The Political Economics of Income Inequality, Government Expenditures and Redistribution – an Empirical Study Using Long-Term Panel Data

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Abstract

The thesis aims to further explain the relationship between income inequality, the welfare state and the level of redistribution. We use a dataset containing unbalanced panel data between 1900 and 2004 for 17 economies and use central government expenditures as a share of GDP and top marginal tax rates. Our results do not support the suggestion made by the Median Voter Theorem that changes in income inequality affect the level of redistribution.

Keywords: Median Voter, Income Inequality, Income Redistribution

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Table of Contents

List of Figures and Tables

1. INTRODUCTION

There is no full-scale explanation for the development, persistence and evolution of the welfare state or its level of redistribution. It is obvious that no single theory or mechanism is able to account for all the characteristics of the welfare state; the study of political economy has provided many theories for the structure and extent of the welfare state. The relationship between income and wealth inequality on one hand and redistribution and the welfare state on the other hand is of particular interest. This particular interest arises from the fact that a positive relationship between income inequality and redistributive policies, under standard assumption that these redistributive policies are negative for economic efficiency and growth, would imply a causal effect from income inequality to inefficient outcomes and hence lower economic growth. The assumed effect would therefore be that income inequality positively affects redistributive policies that in their turn negatively affect economic growth. Our thesis is primarily concerned with the first stage of this assumed causal relationship – the positive relationship between income inequality and a redistributive welfare state.

The most known reason for assuming such a positive relationship is probably the median voter theorem. In simple terms the theorem states that the median voter, having a smaller income than the average income will use his or her political power in elections to redistribute income to himself or herself. However, there has for long been a problem in proving or disproving the median voter theorem empirically. Milanovic (2000) shows for the first time in a panel data study a strong empirical support for the median voter hypothesis using necessary data for such a study. The Milanovic study has several strengths, such as using a consistent data set derived from micro-level data and accounting for country fixed-effects in their estimations.

There are several problems that arise from a general study of the concerned relationship. The problems generally lie in two major fields. Firstly, there are problems concerning the correct measurement of the income inequality variable and redistribution variables, primarily concerning a consistent measure between economies and time periods. Secondly, there are several problems in establishing causality in the direction of income inequality to redistributive policies, as both an intuitive and a theoretical analysis would render that causality runs both ways (Bergh, 2005). The first problem when empirically analyzing the structure and level of redistribution of the welfare state is to find a good measure or proxy that truly captures the size of the welfare state or redistribution (Bergh, 2005). Another difficulty

in analyzing both the welfare state and the income characteristics is to account for the problems of reverse causality and omitted variable bias that will undoubtedly arise in any empirical estimation.

Our thesis aims at further explaining the relationship between tax systems, welfare state arrangement and the developments of income inequality arising from theories in political economics or public choice theory. We seek to gather further knowledge of any causal relationship from income inequality to increased redistribution.

The relationship and causality behind taxation and income is difficult to fully estimate and prove due to the detailed structure and incomparability to tax systems. Hence, all studies that try to estimate the causes behind the structures of taxation of any tax system is likely to suffer from some type of difficulty when trying to account for differences between different tax systems and within a tax system over time.

This thesis makes use of a dataset containing unbalanced panel data between 1900 and 2004 in 17 economies originally compiled by Roine, Vlachos & Waldenström (2009). Our thesis builds on the analysis performed in the mentioned study where the association of income inequality with different factors such as government expenditures, trade openness and the expansion of financial intermediation. This thesis expands on the analysis be trying to see if there is empirical support for the mentioned causal relationship, primarily by looking at the lagged relationship between the income inequality variables and the proxies for redistribution. The main contribution of the thesis is that the expanded dataset enables us to study the hypothesis throughout a much longer period of time, than previously have been done. However, using this expanded dataset comes at some costs in terms of data quality and comparability.

The main disadvantage of using the large dataset is that the ideal, or most commonly used, measures of income inequality or redistribution are missing from the data. We are not able to use the most commonly used Gini coefficient as a measurement of inequality and hence we are not able to use the difference in the Gini coefficient before and after taxes and transfers. We believe that using the share of income earned by the top percentile and top decile as proxies for income inequality and using differences in government expenditures and marginal income tax rates as proxies for income inequality and redistribution respectively, amounts to a consistent analysis, especially when controlling for country-specific effects.

At a superficial analysis, our data support the hypotheses that income inequality affects redistributive measures. However, after controlling for country fixed effects and using lagged dependent variables in order to try to find an indication of causality, the data fails to support our hypotheses. Our results are therefore contrary to those found in Milanovic (2005) who finds a more limited dataset to support a similar hypothesis obtained by the median voter theorem, applied a smaller sample of economies. We see the need for further research on the area, probably using more comparable data when such data becomes available for a large time horizon, such as the one used in this thesis.

The rest of our thesis will be outlined as follows; section 2 will expand on previous research and the current state of knowledge, section 3 will introduce the data used and our choices of measures and proxies for income inequality and redistribution, section 4 will outline the econometric considerations we make and what remedies we use to address the econometric challenges confronted. In section 5 we will present the results of our estimations and finally, in section 6 we will discuss our results, draw possible conclusions from these and give suggestions for further research.

2. PREVIOUS RESEARCH AND THEORY

2.1 Income Inequality and its Determinants

Income inequality can be defined in different ways. Mostly the income of which inequality is measured is the income that comes from all factors of production and including rents (Perkins, Radelet & Radelet 2006). Furthermore it is common to measure both gross factor income, that is the untaxed proceeds from production factors and net income, which is income after taking taxes and transfers into account. Note,

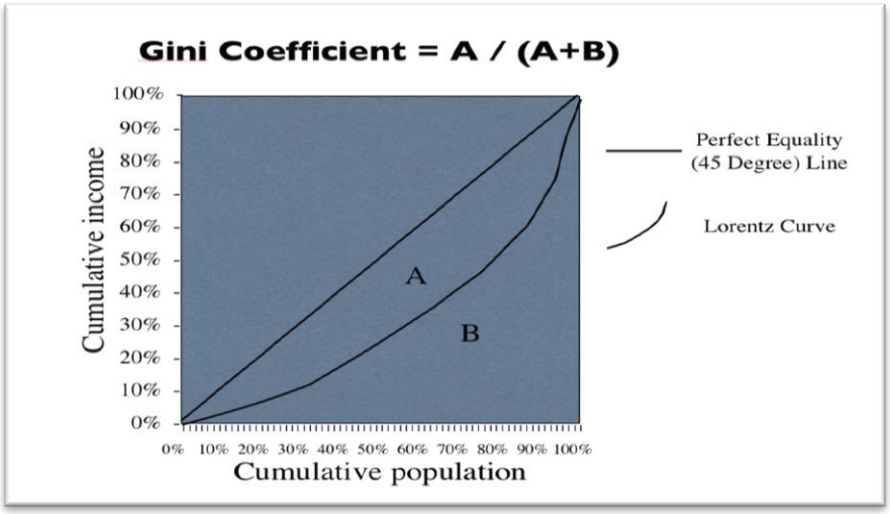

Figure 1: The Gini Coefficient

however that net income inequality does not take into account differences in consuming government spending, such as public health care or education. The most common method of measuring income inequality is measuring the inequality using the Gini coefficient. The Gini coefficient is measured as the proportion of an area measured above the Lorenz curve in a diagram where the Lorenz curve is the cumulative income earned as a function of the cumulative population. The advantage of measuring income inequality using the Gini coefficient is that any shift of income from a richer person to a less rich person in the economy will yield a decrease in the coefficient and hence a lower representation of income inequality. The main disadvantage of using the Gini coefficient is that it does not tell between which groups inequality lies, i.e. is the top percentile much richer than the rest of the top quintile or is the top quintile richer than the bottom four quintiles (Perkins, Radelet & Radelet 2006).

Traditional theories regarding the determinants of income inequality has focused on the role of technological change, globalization and social norms (Roine et al, 2009). However, there is an increasing strand of literature focusing on the role of economic policy in determining income inequality in the long run. Using an extensive panel dataset Roine et al. (2009) are

able to determine that there are several political factors that contribute in affecting the relative shares of income of the top decile of income earners (what they call the upper middle class) and the top percentile (what they call the rich). Most importantly, they show that the size of government as a share of GDP negatively affects the relative income shares of the upper middle class and the rich while high marginal taxes seem only to negatively affect the income share of the upper middle class while leaving the rich largely unaffected. This conclusion creates a challenge of reverse causality when trying to study the effect of changes in income inequality on policies such as marginal tax rates and government size that are known to affect redistribution (Bergh, 2005).

