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# Inequality and the Size of Government*

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**Abstract**

The median voter theory of government size predicts that greater inequality leads to greater demand for redistribution and larger government (Meltzer and Richard, 1981). However, this prediction is often rejected empirically. This paper distinguishes between income inequality induced by differences in labor productivity and income inequality induced by differences in capital income. Whilst the standard argument applies to productivity-induced income inequality, greater capital income inequality leads to smaller government if, as often observed, capital income is difficult to tax. Using OECD data, government size and capital income inequality (proxied by the top 1% income share) are found to be negatively related in both fixed effects and instrumental variable regressions. Moreover, controlling for capital income inequality yields a positive and significant relationship between government size and labor income inequality, as originally conjectured.

*Keywords*: capital income, inequality, size of government
*JEL*: D78, E62, H10

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# 1 Introduction

Neoclassical models of democracy, as articulated by Meltzer and Richard (1981),[1] offer a sanguine prediction: greater before-tax income inequality implies divergence between mean and median income and so, under universal suffrage, raises redistribution. Democracy, in principle, thus provides a corrective to increased inequality, and we should expect increased ex-ante inequality to lead to an increase in redistribution.

However, evidence supporting the Meltzer and Richard (1981) hypothesis is generally weak. For example, the United States and other Anglo-Saxon countries have greater income inequality but lower public sector spending as a share of total GDP, while Scandinavian countries have relatively equal income distributions and a larger government spending share. Perotti (1996), Benabou (1996), Bassett et al. (1999) and Persson and Tabellini (2003) all find an insignificant or even negative link between the size of government and the degree of inequality.[2]

In response to this puzzle, new theoretical work has proposed mechanisms through which greater inequality levels can coexist with smaller government under democracy. For instance, Benabou (2000) identifies a functional role for the government to provide insurance (which implies redistribution) under capital market imperfections. The capacity for society to reach consensus on this role increases as the income distribution becomes more equal and risks become aligned and so government grows with equality. However, this type of mechanism also implies that government size should be positively correlated with economic growth and the evidence relating to the so-called 'Armey curve' surveyed by Bergh and Henrekson (2011) if anything points to a negative relationship, at least for high income countries.[3]

[1] Romer (1975) and Roberts (1977) are important antecedents.

[2] More recent empirical literature (Mello and Tiongson, 2006; Shelton, 2007; and Muinelo-Gallo and Roca-Sagales, 2013) is also unsupportive.

[3] Other mechanisms are proposed by Persson (1995) and Rodriguez (2004). In the former, utility depends on relative consumption. In this model there is increasingly a problem of excessive labor supply in more equal societies and taxes work to increase utility by reducing labor. As in Benabou (2000), greater equality increases the capacity for agreement to tax, which again solves a market failure. Taxes work to eliminate the negative externalities associated with individual labor supply. Rodriguez (2004) instead models the political power of the rich as increasing with inequality, thereby reducing their obligation to pay tax. The democratic

The approach taken in this paper instead revisits Meltzer and Richard (1981) more closely. In the original mechanism, labor is the only source of income and the rich earn more by dint of higher productivity. However, labor is not the only source of income for the rich and, moreover, the labor share of income has declined in recent years (see Azmat et al., 2012; Karabarbounis and Neiman, 2013). Indeed, Piketty (2014) links rising inequality to the declining labor share: if the return to capital exceeds the rate of economic growth, then the capital share grows, and if ownership is concentrated within a small number of dynasties, then inequality inexorably increases. Furthermore, capital income has become more unequal as well as more important. Kaymak and Poschke (2016) document considerable increases in the concentration of wealth in the US over the past 50 years.

Hence we instead ask how inequality stemming from capital income affects government size. Individuals differ in their capital endowment, with a right skewed capital income distribution. The majority of individuals are endowed with limited (or zero) assets or wealth and so are compelled to supply labor for their income, which is taxed. In contrast, if capital-income is not taxed then the capital-rich are relatively less exposed to taxation. In direct contrast to Meltzer and Richard (1981), the key result is that increased inequality in capital income leads to smaller government. When income differences are driven by capital income, the capacity of the median voter to redistribute through the tax system is reduced because the capital-rich supply less (taxable) labor. If capital income inequality increases such that the capital-rich supply less labor, then the preferred labor income tax rate *falls* because the (capital-poor) median voter cannot effectuate redistribution. Our work is related to Krusell and Rios-Rull (1999), who study a version of Meltzer and Richard's model that includes inequality not only in labor income but also in wealth. However, we differ from Krusell and Rios-Rull (1999) as we assume capital income cannot be taxed, for the reasons explained below.

The relationship between the size of government and inequality is investigated empirically using a panel of fifteen OECD countries, including a measure of capital income inequality as an additional explanatory variable. Direct measures of capital income inequality are not

constraint is therefore undermined.

widely available. In the empirical work this is proxied by the top 1% total income share, taken from the World Wealth and Income Database (WID).[4] A theoretical justification for this approach is Piketty (2014), wherein capital is disproportionately owned by a small number of dynasties. In this analysis the larger top income share stems from increasing capital income with fixed capital ownership. Certainly capital income represents an important component of the income of the top 1%. Frydman and Saks (2010) document the increasing importance of stock options and long-term bonuses (also in the form of capital payments) in the remuneration of executives in large publicly traded corporations in the US.

Examination of disaggregated capital income data for a subset of countries provides empirical justification for this proxy. The WID contains non-wage (i.e. capital) income data for the top 1% and the top 10% for Australia, Canada, France and the United States. We posit that the higher the ratio of the share of non-wage income going to the top 1% relative to the top 10% the more unequal the capital income distribution. Ideally given our theory we would require that the numerator and denominator would respectively be the mean and 50th percentile non-wage income, but such data are not available. Nonetheless it seems plausible that inequality between the top 1% and the top 10% would be correlated with the theoretical ideal. Figure 1 plots this measure of capital income inequality together with the top 1% income share for these countries. In all four cases there is a strong correspondence between the direct measure of capital income inequality and the top income share, giving some credence to using the latter to proxy for the former for the wider sample of countries.

The empirical analysis below also separately employs specific measures of productivity-induced labor income inequality as distinct from capital income inequality. As we discuss below the two measures are empirically as well as conceptually distinct from one another. Consistent with our theory, the size of government is negatively associated with capital income inequality. A one standard deviation increase in capital income inequality leads to a reduction in the size of government of around 2.6% of GDP. The negative relationship holds up when the lagged dependent variable is controlled for, and also when capital income

[4] The 0.1% income share could alternatively be used, though the results are very similiar because the correlation between the 0.1% and 1% income shares is around 0.98.

inequality is instrumented with measures of technological progress and capital market access. We also find that once capital income inequality is controlled for, then the impact of labor income inequality becomes positive, consistent with Meltzer and Richard (1981) and in contrast to the voluminous empirical work testing their hypothesis.

The next section theoretically analyzes how the size of government changes with capital income inequality. Section 3 contains the empirical work, and section 4 concludes.

# 2 The Model

As in Meltzer and Richard (1981), individuals, indexed by $i$, have preferences defined over consumption $c_i$ and leisure $l_i$, represented by a strictly concave, continuous and twice-differentiable utility function, $u_i(c_i, l_i)$. Consumption and leisure are both normal goods. Following the original, we first analyze the equilibrium behavior conditional on a given tax policy and then address the tax policy choice itself.

