Income Skewness, Redistribution and Growth: A Reconciliation*

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Abstract

The so-called fiscal policy approach predicts that increases in income skewness should be associated with an intensification of redistributive efforts, at least in democracies. If redistribution is detrimental to growth, then this implies that a poor middle class is bad for long-run productivity; a prediction which has found empirical support. However, cross-country studies tend to find a negative association between income skewness and the amount of redistribution taking place, and, a positive relationship between redistributive taxation and growth. This paper offers a reconciliation of the existing theory and these puzzling findings. Specifically, the model predicts that the traditionally stipulated chains of causality hold within countries, whereas the puzzling correlations mentioned above may arise across countries.

Keywords: Income distribution, Political economy, Endogenous growth

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1 Introduction

The question of how income inequality affects economic activity in the long run has received significant attention from macro-economic researchers. At present several theoretical models compete and complement each other in trying to explain how the size distribution of income affects economic growth. The present paper is preoccupied with one such theory: The so-called fiscal policy approach.

At the risk of oversimplifying, one may summarize the main theoretical predictions of the approach as: (i) increasing skewness of the income distribution tends to increase redistributive government intervention, and (ii) redistribution is detrimental to growth. Accordingly, the reduced form prediction of the theoretical literature is that a more skewed distribution of income is bad for long term growth.

Although the evidence is broadly supportive of the reduced form prediction of the fiscal policy approach (e.g. Clarke, 1995; Perotti, 1996a; Easterly 2001, 2002), the empirical success in terms of the specific mechanisms advocated has been limited. In fact, a number of cross-country studies find that, if anything, (i) Countries with a more skewed distribution appear to redistribute less (Perotti, 1996a; Lindert, 1996; Bassett et al, 1999) and (ii) taxation/redistribution seems to be beneficial to growth (e.g. Perotti 1994, 1996a; Easterly and Rebello, 1993; Sala-i-Martin, 1996). Hence the conclusion would be that:

Although it [the fiscal policy approach] accounts for the negative correlation between inequality and growth found by reduced-form equations, the political economy approach is not fully supported by data ... redistribution is found to have positive rather than negative influence on growth. Moreover, when measures of redistribution such as tax rates or the extent of social spending are regressed on measures of inequality, the coefficient are either insignificant or have the sign opposite to what the theory would predict.


The contribution of the present paper lies in developing a model capable of reconciling the original theory with the above conflicting evidence. Specifically, we show that under plausible assumptions, a negative income skewness/tax relationship, and a positive tax/growth relationship may emerge in a cross-section of countries, while within any one economy, a poorer middle class will lead to more taxation, and more taxation to less growth.

The model developed below builds on the Alesina and Rodrik (1994) [henceforth: AR] framework. Hence, the formal structure allows for productive government investments (financed by

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1The seminal contribution is Galor and Zeira (1993). A review of the literature can be found in Aghion et al. (1999).
2A non-exhaustive list of theoretical contributions include: Alesina and Rodrik (1994); Bertola (1993); Perotti (1993), and Persson and Tabellini (1994); Saint-Paul and Verdier (1993).
3The paper by Saint-Paul and Verdier (1993) contains a slightly different prediction. In their model a poor median voter will prefer more redistribution in the shape of expenditures on education. Since such expenditures are shown to spur growth, an initially skewed distribution is predicted to enhance growth.
wealth taxes) that affect growth, and redistributes consumption.

The key difference to the analysis in AR is our assumption that fundamental (and slow-moving) structural characteristics – notably institutional quality or key determinants thereof – matter both for the distribution of income, and for the level of productivity. Specifically, we posit that countries equipped with a stronger institutional framework tend to be more productive and feature a richer middle class.

The formal link between institutions, productivity and income distribution is introduced in a very simple way. First, stronger institutions are assumed to increase the level of Harrod-neutral productivity. Second, we invoke a standard neoclassical production function so changes in the level of productivity will affect the distribution of factor income. Third, in line with AR the main source of income inequality in the model is heterogeneity in factor endowments; wealth is unequally distributed, labor income is not. As a result, the extent to which inequality of the distribution of wealth is translated into inequality of income depends on the income shares of capital and labor, respectively. In particular, we assume that in countries with a stronger institutional environment labor receives a greater share of income, and therefore these countries have a more equal distribution of income, centeris paribus.

The link between institutions and labor’s share is supported by Rodrik (1999). Using manufacturing data for 93 countries he finds that labor’s share of value added is higher in countries with democratic institutions. Moreover, Rodrik documents that democratic institutions tend to be accompanied by superior performance in terms of bureaucratic efficiency and rule of law; standard measures of institutional quality. More recently, Daudey and Peñalosa (2004) provide evidence in favor of the link between labor’s share and the distribution of income. Using Rodrik’s labor shares, Daudey and Peñalosa find that a larger labor share works so as to reduce aggregate income inequality as measured by the Gini index. They also find a positive impact from labor’s share on the third income quintile suggesting a positive association between labor’s share and the middle class share in total income. Taken together these studies therefore suggest that high-quality institutions tend to increase labor’s share thus leading to a more equal distribution of income, and a larger median income share. The “reduced form” association between institutions and the middle class share is further supported by the work of Easterly (2002). Easterly shows that 19th Century settler mortality rates predict income equality in the late 20th century: Low mortality tends to go hand in hand with a richer middle class. In previous research Acemoglu et al. (2001) have demonstrated a strong association between the same settler mortality rates and institutional "scores" as of the late 1990s. In sum, high quality institutions seem to promote both productivity and economic equality.

On this basis we present the following explanation for what one might term "the fiscal policy puzzle". Within any given economy, increasing wealth inequality, and therefore, holding funda-

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4Hall and Jones (1999) show that institutions have a strong causal effect on not only GDP per worker but also capital-output ratios, human capital stocks and, in particular, total factor productivity.
mental structural characteristics fixed, increasing income inequality, will lead to more redistributive taxation. However, this relationship may break down as soon as one considers economies that differ with respect to the strength of institutions. The reason is that a strong institutional framework implies that the marginal cost of public investment (measured in terms of foregone future consumption) tends to be low, and marginal benefit high, since the level of productivity is "high". As a result, a majority of the electorate may prefer a relatively higher level of government activity than what holds for economies with a weaker institutional infrastructure. Since countries with strong institutions tend to be equal ones, the relationship between taxation and the middle class' share may well be a positive one, but it is generally ambiguous.

At the same time, the model can account for a positive correlation between growth and taxes across countries. As in Barro (1990) the relationship between taxes and growth exhibits the well-known hump-shaped form. However, the growth maximizing tax level is shown to vary across countries. In particular, it is higher in countries with stronger institutions. Consequently, in a cross section of countries, it may appear as if taxation is good for growth. But, as the analysis shows, this is solely a cross-sectional phenomenon. Within any given economy, more taxation will lead to slower growth as the intensity of government involvement moves further beyond the level at which growth is maximized. This is a clear cut prediction since the tax chosen by the median voter always exceeds the growth maximizing level, as in the AR model.

