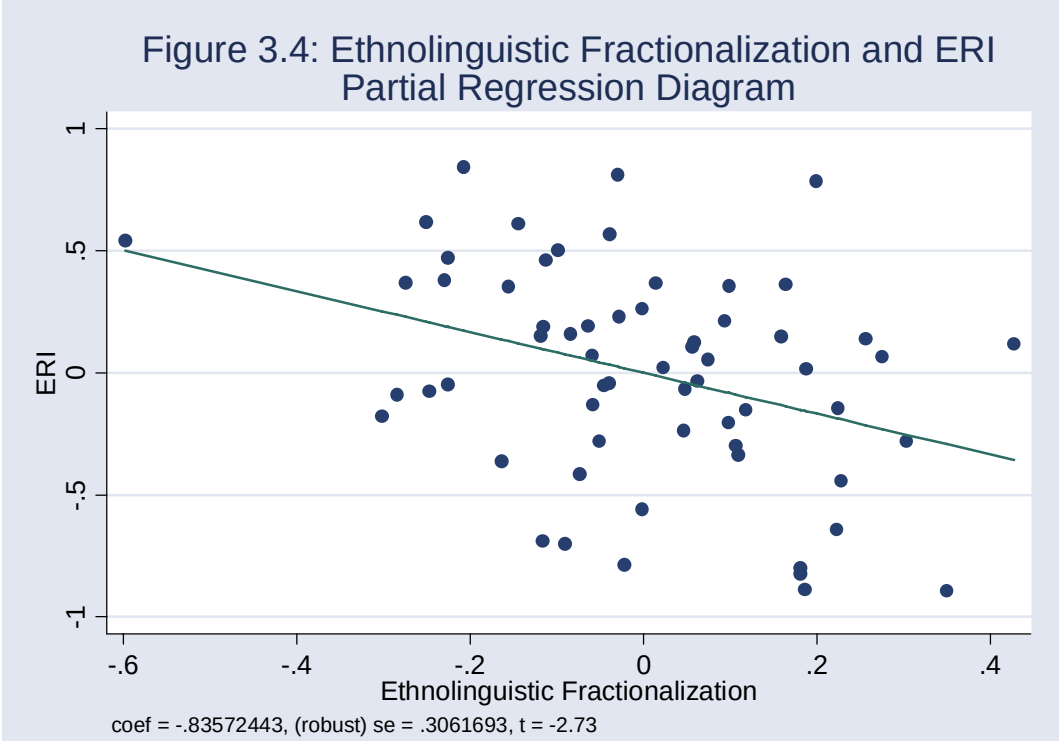


Figure 3.4: Ethnolinguistic Fractionalization and ERI
Partial Regression Diagram
ERI
1
.5
0
-.5
-1
-.6
-.4
-.2
0
.2
.4
Ethnolinguistic Fractionalization
coef = -.83572443, (robust) se = .3061693, t = -2.73

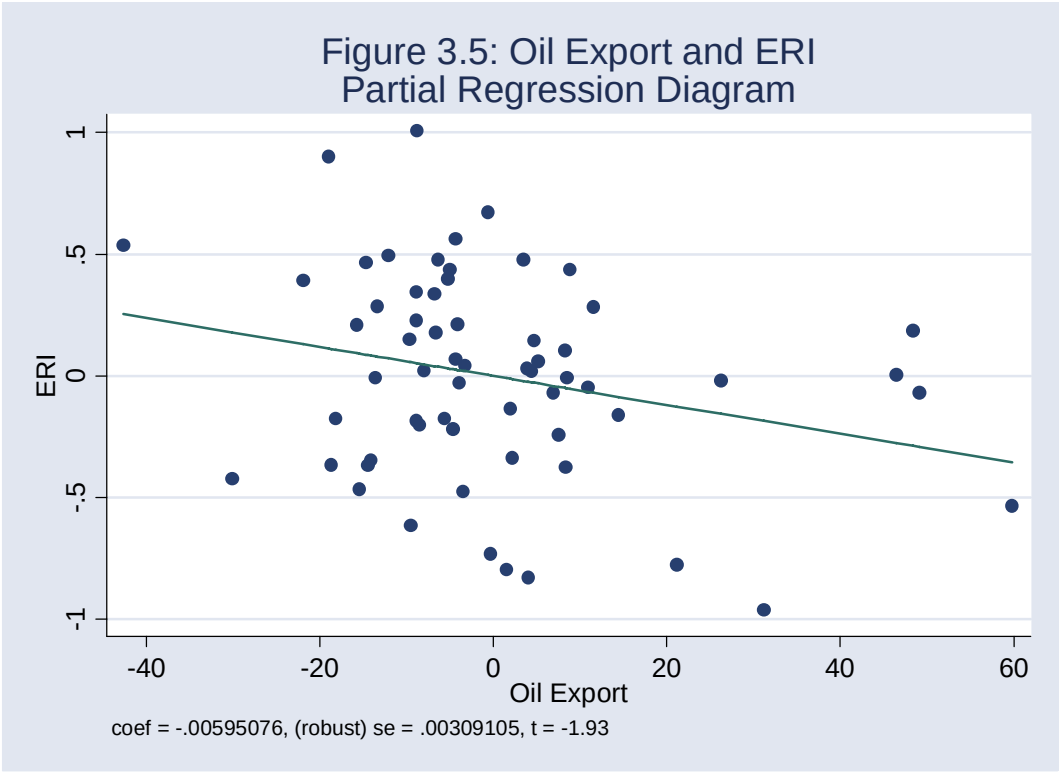
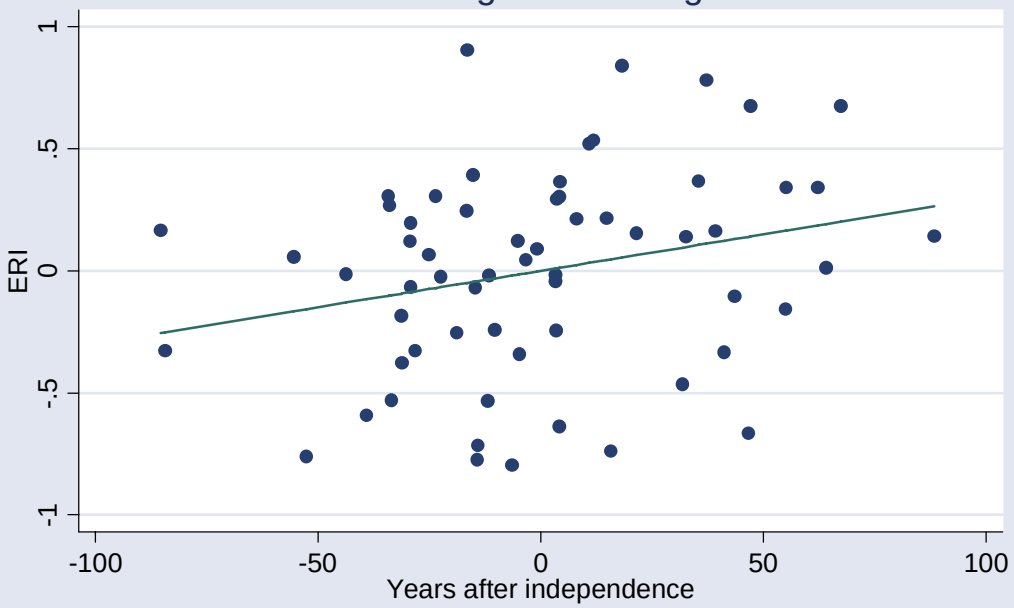


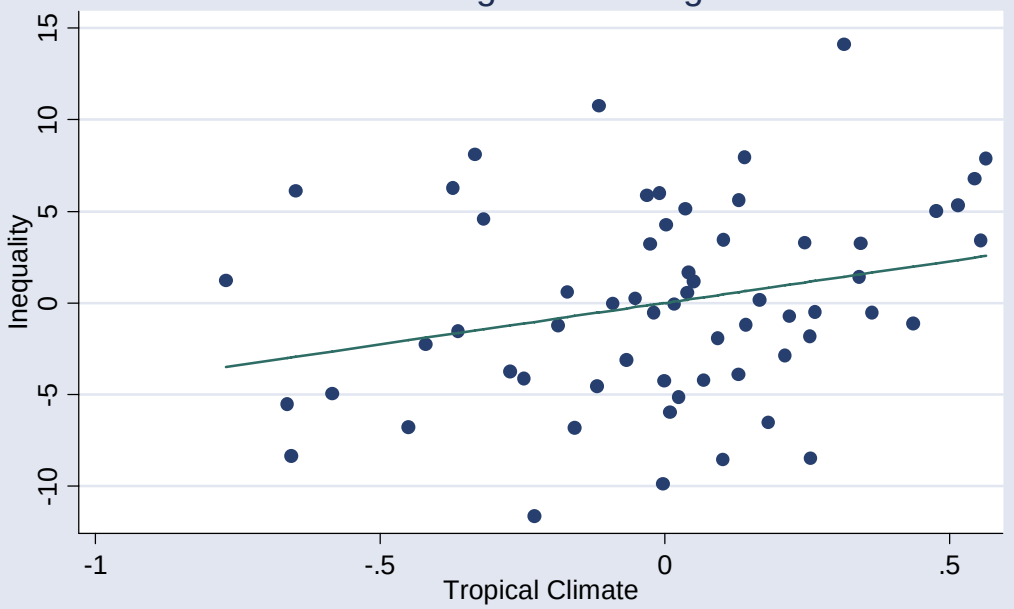
Figure 3.5: Oil Export and ERI
Partial Regression Diagram
ERI
1
.5
0
-.5
-1
-40
-20
0
20
40
60
Oil Export
coef = -.00595076, (robust) se = .00309105, t = -1.93

Figure 3.6: Years after independence and ERI
Partial Regression Diagram

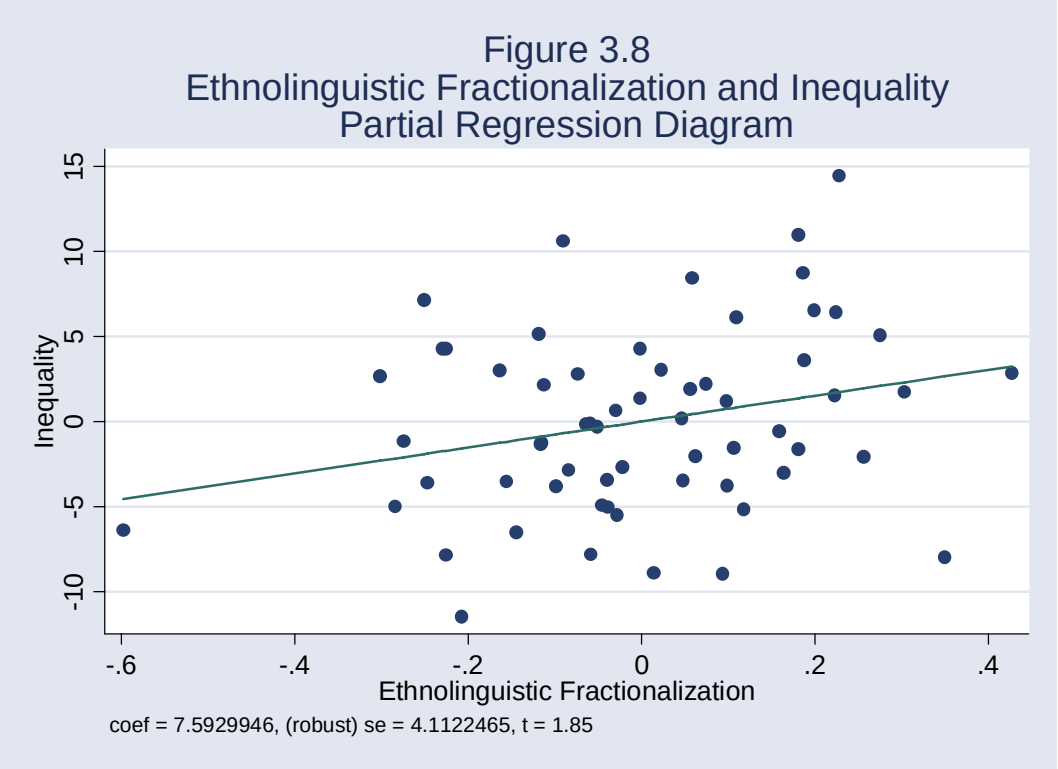


coef = .00298257, (robust) se = .00146699, t = 2.03

Figure 3.7: Tropical Climate and Inequality
Partial Regression Diagram



coef = 4.5513521, (robust) se = 2.3600494, t = 1.93



3.4.2.1. Sensitivity Analysis

To test the robustness of our 2SLS results, a number of alternative specifications are estimated. First, as an alternative, ERI is constructed by normalizing the 'quality of bureaucracy' and 'control of corruption' indices between zero and one and then taking their simple average. These normalized indices are also used separately as another alternative for ERI. In all these specifications, our main results are not altered at all. However, the results are less significant for quality of bureaucracy and democracy is not significant in this specification. The simple average of the quality of bureaucracy' and 'control of corruption yields a t statistic (2.98) slightly higher than initial ERI. These indices used in the construction of ERI are also significant individually at the conventional levels.