## 2.1 Economic Environment

Income may be derived from both labor and capital. All individuals possess a unit of time to allocate to labor $n_i$, or leisure $l_i = 1 - n_i$. Individual labor income $y_i = x_i n_i$ depends on productivity, $x_i$, as well as hours worked, and is taxed at a linear rate $t$. Capital income varies exogenously across individuals and is denoted by $R_i$. Following Meltzer and Richard (1981), consumption is also financed by lump-sum redistribution, $r$, common to all individuals, hence:

$$c_i = (1 - t) x_i n_i + R_i + r. \tag{1}$$

To clarify the argument, capital income is assumed to be untaxed. In practice it is often more difficult to raise taxes on capital than on labor. Capital is often highly mobile internationally, whilst labor is not, and given this Diamond and Mirrlees (1971) show that small open economies should not tax capital income. Indeed, international tax competition limits the democratic control over capital income taxation. Whilst in practice capital income taxation rates are positive, Gordon et al. (2004) observe lower average rates than for labor income in most countries. Moreover, the academic literature documents considerable difficulties with the collection of capital income taxation, primarily due to different types of capital income being taxed differentially (thereby, enabling arbitrage opportunities), and the fact that interest payments are tax-deductible. Indeed Gordon and Slemrod (1988), using US tax return data from 1983, estimated that the tax revenue loss from eliminating capital income taxation completely would be zero, hence that the tax burden on capital was effectively non-existent. It is an open question quite why the median voter would tolerate such a state of affairs, but conceivably the perceived deadweight and/or capital flight losses from increasing capital income taxation to some extent nullifies it as an instrument. Thus we focus on the choice of the labor income tax.

Each individual chooses labor supply so as to maximize:

$$u_i\left(c_i, l_i\right) = u_i\left[\left(1-t\right)x_i n_i + R_i + r, 1 - n_i\right]. \tag{2}$$

The first-order condition is:

$$\left(1-t\right)x u_c - u_l = 0, \tag{3}$$

which determines the labor supply, $n\left[\left(1-t\right)x, R, r\right]$, for those who wish to work.[5] Since leisure is a normal good, we have that:

$$\frac{\partial n}{\partial R} = -\frac{\left(1-t\right)x u_{cc} - u_{cl}}{D} < 0, \tag{4}$$

with $D = \left[\left(1-t\right)x\right]^2 u_{cc} - 2\left(1-t\right)x u_{cl} + u_{ll} < 0$, given the assumption that $u$ is strictly concave. Similarly, since consumption is a normal good we have that:

$$\frac{\partial c}{\partial R} = 1 + \frac{\partial n}{\partial R}\left(1-t\right)x = -\frac{u_{cl}x\left(1-t\right) - u_{ll}}{D} > 0, \tag{5}$$

[5] For simplicity (but without loss of generality) we henceforth assume that the joint distribution of $x$ and $R$ is such that $n_i > 0$ for all $i$, so that everyone supplies a strictly positive amount of market work.

a condition which imposes additional restrictions on $u_{cl}$. Hence, all else equal, people who are relatively capital-rich supply less labor and enjoy higher consumption.

There are two sources of heterogeneity that determine differences in before-tax labor income. Firstly productivity, as analyzed by Meltzer and Richard (1981), and secondly capital income endowments. At the individual level increases in productivity will all else equal increase labor income.[6] On the other hand increases in capital income will all else equal reduce the labor supply and, therefore, labor income. This underpins their proclivity towards taxation of labor income.

Average labor income can thus be written by integrating:

$$\bar{y} = \int_0^\infty \int_0^\infty xn\left[R, r, (1-t)\,x\right] f\left(x, R\right) \mathrm{d}x \mathrm{d}R. \tag{8}$$

where $f(x, R)$ is the joint density function of $x$ and $R$. Individual productivity and capital endowments conceivably are correlated with each other to some extent: if, for example, high productivity individuals simultaneously enjoy high capital income. Finally, the government's balanced budget requirement (in per capita terms) is given by:

$$t\bar{y} = r. \tag{9}$$

[6]Notice that, as in Meltzer and Richard (1981), the sign of

$$\frac{\partial n}{\partial x} = -\frac{(1-t)\,u_c + (1-t)^2\,xnu_{cc} - (1-t)\,nu_{cl}}{D} \tag{6}$$

is indeterminate. Hence, the labor supply could be backward bending as productivity increases. Still, pre-tax labor income may never decline following an increase in productivity. To see this notice that, for any individual earning positive labor income, we have

$$\frac{\partial y}{\partial x} = n + x\frac{\partial n}{\partial x} \quad = -\frac{(1-t)\,nu_c + n\left[u_{cl}\,(1-t)\,x - u_{ll}\right]}{D} > 0, \tag{7}$$

which must be positive given condition (5).

Note that analogous to (4), we have:

$$\frac{\partial n}{\partial r} = -\frac{(1-t)\,xu_{cc} - u_{cl}}{D} < 0. \tag{10}$$

Hence for given productivity and capital income endowment, individual labor supply falls with increased redistribution. Therefore:

$$\frac{\partial \bar{y}}{\partial r} = \int_0^\infty \int_0^\infty x \frac{\partial n}{\partial r} f(x, R)\,\mathrm{d}x\mathrm{d}R < 0. \tag{11}$$

This establishes that the left-hand side of (9) is strictly decreasing with $r$. Moreover, $t\bar{y}$ is non-negative and bounded above by $t\bar{x}$, where $\bar{x}$ is average productivity. In turn, the right-hand side of (9) is strictly increasing with $r$. Thus, there is a unique value of $r$ to satisfy (9) for any $t$.

## 2.2 The Median Voter's Choice of Tax Policy

We now turn to the policy-setting decision. Crucially, the median voter is still a Condorcet winner even though the electorate is heterogeneous on two dimensions. The logic of this is that the preferred tax rate remains a monotonic function of the labor income alone, regardless of the underlying determinants of that labor income. Hence high labor income (whether induced by either high productivity or low capital income) will engender aversion to taxes, whilst low labor income (whether induced by low productivity or a generous capital income inheritance) will engender support for tax-financed redistribution. Formally, the median labor income-earner, $m$, is the median voter. She sets taxes to maximize utility subject to the budget constraint (2), the government budget constraint (9), and a rational anticipation of how taxation will affect the incentives to supply labor in the economy. The first-order condition for the median voter with respect to the tax rate is:

$$\bar{y} - y^m + t\left(\frac{d\bar{y}}{dt}\right) = 0, \tag{12}$$

where $y^m$ is the labor income of the median voter. Condition (12) yields the following solution for the tax rate chosen by the median voter

$$t = \frac{m - 1 + \eta_r}{m - 1 + \eta_r + m\eta_\tau}, \tag{13}$$

with $\eta_r < 0$ and $\eta_\tau > 0$ the partial elasticities of average income (assumed constant, as in Meltzer and Richard, 1981), and $m = \bar{y}/y^m$.[7]

The key insight of Meltzer and Richard (1981) is that an increase in labor income inequality raises taxation, since an increase in income inequality raises $m$ and from (13) we have that

$$\frac{dt}{dm} > 0. \tag{14}$$

Finally, although we impose almost no restrictions on the joint distribution $f(x, R)$, we wish to guarantee that: i) the chosen tax rate is positive; and that ii) the individuals that are in the top of the capital income distribution are never the decisive voter. Thus, in the sequel we make the following two assumptions:

**Assumption 1** *The joint distribution $f(x, R)$ is such that the labor income distribution is right-skewed. Thus, $y^m < \bar{y}$ and the chosen tax rate is positive.*

From (12) we see that Assumption 1 guarantees that the chosen tax rate is positive.

**Assumption 2** *The joint distribution $f(x, R)$ is such that the set of individuals $i \in \mathcal{K}$ with capital income $R_i$ above the 99% percentile of the capital income distribution has productivity $x_i$ which is sufficiently high so that $y_i = x_i n_i > y^m$ for all $i \in \mathcal{K}$.*

We focus on the 99% percentile because in the empirical section that follows we use the income share of the top 1% as our measure of capital income inequality. Figure 2 illustrates the condition imposed by Assumption 2. The locus denoted $y = y^m$ represents productivity and capital income pairs, $(x, R)$, for which labor income $y$ is equal to the median voter's labor income, $y^m$. To the right of this locus, $y > y^m$, since $\frac{\partial y}{\partial x} > 0$ and $\frac{\partial y}{\partial R} < 0$. The dashed line

[7] Details are available in the Appendix A.

denoted $\mathcal{Q}_{99\%}$ represents the 99% quantile of the capital income marginal density function. Assumption 2 is a condition requiring that the set $\mathcal{K}$ of all individuals with capital income above $\mathcal{Q}_{99\%}$ is located to the right of the locus $y = y^m$, as shown in Figure 2.