2.2 The Welfare State, Government Expenditures and Redistribution

The study of the welfare state and its redistributive effects may not primarily have been a concern for economics but rather a subject for sociology or political science. However, we believe that it is important to properly identify a consistent measure or proxy for the level of redistribution of the state. By construction, a welfare state creates some type of redistribution, either in form of direct income redistribution through taxes and transfers or other ways of redistribution (Bradley et al., 2003). Other ways of redistribution means taxation and the provision of public goods that enter the utility function of all agents proportionally to the spending or through direct provision of goods and services to other than persons taxed, i.e. through free health care to the economically disadvantaged (Bergh, 2005).

Traditionally, the quota of the Gini coefficient pre taxes and transfers divided by the same coefficient post taxes and transfers that has been used as a standard measure for the level of redistribution in an economy (Bradley et al., 2003). However, for the following reasons Bergh (2005) argues that this approach does not provide a consistent measure. Firstly, it does not distinguish between redistribution between individuals and intra-individual redistribution between different stages of the life cycle. Secondly, it does not take into account that tax and transfer have pre-tax and transfer redistributive effects, and that this affects labor supply decisions.

Furthermore, it does not take into account the fact that social insurance schemes crowd out market insurance schemes that might have been more or less favorable to high or low-income earners. Finally, the approach does not include the redistribution of earning capabilities that publically funded educational policy typically provides (Bergh, 2005).

Conventional political economy usually proclaims that more unequal societies have a tendency to make more redistribution and that more redistribution has adverse effects to growth. This was studied by Saint Paul & Verdier (1996) and they concluded that the above is not necessarily true. Instead, their data show that negative correlation between inequality and growth instead is a result coming from the fact that more unequal societies instead tend to redistribute less which in turn is essentially detrimental to growth.

In order to reduce poverty and inequality, the debate has often focused on two controversial questions; (1) whether social policies should be directed towards low-income groups or universal and (2) if benefits should be equal for all or income-related. Korpi & Palme (1998) address these questions and argue that social insurance establishments are of the most central importance for redistributive results.

Korpi & Palme's (1998) analysis of the results of different institutional types of welfare states on poverty and inequality indicate that institutional variances lead to unanticipated outcomes and generate a paradox of redistribution. They conclude that the more the state target benefits at the poor and the more anxious we are with creating equality via identical public transfers to all, the less likely we are to lower poverty and inequality.

In an attempt to explain how public sector size and democracy affect income inequality, Lee (2005) conducts a study based on unbalanced panel data for 64 developing and developed countries from 1970 to 1994. The results showed that a strong interaction between democracy and public sector development explains much of the within-country income inequality. It is also clear that public sector expansion translates into worse distributional outcomes in non-democracies or limited democracies because the state is more motivated to support the expansion of particular core industries or client populations in urban formal sectors through targeted taxation or transfer systems.

Furthermore, Lee (2005) concludes that a larger public sector size tends to lead to better distributional outcomes in fully established democracies because the democratic political mechanism enable the state establishments to be more receptive to the demands of low-income citizens and more dedicated to accomplishing better distributional outcomes.

In Bergh (2005), the author finds, as previously mentioned, a bias in the standard way to measure the welfare state redistribution, where it is normal to compare the income distributions before and after taxes and transfers. The paper highlights four different sources

of bias in the pre/post-approach, (1) welfare states use the public education system to influence the allocation of earnings abilities (2) labor supply replies vary between socio-economic groups and depend on taxes and transfers, (3) welfare states redistribute both between individuals and also between generations and (4) the redistribution within social insurance schemes rely on the relationship between risk and income.

When combining theoretical models, numeric simulations and bias caused by the above four factors, Bergh (2005) found results that show that the pre/post method is more biased for welfare states with flat rate welfare transfers and proportional taxation. It also shows that positively income related benefits have a clear redistributive effect and that public spending on lower education decreases inequality.

2.3 Income Taxes and Redistribution

Many countries strive to redistribute income to all of its citizens and one of the most used tools is to put taxation on a person's income and let the state spend the money for her. Although there are many ways for the government to collect economic means from its citizens, for this purpose, the income tax is the very best mean to do it (Allingham & Sandmo 1972).

When we look at studies performed in Germany, we find evidence that the nation's income tax substantially contributes to reduce economic inequality (Bach, Corneo & Steiner; 2012). During the decade of the 1990's, over 50 percent of Germany's tax revenues were contributed by the country's top decile of income earners. As the effective tax rate rose with income during the 1990's, a typical working class family paid around 9 percent in taxes while a family on the more economically benefitted side would pay almost 40 percent (Bach, Corneo & Steiner; 2012).

Even though income tax is very much used to redistribute income, the results of its redistribution effects have been questioned. Roine (2006) draws the conclusion that the richest part of a countries population always invests in tax avoidance. He finds that if taxes are low, the share of the population willing to spend money in order to avoid taxes will be small. However as the taxes go up and/or avoiding taxes becomes less costly, more people will use tax-avoiding activities. The countries government will therefore have to make a decision; increase tax rates and thereby withdraw larger tax payments from those willing to pay the tax

and at the same time drive more people into investing in tax avoiding activities, or lower the tax rate.

Tax evasion has been found to be very hard to escape. There has been found to be a positive correlation between a measure of income inequality and the underreporting rate for salary income. Findings made by Bloomquist (2003) suggest that policies intended to reduce income tax evasion may not achieve the preferred outcome in an environment of rising inequality and actually might have the opposite effect.

Tax avoidance can ultimately become so problematic that the taxes raised by the government in order to achieve a more economically equal society actually make society less equal. Denvil & Sabirianova (2010) show both theoretically and empirically that tax progressivity may actually increase inequality in countries with weak law and order.

Apart from not only making taxation counterproductive, tax avoidance has also been shown to have some distributional characteristics. One of these is labor supply response. Even if the tax rate is proportional to a person's income, everyone with pre-tax income above a certain level will pay a smaller share of their income in taxes compared to the rest of the population. This implies that introducing tax avoidance in a model of redistribution and voting might create a situation where post tax incomes is equalized for most people, but the very wealthiest are not affected to the same degree (Roine, 2006).

It is considered conventional wisdom in the public finance literature that personal income tax structures contain a trade-off between efficiency and equity (Ramsey, 1927) (Mirrlees, 1971). It is also believed that lump sum taxes distort the choices that people make in less dramatic ways and is more efficient than progressive tax schedules, however progressive taxes may be necessary in order to redistribute equity (Denvil & Klara Sabirianova 2010).

Denvil & Klara Sabirianova (2010) developed a theoretical framework showing that increased structural progressivity of the personal income tax structure reduced observed income inequality, and that the effect depended on the type of redistributive environment.

They found that personal income tax progressivity reduces observed inequality in reported gross and net income and showed that the negative effect on income inequality is particularly strong in countries with more developed democratic institutions. They also found a significantly smaller negative effect of personal income tax progressivity on true inequality, approximated by consumption-based measures of the Gini coefficient.

Their empirical analysis then implied that the tradeoff between equity and efficiency does in fact exist. This follows from the negative relationship that they identified between progressivity and income inequality. The result suggests that as taxes became more efficient, income inequality tended to increase (Denvil & Klara Sabirianova 2010).

Hungerford (2011) studied the changes in the distribution of income tax files in the U.S. between 1996 and 2006 and the relationship with the 2001 and 2003 tax cuts. The data showed that the inflation-adjusted after-tax income grew by 25 percent during these ten years. This income growth, though, was not evenly shared throughout the income distribution. Instead, inflation-adjusted income fell for those in the lowest income quintile (bottom 20 percent) and nearly doubled for the wealthiest 0.1% of tax filers. Accordingly, income inequality actually increased between 1996 and 2006 and this was true for both before-tax and after-tax income.

The 2001 and 2003 tax cuts, although reducing taxes for almost all tax filers, reduced taxes for high-income tax filers to a greater extent than for lower-income tax filers. Changes in tax policy also made a substantial contribution to the increase in income inequality, but even in the lack of tax policy changes, income inequality would to have increased. And although earning inequality increased between 1996 and 2006, changes in wages and salaries appear to have had little effect on the increase in overall income (Hungerford, 2011; Lee, 2005).

Voinea & Mihaescu (2009) studied the impact of the 2005 flat tax reform in Romania. They found that the higher the gross wage is, the higher the flat tax gains were. Results drawn from the data indicate that the higher the income level is, the lower the income elasticity of consumption is. One possible explanation according to Voinea & Mihaescu (2009) is that the lowest income families are unable to afford to save as their income is barely enough to meet the basic needs, and once their income grows, they start saving a higher fraction of it.