Table 3.7. Alternative Measures of ERI: 2SLS Regressions

Dependent Variable

Social Security and Welfare Expenditure

	ERI=simple average	*ERI=Control of Corruption*	*ERI=Quality of Bureaucracy*
ERI	15.9184	2.1163	3.5863
	***2.98**	***2.99**	**2.26**
Inequality	0.0295	0.1792	0.0020
	0.43	1.06	0.01
Democracy	-0.2480	-0.2879	-0.2275
	**-1.98	**-1.94	-1.54
Log of Real GDP per capita PPP	-3.0861	-1.7748	-4.1103
	***-3.41**	**-1.99	**-2.57**
% of pop. above 65	1.1841	1.2545	1.2629
	***5.72**	***4.91**	***5.36**
East Asia & Pacific	-0.5008	-0.0554	-1.2551
	-0.27	-0.03	-0.67
Eastern Europe & Central Asia	3.0228	3.3228	2.0447
	*1.64	*1.83	1.14
Middle East & North Africa	1.1546	1.1320	0.4930
	0.55	0.53	0.2
South Asia	-0.2921	1.2678	-2.0300
	-0.15	0.54	-0.96
North America	-1.7973	-2.5625	-1.4466
	-1.34	*-1.8	-0.75
Sub-Saharan Africa	-2.1641	-2.3665	-2.9921
	-1.12	-0.93	-1.01
Latin America & Caribbean	4.2141	2.9843	3.9455
	1.62	1.25	1.31
cons.	13.2433	-2.5835	23.9159
	**2.39	-0.35	**2.11**
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.82	0.80	0.76

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Next, we experiment with a different measure of redistribution in Table 3.8. Among other categories of government expenditures, spending for education and health care are likely to be redistributive to the poor as well (Perotti, 1996; Rigolini, 2003; Sylwester, 2000). Hence, we aggregate education, health care and social security and welfare expenditures and use this expenditure as a share of GDP as our alternative measure of redistribution. We rerun our specifications using this new endogenous variable. Our main estimation results stay essentially the same[39]. ERI turns out to be even more significant (with t-statistic=3.21). All the other significant variables remain significant except the democracy variable. Democracy loses its significance in this regression. But, most importantly for our concern, ERI substantially increases the redistribution and this result is highly significant at one percent level.

[39] Albania is dropped due to the lack of data for other components of redistribution.

Table 3.8. Alternative Measures of Redistribution: 2SLS Regressions	**Dependent Variable** **Education, Heath and Social Security and Welfare Expenditure**	
	OLS	***2SLS***
ERI	2.8506	4.3763
	***2.85**	***3.21**
Inequality	-0.0394	0.1521
	-0.45	0.75
Democracy	-0.1006	-0.3029
	-0.59	-1.37
Log of Real GDP per capita PPP	-1.6926	-3.1596
	-1.36	**-2.21
% of pop. above 65	0.9993	1.2273
	***3.65**	***3.25**
East Asia & Pacific	-0.7125	0.3722
	-0.23	0.14
Eastern Europe & Central Asia	3.8931	6.0336
	1.59	**2.28
Middle East & North Africa	4.1484	4.6670
	1.11	1.42
South Asia	-1.8126	-0.0132
	-0.45	0
North America	-4.8292	-4.8648
	-1.49	***-3.41**
Sub-Saharan Africa	0.5302	-0.8700
	0.15	-0.23
Latin America & Caribbean	4.7206	6.5032
	1.5	*1.75
cons.	17.9274	20.4866
	*1.69	*1.71
# of coun.	61	61
F Test (p-value)	0.00	0.00
R-squared	0.72	0.69

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Next I experiment with using the democracy indicators of Gastil/Freedom instead of the Polity IV indicator of democracy. In doing so, we keep the initial specification of the model constant but only change the democracy indicator. The Gastil/Freedom House indicators in general generate less significant coefficients for democracy. However, the coefficients and significance of other control variables, especially ERI and inequality, remain essentially the same. However, in the third column, the civil liberties variable is not significant. We can conclude that political rights are more relevant for redistribution, considering that its coefficient is significant at the five percent level in Column 2.

Table 3. 9. Alternative Measures of Democracy: 2SLS Regressions

Dependent Variable

Social Security and Welfare Expenditure

	Democracy=Freedom House	*Democracy=Political Rights*	*Democracy=Civil Liberties*
ERI	3.3354	3.4216	2.9138
	***2.59	***2.74	**2.27
Inequality	0.1317	0.1645	0.1580
	0.86	0.99	0.99
Democracy	2.5438	1.0668	0.7305
	*1.8	**2.14	1.06
Log of Real GDP per capita PPP	-3.2970	-3.3317	-3.0486
	***-3.07	***-3	***-3.01
% of pop. above 65	1.3454	1.3770	1.2969
	***5.2	***5.12	***4.97
East Asia & Pacific	0.8800	0.3555	-0.1389
	0.4	0.17	-0.07
Eastern Europe & Central Asia	4.1678	4.0974	3.4811
	*1.97	*1.94	*1.69
Middle East & North Africa	2.9917	2.4799	2.5267
	1.31	1.1	1.06
South Asia	0.3788	0.6823	-0.2284
	0.17	0.3	-0.11
North America	-1.8209	-1.9097	-2.1042
	-1.16	-1.18	-1.16
Sub-Saharan Africa	-1.2596	-2.0327	-2.0908
	-0.49	-0.8	-0.81
Latin America & Caribbean	5.0928	4.7664	3.4372
	1.55	1.51	1.07
cons.	12.0984	11.9976	11.9289
	1.34	1.42	1.39
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.79	0.78	0.77

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

It is likely that a low ERI not only affects the redistributive government expenditure but also other types of government outlays. In order to analyze this argument, we use various other types of government expenditures as dependent variables. Regression results reveal that expenditures on economic affairs and services, public order and safety and recreational and cultural services are not robustly affected by ERI. Either ERI does not appear to be significant in these regressions or it appears with a negative coefficients. This evidence confirms our theory by illustrating that ERI is primarily relevant in redistribution but not for all types of government expenditures.

We also conduct a sensitivity analysis to see how our results changes when we drop ethnolinguistic fractionalization from our set of instruments. The initial results are not altered at all. All the significant variables are still significant as in the initial 2SLS regressions in Table 3.6. ERI is still significant at one percent level. T-statistic for ERI declines only to 2.82 from 3.08.

Other indicators of institutional quality in ICRG indices are also used instead of our ERI indicator in order to analyze whether our ERI variable is different from other indicators in ICRG. It turns out to be that other indicators of institutional quality in ICRG are not significant in redistribution equation. These variables are military in politics, religion in politics, socioeconomic conditions, law and order, investment profile, internal conflict, external conflict and government stability. This result shows that our ERI indicator has primary relevance for redistribution as compared to other indicators of institutional quality in ICRG.

Table 3.10. 2SLS Regressions Other Types of Government Expenditures ***Dependent Variables***

	Economic Affairs and Services	***Public Order and Safety***	***Recreational and Cultural Services***
ERI	0.0029	-0.0019	0.0011
	0.36	-0.91	0.8
Inequality	0.0003	-0.0003	-0.0003
	0.26	-1.01	-1.23
Democracy	-0.0010	0.0003	0.0001
	-1.08	0.94	0.64
Log of Real GDP per capita PPP	-0.0040	0.0006	-0.0012
	-0.5	0.31	-1.05
% of pop. above 65	0.0003	0.0002	0.0000
	0.19	0.32	-0.04
East Asia & Pacific	-0.0085	0.0024	0.0013
	-0.75	0.61	0.79
Eastern Europe & Central Asia	-0.0010	0.0090	0.0021
	-0.08	***2.58	1.28
Middle East & North Africa	0.0107	0.0064	0.0116
	0.67	1.46	2.27
South Asia	-0.0055	-0.0011	-0.0018
	-0.28	-0.21	-0.89
North America	-0.0194	-0.0004	0.0002
	-2.64	-0.22	0.18
Sub-Saharan Africa	-0.0188	0.0030	0.0023
	-1.22	0.57	0.91
Latin America & Caribbean	-0.0126	0.0014	0.0016
	-0.82	0.32	0.69
cons.	0.0718	0.0078	0.0221
	1.15	0.49	*1.68
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.19	0.56	0.41

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

3.4.3. Panel Data Regressions

The determinants of redistribution emphasized in the redistribution literature as well as in this study do not actually have much time series variation. For example, income inequality, efficiency of redistributive institutions, democracy and the share of population over 65 do not vary quickly over time. Hence, initial research on this topic has concentrated on cross-country regression analysis without dealing with the time dimension (Persson and Tabellini, 1992; Easterly and Rebelo, 1993; Perotti, 1996). However, some recent researchers utilize panel data regression techniques to investigate the income inequality and redistribution relationship (Forbes, 2000; Dalgaard et al., 2001, 2003; Rigolini, 2003). The primary motivations behind using panel data regressions are to increase the number of sampling observations and to distinguish country specific unobservables by using random and fixed effect regressions. The latter reason to use panel data regression is quite legitimate given that cross-country specifications cannot account for all the country specific factors relevant for the dependent variable. By the same token, the limited number of observations (countries) as well as the lack of data to control for various country specific features also induce us to resort to panel data regressions. Moreover, panel data regressions provide further robustness tests for the cross country regression results presented in the previous section.

For the panel data regressions, we adopt the same specification as used in the cross-section regressions. Hence, the following equation is estimated:

$$RD_{it} = \alpha_0 + \alpha_1 ERI_{it} + \alpha_2 inequality_{it} + \alpha_3 X_{1it} + \varepsilon_{1it} \qquad (1)$$

Where i and t correspond to countries and half decades, and ε_{1it} represents a country-time error term. Given that the main variables of our model do not vary much over time, we follow the common approach in the empirical growth literature and take averages of every variable over a five-year period instead of using yearly observations. In other words, all the explanatory and dependent variables remain the same as in the cross-section regressions, but are averaged over half decades instead of over all years. Summary statistics and the correlation matrix of five-year averages of variables in our sample are reported in the Appendix. Our constructed ERI variables are also reported in the Appendix as well.

There are numerous panel data regression techniques that are employed in previous empirical studies. Since our main objective is to account for the country-specific unobservable factors, we concentrate on random-and fixed-effect estimations. The random-effect specification assumes that the unobservable country specific, time constant effect is uncorrelated with the explanatory variable, while the fixed-effect specification does not require this assumption. Hence, we first test whether there is an indication for country specific unobservable effect. The Breusch and Pagan Lagrangian Multiplier test for random effects concludes that the existence of unobservable effects is not rejected[40]. Hence, we proceed to run fixed-and random-effect regressions. Table 3.11 reports these results. The first column presents the fixed-effect regression, while the

[40] The explanation for this test is given by Wooldridge (2003). The results of Breusch and Pagan Lagrangian Multiplier test is also presented in the Appendix.

last two columns present the random-effect and random-effect maximum likelihood estimation results, respectively.