## 2.3 Capital Income Inequality and Redistribution

We are interested in the consequences of higher capital income inequality. To study this issue we consider an increase in the capital income earned by the individuals in the set $\mathcal{K}$ of all individuals with capital income above $\mathcal{Q}_{99\%}$. This is represented in Figure 3: the individuals in the set $\mathcal{K}$ that correspond to the original individuals in the top 1% of the capital income distribution receive an exogenous increase in capital income; thus, the set $\mathcal{K}$ shifts upwards in the space $(x, R)$, but still satisfying the restriction imposed by Assumption 2, that guarantees that none of the members of the set $\mathcal{K}$ are the median voter (the new set is represented by the triangle above, in Figure 3). Notice that this experiment constitutes an increase in capital income inequality, since we maintain the capital income of all the other individuals unchanged and, hence, the capital income share of the top 1% is increased.[8] Under a right-skewed labor income distribution $y^m < \bar{y}$, and given (13) above then $t > 0$. As with Meltzer and Richard (1981) demand for redistribution stems from changes in the labor income distribution. However, the labor income distribution may now change depending on the distribution of capital income as well as the productivity distribution.

To see the consequences of higher capital income inequality, notice that all the individuals in the set $\mathcal{K}$ will choose to work less, because they enjoy an increase in their capital income and leisure is a normal good. This will tend to lower the average labor income $\bar{y}$, since we have that

$$\bar{y} = p(\mathcal{K})\,\bar{y}(\mathcal{K}) + (1 - p(\mathcal{K}))\,\bar{y}(\sim \mathcal{K}), \tag{15}$$

where $\bar{y}(\mathcal{K})$ denotes the average labor income of the individuals in the set $\mathcal{K}$, $\bar{y}(\sim \mathcal{K})$ denotes

[8] It is not, however, a mean preserving spread in capital income. But lowering the capital income of the bottom 99% capital income earners in order to preserve the mean capital income would only reinforce our results.

the average labor income of the individuals not in the set $\mathcal{K}$, and $p(\mathcal{K})$ is the probability measure of the set of individuals $\mathcal{K}$. Notice that Assumption 2 guarantees that $\bar{y}(\mathcal{K}) > y^m$.

On the other hand, the reduction in $\bar{y}$ implies that the individuals not in the set $\mathcal{K}$ will receive fewer transfers and, therefore, work more. From Assumption 2, the individual earning the median labor income is not in the set $\mathcal{K}$ and, thus, $y^m$ will increase. The upshot is that $m = \bar{y}/y^m$ is decreased. Hence, the effect of the increase in capital income going to the top capital-income recipients is to reduce the gap between *taxable* mean and median labor income. Hence an increase in overall income inequality can coexist with a reduction in labor income inequality. Since $\frac{dt}{dm} > 0$, it follows that an increase in capital income inequality unambiguously lowers the tax rate chosen.

**Proposition 1** *Suppose the top capital-income recipients are sufficiently productive that they also earn labor income above the median labor income (Assumption 2), and consider an increase in capital-income inequality represented by an increase in the capital income earned by the top capital-income recipients. Then the labor income tax rate $t$ falls as capital income inequality rises.*

The proof of Proposition 1 is in Appendix B. In direct contrast to Meltzer and Richard (1981) government size diminishes with increased capital income inequality. If inequality increases such that the share of capital income going to the top income recipients increases, then the preferred tax rate falls because the (capital) rich are supplying less taxable labor income and hence the capacity of the median voter to redistribute is reduced.

The key issue is the extent to which the median voter can effectively redistribute through the tax system. As discussed above there are good reasons to believe that taxation of relatively mobile capital is considerably more difficult than taxation of labor income. If the rich are rich primarily due to capital income, perhaps because of the rising capital share, and perhaps due to successful reclassification of their income streams, then the capacity of the median voter to redistribute is curtailed. Moreover if rising inequality translates into further reductions in the supply of taxable labor then it follows that the demand for redistribution will fall.

# 3 Evidence

The empirical analysis examines a panel of fifteen OECD countries over the period 1960-2007.[9] Following Pickering and Rockey (2011) and Facchini et al. (2016, forthcoming), the dependent variable is total government outlays as a percentage share of GDP, extracted from the OECD Economic Outlook database. Figure 4 depicts these data, showing all countries experienced an upward trend in the earlier years followed by a period of stasis or even slight decline since around 1990. Table 1 contains descriptive statistics of all the variables used in the analysis.

Figure 5 depicts the top income share data for all 15 countries. Note that the increases in the top income share to some extent coincides with the reversal of the growth of government noted above. Clearly there are interesting differences across the countries, for instance stronger recent increases in the English-speaking countries as discussed by Piketty and Saez (2006). The argument advanced in this paper is the following: as the top income share increases, the supply of taxable labor of the rich falls, and hence support for taxation of labor income falls.

As noted above previous empirical literature has generally been unsupportive of the original Meltzer and Richard (1981) hypothesis. If the mechanism put forward in the present paper is important, and capital-income inequality and productivity differences are correlated with each other, then arguably previous analyses have suffered from an omitted variable bias. A measure of productivity heterogeneity is thus also included in the empirical analysis. This measure is taken from the University of Texas Inequality Project's Estimated Household Income Inequality data.[10] These data (denoted by $UTIP$) use Theil's T statistic - measured across sectors within each country - to estimate wage inequality. Assuming competitive labor markets, then wage inequality should be capturing underlying heterogeneity in productivity.

[9] Specifically the countries included are Australia, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Spain, Sweden, the United Kingdom, and the United States. Current data availability for the top income share precludes using other countries. The sample ends in 2007 due to the substantial toll on government outlays in many countries following the global financial crisis.

[10] See Galbraith and Kum (2005).

Figure 6 depicts these data, which also exhibit increases in recent years, varying across countries. This measure is thus close to Meltzer and Richard (1981) original conception of the driver of the demand for redistribution - productivity-based inequality.

A natural objection here is that the top income share will also be picking up productivity-induced inequality. Inevitably there is a correlation between productivity inequality as measured by $UTIP$ and the income share of the top 1%, but this is somewhat weaker than might be expected. Figure 7 depicts a scatter plot of the two series, exhibiting a correlation coefficient of around 0.53. Hence there is meaningful separate information in the two series. Our argument is that the top income share is especially informative about capital income inequality rather than productivity-induced labour income inequality. The small sample of countries depicted in Figure 1 discussed in the introduction lends some credence to this argument.

The analysis includes control variables following Facchini et al. (2016, forthcoming). Controls include the natural logarithm of GDP per capita in constant chained PPP US$ ($\ln(y)$), taken from the Penn World Tables (e.g. see Ram, 1987). Ideology (denoted $IDEO$) and its interaction with income (denoted $INTERACT$) as used in Pickering and Rockey (2011), are also included as standard. Following Facchini et al. (2016, forthcoming) the labor share of income (denoted $SHARE$) from the OECD database is also included to capture (falling) cost-push effects. Following Kau and Rubin (2002) and Winer et al. (2008) female participation ($FP$) in the labor force is also included. Further controls follow Persson and Tabellini (2003). Demographic effects are encapsulated in the percentage of the population between 15 and 64 years of age and the percentage over the age of 65 (denoted $PROP1564$ and $PROP65$), taken from the World Development Indicators (WDI) database. Following Rodrik (1998) the trade share (the sum of exports and imports as a percentage of GDP, denoted $TRADE$) is also employed in the regression analysis.