The paper proceeds as follows. After a brief review of related literature, Section 2 develops the model and discusses its implications for a cross-section of countries. Section 3 reports the results from examining the "political" and "economic" mechanisms in the context of a sample of OECD countries. We find that data broadly support the theory. Nevertheless, these results should be viewed as tentative, in light of the rather limited number of observations; data constraints imply that only 15 countries are covered in the regressions analysis. A final Section 4 offers brief concluding remarks.

1.1 Related literature

A number of possible explanations for the above mentioned puzzling evidence has been suggested in recent years. Bénabou (1996), Saint-Paul and Verdier (1996) and Lee and Roemer (1998) all demonstrate how more inequality may lead to less redistribution when there is a wealth bias in the political system. In the plausible case where income is lognormal or Pareto distributed, and where the median voter is richer than the person with median income, an increasing variance of the distribution may imply an increasing income share for the median (pivotal) voter, ultimately yielding a negative, or U-shaped, association between inequality and redistribution.

In the empirical work discussed above, however, the independent distribution variable is typically not measures of dispersion (like the Gini-coefficient), but rather measures of income
skewness.\textsuperscript{5} Since the before mentioned contributions all employ a measure of dispersion as their inequality variable, they are unable to explain why the middle class share appears to exhibit a positive (/insignificant) correlation with measures of taxes/redistribution. In contrast, the model developed below is able to account for this fact, but, at the same time, warns that the cross-sectional result may not reflect a causal relationship.

In an extension of previous work, Benabou (2000) develops a model featuring multiple steady states. When comparing steady states the relationship between pre-tax inequality, measured by the variance of the log-normal distribution, and redistribution is negative. The stylized prediction of the model is that within countries the relationship between redistribution and inequality is ambiguous (unless the individual regimes can be identified) while the findings of e.g. Perotti (1996) arise across countries. Aside from the measurement issue of inequality already mentioned, our model is different in that it predicts the “standard” relationship between income skewness and redistribution within countries: More skewness raises redistributive efforts.

Perotti (1996b) points to another reason why inequality and redistribution may be related in the manner suggested by the cross-section evidence. In the standard model redistribution is assumed to be directed towards the poor in a monotonic fashion. This might not be the case empirically. Based on this observation Perotti suggests (informally) that variations of benefit shares across individuals might hold some explanatory power. If redistribution predominantly benefits the rich, then a poorer median voter might want less redistribution. However, evidence from the Luxemburg Income Study (LIS), presented in Milanovic (2000), suggests that (at least in the countries covered) redistribution does in fact benefit the poor. Indeed, net transfers appear to be more or less monotonically decreasing as one moves across income deciles, starting with the poorest.

Another argument for increasing inequality leading to lower taxes is put forward in Lee and Roemer (1999). In their analysis credit markets are absent, and the population is (endogenously) segmented into a group which invests and one which does not (the poor). Taxes are levied on post-investment income. They proceed to demonstrate that if inequality increases, tax revenues tend to decline because the share of the population who does not invest rises. This "tax-base effect" may ultimately be strong enough to produce a negative relationship between income inequality (measured by the variance of a lognormal distribution) and taxes, as the outcome of majority voting. In general their analysis suggest an inverted U-shaped relation between taxes and inequality.

Somewhat related, Rodriguez (1999) questions the assumption of “tax compliance”. In standard models it is assumed that everyone pay their taxes, which may not always be the case. Rodriguez demonstrates that if the median voter recognizes the incentive, on the part of the wealthy, to lobby for tax favors she might choose to lower taxes in the face of increased ineqaul-

\textsuperscript{5}For example, Perotti (1996a) uses the third quintile as a measure of the median voters income.
ity.

In terms of testable predictions the key difference between these theories, and the one developed below, is the nature of the relationship between inequality and redistribution when moving from cross-section to across-time data. All the existing explanations (except Benabou, 2000) imply that the relationship between redistribution and inequality should be the same across time and space whereas our model implies that the correlations may change sign.

The relationship between taxes and growth may also be reversed, as pointed out by e.g. Benabou (1996, 2000) and Aghion et al (1999), if credit markets are imperfect. In this case redistribution may be good for growth as it grants borrowing constrained (poor) individuals the ability to invest. In the presence of tax competition between economies with different levels of productivity a positive association between redistribution and growth may also be obtained (Rehme, 2004). Again, in contrast to our hypothesis these contributions suggest a uniformly positive relationship between taxes/redistribution and growth when moving from the cross-country to across-time dimension of the data.

On the empirical side Milanovic (2000) recently found some corroborating evidence in favor of the original political economy mechanism, using survey data from the LIS, and, adopting a fixed effects approach: The income share of the "middle class" is significant in explaining the amount of redistribution accruing to this group. In terms of the taxes/growth nexus the study by Kocherlakota and Yi (1997) reports a negative impact of taxation on growth, using data spanning more than a century for the United States and United Kingdom. Likewise, looking at a panel of OECD countries Kneller et al. (1999) find a negative impact from taxes on growth. Our theoretical work provides an explanation as to why results differ so markedly between cross-section regressions and panel data (/time series) regressions. Our empirical results can be viewed as complementary to the studies mentioned above.

2 The Model

Consider a closed economy with a constant population of measure one. There is a unique output good which can be consumed or invested. All markets are competitive and we assume the existence of a perfect credit market. Individuals are identical with respect to preferences and productivity. We allow for heterogeneity with respect to wealth only. Taxes are levied on wealth, while labor income is exempt from taxes. The revenue is used to fund public services, and the government balances the budget at all points in time. Finally, each consumer has a unit endowment of labor, which is supplied inelastically.
2.1 The Consumers

The basic problem facing individual $i$ is to maximize the discounted utility from consumption, $c_i(t)$

$$\max_{\{c_i(t)\}_{t=0}^{\infty}} \int_0^\infty \ln c_i(t)e^{-\rho t}dt, \quad \rho > 0,$$

subject to the identity that accumulation of wealth, $\dot{k}_i(t)$, depends on labor income, $w(t)$, after-tax income from wealth $[r(t) - \tau]k_i(t)$, and consumption

$$\dot{k}_i(t) = w(t) + [r(t) - \tau]k_i(t) - c_i(t).$$

The consumer’s problem of deciding on optimal consumption and saving is completed with the No-Ponzi-Game condition, $\lim_{t \to \infty} k_i(t)e^{-r t} \geq 0$. Standard computations lead to the well known Keynes-Ramsey rule,

$$\frac{\dot{c}_i(t)}{c_i(t)} = r(t) - \tau - \rho \equiv \gamma_c,$$

which states that the individual will prefer rising consumption if the after-tax real rate of interest exceeds the rate of time preference. As all individuals face the same interest and tax rate and are equally patient, equation (3) implies that $\gamma_c$ equals the per capita growth rate of consumption, $\gamma_c$. As is shown formally below, the real rate of interest is constant at all points in time ($r(t) = r$). Hence, wealth, and thus capital, must also be accumulated at the rate, $\gamma_c$.6

2.2 The Firms

Production in firm $j$, $Y_j(t)$, is characterized by

$$Y_j(t) = g \left[ \frac{G(t)}{K(t)} \right] F[K_j(t), E(t)L_j].$$

$G(t)$ is productive government expenditure, $K(t)$ is the aggregate capital stock, $K_j(t)$ and $L_j$ are the inputs of physical capital and labor, respectively, while $E(t)$ is an index of each workers productivity at time $t$. Both $E(t)$ and $G(t)/K(t)$ are treated as exogenous by the producers. Note that $\int L_j dj = 1$ as total labor supply is of measure one. The properties of $g(\cdot)$ and $F(\cdot)$ are discussed below.