All these regression results confirm our initial findings in cross-section regressions. Similar to earlier results, the efficiency of redistributive institutions (ERI) strongly increases social security and welfare expenditure, although its coefficient is only significant at a ten percent level with a one-sided test in the fixed-effect regression (t-statistic=1.61). In random effect regressions, its coefficients are significant at one percent level (t-statistics= 2.66 and 2.78, respectively). Other variables give similar results, as well. The coefficient on income inequality appears to be negative and insignificant. The democracy variable is negative but insignificant in all regressions. Wealthier countries redistribute less in the form of social security and welfare expenditure, but this result is not significant at the conventional level. On the other hand, the age structure of the population is highly significant and indicates that a higher share of the elderly increases social security and welfare expenditure. Regional dummies are not jointly significant in the random-effect regressions, and when we drop the regional dummies in the last column, the results are virtually identical, although ERI is only significant at five percent with t-statistic=2.15. Based on this evidence,, we can repeat our earlier main conclusion that ERI plays an important role in stimulating redistribution[41].

The fixed and random effect regressions generate similar results in terms of the coefficient signs of explanatory variables. However, the positive role of ERI on

[41] We have also tried other panel data regression techniques, which are not reported here like various forms of feasible generalized least square and have reached to the similar conclusions.

redistribution appears to be stronger in random-effect regressions. Hence, we run a Hausman specification test to differentiate whether the random-effect model can be rejected in favor of fixed-effect regression. The Hausman specification test fails to reject the null hypothesis that unobservable country-specific factors are uncorrelated with explanatory variables[42]. Hence, this test suggests that random-effect regressions are appropriate.

[42] The outcome of this test is also reported in the Appendix.

Table 3.11. Panel Data Estimations

Dependent Variable
Social Security and Welfare Expenditure

	Fixed Effect	*Random Effect*	*Random Effect MLE*	*Random Effect*
ERI	0.5208	0.7038	0.7144	0.5141
	1.61	***2.66**	***2.78**	**2.15**
Inequality	-0.0158	-0.0181	-0.0176	-0.0214
	-0.56	-0.75	-0.75	-0.93
Democracy / Gastil	-0.0147	-0.0438	-0.0453	-0.0367
	-0.35	-1.25	-1.33	-1.11
Log of Real GDP per capita PPP	-0.2085	-0.8298	-0.8475	-0.7029
	-0.22	-1.51	***-1.62**	-1.49
% of pop. above 65	0.7089	0.9834	0.9909	1.0550
	**2.84	***7.38**	***7.79**	***11.95**
East Asia & Pacific		-2.2766	-2.2231	
		-1.22	-1.27	
Eastern Europe & Central Asia		0.4852	0.5109	
		0.34	0.38	
Middle East & North Africa		-0.2824	-0.2200	
		-0.13	-0.11	
South Asia		-2.0106	-1.9417	
		-0.8	-0.83	
North America		-1.9423	-1.9110	
		-0.86	-0.9	
Sub-Saharan Africa		-1.7295	-1.6785	
		-0.84	-0.86	
Latin America & Caribbean		0.4300	0.5016	
		0.24	0.30	
cons.	3.5295	7.1798	7.2130	5.3420
	0.46	1.48	1.57	1.39
# of obs.	166	166	166	166
# of coun.	63	63	63	63
F Test (p-value)	0.01	0.00	0.00	0.00
R-squared	0.74	0.78		0.75

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

3.4.3.1. Panel Data Regressions when ERI and Income Inequality are Instrumented

In order to account for possible endogeneity of our main variables, we instrument ERI and income inequality in our panel data estimation using the same instruments as for the cross-section case. The dummy for tropical climate is expected to increase income inequality without affecting the error component of the redistribution equation. Ethnolinguistic fractionalization is expected to reduce ERI and increase income inequality. The share of oil in merchandise exports and years after independence are also used as instruments for ERI. The former is expected to reduce ERI, while the latter increases it. Since justifications for these instruments are presented in the previous sections, we do not explain them further at this point.

As with ERI and income inequality, the instruments used to predict them do not change much over time. Oil export and years after independence have some within variation, but the tropical dummy and ethnolinguistic fractionalization have only between variations. However, given that most of the variation in ERI and income inequality come from the between variation, our choice of instruments for the panel data regressions are reasonable.

Table 3.12 presents the first stage and final instrumental variable regressions. We apply the Hausman test for the instrumental variable regressions and find that the random-effect regression results are not systematically different from the fixed-effect regression results. Given that some of our instruments are time-invariant and that the fixed-effect regression specification drops these instruments, we only concentrate on the random-effects results. Similar to the cross-section results, oil exports and

ethnolinguistic fractionalization significantly reduce ERI at the one percent level, while both tropical climate and ethnolinguistic fractionalization significantly exacerbate income inequality. In the final regressions, ERI appears to be highly significant in redistribution equation. Its coefficient is significant at the one percent level (t-statistics=2.96). The coefficient of income inequality is positive and is almost significant at five percent. A positive relationship between income inequality and redistribution emerges when ERI is taken into accounts as in the cross-section regressions. Other results are also stronger than in the cross-sectional 2SLS regressions. Democracy and log GDP per capita enter into the redistribution equation with negative and highly significant coefficients, while the share of population over 65 years of old significantly increases social security and welfare expenditure. In general, it is clear that our previous results are consistent with the panel data regressions[43].

When ERI is dropped from the redistribution equation without changing anything else. Income inequality loses its significance and t-statistics becomes 1.53. This result supports one of the main ideas of the theoretical chapter that when ERI is taken into account income inequality can be significant. When we also drop other instruments and only keep tropical climate dummy to instrument income inequality in the first stage, the results are even more supportive for our theoretical model. The coefficient of income inequality is smaller in magnitude and t-statistic is equal to 0.43.

[43] In the Appendix, estimation results are reported when the number of years from independence is dropped from the first-stage regressions. In general, the main results remain the same. But, the coefficient of income inequality is no longer significant.

Table 3.12. Panel Data Estimation: 2SLS	**Dependent Variable Social Security and Welfare Expenditure**				
	Random effect 2SLS	***ERI First Stage***	***Inequality First Stage***	***Random effect 2SLS***	***Random effect 2SLS***
ERI	3.5554				
	*****2.96**				
Inequality	0.2729			0.1934	0.0789
	****1.96**			1.53	0.43
Democracy	-0.2615	0.0391	0.1284	-0.0693	-0.0392
	*****-2.97**	*****3.69**	1.12	-1.32	-0.83
Log of Real GDP per capita PPP	-3.5645	0.8512	1.8452	-0.5548	-0.6787
	*****-2.92**	*****7.8**	1.56	-0.99	-1.24
% of pop. above 65	1.4101	-0.0443	-0.5519	1.1669	1.0183
	*****8.34**	***-1.87**	****-2.15**	*****8.56**	*****7.67**
East Asia & Pacific	1.1751	-0.4925	-5.6214	-2.2340	-3.0255
	0.62	-1.6	***-1.69**	-1.48	***-1.66**
Eastern Europe & Central Asia	5.7875	-1.2431	-2.8119	0.2464	-0.5696
	****2.7**	*****-5.72**	-1.2	0.21	-0.42
Middle East & North Africa	3.7473	-0.8744	0.821	-0.2647	-1.4340
	***1.67**	****-2.56**	0.22	-0.15	-0.68
South Asia	2.2373	-0.5565	-0.5319	-1.3748	-2.9037
	0.96	-1.48	-0.13	-0.68	-1.25
North America	-1.5476	0.1268	1.8979	-2.2832	-2.2805
	-0.58	0.27	0.38	-1.04	-0.95
Sub-Saharan Africa	-1.1615	-0.0296	2.2381	-2.9181	-3.5684
	-0.5	-0.08	0.53	-1.38	-1.19
Latin America & Caribbean	5.3734	-1.7064	3.3333	-0.7567	-1.3755
	****2.18**	*****-6.63**	1.2	-0.49	-0.61
Tropical		0.0412	4.6749		
		0.28	*****2.94**		
Ethnolinguistic Fractionalization		-1.025	6.3273		
		*****-3.58**	****2.04**		
Oil export		-0.0075	-0.0412		
		*****-2.89**	-1.46		
Years after independence		0.0008	0.0161		
		0.66	1.18		
cons.	12.1752	-5.7811	26.4627	-4.7840	2.8402
	1.22	*****-5.95**	*****2.52**	-0.73	0.36
# of obs.	159	159	159	159	159
# of coun.	62	62	62	62	62
F Test (p-value)	0	0	0	0	0
R-squared	0.69			0.74	0.77

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Hence, number of countries declines to 62. Number of observations declines also due to lack of data for oil export.

3.4.3.2. Sensitivity Analyses of Panel Data Regressions

We have conducted a number of robustness tests to check the sensitivity of our 2SLS panel data regression results. Our general conclusions remain the same for all these robustness tests. First, we use the simple average of the normalized control of corruption and quality of bureaucracy instead of their principal component. We also enter these normalized variables separately in the redistribution equation. These alternative measures of ERI produce highly significant coefficients, except for the quality of bureaucracy as shown in Table 3.13. The simple average of these institutional variables generates a t-statistic of 2.91. T statistic (2.97) is even higher for the control of corruption. When the dependent variable is changed to sum of education, health and social security and welfare expenditure, again the ERI is highly significant in increasing redistribution with t statistics equal to 3.39 as reported in Table 3.14.

Table 3.13. Panel Data Estimation, 2SLS: Alternative Measures of Democracy

Dependent Variable

Social Security and Welfare Expenditure

	ERI=simple average	*ERI=Control of Corruption*	*ERI=Quality of Bureaucracy*
ERI	18.7994	2.8167	3.1918
	*****2.91**	*****2.97**	***1.62**
Inequality	0.2542	0.3939	0.1211
	****1.85**	****2.44**	0.84
Democracy	-0.2640	-0.2261	-0.2013
	*****-2.96**	*****-2.65**	****-2.01**
Log of Real GDP per capita PPP	-3.6640	-2.5832	-3.1242
	*****-2.9**	*****-2.58**	***-1.85**
% of pop. above 65	1.4045	1.4316	1.2236
	*****8.37**	*****7.66**	*****7.91**
East Asia & Pacific	0.9744	2.2139	-1.5311
	0.52	0.99	-0.88
Eastern Europe & Central Asia	5.6134	6.4202	2.7304
	*****2.66**	*****2.69**	1.34
Middle East & North Africa	3.5200	4.9357	0.4996
	1.59	****1.88**	0.24
South Asia	2.0705	3.0489	-0.4916
	0.9	1.16	-0.21
North America	-1.4824	-2.0394	-1.6840
	-0.56	-0.7	-0.7
Sub-Saharan Africa	-1.2806	-0.4718	-2.8265
	-0.56	-0.18	-1.2
Latin America & Caribbean	5.3955	4.6516	3.0176
	****2.17**	1.94	1.02
cons.	3.6313	-11.1859	11.2943
	0.44	-1.37	0.95
# of obs.	159	159	159
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.69	0.64	0.70

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Hence, number of countries declines to 62. Number of observations declines also due to lack of data for oil export.

Table 3.14. Panel Data Estimation, 2SLS: Alternative Measures of Redistribution	**Dependent Variable** **Education, Heath and Social Security and Welfare Expenditure**	
	Random Effect	***2SLS Random Effect***
ERI	1.5541	5.0569
	***3.99**	***3.39**
Inequality	-0.0014	0.2025
	-0.04	1.12
Democracy	-0.0390	-0.2448
	-0.76	**-2.22**
Log of Real GDP per capita PPP	-1.0393	-3.5107
	-1.27	**-2.31**
% of pop. above 65	1.1328	1.3470
	***5.44**	***5.92**
East Asia & Pacific	-0.7949	3.0659
	-0.28	1.21
Eastern Europe & Central Asia	2.6054	9.2463
	1.19	***3.44**
Middle East & North Africa	4.0688	8.9184
	1.26	3.01
South Asia	-1.7230	3.9640
	-0.45	1.3
North America	-4.1950	-4.0414
	-1.21	-1.19
Sub-Saharan Africa	1.5200	2.8199
	0.48	0.94
Latin America & Caribbean	3.5718	9.5563
	1.29	***3.03**
cons.	9.8247	17.0186
	1.35	1.3
# of obs.	155	155
# of coun.	61	61
F Test (p-value)	0.00	0.00
R-squared	0.67	0.60

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Albania is also dropped due to lack of data on heath expenditure. Hence, number of countries declines to 61. Number of observations declines also due to lack of data for oil export.

The results are also robust to alternative measures of democracy. When alternative Freedom House indicators for democracy are used instead of the Polity IV index of democracy, results are not altered much. The composite index of Freedom House democracy indicator produces a t-statistic of 2.99, while their political rights and civil liberty measures give t-statistics of 2.94 and 2.64, respectively.