Total government outlays in OECD countries vary counter-cyclically. There may also be cyclical movements in inequality. To address this potential problem the regression analysis employs the Persson and Tabellini (2003) cyclical control variables - the output gap (denoted $YGAP$) and oil price effects (depending on whether or not the country is a net oil-exporter or importer, denoted $OIL\_EX$ and $OIL\_IM$) are also included in the analysis when annual data are used.

Table 2 contains estimation results from fixed-effects panel regressions with total outlays as a percentage of GDP as the dependent variable. Column 1a represents the current consensus, augmenting the benchmark specification in Facchini et al. (2016, forthcoming) with productivity-induced inequality ($UTIP$), and finding it to be highly insignificant. This insignificance coheres with the findings in Perotti (1996), Persson and Tabellini (2003), Mello and Tiongson (2006), and Shelton (2007). Column 1b further augments this specification with capital income inequality. The estimated coefficient for capital income inequality is negative, with a $p$-value of 1.7% and the estimated relationship is sizable: A one standard deviation increase in capital income inequality is statistically associated with government size which is smaller by 2.63% of GDP, consistent with the theoretical reasoning given here. It is also noteworthy that the coefficient estimate for productivity-induced labor income inequality increases substantially, though is still not statistically significant. Following Facchini et al. (2016, forthcoming) results are also presented (in columns 2a and 2b) using five-year averages of the data, and the results essentially duplicate those in column 1, establishing that the observed correlation is not caused by the cyclical features in the data.

Column 3 of table 2 contains Arellano-Bond dynamic panel estimation results extending the specification used in column 2 to include the lagged dependent variable ($L.OUTLAYS$). Here the negative relationship between government size and capital income inequality holds up, and indeed the coefficient estimate pertaining to labor income inequality is now positive, consistent with the Meltzer and Richard (1981) hypothesis, and significantly different from zero at the 5% level. This evidence suggests that previous tests of the Meltzer and Richard (1981) hypothesis were hampered by the conflation of capital and labor income inequality.

## 3.1 Instrumental Variables Estimation

The empirical analysis presented above establishes a robust negative statistical association between government size and capital income inequality in the presence of a substantial set of controls. However, these results do not establish causality, insofar that the movements in capital income inequality may be endogenous to the size of government, or alternatively both variables may co-move in response to an unobserved driver not accounted for in the controls. What is required for identification is a source of exogenous variation in capital income inequality. In this section we describe and deploy two potential instruments. An advantage of using two independent instruments is that it enables an overidentification test of the exclusion restriction that the instruments are not correlated with the error term in the second stage regression.

The first instrument is the number of internet users in percentage of the total population ($INTERNET$), encapsulating technological change.[11] Skill-biased technological change has been advanced as a (if not the) principle driver of rising inequality in general terms (for example in Goldin and Katz, 2009). Conceivably this process has especially underpinned increasing capital income inequality.[12] Atkinson et al. (2011) indeed document that a large part of the top income share derives from capital income.[13]

There are a number of channels through which advancing information technology could increase capital income inequality. One, as noted above is simply the mechanism advanced in Piketty (2014): if capital income rises with fixed ownership concentration, then capital inequality rises. Another stems from the observation that information technology is 'weightless' and in such circumstances the distinction between labor and capital income becomes somewhat arbitrary. Thus one can equally describe Mark Zuckerberg as being an extremely productive worker, or as having created a company with enormous capital value. Relatedly, information technology plausibly has allowed many diverse activities to upscale their operations, resulting in significant increases in profitability which has in no small part been manifest in increased capital income for share owners or business partners. What is relevant

[11] Taken from the WDI database.

[12] Note that any effect of technological change through labor income inequality, or the labor share, is closed off due to these variables separately being included as controls in the analysis. It is still nonetheless possible that technology is correlated with the error term in the second-stage regression (i.e. violating the exclusion restriction), though the mechanism is not easy to see given the extensive set of controls. Moreover the exclusion restriction is tested below using the Hausman over-identification test.

[13] For instance in their figure 3 capital gains, capital income and business income represent well over half of the income of the top 0.1% in the US.

for the theory above is *liability* for labor, as distinct from capital, income taxation. In particular in the case of new information technology, the new high earners face an interesting problem of how to classify their income.

Plausibly, and indeed empirically as observed above in related situations, they (or their accountants) will classify and organize their income so as to minimize taxation obligations. Given that it is almost universally the case that top marginal labor income taxes are higher than the (effective) top marginal capital income taxes, then income will likely be declared as capital income. To summarize, new technology has resulted in enormous rewards for a small number of people who have substantially registered these rewards in the form of capital income.

Our second instrument encapsulates exogenous variation in what we term as financial inclusiveness. By definition capital income requires capital ownership, and historically such ownership has not been widespread, even in the OECD. A necessary condition for mass ownership of capital assets and equity in particular is an established level of financial inclusion. A well developed financial system is one where it is easy, for all members of the population, to acquire (and sell) different types of capital assets. When financial inclusion is low, then conceivably at least some forms of asset ownership are not feasible for much of the population, and likely those with low income. Following this line of reasoning we conjecture that capital income inequality falls, conditionally, with financial inclusion.

The standard measure of financial inclusion is the ratio of stock market capitalization to GDP. However there are two problems with using this measure as an instrument in the context of our research objective. Firstly stock market capitalization is unlikely to be exogenous: a large public sector by construction implies a small private sector, hence lower stock market capitalization all else equal. Secondly, and more prosaically, the standard source for these data (the World Bank Global Financial Development Database) provides data only from 1989. To uncover exogenous variation in financial inclusion we use the Chinn-Ito index for financial openness ($KAOPEN$), an institutional measure that Chinn and Ito (2006) establish leads to changes in financial development, and therefore financial inclusion once legal systems and institutions are sufficiently developed (conditions which apply in the OECD). Notably these authors rule out reverse causality from financial inclusion to financial openness hence the Chinn-Ito index more plausibly satisfies the exogeneity requirement. To summarize the argument: The Chinn and Ito (2006) index exogenously drives financial inclusion. Exogenous increases in financial inclusion permit wider asset ownership thereby causing capital income inequality to fall. Hence we posit that capital income inequality exogenously falls with increases in the Chinn-Ito index.[14]

Table 3 contains the results of the IV estimation. Column 1 contains results using only the $INTERNET$ instrument, and column 2 contains results using only the $KAOPEN$ instrument. The first-stage coefficient estimates for both instruments exhibit signs as hypothesized. Capital income inequality is estimated to (conditionally) increase with internet coverage, and the hypothesis that this particular instrument is weak can be rejected given that the $F$-statistic of the first stage regression exceeds 14. On the other hand capital income inequality is estimated to conditionally fall with capital market openness. The $F$-stat in this instance does not quite reach the threshold value of 10, but is not far off. Column 3 employs both instruments, with the advantage that this enables application of the overidentification test. The null hypothesis here is that the exclusion restriction is violated, and clearly the test statistic does not indicate rejection of this hypothesis. This test result thus supports the exclusion restriction that the instruments are not correlated with the second-stage error term.

Using the results from column 3, the coefficient estimate for $TOPINC$ in the second stage indicates that a one standard deviation increase in this variable *all else equal* causes a fall in the size of government of about 6% (i.e. using the data in Table 1 around 60% of a standard deviation). Importantly the assumption that all else is equal here is strong: we have already documented the positive correlation between $TOPINC$ and labor income inequality ($UTIP$), and indeed the coefficient estimate for the latter variable suggests an

[14] Dabla-Norris et al. (2015) find that overall inequality actually increases with financial openness. The mechanism discussed therein is skills-bias – financial openness productively adds especially to the highly-skilled, thus increasing wage-inequality. It should be clear that this is a distinct hypothesis from ours, which emphasizes access to capital markets. Note again that labor income inequality is controlled for in both the first and second stages of the IV estimation. Hence the estimated effect of the Chinn-Ito index on capital income inequality is already conditional on any effect it has on labor income inequality.

offsetting effect if both types of inequality simulataneously increase. What is clear from these results is that the effects of inequality in general terms are more complex than implied in the original Meltzer and Richard (1981) model. Labor income inequality now positively affects government size - consistent with Meltzer and Richard (1981). The top income share - which we interpret as a proxy especially for capital income inequality - negatively affects the size of government. This is consistent with the theoretical reasoning in this paper. When it is difficult to tax capital income, then those who rely on labor income become averse to labor income taxation.