In order to increase redistribution of wealth, the paper suggests that the flat tax is replaced by a progressive tax, with two or three brackets, with sizeable differences between them. This is suggested to reduce inequality, and would leave more money to the poorest families, helping them also to access credits. The paper concludes by recommending not to increase VAT, neither to increase the rate of the flat tax since, according to the authors, these two measures would also increase inequality. Instead they recommend the replacement of the flat tax by a progressive tax system, serving two goals: introducing an automatic stabilizer for prices and profits, and lowering income inequality (Voinea & Mihaescu, 2009)

2.4 The Median Voter Theorem

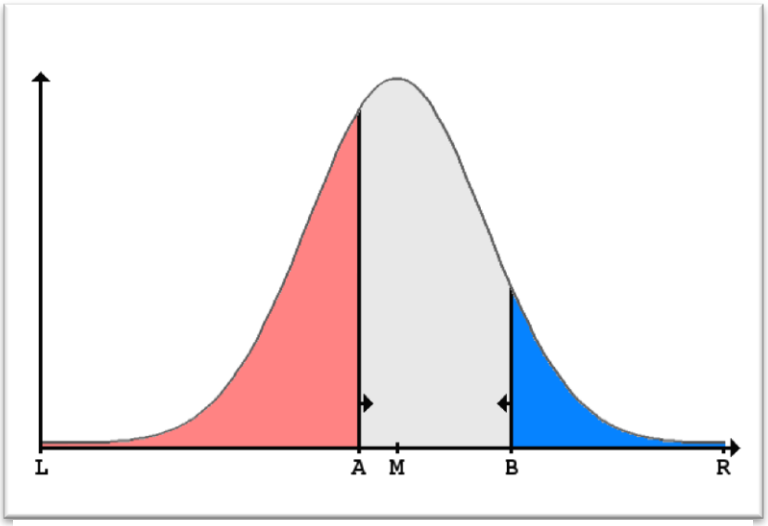

Figure 2: The Median Voter Theorem Source: Hollar (2013)

Although the median voter theorem may appear simple, the model is by no means obvious. Voting, as a form of decision-making, has been used a long time. It was, however, not until Black (1948) wrote his work on majority voting that the median voter theorem saw the light o f. The median voter theorem has since become an important tool in public choice theory (Congleton, 2002).

To welcome the logic of the median voter model, think of a society using representative democracy where voters elect policy makers rather than policies.

Party L and party R is to be found on each side of the political axis. In the model we have three voters; A, B and M. The voters will cast their vote for the party closest to their most ideal policy. Voter A will benefit more if Party L wins the election, voter B on the other hand will benefit more from politics of party R. This means that the party that wins the vote of voter M will eventually win the election. This will launch a race towards the median voter (M) and the party closest to the median voter is also the closest to the votes of more than half of the electorate (Congleton, 2002).

We will now try to present an intuitive description of the median voter theorem. Think of a setting where three agents: A, B and C are to decide upon a market to buy a good that is to be purchased jointly. Agent A favors a market where a good can be ordered for the sum X, B prefers a slightly more expensive good found at a market for the price 2X, and C wishes to purchase an even more expensive good at a third market for the price 4X. In this case B can be said to be the median voter. This is because the same number of individuals prefers a more

expensive good than B, as prefer a less expensive good than B. Let us assume that each member of the group of agents prefer a good with prices closer to their preferred good to ones that are farther from it. Let us assume that their choice of good is determined by majority voting in pair-wise comparisons between the available alternatives and that the good that wins a majority of pair-wise comparisons will be purchased. Now consider some majority decisions over the alternative markets described above:

Figure 3: Market Decision

OPTIONS	PATTERN OF VOTES	RESULT
2X vs. 4X	A: 2X B: 2X C: 4X	2X
X vs. 4X	A: X B: X C: 4X	X
X vs. 2X	A: X B: 2X C: 2X	2X

The weak form of the median voter theorem says that the median voter always casts his or her vote for the policy that is adopted. You can see that B always votes in favor of the outcome that eventually wins the election. Please also note that B's preferred 2X good will defeat the other two in the decision. If there is a median voter, her preferred policy will defeat any other alternative in a pairwise vote. Therefore, once the median voter's favored outcome is reached, it cannot be defeated by another in a pairwise majoritarian election. The strong form of the median voter theorem pronounces that the median voter always gets her most preferred policy (Congleton, 2002).

2.4.1 The Median Voter Theorem Applied to Income Redistribution

In Meltzer & Richard (1981) a general equilibrium theory of redistribution of income from a one-factor economy is developed. In their model the size of government measured by the share of income redistributed is determined by majority rule. In their model voters rationally anticipate the incentives and disincentives caused by redistribution and adapt their votes thereafter. Their model assumes that voters have incentives for both consumption and leisure, that their income is determined by their income from work and by a flat rate subsidy to all voters, and that their income from work is determined by their given level of productivity, their choice of time spent working and the price of labor to which they are price takers. They assume that all proceeds from taxation are spent on the flat rate subsidy to all voters. In the first stage of the model, the voters only maximize their utility through choosing the time spent working as compared to time spent to leisure.

In the second stage of the model Meltzer & Richard (1981) adapt this model to a decision on the tax rate and subsidy rate by majority rule. They use an additional finding by Roberts (1977) that if the ordering of incomes is independent from the choice of tax and subsidy rates, the rational choice of the tax rate and the subsidy is ordered inversely by income. Combining this conclusion with the first stage of the model, they predict that for all median incomes below the average incomes, there will be strictly positive tax and subsidy rates and that these rates increases as the difference between the average income and the income earned by the median voter.

Milanovic (2000) uses 79 observations from household budget surveys from 24 countries in order to apply the median voters' theorem on income redistribution. Although not the first to investigate the correlation between the median voter theorem and redistribution of income (Alesina & Perotti 1996), Milanovic was the first to use factor income distribution in the model. This type of data was until recently unavailable and without this data it is impossible to calculate the extent of redistribution (Alesina & Perotti 1996). Therefore, neither the extent of redistribution of the median voter hypothesis, nor the mechanism behind it has been tested directly. One can assume that greater inequality is related to lower growth numbers, due to the greater redistribution that is requested by the median voter when income distribution is less equal. Despite this, Milanovic (2002) finds that countries with greater inequality of factor income redistribute more to the poor.

2.5 Key Questions of the Thesis

Based on the following research, we pose the following research hypotheses for our thesis:

H1: Changes in income inequality positively or negatively affect the level of redistributive policies.

H2: Changes in the income share for the rich affect redistributive policies differently than changes in the income share for the upper middle class.

H3: Changes in the income share earned by the rich as a proportion of the total income share earned by the rich and the upper middle class affect the level of redistributive policies.

3. DATA

In trying answer our hypothesis, there are several factors to weigh in when choosing the data. Generally, there are problems on finding income data that does not suffer from these problems

to one extent or another. Firstly, much data suffers from inconsistency, either in between measured economies or between observations across year (Deininger & Squire, 1996).

Another tradeoff that will easily be faced when studying income inequality is that between the availability of data and that of high-quality data and good measures. As Deininger & Squire (1996) argues, the best measure for income inequality is using the Gini coefficient complemented by income shares of population quintiles. However, finding consistent data of that measure over several periods of time in different countries is increasingly difficult as one tries to expand to newer periods of time and to more studied economies.

3.1 Sources

We use the dataset compiled by and used in Roine et al. (2009) covering income data for 17 countries for time periods between 1900 and 2004. The dataset also contains relevant variables for the identified countries. We believe the main advantages in using this dataset are the following:

- Panel data over a long period of time has the advantage to be independent on a few years in which there might be a short trend in any variable that is hard to identify.

- The data is available for several countries in different stages of economic development; that feature very different political systems; different levels of democratic accountability.

- The data features income inequality data that gives information on the relative shares of the upper middle class and the rich and we will hence be able to study the different dynamics that this data might pose.

There are also concerns we must address when using this data. Firstly, the data on income inequality differs from the variable most commonly used, which is the data on the Gini coefficient for the studied countries. The main issue of not using this variable is that our data on income inequality intuitively does not provide for a comprehensive measure of the entire income inequality. Furthermore, not using the Gini measure has the drawback of losing comparability with other studies with similar intent such as Milanovic (2000).