Finally, we have tried alternative measures of government expenditures to analyze whether ERI influences all forms of government expenditures similarly or not. Our results show that ERI does not seem to play significant roles in other types of government spending such as in economic affairs and services and in public order and safety. These robustness tests once again show that ERI needs to be taken into account in explaining redistribution. These results are reported in Tables 3.15 and 3.16.

Table 3.15. Panel Data Estimation, 2SLS: Alternative Measures of Democracy

2SLS Regressions Dependent Variable

Social Security and Welfare Expenditure

	Democracy=Freedom House	*Democracy=Political Rights*	*Democracy=Civil Liberties*
ERI	3.5635	3.8161	3.3508
	***2.99	***2.94	***2.64
Inequality	0.2228	0.2666	0.2566
	*1.72	*1.94	**1.87
Democracy	2.4654	1.0587	0.9164
	***2.77	***2.89	**2.00
Log of Real GDP per capita PPP	-3.2988	-3.4838	-2.9994
	***-2.9	***-2.86	***-2.63
% of pop. above 65	1.4520	1.4592	1.4352
	***8.38	***8.32	***8.09
East Asia & Pacific	1.8113	1.3367	0.9503
	0.94	0.7	0.51
Eastern Europe & Central Asia	5.7973	6.0289	5.1504
	***2.8	***2.76	***2.55
Middle East & North Africa	5.0555	4.2755	4.5992
	**2.24	*1.91	**2.04
South Asia	2.3378	2.3065	1.5742
	1.04	0.99	0.7
North America	-1.0824	-1.3011	-1.2392
	-0.42	-0.49	-0.46
Sub-Saharan Africa	0.8146	-0.1911	0.0422
	0.36	-0.08	0.02
Latin America & Caribbean	6.6295	6.1745	5.3996
	***2.48	***2.31	**2.01
cons.	5.7757	6.6344	3.6501
	0.64	0.71	0.41
# of obs.	159	159	159
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.70	0.69	0.69

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Hence, number of countries declines to 62. Number of observations declines also due to lack of data for oil export.

Table 3.16. Panel Data Estimations, 2SLS: Other Types of Government Expenditures ***Dependent Variables***

	Economic Affairs and Services	***Public Order and Safety***	***Recreational and Cultural Services***
ERI	-0.0041	-0.0051	-0.0005
	-0.5	-0.97	-0.53
Inequality	-0.0024	-0.0005	-0.0002
	****-2.15**	-0.75	-1.31
Democracy	-0.0005	-0.0004	0.0001
	-0.73	-0.84	1.06
Log of Real GDP per capita PPP	0.0040	0.0035	0.0008
	0.43	0.59	0.84
% of pop. above 65	-0.0028	-0.0010	0.0000
	****-2.13**	-1.16	0.24
East Asia & Pacific	-0.0272	-0.0154	-0.0002
	***-1.85**	***-1.66**	-0.15
Eastern Europe & Central Asia	-0.0227	-0.0165	0.0004
	-1.56	****-1.81**	0.24
Middle East & North Africa	-0.0175	-0.0137	0.0079
	-1.07	-1.33	*****4.32**
South Asia	-0.0078	-0.0172	-0.0009
	-0.45	-1.58	-0.33
North America	-0.0101	-0.0076	-0.0015
	-0.48	-0.58	-0.63
Sub-Saharan Africa	-0.0213	0.0020	0.0027
	-1.2	0.18	1.33
Latin America & Caribbean	-0.0241	-0.0126	-0.0003
	-1.36	-1.13	-0.15
cons.	0.1510	0.0369	0.0011
	***1.91**	0.74	0.14
# of obs.	162	162	162
# of coun.	62	62	62
F Test (p-value)	0.00	0.01	0.00
R-squared	0.15	0.11	0.36

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Hence, number of countries declines to 62. Number of observations declines also due to lack of data for oil export.

3.5. Determinants of Efficiency of Redistributive Institutions

Our theoretical chapter suggests that ERI is endogenous. In addition, it has implications for the determinants of ERI. For example, our theoretical model shows that income inequality reduces ERI. Similarly, under this framework, our model asserts that when the median voter has more power to set up institutions, he/she prefers higher ERI as compared to the case when decisive voter on institutions is richer than the median voter. Hence, our theoretical model implies that more democratic countries reach a higher level of ERI as long as more democracy indicates more political power for the median voter. Finally, in one of the specifications, we follow Azariadis and Lahiri (2003) and assume that ERI is a positive function of an average income. These three implications of our theoretical model are testable with the available data sets. In this section, we primarily focus on testing these predictions in addition to analyzing some other possible determinants of ERI. In this regard, we also analyze the role of freedom of press on ERI.

In explaining ERI, we start with the reduced form specification of the previous section. Later, we incorporate other potential determinants of ERI into the empirical estimation. Hence, ERI is first regressed on measures of income inequality, democracy, log of real GDP per capita (PPP), share of population over 65 years old and on regional dummies[44]. The first column of Table 3.17, reports the simple OLS regressions on ERI. The robust regression estimation when observations are weighted down with respect to error term is presented in Column 2. The weighted least square estimation in Column 3

[44] Since ERI data of ICRG are available after 1983, all the other control variables are also averaged for years after 1983.

reports the estimation results when the log GDP per capita is used as a weight, considering the idea that in higher income countries data quality is better. In the last column, we enhance the basic model by controlling for ethnolinguistic fractionalization, share of oil export in merchandise export and number of years after independence. These variables are justified as instruments in previous sections and constitute possible determinants of ERI in this section, as well.

In all these empirical estimations, we confirm the main predictions of our theoretical model. Most interestingly, income inequality reduces ERI. The income inequality coefficient is significant at a ten percent level in almost all the regressions in a two-tailed test. In accordance with the theory, democratic countries reach a higher level of ERI and this result is highly significant at even less than one percent in all the regressions. Similarly, the log GDP per capita appears to have highly positive and significant coefficients in all the estimations. Chong and Calderon (2000) also reach a similar conclusion by empirically showing that the direction of causation is mostly from economic development to institutional quality (also see Paldam, 2002). This result confirms one of the premises of our theoretical model that wealthier countries are characterized as having better ERI. In all these regressions, the share of population over 65 years old is not significant, while Latin American countries and Eastern and Central Asian countries tend to have a lower ERI. Moreover, the last column shows that high oil export and ethnolinguistic fractionalization are associated with lower ERI. Whereas, additional years after independence improve ERI.

We run these regressions on the initial sample of countries used in the previous section to be consistent with the earlier redistribution estimations. However, we have

more data available for ERI when we do not analyze social security and welfare expenditures. In this case, our sample of countries increases from 63 to 67 countries. The estimation results on this extended sample are reported in the Appendix. It is apparent that our results in this section are fortified for the larger sample in the Appendix.

Table 3.17. Determinants of ERI: Cross-Sectional Regressions

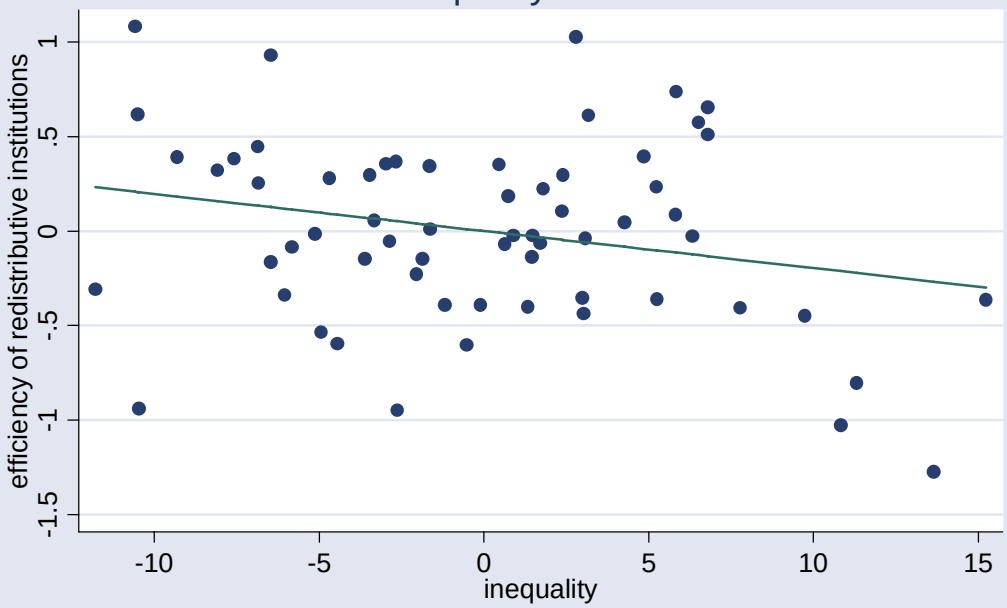
Dependent Variable

Efficiency of Redistributive Institutions

	OLS	*Robust*	*Weighted Least Square*	*OLS*
Inequality	-0.0196	-0.0215	-0.0191	-0.0183
	***-1.8**	***-1.81**	***-1.73**	***-1.84**
Democracy / Gastil	0.0669	0.0581	0.0640	0.0505
	****3.05**	***2.42**	****2.9**	****2.58**
Log of Real GDP per capita PPP	0.7365	0.7409	0.7461	0.8445
	****5.23**	****4.81**	****5.16**	****6.53**
% of pop. above 65	-0.0122	-0.0081	-0.0089	-0.0371
	-0.33	-0.2	-0.24	-1.1
East Asia & Pacific	-0.4032	-0.3268	-0.3655	-0.1519
	-0.94	-0.7	-0.88	-0.39
Eastern Europe & Central Asia	-1.1162	-1.1483	-1.1077	-0.7599
	****-3.57**	****-3.36**	****-3.69**	***-2.54**
Middle East & North Africa	-0.3808	-0.4630	-0.3761	-0.1996
	-0.74	-0.82	-0.74	-0.44
South Asia	-0.5596	-0.5642	-0.5181	-0.1830
	-1.01	-0.93	-0.92	-0.36
North America	-0.1142	-0.0937	-0.1135	0.2023
	-0.25	-0.19	-0.26	0.48
Sub-Saharan Africa	0.2627	0.2386	0.2937	0.6675
	0.52	0.43	0.59	1.41
Latin America & Caribbean	-1.2571	-1.2303	-1.2404	-1.3602
	****-3.14**	****-2.81**	****-3.19**	****-3.89**
Ethnolinguistic Fractionalization				-0.7056
				***-2.2**
Oil export				-0.0065
				***-2.08**
Years after independence				0.0035
				***2.15**
cons.	-4.9821	-4.9199	-5.1134	-5.8047
	****-3.87**	****-3.5**	****-3.87**	****-5.09**
# of coun.	63	63	63	62
F Test (p-value)	0.00	0.00	0.00	0.00
R-squared	0.78		0.79	0.85