Columns 4 and 5 contain estimation results using 5-year averages of the data. For these regressions the lag of the top income share is used as an instrument, because $INTERNET$ and $KAOPEN$ are not sufficiently strong in this setting, where much of the time variation is averaged out. In column 4 $TOPINC$ is again estimated to have a significantly negative impact on government size, whilst labor income inequality ($UTIP$) remains positive and statistically significant. The negative impact of $TOPINC$ survives the addition of the lagged dependent variable in column 5, though the impact of productivity-induced labor income inequality is here reduced.

# 4 Conclusion

This paper analyzes how inequality in the capital income distribution affects the size of government. Capital income is quite distinct from labor income. We define it as rental income, and also model it as untaxed, hence redistribution is financed solely by taxation applied to labor income, and voters have preferences over the tax rate based on their position in the capital income distribution. Despite the fact that there are two underlying sources of heterogeneity in the populations, the median voter is still the unique Condorcet winner because tax preferences are monotonic in labor income.

The result relating taxation levels to capital income inequality is novel. In contrast to Meltzer and Richard (1981) increased capital-income inequality now leads to smaller government.

Agents who are endowed with capital income are less averse to labor-income taxation. The choice of labor income tax depends on the distribution of capital income: if the share of capital income of the rich increases, then their taxable labor supply falls and the preferred tax rate falls because the median voter has a reduced capacity to redistribute through taxation.

The relationship between the size of government and inequality is tested in a panel of OECD countries, augmenting the analysis of Pickering and Rockey (2011) and Facchini et al. (2016, forthcoming) to include capital income inequality as an additional explanatory variable. The measure of capital income inequality in the analysis is the top 1% income share. Consistent with the theory, government size is found to be negatively associated with capital income inequality. Moreover controlling for the top income share renders a consistently positive estimate for the impact of labor income inequality on government size, in line with the original Meltzer and Richard (1981) hypothesis. The negative impact of capital income inequality on government size survives a variety of econometric specifications, including when capital income inequality is instrumented with variables encapsulating technology and access to the capital market.

# Appendix

## A Derivation of Equations (12) and (13)

The problem of the median voter $m$ is to choose the tax rate so as to maximize

$$u^m(c^m, l^m) = u^m\left[(1-t)\, x^m n^m + R^m + t\bar{y}, 1 - n^m\right], \tag{A.1}$$

and the first-order condition for the median voter with respect to the tax rate is

$$\left(\bar{y} - y^m + t\frac{d\bar{y}}{dt}\right) u_c + \left[(1-t)\, x u_c - u_l\right] \left(\frac{dn^m}{dt}\right) = 0. \tag{A.2}$$

Thus, making use of equation (3), the tax rate chosen by the median voter must satisfy

$$\bar{y} - y^m + t\left(\frac{d\bar{y}}{dt}\right) = 0. \tag{A.3}$$

Changes in the tax rate $t$ affect average income via two channels: its effect on the opportunity cost of leisure, and its effect on transfers (from the government's budget constraint $r = t\bar{y}$). In particular, we have that

$$\begin{aligned} \frac{d\bar{y}}{dt} &= \frac{\partial \bar{y}}{\partial r}\frac{dr}{dt} - \frac{\partial \bar{y}}{\partial \tau}, \\ &= \frac{\partial \bar{y}}{\partial r}\left(\bar{y} + t\frac{d\bar{y}}{dt}\right) - \frac{\partial \bar{y}}{\partial \tau}. \end{aligned} \tag{A.4}$$

with $\tau = 1 - t$. Thus, the total derivative of average income with respect to changes in the tax rate is given by

$$\frac{d\bar{y}}{dt} = \frac{y_r\bar{y} - y_\tau}{1 - ty_r} < 0, \tag{A.5}$$

with $y_r = \frac{\partial \bar{y}}{\partial r}$ and $y_\tau = \frac{\partial \bar{y}}{\partial \tau}$.

Finally, making use of (A.5) to substitute in (A.3), we obtain

$$
\begin{aligned}
0 &= \bar{y} - y^m + t\left(\frac{y_r \bar{y} - y_\tau}{1 - t y_r}\right), \\
&= (\bar{y} - y^m)(1 - t) + \left[\frac{\eta_r \bar{y}(1 - t) - \eta_\tau \bar{y} t}{1 - \eta_r}\right],
\end{aligned}
\tag{A.6}
$$

where $\eta_r = y_r (r/\bar{y})$ and $\eta_\tau = y_\tau (\tau/\bar{y})$ are the partial elasticities of average income. Solving the above equation for $t$, yields

$$
t = \frac{m - 1 + \eta_r}{m - 1 + \eta_r + m\eta_\tau}, \tag{A.7}
$$

with $m = \bar{y}/y^m$.

# B Proof of Proposition 1

We begin with the following decomposition of average income

$$
\bar{y} = p(\mathcal{K})\,\bar{y}(\mathcal{K}) + (1 - p(\mathcal{K}))\,\bar{y}(\sim \mathcal{K}), \tag{B.1}
$$

where $\bar{y}(\mathcal{K})$ is the average income of the individuals in set $\mathcal{K}$ and $\bar{y}(\sim \mathcal{K})$ is the average income of the individuals not in set $\mathcal{K}$. From Assumption 2 we have that $\bar{y}^{\mathcal{K}} > y^m$.

Taking the total derivative of $\bar{y}$ with respect to $R(\mathcal{K})$, the capital income of the individuals in set $\mathcal{K}$ in equation B.1 we obtain

$$
\begin{aligned}
\frac{d\bar{y}}{dR(\mathcal{K})} &= p(\mathcal{K})\left(\frac{\partial \bar{y}(\mathcal{K})}{\partial R(\mathcal{K})} + \frac{\partial \bar{y}(\mathcal{K})}{\partial r}\frac{d\bar{y}}{dR(\mathcal{K})}t\right) + (1 - p(\mathcal{K}))\left(\frac{\partial \bar{y}(\sim \mathcal{K})}{\partial r}\frac{d\bar{y}}{dR(\mathcal{K})}t\right), \\
&= p(\mathcal{K})\frac{\partial \bar{y}(\mathcal{K})}{\partial R(\mathcal{K})} + \frac{\partial \bar{y}}{\partial r}\frac{d\bar{y}}{dR(\mathcal{K})}t, \\
&= p(\mathcal{K})\frac{\partial \bar{y}(\mathcal{K})}{\partial R(\mathcal{K})} + \eta_r\frac{d\bar{y}}{dR(\mathcal{K})},
\end{aligned}
\tag{B.2}
$$

where we used the fact that $\eta_r = \frac{\partial \bar{y}}{\partial r}\frac{r}{\bar{y}} = \frac{\partial \bar{y}}{\partial r}\frac{t\bar{y}}{\bar{y}} = \frac{\partial \bar{y}}{\partial r}t$. Using (B.2) to solve for $\frac{d\bar{y}}{dR(\mathcal{K})}$, we obtain

$$\frac{d\bar{y}}{dR(\mathcal{K})} = \frac{p(\mathcal{K})}{1-\eta_r}\frac{\partial \bar{y}(\mathcal{K})}{\partial R(\mathcal{K})} < 0, \tag{B.3}$$

since leisure is a normal good. Thus, average income $\bar{y}$ must fall.