The level of government intervention is divided by the aggregate capital stock so as to capture congestion effects. Hence, in order to increase over-all productivity, $G(t)$ has to rise in proportion to $K(t)$ (see Barro and Sala-i-Martin, 1992). The function $g(\cdot)$ determines the extent to which such an increase is transformed into an increase in (Hicks-neutral) productivity. We assume $g' > 0$, $g'' < 0$ and the Inada condition $\lim_{r \to 0} g' = \infty$, thereby allowing for diminishing returns to productive government investments. As we have assumed a balanced government budget,

\[ \frac{\dot{k}_i(t)}{k_i(t)} = \gamma_c \quad \forall i, t. \]
whereby \( G(t) = \tau K(t) \), it follows that
\[
g \left[ \frac{G(t)}{K(t)} \right] = g(\tau).
\]

Labor productivity, \( E(t) \), expands as productive knowledge is accumulated in the process of capital accumulation:
\[
E(t) = AK(t),
\]
(5)

Equation (5) signifies, that two countries (at a given point in time) with identical capital stocks, labor endowments, and government intervention, may differ with respect to the level of income per capita. The parameter \( A \) in equation (5) parameterizes such cross-country differences. In the sequel we will refer to \( A \) as productivity enhancing “institutions”.

Turning to the functional form of the production function, \( F(\cdot) \) summarizes how combinations of physical capital and labor input are transformed into output. We assume that \( F(\cdot) \) exhibits constant returns in \( K_j(t) \) and \( L_j \).

Given the production function, equation (4), the producers will acquire capital and hire labor until the marginal product equals the real interest rate, \( r(t) \), and the real wage, \( w(t) \), respectively:
\[
\frac{\partial Y_j}{\partial K_j} = r(t),
\]
(6)
\[
\frac{\partial Y_j}{\partial L_j} = w(t).
\]
(7)

In symmetrical equilibrium, all producers choose the same factor intensity \( K_j/L_j \). Using this we may solve for general equilibrium factor prices
\[
g(\tau) [f(A) - Af'(A)] = r,
\]
(8)
\[
g(\tau) Af''(A) k(t) = w(t),
\]
(9)
where \( f(A) \equiv F(1,A) \), \( f' > 0 \), \( f'' < 0 \).

2.3 Measuring Inequality

To incorporate a measure of inequality in the analysis we follow Alesina and Rodrik (1994) and define
\[
\sigma_i \equiv \frac{k(t)}{k_i(t)},
\]
(10)
where \( k \) is the per capita stock of capital. Thus, \( \sigma_i \) denotes the (inverse) relative wealth endowment of individual \( i \). Observe that \( \sigma_i \) is constant as \( \frac{k(t)}{k_i(t)} = \frac{k_i(t)}{k_i(t)} \) for all \( i \). Hence, the distribution of wealth (capital) is time-invariant and predetermined.  

\[\footnote{The derivations of equilibrium factor prices are identical to those in the model developed in Barro and Sala-i-Martin (2004, Ch. 4.3.1).}

\[\footnote{Moreover, this might be a fairly reasonable property of the model from an empirical point of view. In a study of the post World War II period, Li, Squire and Zou (1998) find substantial variation in inequality across countries, but little evidence of substantial long term trends in the size distribution of income within countries. This does not mean, however, that changes in the distribution never occur (see e.g., Atkinson, 1997).}\]
In the present framework, the distribution of wealth is paramount to the political equilibrium. Typically, however, empirical investigations of the fiscal policy approach use measures of income, and not wealth, inequality. Hence, in order to make the theoretical analysis comparable with these empirical studies we need to consider the mapping from the wealth distribution to the (pre-tax) distribution of income, within the present framework. Using the definition of before-tax household income, the definition of $\sigma_i$, and the equilibrium values of factor prices leads to the following expression for individual $i$’s relative income share:

$$\frac{y_i(t)}{y(t)} = \sigma_i^{-1} + \frac{A f'(A)}{f(A)} (1 - \sigma_i^{-1}),$$

where $\frac{A f'(A)}{f(A)}$ is labor’s share in total income while $y(t)$ signifies per capita (or mean) income. As an over-all summary measure of income equality, we use the median income share,

$$\frac{y_m(t)}{y(t)} = \sigma_m^{-1} + \frac{A f'(A)}{f(A)} (1 - \sigma_m^{-1}),$$

(11)

where $\sigma_m^{-1}$ (the wealth share of the person with median wealth) is reasonably assumed to be less than one. In the remaining we make the following important assumption:

**A1** Labors’ share in national income, $w/y = \frac{A f'(A)}{f(A)}$, is increasing in $A$.

Under A1 it follows that countries with stronger institutions, which work to increase $A$, will tend to have a more equal distribution of income, ceteris paribus.²

### 2.4 The Economic Equilibrium

The model reduces to a simple AK-model:

$$y(t) = g(\tau) f(A) k(t).$$

(12)

A well-known property of this type of model is the lack of transitional dynamics. This means that all endogenous variables grow at a common constant rate, at all points in time. Consequently, the Keynes-Ramsey rule, equation (3), pins down the over-all growth rate of (per capita) income in the economy:

$$\gamma = g(\tau) [f(A) - A f'(A)] - \tau - \rho,$$

(13)

which is positive if $g(\tau) [f(A) - A f'(A)] - \tau > \rho$. Taxes have a dual impact on the growth rate, which leads to the familiar hump-shaped relationship between taxes and per capita income growth: At low levels of taxation the productive effect dominates, which is why higher taxes raise growth. At a sufficiently high level of taxation, $\tau^*$, savings are reduced to an extent which exactly off-sets the productive effect. If a higher tax rate is implemented, growth will be reduced. Hence, $\tau^*$, represents the “growth-maximizing” level of taxation. Specifically, $\tau^*$ is given by

$$\frac{\partial \gamma}{\partial \tau} = 0 : g'(\tau^*) = \frac{1}{f(A) - A f'(A)}.$$

(14)

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²Technically, A1 amounts to assuming an elasticity of substitution between capital and labor above 1. Duffy and Papageorgiou (2000) estimate aggregate production functions for a large number of countries and find an elasticity of substitution, between physical and human capital, above unity.
Notice that if $A$ varies from country to country then $\tau^*$ varies too. In particular we have the following result

**Proposition 1** The growth-maximizing tax rate, $\tau^*$, is increasing in $A$.

**Proof.** Differentiation of equation (14) yields $\frac{\partial \tau^*}{\partial A} = \frac{Af''(A)}{g''(\tau^*)} > 0$. Thus, countries with stronger institutions reach maximum growth at a higher level of taxation.