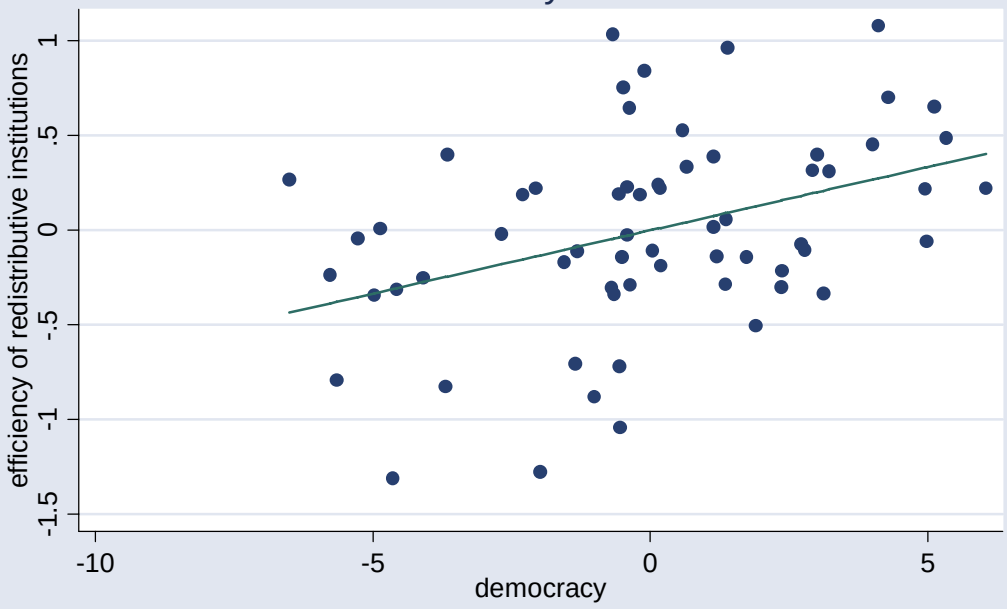
Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Figure 3.9: OLS Partial Regression Diagram
Inequality and ERI



coef = -.01956201, se = .01089069, t = -1.8

Figure 3.10: OLS Partial Regression Diagram
Democracy and ERI



coef = .06691423, se = .02195133, t = 3.05

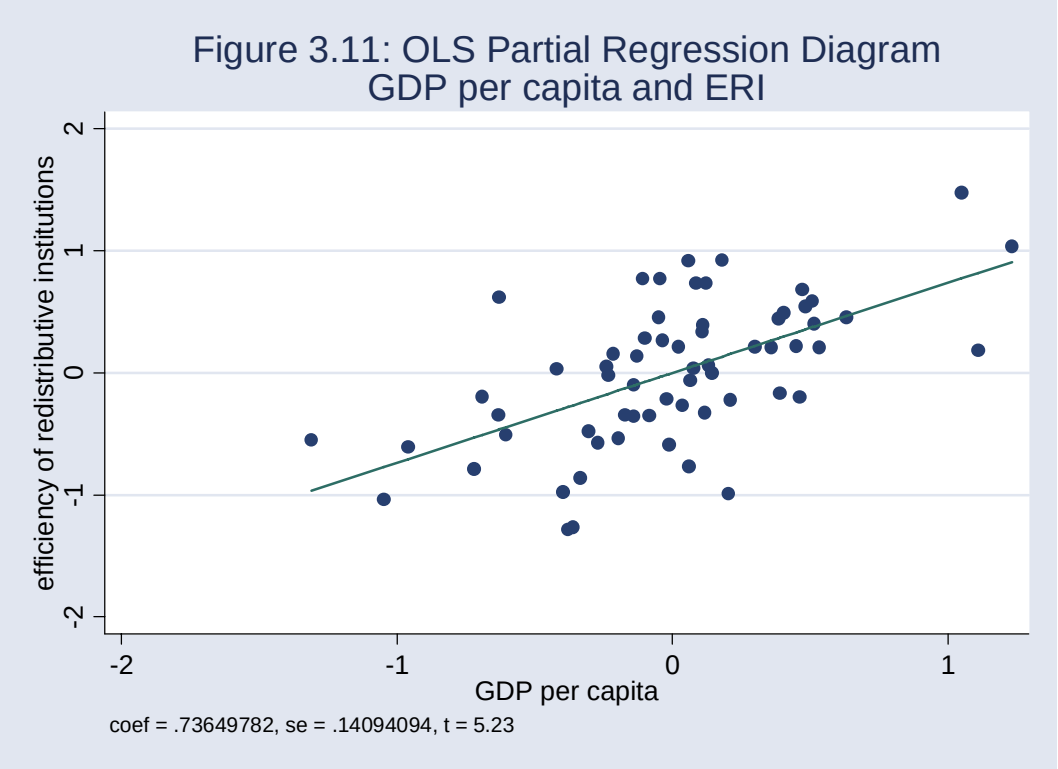


Figure 3.11: OLS Partial Regression Diagram
GDP per capita and ERI
efficiency of redistributive institutions
2
1
0
-1
-2
-2
-1
0
1
GDP per capita
coef = .73649782, se = .14094094, t = 5.23

As a next step, we analyze whether our results survive when income inequality is instrumented. In the previous sections, ethnolinguistic fractionalization and the dummy for tropical climate are used to instrument income inequality. However, ethnolinguistic fractionalization is also significant in directly affecting ERI, we can only use a dummy for tropical climate as an instrument for income inequality. There is also one more alternative instrument for income inequality. We also use the past values of income inequality (before 1985) as an instrument for present income inequality (after 1985). Table 3.18 reports the results of these regressions. Definitely, past value of income inequality is a more significant instrument in the first stage. However, these alternative instruments ultimately generate very similar results.

In the first stage, past value of income inequality is highly significant in estimating the late income inequality at one percent level. Whereas, a tropical dummy is significant at ten percent. In the final regressions, the former results presented in this section remain pretty the much same, except for income inequality. When income inequality is instrumented, income inequality loses its significance in explaining ERI. Hence, one may conclude that an adverse effect of income inequality is not robust to instrumentation of income inequality. This result is also likely to stem from the choice of instrument for income inequality. But, these are the best instruments that we can currently abide, considering the existing limitations in the literature to pinpoint strong instruments for income inequality. However, other results are not altered at all. Among the main predictions of the theoretical model, still higher democracy and a GDP per capita bring higher ERI and these results are highly significant in all the regressions.

Table 3.18. Determinants of ERI: 2SLS Regressions

Dependent Variable

Efficiency of Redistributive Institutions

	IV	*Inequality First Stage: instrument=tropical*	*IV*	*Inequality First Stage: instrument=past inequality*
Inequality	-0.0095		0.0001	
	-0.27		0.01	
Democracy / Gastil	0.0453	0.5812	0.0395	0.1764
	***1.7**	****2.18**	****2.09**	0.77
Log of Real GDP per capita PPP	0.8317	1.3836	0.8177	-1.3573
	*****6.71**	0.76	*****6.94**	-0.87
% of pop. above 65	-0.0296	-0.7487	-0.0213	0.3917
	-0.71	-1.59	-0.67	0.89
East Asia & Pacific	-0.1254	-5.6714	-0.0964	0.2465
	-0.35	-0.98	-0.27	0.05
Eastern Europe & Central Asia	-0.7435	-2.0488	-0.7255	1.7608
	*****-2.76**	-0.48	*****-2.69**	0.5
Middle East & North Africa	-0.2253	4.0227	-0.2535	4.2596
	-0.55	0.62	-0.62	0.82
South Asia	-0.1403	-4.7965	-0.0933	-1.3698
	-0.29	-0.66	-0.2	-0.23
North America	0.1909	1.0059	0.1785	2.8374
	0.51	0.17	0.47	0.58
Sub-Saharan Africa	0.6108	3.1225	0.5484	3.0862
	1.3	0.45	1.27	0.57
Latin America & Caribbean	-1.3866	2.1419	-1.4157	5.7493
	*****-4.28**	0.43	*****-4.46**	1.42
Ethnolinguistic Fractionalization	-0.7669	7.8754	-0.8343	5.1245
	****-2.07**	***1.75**	*****-2.78**	1.41
Oil export	-0.0062	-0.0484	-0.0060	-0.0546
	****-2.14**	-1.06	****-2.1**	-1.51
Years after independence	0.0033	0.0130	0.0032	-0.0044
	****2.16**	0.56	****2.15**	-0.23
Instrument		4.6467		0.6864
		***1.74**		*****5.48**
cons.	-6.0641	29.4118	-6.3494	18.9864
	*****-4.26**	***1.87**	*****-5.88**	1.48
# of coun.	62	62	62	62
F Test (p-value)	0.00	0.00	0.00	0.00
R-squared	0.84	0.52	0.83	0.69

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Given that democracy emerges as one of the major stimulus for better ERI in all these regressions, we attempt to analyze the various components of democracy, which are influential in reaching a higher level of ERI. Hence, we employ the disaggregated measures of democracy by Freedom House and Polity IV. We do not find that there exists significant difference between political rights and civil liberties indices of Freedom House in affecting ERI. However, in Polity IV variables, constraint on the executive appears to be more important than the composite index of Polity IV. Table 3.19 reports these results when income inequality is instrumented with its past value. The results are similar when income inequality is instrumented with the tropical dummy. These regression results are presented in the Appendix as well.

Income inequality has regional characteristics. For example, Latin America is characterized with high income inequality due to its historical experiences which is briefly mentioned earlier, while East Asian countries enjoy more equal distribution of income. Hence, we drop the regional dummies in ERI equation to see how our results in Table 3.18 change. As expected without regional dummies, income inequality now emerges to be significant in ERI equation with t-statistic equal to 1.95. Similar to initial results, GDP per capita is still highly significant at less than one percent level. However, democracy and years after independence lose their significance. All the other results remain unaltered.

Table 3.19. Determinants of ERI: 2SLS Regressions; Alternative Measures of Democracy

	Dependent Variable **Efficiency of Redistributive Institutions**			
	Democracy= Freedom House	***Democracy =Political Rights***	***Democracy =Civil Liberties***	***Democracy=Constraint on Executive***
Inequality	0.0007	0.0002	0.0040	-0.0030
	0.06	0.02	0.33	-0.24
Democracy / Gastil	0.5405	0.1884	0.2531	0.1761
	*****3.47**	*****3.43**	*****3.27**	*****3.72**
Log of Real GDP per capita PPP	0.7747	0.7666	0.7334	0.8110
	*****6.79**	*****6.69**	*****6.08**	*****7.08**
% of pop. above 65	-0.0439	-0.0383	-0.0440	-0.0316
	-1.41	-1.25	-1.4	-1.07
East Asia & Pacific	-0.2768	-0.1588	-0.0210	-0.0821
	-0.81	-0.47	-0.06	-0.25
Eastern Europe & Central Asia	-0.7044	-0.6897	-0.5158	-0.7149
	*****-2.73**	*****-2.67**	***-1.86**	*****-2.82**
Middle East & North Africa	-0.4021	-0.3125	-0.2162	-0.2712
	-1.08	-0.83	-0.55	-0.73
South Asia	-0.0722	-0.1262	0.1023	-0.0857
	-0.16	-0.28	0.22	-0.2
North America	0.1176	0.1212	0.0842	0.1726
	0.32	0.33	0.22	0.48
Sub-Saharan Africa	0.3177	0.4111	0.4709	0.5932
	0.78	1.02	1.14	1.48
Latin America & Caribbean	-1.6393	-1.5256	-1.4926	-1.4308
	*****-5.24**	*****-4.98**	*****-4.79**	*****-4.77**
Ethnolinguistic Fractionalization	-0.7021	-0.7028	-0.7834	-0.8426
	*****-2.45**	*****-2.45**	*****-2.74**	*****-3.06**
Oil export	-0.0044	-0.0051	-0.0048	-0.0046
	-1.57	***-1.85**	***-1.68**	***-1.69**
Years after independence	0.0038	0.0035	0.0036	0.0032
	*****2.67**	*****2.5**	*****2.49**	****2.18**
cons.	-4.7662	-5.0674	-4.7039	-6.8530
	*****-4.12**	*****-4.54**	*****-3.99**	*****-6.91**
# of coun.	62	62	62	62
F Test (p-value)	0.00	0.00	0.00	0.00
R-squared	0.85	0.85	0.84	0.86

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Democracy definitely has certain requirements. We then concentrate on the role of freedom of the press on ERI. When the index of freedom of press by Freedom House[45] is also incorporated into the instrumental variable regression specification, it is clear that freedom of the press significantly increases ERI in the first column of Table 3.20. On the other hand, democracy loses its significance. This result provides evidence that freedom of press is one of the mechanisms to achieve a higher level of democracy. These findings are consistent with earlier research. For example, Lederman et al. (2004) also confirm the importance of freedom of the press in lowering corruption.

Finally, we consider the role of trade on ERI. Definitely, institutions are important in shaping the trade performance of a country. The causality, however, is also likely to work from trade openness to institutions. Trade policies may play a role in shaping the institutions in the long-run. Along this line, Wei (2000) provides evidence that open countries are less corrupt. Hence, we include the total share of import and export in aggregate GDP as an indicator of trade openness into our regression specification in Column 2 of Table 3.20. Our estimation results uncover that trade openness increases ERI. This result is highly significant at even less than a one percent level.

[45] Freedom of House variables for democracy and freedom of the press is rescaled so that higher values indicate more democracy and more freedom of the press.