One known issue is the consistency of data across time and between studied countries. While using panel data the problem of inconsistency in gathered data between countries could be addressed, there still remains a problem if data is inconsistent between different time periods. Especially, when trying to draw inference on tax levels, there might be an unobserved effect

between marginal tax rates and reported income that is caused by differences in tax avoidance and tax evasion during different tax levels.

3.2 Choice of Variables

Table 1: Variables

Variable	Variable definition	Source
Top1	Share of total income earned by those with the 1% highest incomes (“The Rich”)	Roine et al. (2009)
Top10–1	Income share of top 10% less share of top 1% (“The Upper Middle Class” minus “The Rich”)	Roine et al. (2009)
Top1/10	Top1/Top10–1 (“The Rich” relative to “The Upper Middle Class”)	Roine et al. (2009)
Top01/1	Income share of top 0.1% divided by income share earned by the rest of top 1% (“The Very Rich”)	Roine et al. (2009)
GOVSPEND	Central government expenditure divided by GDP	Mitchell (1998)
Margtax	Top marginal tax rate: Margtax2 except for Germany, Japan, Sweden, UK and US where it is calculated for incomes. 5 × GDPpc	Roine & Waldenström (2009)
Margtax2	Top marginal tax rate (statutory top rates)	Roine & Waldenström (2009)
Political Index	Political Index (Democracy – Autocracy)	Roine et al. (2009)
Population	Population	Bolt & van Zanden (2013)
Democracy	Democracy Index	Roine et al. (2009)
Autocracy	Autocracy Index	Roine et al. (2009)
GDP	Gross Domestic Product	Bolt & van Zanden (2013)
GDPpc	Gross Domestic Product per capita	Bolt & van Zanden (2013)

Table 2: List of Countries and Variables Included				
	Top1	**Top10**	**CGOV**	**TopMTAX**
Argentina	Y	N	Y	Y
Australia	Y	Y	Y	Y
Canada	Y	Y	Y	Y
China	Y	Y	Y	Y
Finland	Y	Y	Y	Y
France	Y	Y	Y	Y
Germany	Y	Y	Y	Y
India	Y	N	Y	Y
Ireland	Y	Y	Y	Y
Japan	Y	N	Y	Y
Netherlands	Y	Y	Y	N
New Zealand	Y	Y	Y	Y
Spain	Y	Y	Y	Y
Sweden	Y	Y	Y	Y
Switzerland	Y	Y	Y	N
United Kingdom	Y	Y	Y	Y
United States	Y	Y	Y	Y

3.2.1 Dependent Variables

We believe there is justification to use GOVSPEND as a proxy variable for redistributive policies. We make this decision based on the empirical and theoretical literature linking increases in government expenditures with increased redistribution through welfare states arrangements, both through transfer schemes and through expenditures that are used for welfare arrangements and public goods in general. There is a concern over the comparability of data across the countries in our sample as the redistributive character of central government spending may be significantly different across countries. The use of fixed effects (within) estimation methods could however be used to correct for the lack of comparability between countries. There is also some minor concern for the comparability between time periods in the same country. I.e. the expenditures of public schools in Sweden shifted from the central government to local governments in the 1990's. A drop in expenditure after such as decision should not be associated with a drop in the redistributive effect of the provision of public schools (Roine et al, 2009).

There is significant empirical literature suggesting that marginal taxes increase redistribution and we do therefore believe there is justification for using the top marginal tax rate as a proxy for redistribution. Due to differences in tax codes and the scope for tax avoidance and tax evasion, there is obviously limited comparability across countries, but as with the use of

government expenditures as a proxy for redistribution, there is a remedy through the use of fixed-effects (within) estimation methods. When choosing what tax rate to include as our proxy variable, there are advantages in using the Margtax1 variable before the Margtax2 variable for two reasons. Firstly, the very high tax rates may in fact only affect a very small amount of income earners and may not represent a good measure of redistribution. Secondly, through the possibility of tax avoidance these rates may be rather theoretical than actual since the possibility will reduce any actual marginal tax rate paid. From know, Margtax1 will be denoted as TopMTAX.

None of these proxies are perfect as a measurement of redistribution but we believe that using both the TopMTAX and GOVSPEND variables, we could draw sufficient inference from the data to answer the hypothesis properly.

3.2.2 Independent Variables

In lack of having data on the Gini coefficient we use the income earned by the top percentile and the top decile as a proxy for income inequality. The main disadvantage of using these variables is that they do not properly measure the entire inequality of a concerned economy. I.e. this data tells us nothing about income differences between middle and working classes. Nor does it say anything about the exact scope of redistribution suggested by the median voter hypothesis. Nevertheless, we believe the variables provide a good indication of income inequality and having access to both the share of income earned by the upper decile and the upper percentile enables us to answer hypothesis 3 properly.

The data on income shares is based on incomes pre-taxes. There is a benefit of using pre-tax income shares as these incomes are those that are expected to be redistributed through the process that our independent variables try to measure. The data is collected from tax filings from incomes and includes both incomes from labor and capital. There is a disadvantage using tax data as tax filings may not always be accurate due to tax evasion. The level of tax evasion could differ both between the studied countries and across time periods. The issue of tax evasion hence creates some concerns over data consistency (Roine et al., 2009).

3.2.3 Control Variables

There is a known relationship between income inequality and supply side chocks (Deininger & Squire, 1996) and between long-term changes in GDP (Galor & Zeira, 1993). There is also a known relationship between governments spending and macroeconomic shifts such as supply shocks (Roubini & Sachs, 1993). We do therefore include the GDPpc as a control

variable in order to control for a variable that would otherwise had been an important concern for endogeneity reasons.

Since the theoretical foundation of our thesis is based on the existence of some type of democratic institution through which voters can choose the level of redistribution, we include a Political index as a control variable. There is also empirical evidence that democratic societies redistribute differently from autocratic societies (Lee, 2005). The index is constructed as a combination of a democracy score subtracted by an autocracy score. There may of course be reasons to question the consistency for this index for reasons primarily discussed in political science. They are nevertheless common in studies within economics (Barro, 1996).

3.3 Summary Statistics

Table 3: Summary Statistics

Variables	SD	Min	Max	N	Mean
Top10	5.878	18.50	53.31	807	32.71
Top1	4.552	2.700	28.84	1,079	10.33
Population	185,466	807	1.311e+06	2,626	83,456
GDP	790,693	3,469	8.431e+06	2,486	345,49
GDPpc	5,979	438.5	29,037	2,486	7,246
GOVSPEND	0.0568	0.0110	0.488	1,685	0.151
TopMTAX	0.132	0.220	0.877	612	0.528
Democracy index	3.473	0	10	2,181	7.735
Autocracy index	2.585	0	9	2,181	1.392
Political index	6.011	- 9	10	2,236	6.199

Table 4: Correlation Table Part 1						
	Country ID	**Year**	**Top10**	**Top1**	**Top10-Top1**	**GOVSPEND**
Country ID	1.0000					
Year	- 0.028	1.0000				
Top10	0.0961	- 0.027	1.0000			
Top1	0.1072	- 0.085	0.8544	1.0000		
Top10-Top1	0.0679	0.0240	0.9127	0.5674	1.0000	
GOVSPEND	0.2425	0.4494	- 0.266	- 0.296	- 0.189	1.0000
TopMTAX	- 0.127	- 0.160	- 0.323	- 0.401	- 0.197	0.1661
Population	- 0.063	0.2221	- 0.218	- 0.141	- 0.235	- 0.277
GDP	0.2959	0.2667	0.2863	0.3956	0.1426	- 0.152
GDPpc	0.1689	0.6364	0.3027	0.2819	0.2579	0.5052
Democracy	0.2498	- 0.165	0.2783	0.2651	0.2325	0.2715
Autocracy	- 0.206	0.1945	- 0.332	-0.2954	- 0.293	- 0.275
Political Index	0.2346	- 0.178	0.3026	0.2798	0.2595	0.2756

Table 5: Correlation Table Part 2							
	TopMTAX	**Population**	**GDP**	**GDPpc**	**Democracy**	**Autocracy**	**Political Index**
Country ID							
Year							
Top10							
Top1							
Top10-Top1							
GOVSPEND							
TopMTAX	1.0000						
Population	- 0.244	1.0000					
GDP	- 0.418	0.5549	1.000				
GDPpc	- 0.204	- 0.294	0.371	1.0000			
Democracy	0.0105	- 0.892	- 0.27	0.4309	1.0000		
Autocracy	- 0.093	0.9486	0.295	- 0.441	- 0.961	1.0000	
Political Index	0.0444	- 0.923	- 0.28	0.4392	0.9938	- 0.986	1.0000