The intuition is simply that as $A$ goes up, government investments become more productive (in the sense that the ability of such investments to increase the marginal product of capital rises):

$$\frac{\partial MP}{\partial \tau \partial A} = -g'(\tau) Af''(A) = g''(\tau) F_{KL} > 0.$$ As we assume diminishing returns to $\tau$ ($g'' < 0$), it follows that the level of government intervention which maximizes the net return on investments becomes higher. We now turn to the determination of the tax rate.

### 2.5 The Political Equilibrium

We assume that taxes are chosen through majority voting. Hence we follow the conventional approach to determination of the political equilibrium within this line of literature, the median voter theorem. To apply the median voter theorem, preferences must be single peaked and the preferred tax rate must be monotonic across individuals, i.e., across relative factor endowments.

As a consequence of the balanced growth property of the model, $\sigma_i$ is constant, so we can abstract from issues of time inconsistency and strategic voting when it comes to the political equilibrium.\(^10\)

To solve for the preferred tax rate we need an expression for the path of consumption. This can easily be found by using $\gamma c_i = \gamma k_i$ to equate (3) and (2). After rearranging one obtains:

$$c_i(t) = \left[ \frac{\omega(t)}{k_i(t)} + \rho \right] k_i(t) = [g(\tau) Af'(A) \sigma_i + \rho] k_i(t),$$

where the last part of equation (15) follows from the equilibrium real wage, equation (9), and the definition of $\sigma_i$, equation (10). Furthermore, since $\frac{k_i(t)}{k_i(0)} = \gamma$ \forall i the entire time path of consumption can be written as

$$c_i(t) = [g(\tau) Af'(A) \sigma_i + \rho] k_i(0) e^{\gamma t}.$$ Note that the level of consumption is increasing in $\tau$ through the real wage. At the same time, however, the tax rate will have a negative effect on (future) consumption via reductions in the growth of consumption $\gamma$ (insofar as $\tau > \tau^*$, of course). In other words, the consumer ultimately faces the problem of trading-off these two effects against each other, i.e., a static gain versus a

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\(^{10}\)From a technical perspective we assume, like Alesina and Rodrik (1994), that taxes are only voted on at time zero, and are required to be constant. Recently, Lindner and Strulik (2004) have demonstrated that the “Alesina and Rodrik solution” can be obtained as a time consistent Markovian Stackelberg equilibrium in a differential game between the government and the median voter. In particular, the solution involves a time constant tax rate (without this being imposed up front). The Lindner/Strulik Theorem applies here as well, since our model is similar in structure to Alesina and Rodrik’s.
dynamic loss. The solution will depend on the individual’s relative factor endowment, \( \sigma_i \), as will be clear momentarily.

The problem of individual \( i \) is to choose the tax rate which maximizes discounted intertemporal utility. Insertion of the consumption path in equation (1), and integration of the resulting expression leads to the following, obviously static, maximization problem:

\[
\max_{\tau} \frac{1}{\rho} \left( \ln c_i(0) + \frac{\gamma}{\rho} \right),
\]

subject to equation (13). The first order condition is

\[
\frac{\partial c_i(0)}{\partial \tau} c_i(0) = \sigma_i g(\tau) Af(\tau) \rho + \sigma_i g(\tau) Af^\prime(\tau) \rho = \frac{1}{\rho} \frac{\partial \gamma}{\partial \tau} = \frac{1 - g'(\tau)(f(A) - Af'(A))}{\rho}.
\]

The semi-elasticity, \( \frac{\partial c_i(0)}{\partial \tau} c_i(0) \), represents the marginal benefit (MB) from an increase in taxes, and \( -\frac{1}{\rho} \frac{\partial \gamma}{\partial \tau} \) is the marginal cost. It is apparent that all individuals face the same marginal costs (MC) while MB varies. The first order condition is illustrated in the upper panel of Figure 1; the lower panel shows the relation between growth and taxes. Marginal cost is zero if \( \frac{\partial \gamma}{\partial \tau} = 0 \), i.e., when the tax rate equals the growth maximizing rate, \( \tau^* \). The MC-curve is upward sloping in \( \tau > \tau^* \) as the dynamic loss mentioned above increases with the deviation from the growth-maximizing tax level.

Next, consider the MB term. As \( g'' < 0 \) it follows from equation (18) that the MB-curve will be downward sloping. Individual \( i \)'s preferred tax rate is uniquely determined at the intersection of the two curves. As can be seen from equation (18), the MB-curve shifts up if \( \sigma_i \) increases.

As for the actually implemented tax rate, it follows from the median voter theorem that the chosen tax rate through majority voting should be the one preferred by the median voter. Hence, the implemented tax rate reflects the median wealth share, \( \sigma_m \), assuming full participation at elections. In sum we have:

**Proposition 2** Redistri bution, income skewness and growth within an economy. Assume a fixed institutional framework, i.e. A constant. Then: (i) The chosen tax rate is decreasing in the wealth (and income) share of the median voter; (ii) the chosen tax rate is above the growth maximizing level; (iii) growth is decreasing in the degree of wealth (and income) skewness.

**Proof.** See Appendix A.1. \( \blacksquare \)

Thus, increases in wealth inequality, and therefore income inequality (cf. equation (11)), will lead to more taxation and less growth, as the selected tax rate moves further beyond the growth maximizing level.

### 2.6 Cross-sectional Implications of the Model

In this section we examine the nature of the relationship between income inequality, taxes and growth when two different countries (equipped with different levels of institutional quality, i.e. different \( A \)'s), are compared. We start by noting that:
Lemma For $\sigma_i$ given, stronger institutions (higher $A$), implies higher marginal benefits ($MB$) from taxation/redistribution, and lower marginal costs ($MC$).

Proof. $MB = \frac{\sigma_i g'(\tau) A f'(A)}{\rho + \sigma_i g(\tau) A f'(A)} = \frac{\sigma_i g'(\tau) \alpha_L(A) f(A)}{\rho + \sigma_i g(\tau) \alpha_L(A) f(A)}$, where $\alpha_L(A) \equiv f'(A) A / f(A)$ is labor’s share. Under A1, and since $f'(A) > 0$ it follows immediately that $\partial MB / \partial A > 0$. $MC = -\frac{\rho \gamma'}{\rho \tau} = -\frac{1}{\rho} [g'(\tau) (f(A) - A f'(A)) - 1]$. Clearly $\partial MC / \partial A < 0$ since $f''(A) < 0$.