Table 3.20. Other Determinants of ERI: 2SLS Regressions

Dependent Variable

Efficiency of Redistributive Institutions

	X=freedom of Press	*X=trade*
Inequality	0.0007	-0.0030
	0.05	-0.24
Democracy / Gastil	0.0050	0.0435
	0.21	***2.33
Log of Real GDP per capita PPP	0.8290	0.7321
	***7.48	***6.5
% of pop. above 65	-0.0492	-0.0101
	-1.61	-0.35
East Asia & Pacific	-0.1601	-0.1895
	-0.48	-0.57
Eastern Europe & Central Asia	-0.6285	-0.6271
	**-2.43	***-2.55
Middle East & North Africa	-0.3467	0.0320
	-0.89	0.09
South Asia	0.0957	0.2269
	0.21	0.51
North America	0.0769	0.7015
	0.21	*1.88
Sub-Saharan Africa	0.3535	0.9406
	0.84	**2.33
Latin America & Caribbean	-1.5721	-1.3289
	***-5.1	***-4.63
Ethnolinguistic Fractionalization	-0.7719	-0.8230
	***-2.75	***-2.91
Oil export	-0.0055	-0.0036
	***-2.03	-1.34
Years after independence	0.0035	0.0063
	***2.5	***4.04
X	0.0135	0.0069
	***2.6	***3.33
cons.	-5.5559	-6.5022
	***-5.45	***-5.99
# of coun.	62	62
F Test (p-value)	0.00	0.00
R-squared	0.85	0.86

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

3.6. Conclusion

This chapter empirically analyzes the role of efficiency of redistributive institutions on the redistribution in the form of social security and welfare spending. Moreover, this chapter also sheds some light on the determinants of ERI. When measures of ERI are incorporated into the existing empirical specifications of income inequality and redistribution, cross-sectional and panel data regressions show that ERI significantly increases the redistribution. This result is robust to alternative specifications of the empirical model as well as to alternative data sets. However, we find weaker evidence for the role of income inequality on redistribution. Income inequality does not appear to be strongly significant in various specifications of the redistribution equation. Based on this evidence, this chapter concludes that efficiency of redistributive institutions play an important role in redistribution but this effect does not resolve the fiscal policy puzzle that is emphasized in the theoretical chapter. On the other hand, our empirical results in this chapter confirm our theoretical model that increase in GDP per capita and democracy increases ERI. However, there is less convincing evidence for the negative role of income inequality on ERI. Among the other determinants of ERI, freedom of the press and trade openness improve ERI substantially.

A. Appendices

A.2. Appendices for Chapter 2

A.2.1. 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.2.2.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.2.3. 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.2.4.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.2.5. 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[46] $E(y_d) = \bar{y}$. Therefore, Equation 7 becomes

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

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.

[46] 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.

A.3. Appendices for Chapter 3

A.3.1. Appendix for the Bringing the Theory to the Data

A group of experts evaluate the countries in ICRG sample and give points for each category based on the following explanations in this section. These explanations of ICRG variables are obtained from the official manual of ICRG.

> **Control over Corruption** "is a measure of corruption within the political system. Such corruption is a threat to foreign investment for several reasons: it distorts the economic and financial environment; it reduces the efficiency of government and business by enabling people to assume positions of power through patronage rather than ability, and, last but not least, introduces an inherent instability into the political process".
>
> **Quality of Bureaucracy** indicates that "countries where the bureaucracy has the strength and expertise to govern without drastic changes in policy or interruptions in government services. In these low-risk countries, the bureaucracy tends to be somewhat autonomous from political pressure and to have an established mechanism for recruitment and training. Countries that lack the cushioning effect of a strong bureaucracy receive low points because a change in government tends to be traumatic in terms of policy formulation and day-to-day administrative functions."

Investment Profile "is a measure of the government's attitude to inward investment as determined by our assessment of four sub-components: the risk to operations, taxation and repatriation and labor costs".

Law and Order "are assessed separately, with each sub-component comprising zero to three points. The Law sub-component is an assessment of the strength and impartiality of the legal system, while the Order sub-component is an assessment of popular observance of the law."

Government Stability "is a measure both of the government's ability to carry out its declared program(s), and its ability to stay in office. This will depend on the type of governance, the cohesion of the government and governing party or parties, the closeness of the next election, the government's command of the legislature, popular approval of government policies, and so on."

Socioeconomic Conditions "is an attempt to measure general public satisfaction, or dissatisfaction, with the government's economic policies. In general terms, the greater the popular dissatisfaction with a government's policies, the greater the chances that the government will be forced to change tack, possibly to the detriment of business, or will fall."

Internal Conflict "is an assessment of political violence in the country and its actual or potential impact on governance. The highest rating is given to those

countries where there is no armed opposition to the government and the government does not indulge in arbitrary violence, direct or indirect, against its own people."

External Conflict "is an assessment both of the risk to the incumbent government and to inward investment. It ranges from trade restrictions and embargoes, whether imposed by a single country, a group of countries, or the international community as a whole, through geopolitical disputes, armed threats, exchanges of fire on borders, border incursions, foreign-supported insurgency, and full-scale warfare."

Ethnic Tensions "measures the degree of tension within a country attributable to racial, nationality, or language divisions. Lower ratings are given to countries where racial and nationality tensions are high because opposing groups are intolerant and unwilling to compromise. Higher ratings are given to countries where tensions are minimal, even though such differences may still exist."

Religious Tensions "may stem from the domination of society and/or governance by a single religious group that seeks to replace civil law by religious law and to exclude other religions from the political and/or social process; the desire of a single religious group to dominate governance; the suppression off religious freedom; the desire of a religious group to express its own identity, separate from the country as a whole."

Military in Politics: "The military is not elected by anyone. Therefore, its involvement in politics, even at a peripheral level, is a diminution of democratic accountability. However, it also has other significant implications. The military might, for example, become involved in government because of an actual or created internal or external threat. Such a situation would imply the distortion of government policy in order to meet this threat, for example by increasing the defense budget at the expense of other budget allocations."

Description of Construction of Polity Variable in the Manual of Polity IV

Following explanations for the construction of Polity IV variables are directly obtained from the manual of Polity IV.

"2. Indicators of Democracy and Autocracy (Composite Indicators)

In an attempt to facilitate empirical analysis of these and other historical trends, Polity IV includes constructed annual measures for both institutionalized democracy (DEMOC) and autocracy (AUTOC), as many polities exhibit mixed qualities of both of these distinct authority patterns. The measures are composite indices derived from the coded values of authority characteristic component variables according to the formulas, originally designed by Gurr, provided below. A third indicator, POLITY, is derived simply by subtracting the AUTOC value from the DEMOC value; this procedure provides a single regime score that ranges from +10 (full democracy) to 10 (full autocracy). During periods of central authority interruption, collapse, or transition, the

DEMOC, AUTOC, and POLITY scores will be the assigned Standardized Authority Code. The fourth variable listed in this section, DURABLE, provides a running measure of the durability of the regime's authority pattern for a given year, that is, the number of years since the last substantive change in authority characteristics (defined as a 3-point change in the POLITY score).

2.1 DEMOC

Institutionalized Democracy: Democracy is conceived as three essential, interdependent elements. One is the presence of institutions and procedures through which citizens can express effective preferences about alternative policies and leaders. Second is the existence of institutionalized constraints on the exercise of power by the executive. Third is the guarantee of civil liberties to all citizens in their daily lives and in acts of political participation. Other aspects of plural democracy, such as the rule of law, systems of checks and balances, freedom of the press, and so on are means to, or specific manifestations of, these general principles. We do not include coded data on civil liberties.

The Democracy indicator is an additive eleven-point scale (0-10). The operational indicator of democracy is derived from codings of the competitiveness of political participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive using the following weights:

Authority Coding Scale Weight

Competitiveness of Executive Recruitment (XRCOMP):

(3) Election +2

(2) Transitional +1

Openness of Executive Recruitment (XROPEN):

only if XRCOMP is Election (3) or Transitional (2)

(3) Dual/election +1

(4) Election +1

Constraint on Chief Executive (XCONST):

(7) Executive parity or subordination +4

(6) Intermediate category +3

(5) Substantial limitations +2

(4) Intermediate category +1

Competitiveness of Political Participation (PARCOMP):

(5) Competitive +3

(4) Transitional +2

(3) Factional +1

This "institutional democracy" indicator follows a logic similar to that underlying the Polity I analyses. There is no "necessary condition" for characterizing a political system as democratic; rather democracy is treated as a variable. For example, the scale discriminates among Western parliamentary and presidential systems based on the extent of constraints on the chief executive. Charles de Gaulle as president of the French Fifth Republic operated within slight to moderate political limitations. Thus the early years of the Fifth Republic have lower Democracy scores than the United States or the Federal Republic of Germany, where constraints on the executive approach parity. Similarly, the

onset of "cohabitation" in France during the second phase of the first Mitterrand presidency is marked by a shift toward parity on the Executive Constraints scale and a concomitant increase in France's Democracy score.

If the composite indicator of institutionalized democracy is inappropriate for some conceptual purposes, it can be easily redefined either by altering the constituent categories and weights, or by specifying some minimum preconditions. **A mature and internally coherent democracy, for example, might be operationally defined as one in which (a) political participation is fully competitive, (b) executive recruitment is elective, and (c) constraints on the chief executive are substantial.**

2.2 AUTOC

Institutionalized Autocracy: "Authoritarian regime" in Western political discourse is a pejorative term for some very diverse kinds of political systems whose common properties are a lack of regularized political competition and concern for political freedoms. We use the more neutral term Autocracy and define it operationally in terms of the presence of a distinctive set of political characteristics.

In mature form, autocracies sharply restrict or suppress competitive political participation. Their chief executives are chosen in a regularized process of selection within the political elite, and once in office they exercise power with few institutional constraints. Most modern autocracies also exercise a high degree of directiveness over social and economic activity, but we regard this as a function of political ideology and choice, not a defining property of autocracy. Social democracies also exercise relatively high degrees of directiveness. We prefer to leave open for empirical investigation the

question of how Autocracy, Democracy, and Directiveness (performance) have covaried over time. An eleven-point Autocracy scale is constructed additively. Our operational indicator of autocracy is derived from codings of the competitiveness of political participation, the regulation of participation, the openness and competitiveness of executive recruitment, and constraints on the chief executive using the following weights:

Authority Coding Scale Weight

Competitiveness of Executive Recruitment (XRCOMP):

(1) Selection +2

Openness of Executive Recruitment (XROPEN):

only if XRCOMP is coded Selection (1)

(1) Closed +1

(2) Dual/designation +1

Constraints on Chief Executive (XCONST):

(1) Unlimited authority +3

(2) Intermediate category +2

(3) Slight to moderate limitations +1

Regulation of participation (PARREG):

(4) Restricted +2

(3) Sectarian +1

Competitiveness of Participation (PARCOMP):

(1) Repressed +2

(2) Suppressed +1

The logic of this "institutionalized autocracy" scale is similar to that of the institutionalized democracy scale, below, and it is subject to the same kinds of operational redefinition to suit different theoretical purposes. Note that the two scales do not share any categories in common. Nonetheless many polities have mixed authority traits, and thus can have middling scores on both Autocracy and Democracy scales. These are the kinds of polities which were characterized as "anocratic" and "incoherent" in the Polity I studies. As a group they proved to less durable than coherent democracies and autocracies (see Gurr 1974, Harmel 1980, Lichbach 1984).

2.3 POLITY

Combined Polity Score: The POLITY score is computed by subtracting the AUTOC score from the DEMOC score; the resulting unified polity scale ranges from +10 (strongly democratic) to -10 (strongly autocratic)."

Description of Construction of Gastil / Freedom House Democracy Variable from their web page

"Raw Points – The ratings process is based on a checklist of 10 political rights questions (grouped into three subcategories) and 15 civil liberties questions (grouped into four subcategories). Raw points are awarded to each of these questions on a scale of 0 to 4, where 0 points represents the smallest degree and 4 points the greatest degree of rights or liberties present. The only exception to the addition of 0 to 4 points per checklist item is Additional Discretionary Question B in the Political Rights Checklist, for which 1 to 4 points are subtracted depending on the severity of the situation. The highest number of

points that can be awarded to the political rights checklist is 40 (or a total of up to 4 points for each of the 10 questions). The highest number of points that can be awarded to the civil liberties checklist is 60 (or a total of up to 4 points for each of the 15 questions).

To answer the political rights questions, Freedom House considers to what extent the system offers voters the opportunity to choose freely from among candidates and to what extent the candidates are chosen independently of the state. However, formal electoral procedures are not the only factors that determine the real distribution of power. In many countries, the military retains a significant political role, while in others, the king maintains considerable power over the elected politicians. In addition, elected governments must exhibit levels of accountability, openness, and transparency between elections.

