The Political Economy of Redistributive Taxation and Growth: Reconciling Theory with Evidence*

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Abstract

The so-called fiscal policy approach predicts that a relatively poorer middle class (i.e., a lower median/mean income ratio) should lead to more redistributive efforts, and thereby to lower growth. While the reduced form prediction appears to be consistent with the data, the individual mechanisms have at best received only limited support. In fact, some studies even find a positive link between the income share of the middle class and redistribution, and between taxation and growth. We construct a political-economy endogenous growth model which demonstrates that these puzzling patterns may arise if one fails to take the impact of economic institutions on growth and inequality into account. We argue this reconciles the theory with the seemingly conflicting evidence.

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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. Several theoretical models compete and complement each other in trying to explain how the size distribution of income affects economic growth.[1] The present paper is preoccupied with one such theory: The so-called fiscal policy approach.[2]

At the risk of oversimplifying, one may summarize the main theoretical predictions of the approach as: (i) increasing skewness of the income distribution (i.e., a relatively poorer median voter) tends to increase redistributive government intervention, and (ii) redistribution is detrimental to growth.[3] Accordingly, the reduced form prediction of the theoretical literature is that a more *skewed* distribution of income is bad for long term growth.[4]

The theoretically prediced reduced form link between the share of the middle class and economic prosperity has recieved considerable empirical support over the years (e.g. Perotti, 1996a; Easterly 2001, 2007).[5] However, the empirical success in terms of the proposed mechanisms, linking skewness and growth, 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; Moene and Wallerstein, 2001; Bradley et al, 2003; Iversen and Soskice, 2006) 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 seem to be that (Aghion et al, 1999, p. 1621):

> 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 extend 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 proposing a theory capable of reconciling the original theory with the above conflicting evidence. Specifically, we argue that under plausible assumptions, a negative income skewness/tax relationship, and a positive tax/growth relationship

[1] The seminal contribution is Galor and Zeira (1993). A review of the literature can be found in Aghion et al. (1999).

[2] A 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). The term "fiscal policy approach" was introduced by Perotti (1996a).

[3] In what follows we will distinguish between inequality in the sense of a lower middel class share (median/mean ratio) and inequality in the sense of increasing income *dispersion* (reflected in, say, a greater Gini coefficient) by referring to the former as greater "income skewness".

[4] The 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.

[5] It is worth noting that if measures of income *dispersion* is used, such as the Gini index, the reduced form empirical link to growth is less clear. See e.g. Bannerjee and Duflo (2003).

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.

Our reconciliation rests on two key assumptions. First, countries differ in terms of the efficacy of economic institutions; in some places these are more supportive of economic activity than in other places. Second, economic institutions shape the distribution of income. In particular, in countries with "poor" institutions, the distribution of income will tend to be more unequal. Both assumptions are arguably plausible, and can be motivated theoretically as well as empirically (see Acemoglu et al., 2005).

With these assumptions in mind, consider the problem for a decisive voter in selecting her preferred tax rate, which trades off the cost of taxation against the benefits accruing to the agent from the use of the revenue. In the presence of a poorly developed institutional infrastructure, the benefits from taxation may well be smaller, and the cost greater, than in places with "good" institutions. As a result, one might expect to see less taxation and redistribution emerging in the former societies. But if these societies simultaneously are more unequal, due to the poor institutional setting, it may seem as if, in a cross-section of countries, that "more inequality leads to less taxation and redistribution". Moreover, since poor institutions inherently lower the incentive to accumulate, growth may be lower in such societies, despite the fact that the level of taxation is lower. Accordingly, in a cross-section of countries, it may also seem as if lower taxation reduces growth. Observe that these are exactly the sort of patterns that Perotti (1996a) detected in his cross-country analysis.

What would be an appropriate test of this hypothesis? If economic institutions are relatively persistent, one would expect the traditionally stipulated chains of causality to play out if identification is sought solely in the time-series dimension of the data; that is, if economic institutions are held constant. To put it differently: the key prediction is that the link between inequality and taxes, and taxes and growth *differs* depending on whether we examine a cross-section of countries, or focus on time-series variations. We will return to this prediction in detail below.[6]

To capture the basic ideas conveyed above we build on the Alesina and Rodrik (1994) [henceforth: AR] framework. Hence, the formal structure allows for productive government investments (financed by 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 economic institutional quality or key determinants thereof – matter *both* for the distribution of income, and for general productivity. Specifically, we posit that countries equipped with a stronger institutional framework tend to be more productive and feature a richer middle class.

[6] Naturally, the traditional mechanisms should also be detectable in a cross section if economic institutions are appropriately controlled for. This, however, might be challenging. Acemoglu et al (2001) suggests that a *cluster* of institutions might be highly persistent, reflecting high risk of expropriation; high levels of corruption; poor labor market institutions and more. Hence, a fixed effects approach (or pure time series) seem like a more promising economical approach if economic institutions are to be fully controlled for in an empirical analysis.