In turn, we have that

$$\frac{dy^m}{dR(\mathcal{K})} = \frac{\partial y^m}{\partial r}\frac{\partial \bar{y}}{\partial R(\mathcal{K})}t > 0. \tag{B.4}$$

Thus, we have established that $\bar{y}$ must fall and $y^m$ must increase following an increase in the capital-income going to the top capital-income recipients. Therefore, $m = \bar{y}/y^m$ falls and the increase in capital income inequality lowers labor income inequality. The upshot is that the increase in the capital income going to the top capital-income recipients results in a lower $t$, the labor income tax chosen by the median voter.

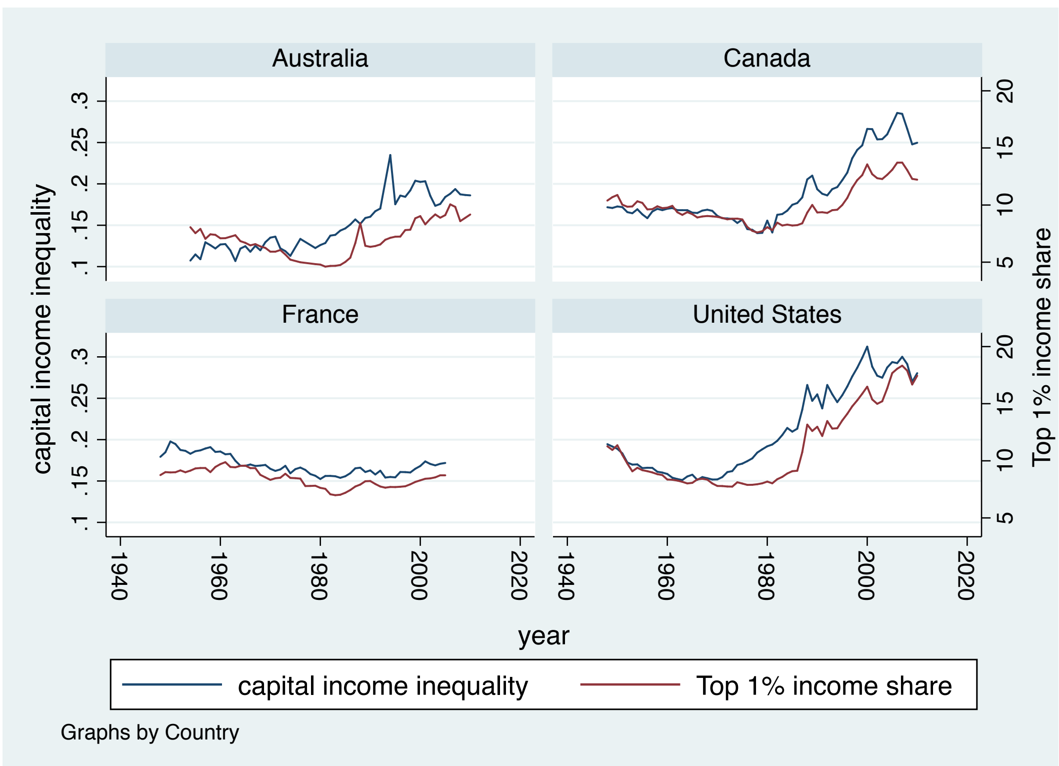


Figure 1: Capital Income Inequality Versus Top 1% Income Share

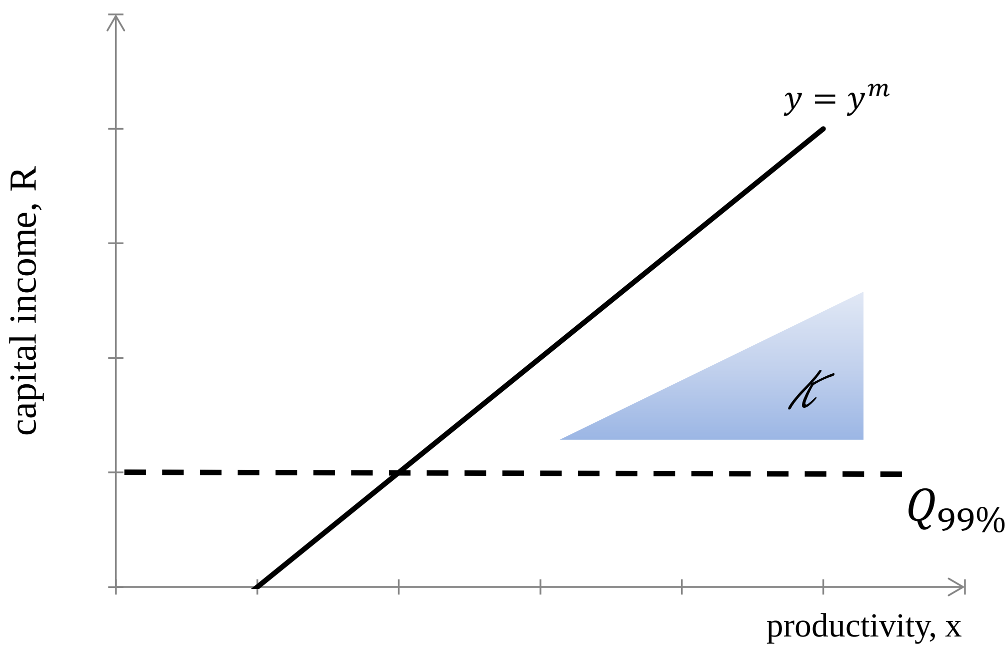


Figure 2: Capital Income and Productivity Joint Distribution (Assumption 2)