Table 6: Correlation Table First Differences						
	ΔTop10	**ΔTop10-Top1**	**ΔTop1**	**ΔGOVSPEND**	**ΔTopMTAX**	**ΔGDPpc**
ΔTop10	1.0000					
ΔTop10-Top1	0.7744	1.0000				
ΔTop1	0.8462	0.3182	1.0000			
ΔGOVSPEND	- 0.092	0.0114	- 0.148	1.0000		
ΔTopMTAX	- 0.184	- 0.096	- 0.195	0.0592	1.0000	
ΔGDPpc	0.0325	- 0.139	0.1665	- 0.422	- 0.035	1.0000

4. ECONOMTERIC CONSIDERATIONS

4.1 Omitted Variable Bias

Generally, when trying to establish a causal relationship between a proxy for income redistribution and income inequality measures there will be several issues that could impede a correct estimation or lead to erroneous conclusions. A naïve approach to estimating such a relationship would be by estimating the following regression using the ordinary least squares (OLS) method:

$$R = \beta_0 + \beta_1 Im_{i,t} + \varepsilon_{i,t} \quad [1]$$

In this equation *R* is the measure or proxy of redistribution and *Im* is the measure of income inequality. The approach above suffers from several problems, most notably those of omitted variable bias and reverse causality. Much previous research has shown these two general problems to be a large concern when estimating a relationship between income inequality and redistribution (Bergh, 2005; Milanovic, 2000). A model that can be used to remedy some of these concerns is the fixed effects model as presented below.

$$R_{i,t} = \beta_0 + \beta_1 Im_{i,t} + \boldsymbol{\beta x_{i,t}} + \boldsymbol{\delta y_i} + \boldsymbol{\gamma z_t} + \varepsilon_{i,t} \quad [2]$$

In this model *Im* represents the income inequality measure, *X* represents a number of known and measured control variables, $\boldsymbol{y_i}$ represents a vector of unknown and/or immeasurable variables that varies between countries but not between different years. An example of such a variable is the structure of the welfare state and it redistributive effectiveness. Furthermore, $\boldsymbol{z_t}$ represents a vector of unobserved and or immeasurable effects that varies between time periods but not between countries. One such effect might be the overall spending associated with a specific time period or technological developments.

There are generally two ways of estimating a model including unobserved variables for different countries and years – the fixed effects regression and the first differencing approach. The fixed effects regression model contains certain assumptions in order to produce consistent results, most notably that the idiosyncratic errors display no serial correlation. Using a long panel with few studied countries, this assumption is very likely to be violated (Wooldridge, 2002). Our main approach will thus be to estimate the following equation:

$$\Delta R_{i,t} = \beta_0 + \beta_1 \Delta Im_{i,t} + \boldsymbol{\beta} \Delta \boldsymbol{x_{i,t}} + \boldsymbol{\delta y_i} + \boldsymbol{\gamma z_t} + \varepsilon_{i,t} \quad [3]$$

We choose to primarily use the generalized least-squares (GLS) procedure for this estimation. As a complement, we use a fixed effects regression using the first-differenced variables. Since first-differenced data on an annual basis may be somewhat noisy, we also estimate the model above using a moving-averages model of five years as a complement to the estimations using non-moving averages model of the first-differenced data. For consistency reasons, we also process the first-differenced data in fixed-effects (within) methods. This is primarily not done to remove unobserved effects but due to our concerns of data comparability across countries.

4.2 Multicollinearity

The problem with multicollinearity arises when two or more of the independent variables are highly correlated with each other. Multicollinearity increases standard errors and hence decreases the credibility of the coefficients. There is not a set rule for what level of multicollinearity that poses a problem (Wooldridge, 2002). Many experts have agreed on a rule of thumb of 0.8. Our data shows that there is strong correlation between the Top1 and Top10-1 variables measuring the income shares of the top percentile and the top decile apart for the top percentile of the population respectively. This strong correlation remains in the first-differenced data. There is hence a reason for some concern for multicollinearity in our data. We will use specifications where both the Top1 and Top10-1 variables are included and where one of those are excluded. By this approach, we will return to any remaining concerns should the different specifications produce inconclusive results.

4.3 Heteroskedasticity

A basic assumption in an OLS and GLS regression is that of homoskedasticity. This implies a constant variance of the error term. If the assumption of homoskedasticity is violated, the regression is heteroskedastic and the coefficients become biased (Wooldridge, 2002). By using robust standard errors available for both ordinary least squares (OLS) procedures and

generalized least squares procedures (GLS), we can ensure that that inference drawn is correct. As we have no reason to believe there is homoskedasticity in our sample, we will use robust standard errors consistently throughout our study.

4.4 Reverse Causality

As previously mentioned, reverse causality is of a particular concern in this field. The data in our study was used in Roine et al. (2009) to establish a long run tendency that increases in government spending do reduce the share of income earned by the upper middle class and that higher marginal taxes will negatively affect both the income share held by the top percentile and the top decile. They argue that the government spending has a causal and marginal tax rates has a causal effect among other variables on the income shares earned by the groups mentioned above. They do however clarify that reverse causality cannot be completely ruled out. This fact, together with the theoretical and empirical findings in previous studies causes us to believe that causality of the observed variables does in fact run both ways.

A major difficulty for the econometric set-up will thus be to ensure that any significant correlation in the study should be able to interpret as a causal effect from the income inequality variables to the redistribution proxies of government spending and marginal tax rates. Wooldridge (2002) argues that including a lagged dependent variable can increase the ability to interpret the relationship between two variables as causal. We argue that this interpretation is firstly applicable to our study and that using a lagged variable also makes theoretical sense in our study. Any political process can be expected to take time and although models such the one used in Meltzer & Richard (1981) assumes simultaneous action and determination of the size of government expenditures, taxation and levels of redistribution it can be assumed that political processes take some time and that there is duration between the time changes in income inequality are observed and before they can in fact affect redistribution, the level of expenditures or changes in marginal tax rates. We choose a lagged period of four years. According to Box-Steffensmeier & Jones (1997) it is hard to exactly define a reasonable time horizon for a political process as used in our study. We believe that four years is a reasonable time span to use for the study for the following reasons. Firstly, our long-range dataset enables us to use some generosity in having a generally long time span. Secondly, a time horizon of four years creates a fairly large possibility that there will have occurred an election between any of those dates, although actually gathering information on those elections is beyond the scope of this thesis. However, we do not believe elections are essential for this process to take place as political decision-makers adopt policies based on

expectations of voter preferences and their incentives to be re-elected. Thirdly, when using the moving averages approach a time horizon of four years will ensure no observation will contribute to both the dependent a lagged independent variable.

Despite the efforts of lagging the dependent variables, we cannot of course rule out the existence of reverse causality should the estimations render statistically significant correlations. One main reason for the concern of reverse causality to remain is the fact that is empirical support for long-run tendencies in the opposite direction.

4.5 Serial Autocorrelation

Serial autocorrelation in the error term is a known problem when using panel data of long time series.

Assume the model below:

$$\Delta R_{i,t} = \beta_0 + \beta_1 \Delta Im_{i,t-4} + \boldsymbol{\beta}\Delta \boldsymbol{x_{i,t}} + \boldsymbol{\delta y_i} + \boldsymbol{\gamma z_t} + \varepsilon_{i,t} \text{ [4]; } \varepsilon_{i,t} = \rho \varepsilon_{i,t-1} + \sigma u_{i,t} \text{ [5]}$$

The model above has an autoregressive term of order 1, called an AR(1) term. Estimating the model above would render biased estimates of our β-parameters if one does not account for the autocorrelation in some way (Wooldridge, 2002). Several models of GDP growth and government spending include an autoregressive term. This can be believed to be especially prevalent in data that is not first-differenced as above. We believe, however, the possibility of such serial autocorrelation to be of concern also in the model above, especially in the cases we estimate the model using moving-averages of the data. We will therefore use a GLS estimation method that does estimate the first-order autoregressive term, that is it will provide an estimate of the ρ-term in the model above. In our fixed effects model using the first-differenced data, we will use a method for the existence of first-order autocorrelation.

Autocorrelation may still be a concern as there might be higher-order autocorrelation in our data. It is more difficult to estimate a GLS method or OLS model for panel data correcting for higher-order autocorrelation but we believe it is necessary to mention this, as a reason for caution.