There are two contrasting effects on $MB$ from a higher level of $A$. On the one hand, since the wage goes up marginal utility from consumption (1/c ) falls. On the other hand, a higher wage makes consumption more sensitive to tax changes ($\partial c / \partial \tau$ rises). On net the second effect dominates, which is why $MB$ rises.

On this basis we can prove the following result:

Proposition 3 Redistribution and income skewness in a cross-section of countries.
All else equal, countries with stronger institutions (higher $A$) will (i) choose a higher level of taxation/redistribution and (ii) be more equal measured by both pre- and post tax income skewness.

**Proof.** See Appendix A.2.

Hence, Proposition 3 shows that if a (sufficiently) large fraction of the cross-country variation in personal income inequality is driven by variations in the institutional framework of individual economies, then societies featuring a less skewed income distribution may well be characterized by higher levels of taxation and redistribution. However, as Proposition 2 demonstrates, this can occur even though “the world works” in accordance with standard political economy growth models, associated with the fiscal policy approach to income distribution and growth.

Figure 2 illustrates these results geometrically. Two economies are depicted in one MC/MB diagram; they differ solely with respect to $A$. For illustrative purposes the figure is drawn such that equilibrium MC(/ MB) are identical across the two countries. This need not be the case in general however, as it depends on the relative size of the shifts in the MB and MC-curves, generated by changes in $A$.

The lower panel illustrates how the variation in taxes is translated into variation in growth rates. Proposition 1 states that in a society with strong institutions the growth maximizing tax will be higher, as illustrated in Figure 2. As a result, the two economies map into the $(\gamma, \tau)$ space as points A and B. Hence, the relative more equal society, featuring higher taxes, is the fastest growing (point B). Again, this is solely a cross-section phenomenon. Increasing the tax rate will unambiguously hamper growth within both economies.

It should be recognized that this analysis only illustrates the potential for these patterns to arise in a cross-section of countries. Ultimately, other configurations are theoretically feasible. For example, suppose the country with “bad” institutions also has a more unequal distribution of wealth. Then the associated MB–curve (i.e. $MB_{LOW\,A,UNEQUAL}$) will be placed further to the right than illustrated in Figure 2. This is because a poorer median voter will prefer more redistribution since MB increases when the wealth share declines (cf. proposition 2, i). Therefore, depending on the size of the difference in wealth inequality between the two economies, the unequal country may end up implementing a relatively higher tax rate.

Likewise, the implied relationship between growth and taxes may be a negative one. Indeed, in general we have

**Proposition 4** *Growth and taxes in a cross section of countries.* Suppose individual countries differ solely with respect to institutional quality, i.e. $A$. Then the cross-country relationship between equilibrium taxes and growth is ambiguous.

**Proof.** See Appendix A.3.

Nevertheless, the key insight gained from this analysis is that the puzzling cross-sectional relationships between income skewness, redistribution/taxes and growth are fully reconcilable.
with an essentially standard political economy growth model featuring majority voting over taxes.

Importantly, this purposed theoretical explanation can be confronted with data. According to the model, within any single country one should expect the “standard” interrelationships between income skewness, taxes and growth (Proposition 2). In a cross-section of countries, on the other hand, one may observe a reversal of correlations (Propositions 3 and 4). These predictions clearly differs from the results in the literature discussed in Section 1.1. In these contributions the cross-sectional findings are given a causal interpretation. Accordingly, the positive correlation between taxes and equality, and between taxes and growth, should arise within as well as across countries. This provides a case for testing the model to which we now turn.

Figure 2: A possible configuration of income skewness, redistributive taxes and growth in a cross-section.
3 Empirical Assessment

This section examines whether cross-country data supports the causal links between income skewness and growth based on the above abridged version of the fiscal policy approach. As indicated below there are quite serious data limitations which is why the analysis perhaps should be seen more as an empirical illustration rather than a test of the theory outlined above.

Based on the theoretical model the inequality variable should be a measure of income skewness. Much of the previous literature has used data from the inequality data base initially complied by Deninger and Squire (1996). The use of the Deninger and Squire data set in cross-country regressions has been criticized, in particular, by Atkinson and Brandolini (2001). In the present analysis we follow their advice and use a data set in which the income skewness measure is as fully consistent as possible even though this limits the number of observations considerably compared to using the Deninger and Squire data.

Milanovic (2000) reports several income distribution measures based on the Luxembourg Income Survey (LIS) database for 24 OECD countries. In the empirical illustration below we use the distribution of factor incomes plus pension transfers (factor P income in Milanovic, 2000) and measure income skewness by the cumulated share of the first five deciles in the distribution.\(^{11}\) In the following this measure is referred to as the median income share.

Turning to the data for redistribution, Perotti (1996:169) discusses the choice of relevant fiscal variables to include in the model. In particular he selects a set of (average) tax rates along with four expenditure measures from the functional classification of public expenditure. However, a broad country coverage of public expenditure limits the data source to “Government Finance Statistics” from the IMF. Unfortunately, GFS concentrate on central government statistics, while the local government expenditure are more difficult to assess intertemporally. Since many expenditures are administered by local governments in federal countries, cross country comparisons of central government expenditures are problematic if the composition of local and central expenditures changes over time.\(^{12}\) Consequently, we have chosen to focus on tax revenue statistics from OECD, which include both local and central government revenue. Specifically, we have compiled a data set encompassing two average taxes; taxes on income, profits, and capital gains (in brief; taxes on income) and taxes on property. Both are measured as percentages of GDP. The combination of median income share and tax data creates an unbalanced panel of 15 high income OECD countries with (at most) 56 country-year observations.\(^{13}\)

The theory developed above emphasizes the importance of accounting for institutional differences in cross country analyses of the fiscal policy approach. Even though the specific kind of institution is not explicit in the theoretical section the basic assumption is that labor’s share of

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\(^{11}\) The data is reported in Milanovic, 2000, Appendix E.

\(^{12}\) The much cited study by Easterly and Rebelo (1993) notes explicitly that their expenditure data, which derives from GFS, suffers from this problem.

\(^{13}\) The countries are Australia, Belgium, Canada, Denmark, Finland, France, Ireland, Italy, the Netherlands, Norway, Spain, Sweden, United Kingdom, and United States.
value added varies with institutional quality. As mentioned in the introduction, Rodrik (1999) finds that labor’s share of value added is higher in countries with democratic institutions. However, as the variation in some measures of institutional quality, say bureaucratic efficiency and rule of law, is quite limited in the sample of 15 high income OECD countries the standard measures of institutional quality may not be sufficient in this analysis.

Table 1 reports the estimated impact on labor’s share of value added of two popular institutional measures; ‘rule of law’ and government antidiversive policies (GADP, see Hall and Jones, 1999). Both measures are based on data from the International Country Risk Guide (ICRG), and both have been used frequently in cross country growth regressions. The results in Table 1 indicate that even within the 15 high income OECD countries there is a statistically significant covariation between the two institutional measures and labor’s share of value added. However, for ‘rule of law’ the the covariation is only marginally significant.