In answering the civil liberties questions, Freedom House does not equate constitutional guarantees of human rights with the on-the-ground fulfillment of these rights. Both laws and actual practices are factored into the ratings decisions. For states and territories with small populations, particularly tiny island nations, the absence of trade unions and other forms of association is not necessarily viewed as a negative situation unless the government or other centers of domination are deliberately blocking their establishment or operation.

Political Rights and Civil Liberties Ratings – The total number of points awarded to the political rights and civil liberties checklists determines the political rights and civil liberties ratings. Each point total corresponds to a rating of 1 through 7, with 1 representing the highest and 7 the lowest level of freedom.

Status of Free, Partly Free, Not Free – Each pair of political rights and civil liberties ratings is averaged to determine an overall status of "Free," "Partly Free," or "Not Free." Those whose ratings average 1.0-2.5 are considered Free, 3.0-5.0 Partly Free, and 5.5-7.0 Not Free. [In previous years, countries or territories with a combined average score of 5.5 could be either Partly Free or Not Free, depending on the total number of raw points that they received.]

POLITICAL RIGHTS AND CIVIL LIBERTIES CHECKLIST

POLITICAL RIGHTS

A. Electoral Process

1. Is the head of state and/or head of government or other chief authority elected through free and fair elections?

2. Are the legislative representatives elected through free and fair elections?

3. Are there fair electoral laws, equal campaigning opportunities, fair polling, and honest tabulation of ballots?

B. Political Pluralism and Participation

1. Do the people have the right to organize in different political parties or other competitive political groupings of their choice, and is the system open to the rise and fall of these competing parties or groupings?

2. Is there a significant opposition vote, de facto opposition power, and a realistic possibility for the opposition to increase its support or gain power through elections?

3. Are the people's political choices free from domination by the military, foreign powers, totalitarian parties, religious hierarchies, economic oligarchies, or any other

powerful group?

4. Do cultural, ethnic, religious, and other minority groups have reasonable self-determination, self-government, autonomy, or participation through informal consensus in the decision-making process?

C. Functioning of Government

1. Do freely elected representatives determine the policies of the government?

2. Is the government free from pervasive corruption?

3. Is the government accountable to the electorate between elections, and does it operate with openness and transparency?

Additional discretionary Political Rights questions:

A. For traditional monarchies that have no parties or electoral process, does the system provide for consultation with the people, encourage discussion of policy, and allow the right to petition the ruler?

B. Is the government or occupying power deliberately changing the ethnic composition of a country or territory so as to destroy a culture or tip the political balance in favor of another group?

NOTE: For each political rights and civil liberties checklist question, 0 to 4 points are added, depending on the comparative rights and liberties present (0 represents the least, 4 represents the most). However, for additional discretionary question B only, 1 to 4 points are subtracted, when necessary.

CIVIL LIBERTIES

D. Freedom of Expression and Belief

1. Are there free and independent media and other forms of cultural expression? (Note: in

cases where the media are state-controlled but offer pluralistic points of view, the survey gives the system credit.)

2. Are there free religious institutions, and is there free private and public religious expression?

3. Is there academic freedom, and is the educational system free of extensive political indoctrination?

4. Is there open and free private discussion?

E. Associational and Organizational Rights

1. Is there freedom of assembly, demonstration, and open public discussion?

2. Is there freedom of political or quasi-political organization? (Note: this includes political parties, civic organizations, ad hoc issue groups, etc.)

3. Are there free trade unions and peasant organizations or equivalents, and is there effective collective bargaining? Are there free professional and other private organizations?

F. Rule of Law

1. Is there an independent judiciary?

2. Does the rule of law prevail in civil and criminal matters? Are police under direct civilian control?

3. Is there protection from police terror, unjustified imprisonment, exile, or torture, whether by groups that support or oppose the system? Is there freedom from war and insurgencies?

4. Is the population treated equally under the law?

G. Personal Autonomy and Individual Rights

1. Is there personal autonomy? Does the state control travel, choice of residence, or choice of employment? Is there freedom from indoctrination and excessive dependency on the state?

2. Do citizens have the right to own property and establish private businesses? Is private business activity unduly influenced by government officials, the security forces, or organized crime?

3. Are there personal social freedoms, including gender equality, choice of marriage partners, and size of family?

4. Is there equality of opportunity and the absence of economic exploitation?"

A.3.2. Appendix for the Estimation Specification and Cross-Section Regressions

Table A.1	Variance Inflation Factor	
Variable	**VIF**	**1/VIF**
Latin America & Caribbean	8.74	0.114428
Sub-Saharan Africa	6.38	0.156816
% of pop. above 65	6.28	0.159222
Eastern Europe & Central Asia	5.83	0.171613
Log of Real GDP per capita PPP	5.08	0.196772
ERI	4.7	0.212778
East Asia & Pacific	3.65	0.274133
Middle East & North Africa	3.63	0.275334
Democracy	3.58	0.279216
Inequality	2.37	0.421323
South Asia	2.23	0.44919
North America	1.48	0.673583
Mean VIF	4.5	

Table A.2. Alternative Instrument for Income Inequality	**Dependent Variable**		
	Social Security and Welfare Expenditure		
	2SLS	***ERI First Stage***	***Inequality First Stage***
ERI	2.9680		
	***3.01**		
Inequality	0.0287		
	0.42		
Democracy	-0.2433	0.0433	0.1597
	-1.96	***2.64**	0.81
Log of Real GDP per capita PPP	-2.8871	0.8327	-1.8906
	***-3.37**	***6.51**	-1.09
% of pop. above 65	1.1701	-0.0242	0.5012
	***5.78**	-0.55	1.2
East Asia & Pacific	-0.4390	-0.1286	0.7202
	-0.24	-0.32	0.18
Eastern Europe & Central Asia	3.0584	-0.7247	1.5693
	*1.68	**-2.41	0.55
Middle East & North Africa	1.2196	-0.2309	4.4562
	0.59	-0.5	1.1
South Asia	-0.1193	-0.1579	-1.0926
	-0.06	-0.36	-0.2
North America	-1.8480	0.1256	3.4913
	-1.44	0.26	1.24
Sub-Saharan Africa	-2.0091	0.5401	3.0402
	-1.05	1.14	0.6
Latin America & Caribbean	4.1566	-1.4173	5.9880
	1.63	***-3.66**	*1.67
Past Inequality		-0.0010	0.7054
		-0.09	***6.01**
Ethnolinguistic Fractionalization		-0.8245	4.9224
		***-2.69**	1.43
Oil export		-0.0061	-0.0516
		-2.04	-1.61
Years after independence		0.0030	-0.0033
		*1.93	-0.2
cons.	20.3905	-6.3977	21.8364
	***3.13**	***-6.47**	*1.75
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.82	0.84	0.69

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %.

Table A.3. **Correlation Matrix of Instruments**

	ERI	*Inequality*	*Tropical*	*Ethnolinguistic Fractionalization*	*Oil export*	*Years after independence*
ERI	1					
Inequality	-0.1001	1				
Ethnolinguistic Fractionalization	-0.2515	0.1405	1			
Oil export	-0.1818	0.0404	-0.0079	1		
Tropical	-0.1639	0.5217	0.1668	0.1446	1	
Years after independence	0.1709	0.3691	-0.4202	-0.0677	0.2022	1

Table A.4. **Summary Statistics of Instruments in Cross-Section**

Variable	Obs	Mean	Std. Dev.	Min	Max
ERI	63	0.007299	1.025953	-1.7296	2.354461
Inequality	63	41.77068	8.348125	23.22143	63.65
Ethnolinguistic Fractionalization	62	0.326874	0.269083	0.0124	0.8898
Oil export	63	15.81835	22.23446	0.029759	91.07048
Tropical	63	0.285714	0.455383	0	1
Years after independence	63	69.20635	55.04548	10	200

A.5. Countries in Regressions

Code	Country	Years	Code	Country	Years
ALB	*Albania*	*95-98*	MAR	*Morocco*	84-99
ARG	*Argentina*	*84-01*	MDA	*Moldova*	96-02
AUS	*Australia*	*84-98*	MDG	*Madagascar*	88-99
AZE	*Azerbaijan*	*94-99*	MEX	*Mexico*	84-00
BGR	*Bulgaria*	*88-01*	MNG	*Mongolia*	92-01
BHS	*Bahamas*	*84-01*	MYS	*Malaysia*	85-97
BLR	*Belarus*	*92-01*	NIC	*Nicaragua*	90-94
BOL	*Bolivia*	*86-01*	NOR	*Norway*	84-99
BRA	*Brazil*	*84-98*	PAK	*Pakistan*	98-02
CAN	*Canada*	*84-01*	PAN	*Panama*	84-00
CHL	*Chile*	*84-01*	POL	*Poland*	94-01
CIV	*Ivory Coast*	*84-90*	PRY	*Paraguay*	84-93
CMR	*Cameroon*	*84-99*	ROM	*Romania*	84-01
COL	*Colombia*	*84-99*	RUS	*Russia*	94-01
CRI	*Costa Rica*	*84-01*	SEN	*Senegal*	84
CZE	*Czech Republic*	*93-01*	SGP	*Singapore*	84-01
DNK	*Denmark*	*84-00*	SLV	*El Salvador*	98-01
DOM	*Dominican Republic*	*84-00*	SVK	*Slovak Republic*	96-01
EGY	*Egypt*	*84-97*	SVN	*Slovenia*	93-01
EST	*Estonia*	*91-01*	SWE	*Sweden*	84-99
ETH	*Ethiopia*	*84-99*	THA	*Thailand*	84-01
GBR	*United Kingdom*	*84-99*	TTO	*Trinidad and Tobago*	93-95
HRV	*Croatia*	*84-01*	TUN	*Tunisia*	84-00
HUN	*Hungary*	*84-01*	TUR	*Turkey*	84-01
IDN	*Indonesia*	*94-01*	UKR	*Ukraine*	99-01
IRL	*Ireland*	*84-97*	URY	*Uruguay*	84-01
IRN	*Iran*	*84-00*	USA	*United States*	84-01
JAM	*Jamaica*	*92-01*	VEN	*Venezuela*	84-01
KAZ	*Kazakhstan*	*97-01*	ZAF	*South Africa*	84-99
LKA	*Sri Lanka*	*84-01*	ZMB	*Zambia*	84-88
LTU	*Lithuania*	*93-01*	ZWE	*Zimbabwe*	84-97
LVA	*Latvia*	*94-01*			

A.3.3. Appendix for the Panel Data Regressions

Table A.6. Panel Data Estimation: 2SLS without years after independence

	Dependent Variable Social Security and Welfare Expenditure		
	Random effect IV	***ERI First Stage***	***Inequality First Stage***
ERI	3.1293		
	****2.13**		
Inequality	0.0814		
	0.51		
Democracy	-0.1697	0.0347	0.1653
	****-2.07**	*****3.35**	1.49
Log of Real GDP per capita PPP	-2.4110	0.5960	0.4769
	****-2.31**	*****4.34**	0.32
% of pop. above 65	1.1659	-0.0443	-0.0356
	*****7.46**	-1.33	-0.1
East Asia & Pacific	0.6321	-0.7835	-3.6619
	0.26	***-1.68**	-0.73
Eastern Europe & Central Asia	4.8467	-1.5241	-3.8468
	***1.66**	*****-4.92**	-1.15
Middle East & North Africa	3.0967	-1.1768	3.3276
	1.08	****-2.45**	0.64
South Asia	2.0917	-1.1101	-2.2110
	0.64	***-1.88**	-0.35
North America	-1.7205	0.1123	3.3221
	-0.7	0.21	0.57
Sub-Saharan Africa	0.4345	-0.7534	4.4934
	0.14	-1.39	0.77
Latin America & Caribbean	5.0931	-1.9788	5.9471
	1.51	*****-5.1**	1.43
Tropical		0.0619	5.4022
		0.28	****2.26**
Ethnolinguistic Fractionalization		-0.9694	5.8481
		*****-2.51**	1.41
Oil export		-0.0053	-0.0322
		***-1.66**	-0.95
cons.	12.0950	-3.2156	33.2986
	1.43	*****-2.67**	*****2.57**
# of obs.	159	159	159
# of coun.	62	62	62
F Test (p-value)	0.00	0.00	0.00
R-squared	0.74		

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Countries have unequal number of observations. El Salvador does not have data on ethnolinguistic fractionalization. Hence, number of countries declines to 62. Number of observations declines also due to lack of data for oil export.