4.6 Unbalanced Panel

As previously mentioned our data is of an unbalanced panel. All of our estimation methods allow for automatic correction in the estimators in the existence of panel data. This correction is automatically done by our statistical package (StataCorp, 2013). One remaining concern is

the fact that some of the dependent variables are not observed across certain countries. Different specification will therefore include more studied countries, depending on whether the Top10-1 variable is used in the specification as data is missing on that variable from many countries. Should the results differ from different specification, there is a risk that the results must be considered to be inconclusive.

4.7 Specifications

Based on the considerations above, we will estimate the following specifications.

$$\Delta GOVSPEND_{i,t} = \beta_0 + \beta_1 \Delta Top10 - 1_{i,t-4} + \beta_2 \Delta Top1_{i,t-4} + \beta_3 \Delta GDPpc_{i,t} + \beta_4 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [6]$$

$$\Delta GOVSPEND_{i,t} = \beta_0 + \beta_1 \Delta Top10 - 1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [7]$$

$$\Delta GOVSPEND_{i,t} = \beta_0 + \beta_1 \Delta Top1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [8]$$

$$\Delta GOVSPEND_{i,t} = \beta_0 + \beta_1 \Delta Top10/Top1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [9]$$

$$\Delta MARGTAX_{i,t} = \beta_0 + \beta_1 \Delta Top10 - 1_{i,t-4} + \beta_2 \Delta Top1_{i,t-4} + \beta_3 \Delta GDPpc_{i,t} + \beta_4 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [10]$$

$$\Delta MARGTAX_{i,t} = \beta_0 + \beta_1 \Delta Top10 - 1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [11]$$

$$\Delta MARGTAX_{i,t} = \beta_0 + \beta_1 \Delta Top1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [12]$$

$$\Delta MARGTAX_{i,t} = \beta_0 + \beta_1 \Delta Top10/Top1_{i,t-4} + \beta_2 \Delta GDPpc_{i,t} + \beta_3 Political\ Index_{i,t} + \varepsilon_{i,t} \quad [13]$$

The estimations using specifications 6 and 10 are used to test hypotheses 1 and 2. Under the null hypothesis of H1, β_1 and β_2 are both zero. Under the null hypothesis of H2, both β_1 and β_2 are statistically different from zero and their values are of different magnitude or one of the estimated coefficients are statistically different from zero while the other is not.

Likewise, the estimations using specifications 7,8, 11 or 12 are used to test hypotheses 1 and 2. The same expectations of the character and the statistical significance of the estimated coefficients apply to these specifications, but these specifications are to a large extent used to address the concerns of multicollinearity.

The estimations using specifications 9 and 13 are used to test hypothesis 3. Under the null hypothesis of H3, β_1 is zero. In order to find any strong support for any of the hypotheses, we

expect that the coefficients from both the estimations using GOVSPEND and MARGTAX as dependent variables to be statistically significant and to have the same sign.

We will however begin by presenting the results using a naïve approach, that is estimating the equations using the control variables, but without using the first-differenced variables, the lagged dependent variables or the control for first-order autocorrelation. We do this in order to see if the econometric tools actually make a difference for the conclusions of our study. Under the estimated equations, the same assumptions on the significance and the signs of the estimated coefficients will remain the same as previously stated, although the results will, for reasons of consistency, not be used to draw conclusions on the hypotheses of the thesis.

The use of a linear specification is by no means given although it is supported by the model in Meltzer & Richard (1981). The linear relationship in their model is however based on an assumption of the distribution of productivity and pre-tax income. Since there is no other suggestion for a specification and a linear specification is used in Milanovic (2002) we decide to use a linear specification as well.

5. RESULTS

Table 7: Feasible GLS Estimation - Government Spending

	(1)	(2)	(3)	(4)
VARIABLES	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**
ΔTop10-1_Lag4	0.000374	0.000229		
	(0.000520)	(0.000526)		
ΔTop1_Lag4	- 0.00098*		- 0.00067	
	(0.000501)		(0.000422)	
ΔGDPpc	-9.83e-06***	-9.84e-06***	-9.01e-06***	-9.88e-06***
	(8.66e-07)	(8.67e-07)	(8.10e-07)	(8.66e-07)
Political Index	0.000115	0.000119	0.000124	9.51e-05
	(0.000103)	(0.000103)	(9.75e-05)	(9.75e-05)
ΔTop10/Top1_Lag4				0.00381**
				(0.00166)
Constant	0.00314***	0.00308***	0.00259***	0.00335***
	(0.00103)	(0.00104)	(0.000963)	(0.000979)
Observations	605	605	718	605
Number of Countries in Sample	14	14	17	14
Correlation (AR1)	0.2506	0.2428	0.2278	0.2529

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

Controlling for a change in government spending, a feasible GLS estimation will consistently estimate a model under the assumption that all aspects of the model are completely specified

(StataCorp LP 2013). Table 7 shows a regression where we look at a change in government spending and find a significant correlation with GDP per capita and a smaller but still significant correlation with a change in the income earned by the top percentile. It should be noted that despite the significant correlation with changes in GDP per capita, the correlation is too small to have any economic significance. The result would suggest a small decrease in government spending caused by the increased share of income contrary to what would have been suggested by the median voter hypothesis. The result however becomes insignificant when a larger sample of countries is included. There is also a correlation between the increased shares of income earned by the upper middle class compared to the income earned by the rich.

Table 8: Feasible GLS Estimation - Top Marginal Tax

	(1)	(2)	(3)	(4)
VARIABLES	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**
ΔTop10-Top1_Lag4 _4	0.000691	0.000165		
	(0.000966)	(0.000861)		
ΔTop1_Lag4	- 0.0024		- 0.0016	
	(0.00159)		(0.00132)	
ΔGDPpc	1.86e-06	1.76e-06	3.40e-06	2.00e-06
	(2.16e-06)	(2.10e-06)	(2.51e-06)	(2.24e-06)
Political Index	-3.08e-05	-2.01e-05	-4.19e-05	-2.85e-05
	(7.79e-05)	(7.82e-05)	(0.000112)	(7.95e-05)
ΔTop10/Top1_Lag4				0.000711
				(0.00195)
Constant	- 0.00046	- 0.00057	- 0.00084	- 0.00056
	(0.000837)	(0.000820)	(0.00108)	(0.000828)
Observations	474	474	547	474
Number of Countries in Sample	12	12	15	12
Correlation (AR1)	0.1450	0.1547	0.3904	0.1455

***** p<0.01, ** p<0.05, * p<0.1**

***** p<0.01, ** p<0.05, * p<0.1**

Continuing using the feasible GLS estimation regression we look at a change in top marginal tax rates (table 8). Here we do not find any correlation that is statistically significant.

Table 9: Feasible GLS Estimation - Moving Average Government Spending				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**
ΔTop10-Top1_Lag4 _4	- 0.00066	- 0.00064		
	(0.000578)	(0.000564)		
ΔTop1_Lag4	0.000110		7.22e-05	
	(0.000602)		(0.000499)	
ΔGDPpc	-8.63e-06***	-8.64e-06***	-8.29e-06***	-8.93e-06***
	(8.28e-07)	(8.28e-07)	(7.95e-07)	(8.35e-07)
Political Index	0.000102	0.000102	0.000124	0.000106
	(0.000102)	(0.000102)	(0.000101)	(0.000106)
ΔTop10/Top1_Lag4				0.000966
				(0.00184)
Constant	0.00278***	0.00279***	0.00223**	0.00285***
	(0.00103)	(0.00103)	(0.000997)	(0.00107)
Observations	549	549	647	549
Number of Countries in Sample	14	14	16	14
Correlation (AR1)	0.7873	0.7880	0.7885	0.8096
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

Table 9 is also a feasible GLS estimation regression, now with moving average data and looking at government spending. Here we find a significant correlation with changes in GDP per capita. The other previous significant correlations that we found while not using moving averages data have now disappeared.

Table 10: Feasible GLS Estimation - Moving Average Top Marginal Tax				
	(1)	(3)	(4)	(5)
VARIABLES	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**
ΔTop10-1_Lag4	0.000828	0.000750		
	(0.00166)	(0.00166)		
ΔTop1_Lag4	- 0.00035		- 0.0011	
	(0.00214)		(0.00209)	
ΔGDPpc	3.98e-06	4.18e-06	4.23e-06	4.11e-06
	(2.88e-06)	(2.87e-06)	(2.89e-06)	(2.91e-06)
Political Index	-5.26e-05	-4.92e-05	-8.48e-05	-5.48e-05
	(0.000113)	(0.000117)	(0.000141)	(0.000123)
ΔTop10/Top1_Lag4				- 0.00021
				(0.00482)
Constant	- 0.0014	- 0.0015	- 0.0015	- 0.0014
	(0.00126)	(0.00129)	(0.00152)	(0.00134)
Observations	422	422	485	422
Number of Countries in Sample	12	12	14	12
Correlation (AR1)	0.7958	0.8054	0.8021	0.8001
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

In table 10 we see the result from a feasible GLS estimation regression looking at a change in top marginal tax with moving average data. We do not find any results that are statistically significant.