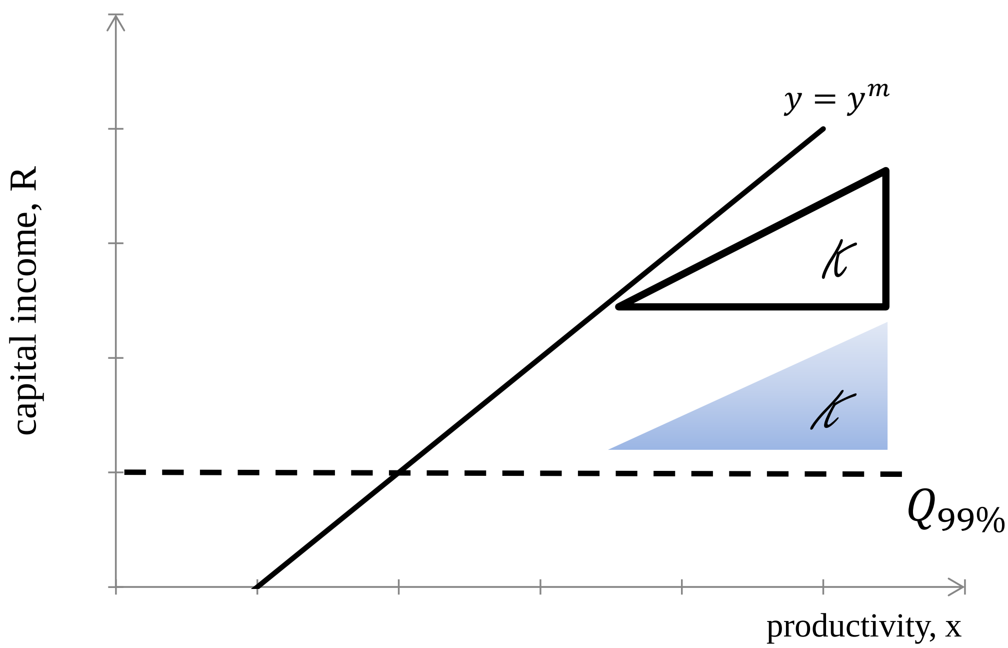


Figure 3: Increase in Capital Income Inequality

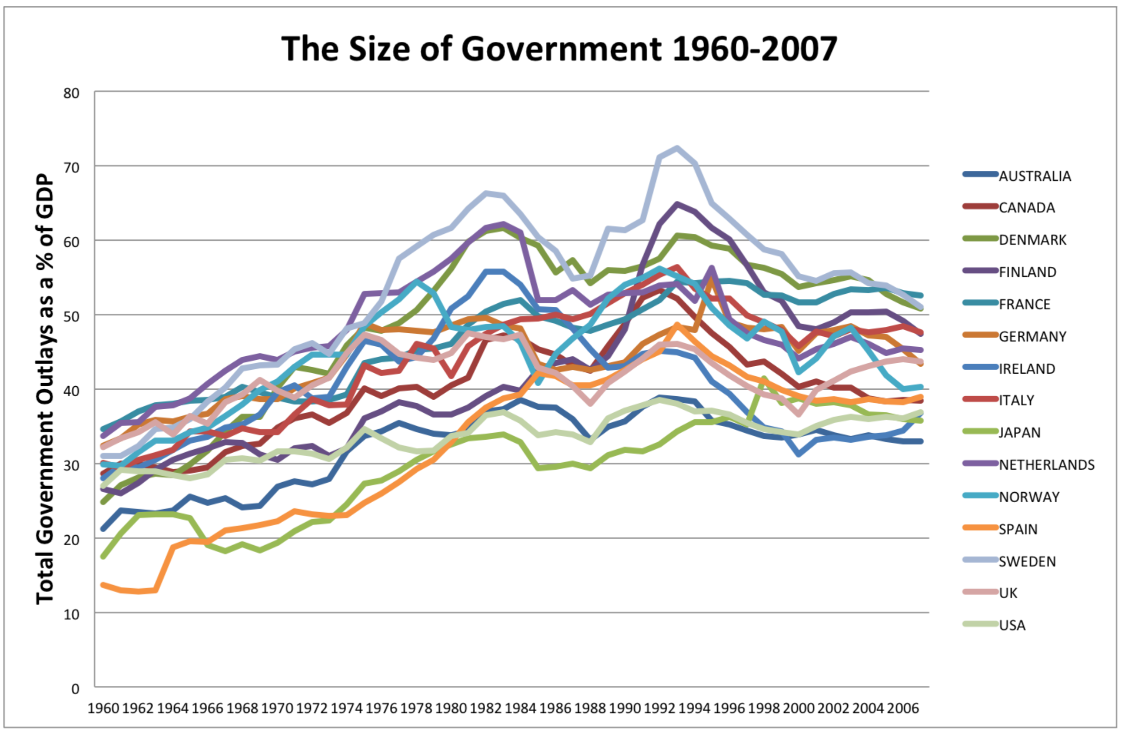


Figure 4: The Size of Government, 1960-2007

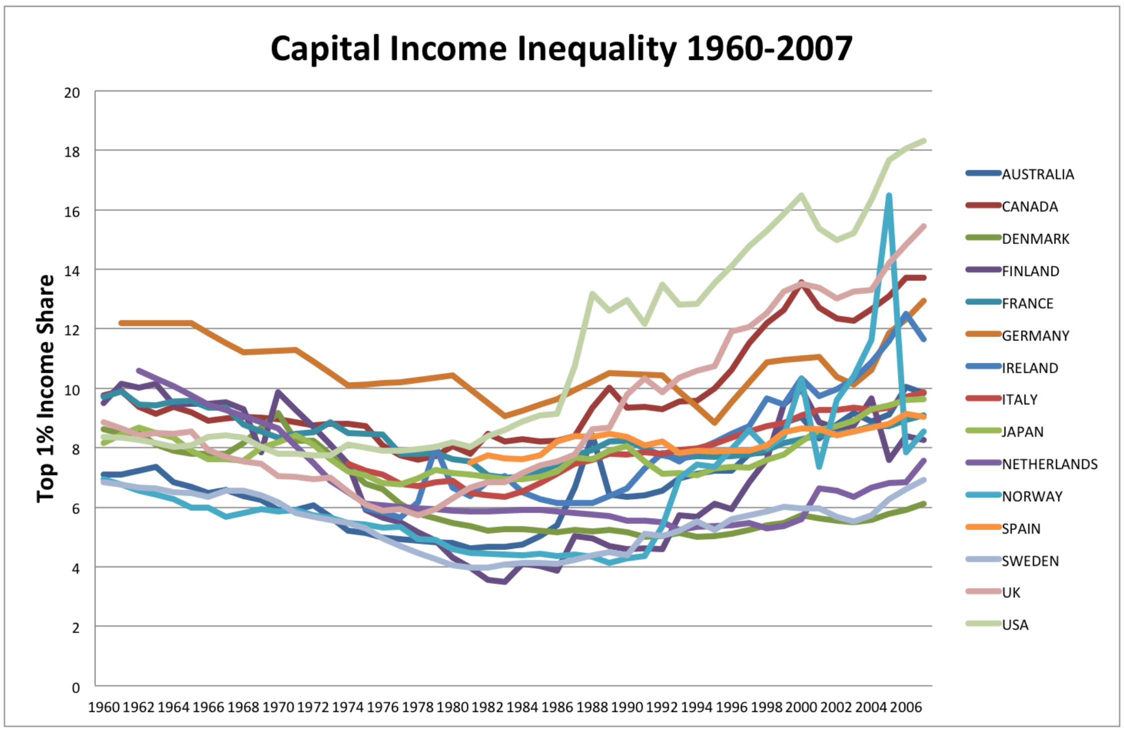


Figure 5: Capital Income Inequality, 1960-2007


Figure 6: Labor Income Inequality, 1960-2007

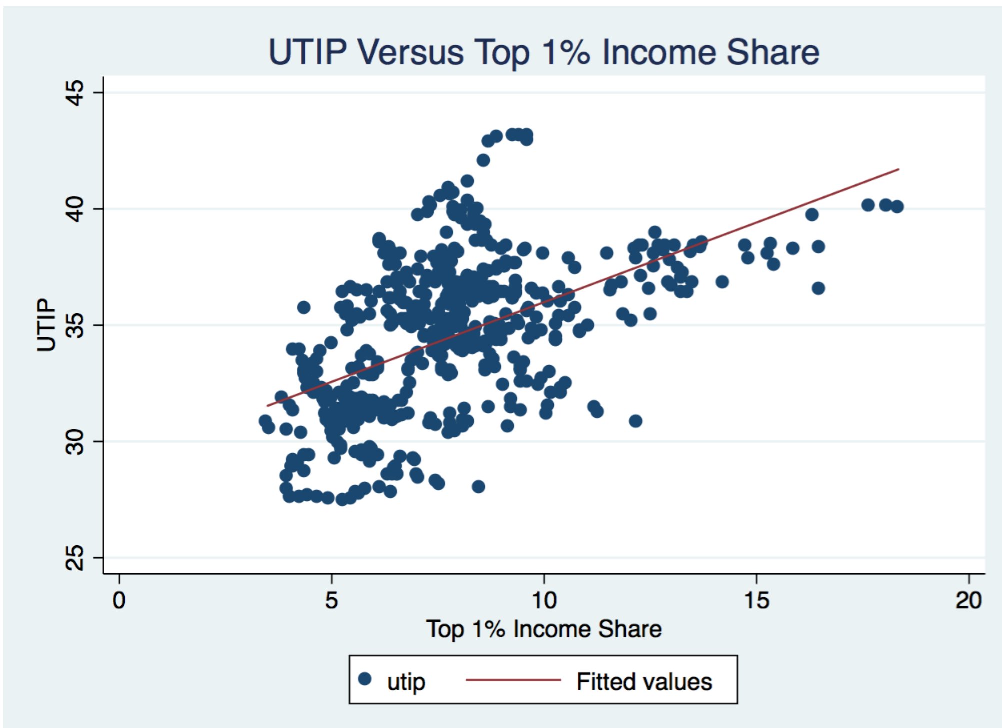


Figure 7: Labor Income Inequality and Capital Income Inequality, 1960-2007

Table 1: Descriptive Statistics

| | obs | mean | std. dev. | min | max |
|---|---|---|---|---|---|
| $OUTLAYS$ | 720 | 41.50 | 10.14 | 12.8 | 72.4 |
| $TOPINC$ | 617 | 7.89 | 2.44 | 3.49 | 18.33 |
| $UTIP$ | 625 | 34.61 | 3.25 | 27.42 | 43.16 |
| $SHARE$ | 548 | 67.97 | 6.03 | 44.74 | 82.10 |
| $FP$ | 622 | 57.73 | 12.94 | 27.96 | 82.46 |
| $\ln(y)$ | 720 | 2.94 | 0.439 | 1.57 | 3.93 |
| $IDEO$ | 683 | 0.043 | 0.117 | -0.266 | 0.337 |
| $PROP1564$ | 720 | 65.20 | 2.62 | 57.63 | 69.89 |
| $PROP65$ | 720 | 12.79 | 2.84 | 5.73 | 21.02 |
| $TRADE$ | 710 | 53.58 | 28.40 | 8.93 | 178.25 |
| $YGAP$ | 720 | 0.026 | 1.34 | -4.75 | 5.83 |
| $OIL\_EX$ | 720 | 4.60 | 12.05 | 0 | 72.36 |
| $OIL\_IM$ | 720 | 15.06 | 15.86 | 0 | 72.36 |
| $INTERNET$ | 720 | 10.91 | 22.50 | 0 | 87.76 |
| $KAOPEN$ | 564 | 1.41 | 1.22 | -1.89 | 2.39 |

Notes: $OUTLAYS$ denotes total government outlays as a percentage of GDP - taken from the OECD Economic Outlook database. $TOPINC$ is the top 1% income share - taken from the WID. $UTIP$ is the University of Texas Inequality Project's Estimated Household Income Inequality. $SHARE$ is the business sector labor share - taken from the OECD database. $FP$ is the female labor force as a percentage of the female population between 15 and 64 - also taken from the OECD database. $y$ is real GDP per capita in $000s of 2005 prices - taken from the Penn World Tables. $IDEO$ is ideology used in Pickering and Rockey (2011). $PROP1564$ and $PROP65$ are respectively the proportion of the population aged between 15 and 64, and 65 and above - taken from WDI database. $TRADE$ is the sum of exports and imports as a percentage of GDP. $YGAP$ is the difference between the actual output and its trend value in percentage - also taken from WDI database. $OIL\_EX$ and $OIL\_IM$ are respectively the oil price times a dummy variable equal to 1 if net exports of oil are positive; and the oil price times a dummy variable equal to 1 if net exports of oil are negative - taken from US Energy Information Administration. $INTERNET$ is the number of internet users per 100 people - also taken from WDI database. $KAOPEN$ is the Chinn and Ito (2006) index for financial openness.

Table 2: Panel Estimation Results with Fixed Effects

| | (1a) | (1b) | (2a) | (2b) | (3) |
|---|---|---|---|---|---|
| *L.OUTLAYS* | | | | | 0.423<br>(0.096)*** |
| *TOPINC* | | -1.079<br>(0.401)** | | -1.134<br>(0.367)*** | -0.632<br>(0.361)* |
| *UTIP* | 0.139<br>(0.422) | 0.730<br>(0.460) | 0.132<br>(0.496) | 0.497<br>(0.408) | 0.932<br>(0.375)** |
| *SHARE* | 0.473<br>(0.155)*** | 0.364<br>(0.127)** | 0.695<br>(0.200)*** | 0.522<br>(0.163)*** | 0.696<br>(0.164)*** |