Table 1 reports the association between the three labor market regulation indexes and labor’s share of value added across the 15 OECD countries. As seen, labor’s share of value added is negatively related to two of the indexes; labor regulation laws and collective agreement laws, while there is no significant association with the social security laws index.

In addition to the labor regulation indexes we also consider two other variables used in the

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14The institutional measure GADP includes rule of law as one of five components of government antidiversive policies, see Hall and Jones (1999).

15We thank an associate editor for leading us in the direction of labor market institutions.

16see Botero et al. (2004) for a precise description of the indexes.
study by Botero et al.; union coverage and the percentage of the labor force covered by collective agreements (denoted ‘collective agreement’). Although Botero et al. consider these variables to be measures of political orientation, one may equally well think of the variables as measures of labor market institutions. The bottom part of Table 1 shows that union coverage is not significantly correlated with labor’s share of value added. In contrast, there is a quite strong correlation with the share of the labor force covered by collective agreement.17

Based on the results in Table 1 we use GADP, the indexes of labor regulation and the share of the labor force covered by collective agreement as institutional measures in the empirical assessment of the fiscal policy approach given below. Following Perotti (1996) the two individual causal relationships are examined in turn. First, the link between income skewness and redistribution ("the political mechanism"), and subsequently the link between redistribution and growth ("the economic mechanism").

Regressions (1) and (5) in Table 2 report the unconditional impact of the middle income share on the two average tax measures. Interestingly, the association between the middle income share and the average tax on property is in keeping with the traditional fiscal policy approach. This is encouraging, since the property tax is a reasonable empirical counterpart to the wealth tax rate of the theoretical model. In addition, since the analysis pertains to a group of relatively homogenous countries it is not completely unexpected that an “unconditional” negative association emerges. Still, as shown in regression (5) we do see the puzzling positive association between middle class’ share, and the average tax rate on income. We expect this positive association to disappear once appropriate controls are added, among them selected institutional measures.

In regressions (2) three controls are added to the models. GDP per capita (in logs) is included to capture the notion of redistribution as a luxury good (“Wagner’s law”) while the share of the population over 65 is included to capture increased need for (tax financed) redistributive expenditure dictated by demographic changes. Finally the size of the population (in logs) is included to control for possible scale-effects in the provision of public goods.18

In contrast to the results in Perotti (1996) the share of the population over 65 is not significant in any of the specifications of the political mechanism in Table 2. This may be explained by our choice of measure of income skewness, as the income definition includes pensions, which is the main old-age public transfer. Hence, much of the variation in income skewness and transfers caused by demographic differences across countries is already accounted for in the definition of the middle income share.

The size of the population appears to increase average taxes on property while the average

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17 The relationship between labor market institutions, such as collective agreement, and economic performance has been analyzed in many studies. See, for example, Calmfors and Driffil (1988).

18 Data on GDP and the population is from Penn World Tables 6.1. Data on the share of the population over 65 is from World Development Indicators.
taxes on income decrease. The negative impact on income taxes is as expected if there are scale-effects in the provision on public goods, while the positive impact on property taxes is more difficult to explain.

Turning to real GDP per capita, regressions (2) and (6) show that the impact on the average taxes on property is insignificant while there is a positive impact on the average taxes on income. The positive impact on income taxes may be interpreted as support of redistribution as a luxury good, but following our theoretical model another interpretation is also possible. As the variation in GDP per capita includes variation, which is caused by differences in institutions, GDP per capita may also be interpreted as a (noisy) measure of the institutional differences. By this interpretation, the positive impact of GDP per capita on average income taxes follows from Proposition 3.

Finally, the inclusion of the three controls results in a slight drop in the estimated negative impact of the middle income share on property taxes, while the impact on income taxes becomes insignificant.

The Hall and Jones measure of government anti-diverse policies (GADP) is added to the model in regressions (3) and (7). Consistent with the theory, GADP is positively associated with the two average tax rates, although it is imprecisely estimated in regression (3). Note, however, that once GADP is added to the list of regressors GDP per capita is no longer significant in the income tax regression, and the point estimate for GDP per capita is lowered (yet insignificant) in the property tax regression. These findings could be seen as an indication that GDP per capita is a noisy measure of institutions. Adding GADP has little effect on the (negative) association between middle class' share and the average tax on property, and the association between income skewness and the income tax remains insignificant.

In regressions (4) and (8) in Table 2 the indexes of labor regulation are used as controls instead of GADP. Controlling for differences in labor market regulation has a quite dramatic impact on the model fit, and all four of the measures are individually, statistically significant. In addition, conditional on the labor regulation variables neither GDP per capita nor the size of the population have a significant impact on the two average tax rates. The only significant variable apart from the labor regulation measures is the middle income share. In the property tax relation the impact of income skewness is negative as predicted from the theory, while the impact on the average income tax is significantly positive in regression (8). Still the size of the positive association between the average income tax the the middle class' share is lowered by the inclusion of the institutional measures (cf. regression 5).

In sum, in this small sample of OECD countries there appears to be support for the political mechanism, especially when the average tax on property is considered. For the average tax on income the estimated impact of the middle income share remains positive when labor market institutions are controlled for, but is insignificant (compared with an unconditional positive
association) when the GADP variable is used as a measure for institutional differences across OECD.

Using the results for the political mechanism in Table 2 we next examine the economic mechanism. Regressions (1)-(3) in Table 3 are based on regressions (3) and (7) in Table 2, i.e., GADP is included in a growth regression as a measure of institutions. The other controls are standard in the literature; GDP per capita captures the convergence effect, and secondary schooling controls for possible differences in human capital.\textsuperscript{19}

[Insert Table 3 about here]

Regression (1) in Table 3 is a least squares regression, thus it ignores the endogeneity of taxes; regressions (2) and (3) are instrumental variable regressions using middle income share, the fraction of the population over 65 and the size of the population as instruments for the two average taxes. Regression (2) is based on two-stage least squares (TSLS) while regression (3) uses the limited information maximum likelihood estimator (LIML). The three regressions show that the tax rates are positively associated with growth, but imprecisely estimated. In fact, none of the regressors included are individually significant in this model. Furthermore, while the tests for over-identifying restrictions cannot reject the null of valid instruments, we also find, using the F-transform of the Cragg-Donald test proposed by Stock and Yogo (2005), that the instruments are weak. This result is not surprising in light of the results in Table 2.

In regressions (4)-(6) the labor regulation indexes are used as controls instead of GADP. This leads to significant changes in the results. GDP per capita is significantly negative, showing conditional convergence. Moreover, two of the labor regulation variables, employment laws and collective agreement, are also significant, and with the expected sign according to the results in Table 1. Yet, the most important result in regressions (4)-(6) is that the impact of taxes on property is significantly negative, in accordance with the theory. Moreover, the difference between the least squares result (regression (4)) and the two instrumental variables estimators underlines that the average taxes are endogenous. Once more, the Stock and Yogo test for weak instruments indicates that the instruments are weak and this is is the reason why we report the results of both the TSLS and the LIML estimator. The two regressions give very similar results and the conditional likelihood ratio test for significance of the two tax rates developed by Moreira (2003) shows that the taxes are jointly significant at a 10 percent level.