Table 11: Fixed Effects Regression Allowing for AR(1) Autocorrelation - Government Spending

VARIABLES	(2) ΔGOVSPEND	(3) ΔGOVSPEND	(4) ΔGOVSPEND	(5) ΔGOVSPEND
ΔTop10-1_Lag4	0.000156	-3.09e-05		
	(0.000612)	(0.000604)		
ΔGDPpc	-1.02e-05***	-1.02e-05***	-9.71e-06***	-1.02e-05***
	(1.00e-06)	(1.00e-06)	(9.36e-07)	(1.00e-06)
Political Index	0.000186	0.000189	- 0.00050	0.000200
	(0.000749)	(0.000743)	(0.000329)	(0.000746)
ΔTop1_Lag4	- 0.00099*		- 0.00050	
	(0.000592)		(0.000469)	
ΔTop10/Top1_Lag4				0.00390**
				(0.00181)
Constant	0.00248	0.00246	0.00851***	0.00236
	(0.00551)	(0.00553)	(0.00245)	(0.00549)
Observations	591	591	701	591
Number of Countries in Sample	14	14	17	14

Standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

The first results of our fixed effects regression allowing for AR(1) autocorrelation regressions (table 11) where we look at a change in government spending show that there are a few cases where the estimated coefficients are statistically significant. Fixed effects regression allowing for AR(1) autocorrelation is a model that fits cross-sectional time-series regression models when the disturbance term is first-order autoregressive (StataCorp LP 2013). There is a strong negative correlation between a change in government spending and a change in GDP per capita. The logic behind this finding is since the government's expenditures are relatively constant; a cut back in the private sector will make government spending as a share of GDP per capita larger and is supported by previous studies such as Roubini & Sachs (1989).

We also find a small negative correlation (statistically significant on a 10 percent level) between the income earned by the top percentile and the change in government spending telling us that government spending becomes relatively smaller. There is also a significant correlation between the changes in government spending and the changes in income in the top 10 percent over the top 1 percent (ΔTop10/Top1) as in the case when we used the feasible GLS method for estimation.

Table 12: Fixed Effects Regression Allowing for AR(1) Autocorrelation - Top Marginal Tax				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**
ΔTop10-1_Lag4	0.00180	0.00122		
	(0.00292)	(0.00287)		
ΔTop1_Lag4	- 0.0031		- 0.0024	
	(0.00303)		(0.00276)	
ΔGDPpc	-2.98e-06	- 3.13e-06	-2.60e-06	-3.02e-06
	(5.06e-06)	(5.06e-06)	(4.89e-06)	(5.06e-06)
Political Index	0.000681	0.000710	0.000813	0.000619
	(0.00308)	(0.00308)	(0.00302)	(0.00307)
ΔTop10/Top1_Lag4				0.00404
				(0.00920)
Constant	- 0.0071	- 0.0073	- 0.0092	- 0.0065
	(0.0254)	(0.0254)	(0.0255)	(0.0254)
Observations	462	462	532	462
Number of Countries in Sample	12	12	15	12
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

After the first regression where we controlled for government spending we now instead focus on a change in top marginal tax (table 12). None of the results however show up to be significant.

Table 13: Fixed Effects Regression Allowing for AR(1) Autocorrelation - Moving Average Government Spending				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**
ΔTop10-1_Lag4	- 0.00090	- 0.00089		
	(0.000685)	(0.000655)		
ΔTop1_Lag4	2.20e-05		-8.32e-05	
	(0.000725)		(0.000586)	
ΔGDPpc	-9.98e-06***	-9.98e-06***	-1.02e-05***	-1.02e-05***
	(1.01e-06)	(1.01e-06)	(9.51e-07)	(1.01e-06)
Political Index	7.30e-05	7.30e-05	9.83e-05	4.64e-05
	(0.000352)	(0.000352)	(0.000319)	(0.000352)
ΔTop10/Top1_Lag4				0.00150
				(0.00204)
Constant	0.00358***	0.00358***	0.00339***	0.00386***
	(0.000611)	(0.000610)	(0.000529)	(0.000595)
Observations	535	535	631	535
Number of Countries in Sample	14	14	16	14
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

Continuing with the fixed effects regression allowing for AR(1) autocorrelation regression, again looking at government spending but using moving average data (table 13) we find a

significant correlation with GDP per capita. However, we do not find a significant correlation between the income share earned by the top percentile or their share compared to the share earned by the upper middle class as we did when using non-moving average data.

Table 14: Fixed Effects Regression Allowing for AR(1)Autocorrelation - Moving Average Top Marginal Tax				
VARIABLES	(1) **ΔTopMTAX**	(2) **ΔTopMTAX**	(3) **ΔTopMTAX**	(4) **ΔTopMTAX**
ΔTop10-1_Lag4	0.00133	0.00350		
	(0.00310)	(0.00298)		
ΔTop1_Lag4	0.00856**		0.00469	
	(0.00361)		(0.00325)	
ΔGDPpc	-4.92e-06	-5.18e-06	-3.52e-06	-3.08e-06
	(5.66e-06)	(5.68e-06)	(5.86e-06)	(5.50e-06)
Political Index	0.000358	0.000292	- 0.00018	0.000387
	(0.000592)	(0.000594)	(0.000573)	(0.000591)
ΔTop10/Top1_Lag4				- 0.031**
				(0.0129)
Constant	- 0.0030***	- 0.0025**	0.000901	- 0.0039***
	(0.00112)	(0.00115)	(0.00123)	(0.00113)
Observations	495	495	654	495
Number of Countries in Sample	12	12	15	12
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

We continue with our final fixed effects regression allowing for AR(1) autocorrelation regression (table 14). We are studying the change in marginal tax rates using moving average data. Here we see that the share of income earned by the top percentile is significantly correlated with the top marginal tax. At this case, the results suggest that an increase in their income share increases taxes, a result inconsistent with the correlation between government spending.

Table 15: Fixed Effects Regression - Government Spending				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**	**ΔGOVSPEND**
ΔTop10-1_Lag4	- 0.00026	- 0.00042		
	(0.000631)	(0.000616)		
ΔTop1_Lag4	- 0.00071		- 0.00059	
	(0.000625)		(0.000477)	
ΔGDPpc	-9.97e-06***	-1.00e-05***	-9.52e-06***	-9.96e-06***
	(9.69e-07)	(9.68e-07)	(9.04e-07)	(9.67e-07)
Political Index	0.000286	0.000287	-0.000427	0.000317
	(0.000617)	(0.000618)	(0.000287)	(0.000615)
ΔTop10/Top1_Lag4				0.00332*
				(0.00188)
Constant	0.00162	0.00163	0.00789***	0.00133
	(0.00586)	(0.00586)	(0.00270)	(0.00584)
Observations	605	605	718	605
R-squared	0.157	0.155	0.142	0.159
Number of Countries in Sample	14	14	17	14
Correlation	0.7873	0.7880	0.7885	0.8096
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

We now try a fixed effects regression without allowing for AR(1) autocorrelation, and control for government spending (table 15). We find a negative correlation with changes GDP per capita. We also find the correlation with a change in the income earned by the top decile over the top percentile.

Table 16: Fixed Effects Regression - Top Marginal Tax				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**
ΔTop10-1_Lag4	0.000832	8.43e-05		
	(0.00298)	(0.00290)		
ΔTop1_Lag4	- 0.0035		- 0.0026	
	(0.00311)		(0.00275)	
ΔGDPpc	-3.24e-06	-3.38e-06	-2.97e-06	-3.32e-06
	(4.95e-06)	(4.95e-06)	(4.72e-06)	(4.95e-06)
Political Index	0.000512	0.000521	0.000939	0.000522
	(0.00282)	(0.00282)	(0.00278)	(0.00281)
ΔTop10/Top1_Lag4				0.00357
				(0.00939)
Constant	- 0.0050	-0.00504	- 0.0099	- 0.0051
	(0.0264)	(0.0264)	(0.0261)	(0.0263)
Observations	474	474	547	474
R-squared	0.004	0.001	0.003	0.001
Number of Countries in Sample	12	12	15	12
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

A fixed effects regression where we look at a change in top marginal tax (table 16) gives us no significant correlation between a change in top marginal tax and any of the variables.