A.7. Breusch and Pagan Lagrangian multiplier test for random effects:

Social Security and Welfare Expenditure[code2,t] = Xb + u[code2] + e[code2,t]

Estimated results:

Var		sd = sqrt(Var)
Social Security and Welfare Expenditure	30.5972	5.531473
e	1.468747	1.211919
u	5.599781	2.366386

Test: Var(u) = 0
chi2(1) = 88.66
Prob > chi2 = 0.0000

A.8. Hausman Specification Test

Coefficients	(b) fixed	(B)	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
ERI	0.520761	0.51408	0.006681	0.217933
Inequality	-0.01577	-0.02136	0.005596	0.016513
Democracy	-0.01473	-0.0367	0.021974	0.027013
Log of Real GDP per capita PPP	-0.20853	-0.70292	0.494393	0.820651
% of pop. above 65	0.708934	1.055042	-0.34611	0.233162

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 3.48
Prob>chi2 = 0.6266

A.9. Summary Statistics Panel Data

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
Social Security and Welfare Expenditure	159	6.664672	5.568962	0.073963	21.59355
ERI	159	0.157238	1.094952	-2.20162	2.381169
Inequality	159	42.47868	8.031576	21.00599	64.095
Democracy	159	4.848113	5.909831	-9	10
Log of Real GDP per capita PPP	159	8.732927	0.740231	6.319616	10.15141
% of pop. above 65	159	7.895565	4.528823	2.501251	17.87484
East Asia & Pacific	159	0.125786	0.332656	0	1
Eastern Europe & Central Asia	159	0.238994	0.427816	0	1
Middle East & North Africa	159	0.069182	0.254566	0	1
South Asia	159	0.037736	0.191159	0	1
North America	159	0.012579	0.111799	0	1
Sub-Saharan Africa	159	0.069182	0.254566	0	1
Latin America & Caribbean	159	0.339623	0.475078	0	1
Tropical	159	0.283019	0.451889	0	1
Ethnolinguistic Fractionalization	159	0.274382	0.240112	0.0124	0.8898
Oil export	159	13.94715	19.64685	0.000478	94.08089
Years after independence	159	73.77358	58.26532	0	195

A.10. Correlation Matrix of Panel Data

		1	*2*	*3*	*4*	*5*
	Social Security and Welfare					
1	***Expenditure***	1				
2	***ERI***	0.3792	1			
3	***Inequality***	-0.352	-0.1275	1		
4	***Democracy***	0.3322	0.387	-0.0061	1	
5	***Log of Real GDP per capita PPP***	0.5239	0.6665	-0.1753	0.359	1
6	***% of pop. above 65***	0.8643	0.4386	-0.4586	0.4085	0.6315
7	***Tropical***	-0.4368	-0.1095	0.4121	-0.1155	-0.2592
8	***Ethnolinguistic Fractionalization***	-0.3233	-0.2251	0.0266	-0.3328	-0.3187
9	***Oil export***	-0.1779	-0.0907	0.0031	-0.1257	0.0808
10	***Years after independence***	0.0551	0.131	0.3698	0.292	0.1802

		6	*7*	*8*	*9*	*10*
6	***% of pop. above 65***	1				
7	***Tropical***	-0.4915	1			
8	***Ethnolinguistic Fractionalization***	-0.2196	0.229	1		
9	***Oil export***	-0.1147	0.2156	-0.0623	1	
10	***Years after independence***	-0.112	0.1455	-0.4408	-0.0507	1

A.11. Data on ERI in Panel

Country	***Half-decade***	***ERI***
Albania	1995	-0.9285514
Argentina	1995	-0.2695251
Argentina	1985	0.2294731
Argentina	1990	0.056902
Argentina	2000	0.0675341
Australia	1980	1.888108
Australia	1990	1.888108
Australia	1985	1.888108
Azerbaijan	1995	-1.339435
Bahamas	1995	0.8122606
Belarus	1995	-0.3533144
Belarus	2000	-1.072361
Bolivia	1985	-2.201623
Bolivia	2000	-0.5203894
Bolivia	1990	-1.656992
Bolivia	1995	-0.564694
Brazil	1985	0.8122606
Brazil	1990	0.6972132
Brazil	1980	0.5246421

Brazil	1995	0.0375197
Bulgaria	1990	0.2294731
Bulgaria	2000	-0.6025661
Bulgaria	1995	0.2294731
Cameroon	1980	-0.5138193
Cameroon	1995	-0.4906911
Canada	1980	2.381169
Chile	1990	-0.2635872
Chile	1995	0.5126638
Chile	2000	0.750628
Chile	1980	0.2407255
Chile	1985	-0.2635872
Colombia	1995	-0.4742264
Colombia	1985	0.3192003
Colombia	1990	0.3192003
Costa Rica	1995	0.7225334
Costa Rica	1985	0.7225334
Costa Rica	2000	0.101072
Costa Rica	1990	0.771099
Costa Rica	1980	0.7225334
Croatia	2000	0.3808328
Croatia	1995	-0.7323647
Czech Republic	1995	0.8122606
Czech Republic	1990	0.976614
Denmark	1985	2.381169
Denmark	1995	2.381169
Denmark	1990	2.381169
Denmark	1980	2.381169
Dominican Republic	1995	-0.2165609
Dominican Republic	1990	-0.2635872
Dominican Republic	1985	-0.2635872
Dominican Republic	1980	-0.2635872
Egypt	1990	-0.2553695
Egypt	1995	-0.567641
El Salvador	2000	-0.1711384
El Salvador	1995	-0.3017285
Estonia	2000	0.5460935
Estonia	1995	1.305321
Ethiopia	1995	-1.388001
Ethiopia	1980	-0.9361018
Hungary	1995	1.737555
Indonesia	1990	-1.211684
Indonesia	1995	-0.5855572
Indonesia	2000	-0.9424523
Iran	1980	-0.8463746
Iran	1990	-0.3398114
Iran	1995	0.5305799
Iran	1985	-0.8463746
Ireland	1985	1.596715
Ireland	1990	1.81526

Ivory Coast	1985	0.3192003
Jamaica	1995	0.3192003
Jamaica	2000	-0.1430438
Jamaica	1990	-0.4951628
Kazakhstan	2000	-0.808008
Latvia	1995	-0.2635872
Latvia	2000	-0.336399
Lithuania	2000	-0.2028619
Lithuania	1995	-0.2635872
Madagascar	1995	-0.3533144
Madagascar	1990	-0.1201994
Malaysia	1985	0.691202
Malaysia	1990	0.2294731
Malaysia	1980	1.305321
Malaysia	1995	0.572438
Mexico	1995	-0.1873484
Mexico	1990	-0.2635872
Mexico	1985	-0.5452678
Mexico	1980	-0.2635872
Mexico	2000	0.1034864
Moldova	1995	-0.7566475
Moldova	2000	-0.8901846
Mongolia	1995	0.1555141
Morocco	1980	-0.5138193
Morocco	1995	-0.2635872
Morocco	1990	-0.2635872
Nicaragua	1990	0.1397459
Norway	1990	2.114058
Norway	1985	2.099488
Norway	1995	2.036026
Norway	1980	2.381169
Pakistan	1995	-0.518335
Panama	1985	-1.922222
Panama	1995	-0.7760738
Panama	2000	-0.5502436
Panama	1990	-1.893083
Panama	1980	-1.922222
Paraguay	1990	-1.38424
Poland	2000	0.0418539
Poland	1990	1.219398
Poland	1995	1.270969
Romania	1985	-1.922222
Romania	1990	-0.4317598
Romania	1995	-0.7395449
Romania	2000	-1.113449
Russia	1995	-0.9725867
Russia	2000	-1.832495
Senegal	1980	-0.2635872
Singapore	1980	2.089775
Singapore	1985	1.793939

Singapore	1990	1.103654
Singapore	1995	1.249351
Slovak Republic	1995	0.7117975
Slovak Republic	2000	0.4116491
Slovenia	1995	0.8122606
Slovenia	2000	0.5451862
South Africa	1995	0.8309171
Sri Lanka	1990	-0.2635872
Sri Lanka	1995	0.0897727
Sri Lanka	1985	-0.2635872
Sri Lanka	2000	-0.0376012
Sri Lanka	1980	-0.2635872
Sweden	1985	2.381169
Sweden	1980	2.381169
Sweden	1990	2.381169
Thailand	1990	0.610594
Thailand	1985	0.4211881
Thailand	2000	-0.8901846
Thailand	1980	0.0278065
Thailand	1995	-0.0117717
Trinidad and Tobago	1990	-0.2635872
Trinidad and Tobago	1980	-0.7566475
Tunisia	1990	-0.2635872
Tunisia	2000	-0.5203894
Tunisia	1980	-0.2635872
Tunisia	1995	-0.2635872
Tunisia	1985	-0.2635872
Turkey	1990	0.2257857
Turkey	2000	-0.582022
Turkey	1985	-0.3539816
Ukraine	1995	-0.8463746
Ukraine	2000	-1.565421
United Kingdom	1990	1.888108
United Kingdom	1985	2.233251
United Kingdom	1995	1.830585
United Kingdom	1980	2.381169
United States	1980	2.09355
Uruguay	1980	-0.8463746
Uruguay	1995	-0.3704316
Uruguay	2000	-0.2635872
Uruguay	1985	-0.8463746
Venezuela	1985	-0.2635872
Venezuela	1980	-0.5512056
Venezuela	1995	-0.5452678
Zambia	1980	-1.967013
Zimbabwe	1990	0.3819215
Zimbabwe	1995	-0.0857454

A.3.4. Appendix for the Determinants of Efficiency of Redistributive Institutions

Table A.12. Determinants of ER; Extended Sample of Countries: Cross-Sectional Regressions

Dependent Variable
Efficiency of Redistributive Institutions

	OLS	*Robust*	*Weighted Least Square*	*OLS*
Inequality	-0.0218	-0.0253	-0.0213	-0.0206
	***-2.1**	****-2.24**	****-2.01**	****-2.12**
Democracy / Gastil	0.0728	0.0653	0.0694	0.0600
	****3.54**	****2.93**	****3.35**	****3.2**
Log of Real GDP per capita PPP	0.7007	0.6980	0.7123	0.7783
	****5.36**	****4.92**	****5.3**	****6.43**
% of pop. above 65	-0.0119	-0.0082	-0.0087	-0.0329
	-0.33	-0.21	-0.24	-0.98
East Asia & Pacific	-0.3970	-0.3245	-0.3574	-0.1113
	-0.96	-0.72	-0.89	-0.29
Eastern Europe & Central Asia	-1.1279	-1.1705	-1.1197	-0.7891
	****-3.73**	****-3.57**	****-3.86**	****-2.67**
Middle East & North Africa	-0.2521	-0.3268	-0.2598	-0.0302
	-0.52	-0.62	-0.54	-0.07
South Asia	-0.5147	-0.5198	-0.4691	-0.0333
	-1.03	-0.96	-0.93	-0.07
North America	-0.0927	-0.0630	-0.0933	0.2439
	-0.21	-0.13	-0.22	0.58
Sub-Saharan Africa	0.2662	0.2528	0.2970	0.7014
	0.55	0.48	0.62	1.51
Latin America & Caribbean	-1.2754	-1.2544	-1.2570	-1.3769
	****-3.28**	****-2.98**	****-3.33**	****-3.96**
Ethnolinguistic Fractionalization				-0.7806
				****-2.58**
Oil export				-0.0053
				***-1.75**
Years after independence				0.0031
				****1.96**
cons.	-4.6043	-4.4195	-4.7528	-5.1769
	****-3.92**	****-3.47**	****-3.92**	****-4.91**
# of coun.	67	67	67	66
F Test (p-value)	0.00	0.00	0.00	0.00
R-squared	0.79		0.80	0.84

Notes: (*) indicates significance at 10 %; (**) indicates significance at 5 %; (***) indicates significance at 1 %. Guatemala, India, Peru and Yemen are also included this extended sample. El Salvador is dropped due to lack of data on ethnolinguistic fractionalization in the last column.

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.

.