To (partly) overcome the problem of weak instruments we simplify the growth regression in regressions (7)-(9) by (somewhat \textit{ad hoc}) excluding the two insignificant labor regulation indexes, collective relations laws and social security laws. The two indexes are instead included as instruments for the two taxes. This simplification of the growth model results in significant

\textsuperscript{19}The small set of controls are similar to the ones used in Perotti (1996) and other studies of income inequality and growth. We also examined other ‘standard’ growth determinants from Doppelhofer, Miller and Sala-i-Martin (2001). However, due to the small country sample and the similarities of the OECD countries in many respects, the standard growth determinants were insignificant in our sample.
negative impacts of both property and income taxes in the two instrumental variable regressions. The significance of the two taxes is confirmed by the conditional likelihood ratio test. This strengthens the support for the economic mechanism. Still, in order to find support for the full theory it is also necessary to test if the middle income share is a relevant instrument in the regressions. This is tested using the instrument relevance test developed by Hall and Peixe (2003). The result of that test is reported in the last row in Table 3. As seen, we reject the hypothesis of irrelevance of the middle income share at conventional levels of significance. Thus, the middle income share carries relevant information about the two average taxes in the growth regressions linking the political and the economic mechanisms.

4 Conclusion

In this paper we have suggested a theoretical explanation for the fiscal policy puzzle. The theoretical model demonstrates how slow-moving structural characteristics (like institutions) – which matter for both long-run productivity and the distribution of income – could be responsible for the following puzzling cross-country regularities: (1) A positive relationship between the income share of the middle-class and the amount of redistribution/taxation; (2) A positive correlation between average tax rates and average growth rates. At the same time the model also predicts that the relationships (1) and (2) may change radically when moving from pure cross-country to across-time observation of economic systems (or once time invariant determinants are controlled for). The model predicts that within countries a reduction in the income share accruing to the middle-class should be associated with increasing taxes; and this, in turn, with slower growth in income per capita. Our estimates are broadly consistent with the independent findings of Milanovic (2000), as for the inequality/redistribution link, and Kocherlakota and Yi (1997) and Kneller et al. (1999), in terms of the tax/growth mechanism. Whether these results stand up in more heterogeneous samples, encompassing non-OECD countries, is a question for future work to resolve. Nevertheless, it seems fair to conclude that the fiscal policy approach might still prove to be a viable theoretical account of why a skewed distribution of income should hamper growth.
A Proofs

A.1 Proposition 2

(i) Assuming majority voting the selected tax rate fulfills
\[
\frac{\sigma_m g^{\prime}(\tau) A f^{\prime}(A)}{\rho + \sigma_m g^{\prime}(\tau) A f^{\prime}(A)} = -\frac{1}{\rho} \frac{\partial \gamma}{\partial \tau}
\]
differentiation shows that the left hand side is increasing in \(\sigma_m\) - the inverse wealth share. Given \(A\) is constant, equation (11) implies that a higher income share is associated with a lower level of taxation.

(ii) Note that if \(\sigma_i = 0\), the first order condition reads
\[
\frac{\sigma_i g^{\prime}(\tau) A f^{\prime}(A)}{\rho + \sigma_i g^{\prime}(\tau) A f^{\prime}(A)} = 0 = -\frac{1}{\rho} \frac{\partial \gamma}{\partial \tau}.
\]
The last equality is fulfilled by \(\tau^*\). Observe that \(\frac{\sigma_ig^{\prime}(\tau) A f^{\prime}(A)}{\rho + \sigma_ig^{\prime}(\tau) A f^{\prime}(A)}\) is monotonically increasing in \(\sigma_i\). Hence for \(\forall \sigma_i > 0\), the individually preferred tax rate \(\tau_i > \tau^*\). (iii) follows directly from (i) and (ii).

A.2 Proposition 3

Proof. The first part follows directly from the Lemma.

Turning to the second part of the proposition. Consider pre-tax skewness (or gross tax [\(g\tau\)] inequality). Since \(w\) is the same for all agents we have (letting \(y_{g\tau}^m\) denote gross tax median income, while \(y^{g\tau}\) denotes mean income)
\[
y^{g\tau} - y_{g\tau}^m = rk - ra_i,
\]
\[
y^{g\tau} - y^{g\tau}_i = \alpha_K (A) \left( \frac{\sigma_m - 1}{\sigma_m} \right),
\]
as \(y^{g\tau}\) is simply GDP (per capita), and capitals' share \(\alpha_K (A) \equiv rk/y^{g\tau}\). So when \(A\) rises, a larger fraction of national income falls on wages, which makes the pre-tax distribution of income more equal.

Next, consider net of taxes [\(n\tau\)] inequality. Define:
\[
y^{n\tau} = w + (r - \tau) k = y^{g\tau} - \tau k.
\]
Then we find that the difference
\[
y^{n\tau} - y_{n\tau}^m = y^{g\tau} - y_{g\tau}^m - \tau k + \tau a_m
\]
\[
y^{g\tau} - y_{g\tau}^m - \left[ 1 - \frac{a_m}{k} \right] \tau k
\]
using (19)
\[
(y - \tau) k \left( \frac{\sigma_m - 1}{\sigma_m} \right).
\]
In relative terms
\[
\frac{y^{n\tau} - y_{n\tau}^m}{y^{g\tau}} = \left[ \frac{(r - \tau) k}{w + (r - \tau) k} \right] \left( \frac{\sigma_m - 1}{\sigma_m} \right)
\]
\[
= \left( \frac{1}{(r - \tau) k + 1} \right) \left( \frac{\sigma_m - 1}{\sigma_m} \right).
\]
Accordingly, if \( \frac{w}{(r-\tau)k} \) rises when \( A \) goes up then the distribution becomes more equal post-tax. And this ratio must go up. We know that
\[
\frac{\partial (w)}{\partial A} = \frac{\partial \left( \frac{\alpha_L(A)}{\alpha_K(A)} \right)}{\partial A} > 0
\]
since this follows from \( \alpha_L(A) > 0 \) (Assumption A1). Now, since \( \partial (r-\tau)k/\partial A < \partial rk/\partial A \) (recall, \( \partial \tau/\partial A \) is unambiguously positive – Proposition 3(i)), the result follows.