| *FP* | -0.064<br>(0.188) | -0.019<br>(0.192) | -0.055<br>(0.221) | -0.096<br>(0.257) | 0.141<br>(0.112) |
| $\ln(y)$ | -7.484<br>(3.771)* | -1.139<br>(3.786) | -6.217<br>(4.501) | 2.342<br>(4.222) | -0.641<br>(4.419) |
| *IDEO* | -53.942<br>(22.948)** | -38.339<br>(23.633) | -58.428<br>(23.033)** | -34.991<br>(24.511) | -7.101<br>(19.769) |
| *INTERACT* | 1.434<br>(0.877) | 0.516<br>(0.918) | 1.448<br>(0.805)* | 0.388<br>(0.863) | 0.145<br>(0.723) |
| *PROP*1564 | 0.593<br>(0.507) | 0.239<br>(0.503) | 0.885<br>(0.579) | 0.549<br>(0.591) | 0.168<br>(0.358) |
| *PROP*65 | 1.967<br>(0.620)*** | 1.102<br>(0.609)* | 1.926<br>(0.604)*** | 1.318<br>(0.572)** | 0.160<br>(0.388) |
| *TRADE* | -0.026<br>(0.047) | -0.046<br>(0.046) | -0.031<br>(0.054) | -0.087<br>(0.053) | -0.057<br>(0.065) |
| *YGAP* | -0.682<br>(0.158)*** | -0.562<br>(0.180)*** | | | |
| *OIL_EX* | 0.031<br>(0.049) | 0.003<br>(0.036) | | | |
| *OIL_IM* | 0.052<br>(0.030) | 0.045<br>(0.024)* | | | |
| Obs | 506 | 462 | 113 | 113 | 98 |
| No. Countries | 15 | 15 | 15 | 15 | 15 |
| Data | Annual | Annual | 5-year averages | 5-year averages | 5-year averages |
| $R^2$ (within) | 0.42 | 0.48 | 0.41 | 0.47 | |

Notes: Panel regressions of government outlays as a percentage share of GDP including fixed effects, *SHARE*, *FP*, $\ln(y)$, *IDEO*, *INTERACT*, *PROP*1564, *PROP*65, *TRADE*, *YGAP*, *OIL_EX*, *OIL_IM* as control variables. Column (3) contains Arellano-Bond estimation with lagged values of both the predetermined and endogenous variables as instruments. Robust standard errors are shown in parentheses. Standard errors are clustered by country. *, **, and *** respectively denote significance levels at 10%, 5% and 1%.

Table 3: Instrumental Variable Estimation Results

| | (1) | (2) | (3) | (4) | (5) |
|---|---|---|---|---|---|
| $L.OUTLAYS$ | | | | | 0.523<br>(0.067)*** |
| $TOPINC$ | −4.105<br>(1.186)*** | −2.462<br>(1.213)** | −3.404<br>(0.903)*** | −1.754<br>(0.392)*** | −0.653<br>(0.326)** |
| $UTIP$ | 1.932<br>(0.485)*** | 1.420<br>(0.460)*** | 1.753<br>(0.370)*** | 0.836<br>(0.350)** | 0.269<br>(0.280) |
| Obs | 462 | 457 | 457 | 112 | 112 |
| No. Countries | 15 | 15 | 15 | 15 | 15 |
| Method | IV | IV | IV | IV | IV |
| Data | Annual | Annual | Annual | 5-year averages | 5-year averages |
| Instruments | $INTERNET$<br>0.017<br>(0.004)*** | $KAOPEN$<br>−0.246<br>(0.082)*** | $INTERNET$<br>0.015<br>(0.004)***<br>$KAOPEN$<br>−0.208<br>(0.082)** | $L.TOPINC$<br>0.801<br>(0.056)*** | $L.TOPINC$<br>0.825<br>(0.062)*** |
| $F$ | 14.78 | 9.038 | 10.64 | 205.3 | 177.9 |
| $p_{\chi^2}$ | | | 0.359 | | |

Notes: IV is estimated by two-stage-least squares. First stage coefficients are reported below the named instruments in the Instruments row. $F$ is an $F$-statistic for the statistical significance of the instruments in the first stage regression. $p_{\chi^2}$ is the $p$-value for the Chi-squared test of overidentifying restrictions. See also notes for table 2 for other details.

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