Table 17: Fixed Effects Regression - Moving Average Government Spending

VARIABLES	(1) ΔGOVSPEND	(2) ΔGOVSPEND	(3) ΔGOVSPEND	(4) ΔGOVSPEND
ΔTop10-Top1_Lag4 _4	- 0.0032**	- 0.0033**		
	(0.00139)	(0.00137)		
ΔTop1_Lag4	- 0.00026		- 0.0014	
	(0.000931)		(0.000852)	
ΔGDPpc	-5.05e-06**	-5.12e-06**	-4.88e-06**	-5.27e-06**
	(1.81e-06)	(1.80e-06)	(1.80e-06)	(1.96e-06)
Political Index	- 0.00012**	-0.000128**	5.61e-05	5.50e-06
	(5.51e-05)	(5.47e-05)	(8.37e-05)	(2.50e-05)
ΔTop10/Top1_Lag4				0.00418
				(0.00278)
Constant	0.00387***	0.00392***	0.00192*	0.00258***
	(0.000899)	(0.000886)	(0.00105)	(0.000831)
Observations	549	549	647	549
R-squared	0.134	0.134	0.075	0.090
Number of Countries in Sample	14	14	16	14

Robust standard errors in parentheses
***** p<0.01, ** p<0.05, * p<0.1**

Using a fixed effects regression and moving average data we find some significant correlation with government spending (table 17). The share of income earned by 10 percent compared to the top 1 percent income holders is correlated with our independent variable, and so are both the GDP per capita and political index. At this stage, we should note that there is a case of very strong autocorrelation in the error term as proven by the feasible GLS estimation.

Table 18: Fixed Effects Regression - Moving Average Top Marginal Tax				
	(1)	(2)	(3)	(4)
VARIABLES	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**	**ΔTopMTAX**
ΔTop10-Top1_Lag4 _4	0.00240	0.00250		
	(0.00557)	(0.00630)		
ΔTop1_Lag4	0.000369		0.00717	
	(0.00363)		(0.00455)	
ΔGDPpc	-1.05e-05	-1.04e-05	-1.13e-05	-9.87e-06
	(1.06e-05)	(1.03e-05)	(7.52e-06)	(9.02e-06)
Political Index	- 0.00031	- 0.00032	- 0.00090	-0.000171
	(0.000207)	(0.000234)	(0.000598)	(0.000214)
ΔTop10/Top1_Lag4				- 0.0097
				(0.0118)
Constant	0.00224	0.00225	0.00902*	0.000841*
	(0.00338)	(0.00343)	(0.00421)	(0.000463)
Observations	507	507	669	507
R-squared	0.010	0.010	0.027	0.009
Number of Countries in Sample	12	12	15	12
Robust standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

Using the fixed effects regression and data with moving average together with top marginal tax (table 18) we cannot find any statistically significant results.

Table 19: OLS Naïve Government Spending				
	(1)	(2)	(3)	(4)
VARIABLES	**GOVSPEND**	**GOVSPEND**	**GOVSPEND**	**GOVSPEND**
Top1	- 0.0048***		- 0.0083***	
	(0.000441)		(0.000658)	
GDPpc	4.47e-06***	3.97e-06***	3.10e-06***	3.16e-06***
	(2.76e-07)	(3.63e-07)	(3.33e-07)	(3.29e-07)
Political Index	- 0.00081*	0.000852	0.00234***	0.00293***
	(0.000484)	(0.000665)	(0.000609)	(0.000613)
Top10-Top1		- 0.0030***	0.00104	
		(0.000603)	(0.000631)	
Top10 / Top1				0.0269***
				(0.00190)
Constant	0.156***	0.182***	0.154***	- 0.0057
	(0.00671)	(0.0142)	(0.0129)	(0.0105)
Observations	809	662	662	662
R-squared	0.387	0.198	0.354	0.361
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

Using the naïve estimations, using the OLS regression we find a negative significant correlation between government spending and the income earned by the top decile and

percentile as and also between government spending and GDP per capita and government spending (table 19).

Table 20: OLS Naïve Marginal Tax				
	(1)	(2)	(3)	(4)
VARIABLES	**TopMTAX**	**TopMTAX**	**TopMTAX**	**TopMTAX**
Top1	- 0.019***		- 0.023***	
	(0.00173)		(0.00262)	
GDPpc	-5.74e-06***	-6.45e-06***	-5.24e-06***	-6.98e-06***
	(9.73e-07)	(1.29e-06)	(1.21e-06)	(1.20e-06)
Political Index	0.00823***	0.00781***	0.00952***	0.0110***
	(0.00152)	(0.00190)	(0.00178)	(0.00184)
Top10-Top1		- 0.0077***	0.00157	
		(0.00187)	(0.00204)	
Top10 / Top1				0.0615***
				(0.00680)
Constant	0.686***	0.720***	0.655***	0.264***
	(0.0198)	(0.0422)	(0.0400)	(0.0378)
Observations	576	491	491	491
R-squared	0.240	0.095	0.218	0.198
Standard errors in parentheses				
***** p<0.01, ** p<0.05, * p<0.1**				

When looking at the top marginal tax (table 20) we see a significant correlation with the income earned by tope percentile and decile. There is also a significant correlation with GDP per capita and the top income holders (Top 10 – Top 1). Here, we also find statistically significant correlations with our Political index control variable suggesting a positive relationship with marginal taxes and democratic societies.

6. CONCLUSION AND DISCUSSION

In this section we will analyze the results of the regression and the results will be compared to the theories from previous literature and research. A brief section on restrictions of the thesis and suggestions for future research will also be offered.

6.1 Analysis of Results

Independently of the statistical estimation method used, the results generally remain consistent while using the same dependent variable. The results from the estimations using government spending as a dependent variable sometimes briefly suggest a positive relationship between central government spending and the income earned by the top decile compared to the income earned by the top percentile. That result would suggest that as the upper middle class grows earns more relatively to the rich, income redistribution increases.

This result could give some support to our hypothesis 3. This tendency is neither fully consistent across all specifications, i.e. when using the moving averages approach. Nor is it supported by the results when the marginal tax rate as a dependent variable. We must therefore conclude that there is not sufficient proof for supporting hypothesis 3.

When analyzing the other results, there are no statistically significant correlations that remain consistent across the different use of government spending and marginal tax rates as independent variables or the different estimation methods. The only case where most correlations are significant is when moving averages data and not correcting for autocorrelation, an approach that will most probably have rendered some bias in the results. Given these results there is no possibility to argue for the support of hypotheses 1 or 2.

The naïve regressions using OLS suggest strong negative correlations between high income inequality and low level of redistributive policies. Since these correlations disappear through our different econometric corrections we hypothesize two plausible causes that are not mutually exclusive. Firstly, the level of income inequality and redistribution may in fact be caused by other factors that are not observed in our data and that are specific for different time periods or different countries. Secondly, it could be that causality primarily runs from redistributive policies that in fact decrease income inequality before taxes. This would be highly consistent with the indications in Roine et al. (2009) that used the data for slightly different questions. Such a direction of causality would be consistent with the findings by Bergh (2005) that suggest that much redistribution is done through government spending that affects income inequality before taxes and transfers rather than redistributes already earned income.

Our results however differ from those suggested by the marginal voter hypothesis and other similar theories in political economy. It is hard to suggest a definite reason for this inconsistency with previous studies. A plausible cause could be that our proxy variables for redistribution, marginal tax rates and government expenditures are not actually true representatives on the level of redistribution as they are in fact drivers of income equality before taxes. Another possible scenario is that the processes of redistribution have not worked in earlier periods of history.

6.2 Discussion and Suggestions for Further Research

Apart from the concern previously mentioned that our proxies for redistribution do not correctly measure the level of redistribution, there is a possible concern that the within-

country variation in our proxies for income redistribution, the marginal tax rate has not been large enough to render results significant enough to draw any conclusion. Since the results are not conclusive using the other proxy, government expenditures, we do not believe that would have changed the conclusion that the data does not support any of our hypotheses.

With the gain of studying the median voter hypothesis with a dataset covering a long period of time, there has been a tradeoff in not using comparative measures for income inequality and redistribution. We believe that further research on data with Gini coefficients across longer periods of time and on more studied economies would be necessary to gain more insight to the dynamics of income inequality and redistribution. As theories also predict that income inequality slows down economic growth through redistribution, we believe that further research on the dynamics of all these variables could be insightful, possibly through the use of these data.

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