**A.3 Proposition 4**

Changes in \( A \) will affect \( \gamma \) both directly, and indirectly through the selected tax rates. Total differentiate equation (13):
\[
d\gamma = (g'(\tau)(f(A) - Af'(A)) - 1)d\tau - g(\tau)Af''(A)\,dA.
\]
Hence, the impact on \( \gamma \) from an incremental increase in \( A \) is
\[
\frac{\partial \gamma}{\partial A} = (g'(\tau)(f(A) - Af'(A)) - 1)\frac{\partial \tau}{\partial A} - g(\tau)Af''(A).
\]
The latter term is positive, but the first term is negative. This follows from the first order conditions associated with optimal choice of the tax rate which says that \( MB = \frac{\sigma g'(\tau)Af'(A)}{\rho + \sigma g(\tau)Af'(A)} = MC = -\frac{1}{g'(\tau)} = -\frac{1}{g'(\tau)(f(A) - Af'(A)) - 1} > 0 \), implying that \( 1-g'(\tau)(f(A) - Af'(A)) \approx 1 \). As a result, one should expect a positive relationship between the selected tax rate, and \( \gamma \), when looking across countries that differ with respect to \( A \). However, if \( |\frac{\partial \tau}{\partial A}| \) is sufficiently large, the implied covariation between \( \gamma \) and \( \tau \) could be negative.
References


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<th>Regression coefficient</th>
<th>Absolute $t$-value</th>
<th>Number of observations</th>
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Note: * significant at 10%; ** significant at 5 percent
Table 2: The impact of the middle class share of income on property and income taxes

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<th>Dependent variable</th>
<th>Regression</th>
<th>Tax on property</th>
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<th>Tax on income</th>
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Note: Heteroskedasticity robust (HC3) standard errors in parentheses. All regressions include a constant. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.
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<td>Regression Estimator</td>
<td>OLS</td>
<td>TSLS</td>
<td>LIML</td>
<td>OLS</td>
<td>TSLS</td>
<td>LIML</td>
<td>OLS</td>
<td>TSLS</td>
<td>LIML</td>
</tr>
<tr>
<td>Tax on property</td>
<td>0.05</td>
<td>0.863</td>
<td>1.714</td>
<td>-0.336*</td>
<td>-0.932**</td>
<td>-0.970**</td>
<td>-0.404**</td>
<td>-0.771**</td>
<td>-0.817**</td>
</tr>
<tr>
<td>(0.141)</td>
<td>(1.635)</td>
<td>(3.962)</td>
<td>(0.199)</td>
<td>(0.469)</td>
<td>(0.486)</td>
<td>(0.185)</td>
<td>(0.320)</td>
<td>(0.336)</td>
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<tr>
<td>Tax on income</td>
<td>-0.004</td>
<td>0.197</td>
<td>0.414</td>
<td>-0.004</td>
<td>-0.091</td>
<td>-0.096</td>
<td>-0.044</td>
<td>-0.084**</td>
<td>-0.088**</td>
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<tr>
<td>(0.038)</td>
<td>(0.418)</td>
<td>(1.012)</td>
<td>(0.043)</td>
<td>(0.081)</td>
<td>(0.084)</td>
<td>(0.033)</td>
<td>(0.042)</td>
<td>(0.043)</td>
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<tr>
<td>(1.404)</td>
<td>(7.094)</td>
<td>(16.934)</td>
<td>(1.038)</td>
<td>(1.167)</td>
<td>(1.181)</td>
<td>(1.053)</td>
<td>(1.132)</td>
<td>(1.148)</td>
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<tr>
<td>Secondary years of edu.</td>
<td>0.213</td>
<td>0.634</td>
<td>1.08</td>
<td>0.095</td>
<td>-0.011</td>
<td>-0.018</td>
<td>0.129</td>
<td>0.037</td>
<td>0.027</td>
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<tr>
<td>(0.177)</td>
<td>(0.884)</td>
<td>(2.109)</td>
<td>(0.130)</td>
<td>(0.162)</td>
<td>(0.165)</td>
<td>(0.131)</td>
<td>(0.149)</td>
<td>(0.152)</td>
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<tr>
<td>Employment laws</td>
<td>-1.165**</td>
<td>-1.392**</td>
<td>-1.406**</td>
<td>-0.896*</td>
<td>-1.326**</td>
<td>-1.366**</td>
<td>-0.896*</td>
<td>-1.326**</td>
<td>-1.366**</td>
</tr>
<tr>
<td>(0.557)</td>
<td>(0.638)</td>
<td>(0.646)</td>
<td>(0.540)</td>
<td>(0.618)</td>
<td>(0.630)</td>
<td>(0.540)</td>
<td>(0.618)</td>
<td>(0.630)</td>
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<tr>
<td>Collective relations laws</td>
<td>0.34</td>
<td>-0.28</td>
<td>-0.318</td>
<td>0.34</td>
<td>-0.28</td>
<td>-0.318</td>
<td>0.34</td>
<td>-0.28</td>
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<tr>
<td>(0.401)</td>
<td>(0.623)</td>
<td>(0.640)</td>
<td>(0.401)</td>
<td>(0.623)</td>
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<td>(0.623)</td>
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<td>Social security laws</td>
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<td>-0.271</td>
<td>-0.22</td>
<td>-1.1</td>
<td>-0.271</td>
<td>-0.22</td>
<td>-1.1</td>
<td>-0.271</td>
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<tr>
<td>(0.710)</td>
<td>(1.017)</td>
<td>(1.039)</td>
<td>(0.710)</td>
<td>(1.017)</td>
<td>(1.039)</td>
<td>(0.710)</td>
<td>(1.017)</td>
<td>(1.039)</td>
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<tr>
<td>(0.869)</td>
<td>(1.166)</td>
<td>(1.189)</td>
<td>(0.785)</td>
<td>(1.128)</td>
<td>(1.173)</td>
<td>(0.785)</td>
<td>(1.128)</td>
<td>(1.173)</td>
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<td>Observations</td>
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<td>46</td>
<td>46</td>
<td>44</td>
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<tr>
<td>OLS test&lt;sup&gt;a&lt;/sup&gt;</td>
<td>0.55</td>
<td>0.64</td>
<td>0.45</td>
<td>0.64</td>
<td>0.46</td>
<td>0.61</td>
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<td>WI test&lt;sup&gt;b&lt;/sup&gt;</td>
<td>0.11</td>
<td>2.7</td>
<td>3.51</td>
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<td>CLR test of significance&lt;sup&gt;c&lt;/sup&gt;</td>
<td>0.66</td>
<td>0.09</td>
<td>0.02</td>
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<tr>
<td>Relevance of mid. inc. share&lt;sup&gt;d&lt;/sup&gt;</td>
<td>0.13</td>
<td>0.01</td>
<td>0.01</td>
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</tr>
</tbody>
</table>

Notes: Standard errors in parentheses. All regressions include a constant and time trends. * significant at 10 percent; ** significant at 5 percent; *** significant at 1 percent.

<sup>a</sup>Sargan/Anderson-Rubin test for over-identifying restrictions (the p-value is reported). <sup>b</sup>Stock and Yogo (2005) test of weak instruments. <sup>c</sup>Conditional likelihood ratio test of joint significance of the endogenous regressors (the p-value is reported). <sup>d</sup>Test of relevance of Middle income share as an instrument (the p-value is reported).