The formal links between economic institutions, productivity and income distribution are introduced in a very simple way. First, stronger institutions are assumed to increase the level of Harrod-neutral productivity. In an AK-setting higher productivity translates into faster growth along a balanced growth path, ceteris paribus.

Second, the impact of economic institutions on the distribution of income is captured in the following way. We invoke a standard neoclassical production function. Therefore, changes in the level of productivity will affect the distribution of *factor* income. 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. To capture a link between institutions (captured crudely by the above mentioned productivity constant), we assume that in countries with a stronger institutional environment labor receives a greater share of income which generates a more equal distribution of income, ceteris paribus.

The first assumption is fairly uncontroversial; considerable evidence has been marshalled to show that institutions indeed influence long-run growth (e.g., Hall and Jones, 1999; Acemoglu et al, 2001; 2002; 2005). The second assumption is perhaps more unconventional, but seems to be empirically plausible. Rodrik (1999) shows, using manufacturing data for 93 countries, 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 economic institutional quality. In addition, Daudey and Peñalosa (2007) find, using Rodrik's labor shares, 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 middleclass share in total income. In sum, the work of Rodrik and Daudey and Peñalosa provide corroborating evidence of institutions influencing the personal income distribution in the manner captured by the model.[7]

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 fundamental 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

[7] Why could strong economic institutions in practise work to increase the labor share in national income? Rodrik (1999) discuss several mechanisms based on a bargaining perspective on wage determination. Stronger adherence to rule of law (facilitated by democratic institutions perhaps) might increase the relative bargaining power of workers; greater regime stability (brought on by democracy) can increase the outside option for workers; freedom of association, a human right usually respected in democracies, admit workers to organize, and finally, greater political competition can facilitate legislation partial to worker interests. See also Acemoglu and Robinson (2008a) for a theory where "poor institutions" are modelled as labor repressive, similar to what we implicitly assume.

future consumption) tends to be comparatively 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 the related theoretical literature, Section 3 develops the model, whereas Section 4 discusses its implications for a cross-section of countries; we also discuss how the theory can be confronted with the data and interpret existing studies in light thereof. A final Section 5 offers brief concluding remarks.

2 Related literature

A number of possible explanations for the above mentioned puzzling evidence have been suggested. 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.[8] 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

[8]For example, Perotti (1996a) uses the third quintile as a measure of the median voters income.

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.[9]

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 (2004) 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 inequality.

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)

[9] More recently, Finseraas (2009) has documented, consistent with the Metzler- Richards theory, that poor individuals *demand* more redistribution using micro data for 22 European countries; data on preferences for redistribution derive from European Value Survey. Georgiadis and Manning (2012) obtain similar results for the UK, but observe that beliefs about the adverse incentive effect of redistribution has an even bigger impact on desired redistribution in the UK. They use this finding to account for the lack of increased redistribution during the 80's and 90's where inequality rose in the UK; during this period the electorate apparently increasingly grew to believe that redistribution is bad for incentives, which worked to counteract the influence from increasing inequality.

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.

3 The Model

Consider a closed economy with a constant population of measure one. There is a single output good which can be consumed or invested. All markets are competitive and there is 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.

3.1 The Consumers

Individual i maximizes the discounted utility from consumption, $c_i(t)$

$$\max_{\{c_i(t)\}_{t=0}^{\infty}} \int_0^{\infty} \ln c_i(t) e^{-\rho t} dt, \ \rho > 0, \tag{1}$$

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

$$\dot{k}_i(t) = w(t) + [r(t) - \tau] k_i(t) - c_i(t). \tag{2}$$

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

$$\frac{\dot{c}_i(t)}{c_i(t)} = r(t) - \tau - \rho \equiv \gamma_{c_i}, \tag{3}$$

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 γ_{c_i} equals the per capita growth rate of consumption, γ_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, γ_c.

3.2 The Firms

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

$$Y_j(t) = g\left[\frac{G(t)}{K(t)}\right] F\left[K_j(t), E(t) L_j\right]. \tag{4}$$

$G(t)$ 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 $\int_i L_j dj = 1$ 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 $\lim_{\tau \to 0} g' = \infty$, thereby allowing for diminishing returns to productive government investments. As we have assumed a balanced government budget, 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:

$$E(t) = AK(t). \tag{5}$$

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 economic 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:

$$\frac{\partial Y_j(t)}{\partial K_j(t)} = r(t), \tag{6}$$

$$\frac{\partial Y_j(t)}{\partial L_j(t)} = w(t). \tag{7}$$

In symmetrical equilibrium, all producers choose the same factor intensity K_j/L_j. Using this we may solve for general equilibrium factor prices

$$g(\tau)\left[f(A) - Af'(A)\right] = r, \tag{8}$$

$$g(\tau)\, Af'(A)\, k(t) = w(t), \tag{9}$$

where $f(A) \equiv F(1, A)$, $f' > 0$, $f'' < 0$.[10]

3.3 Measuring Inequality

To incorporate a measure of inequality in the analysis we follow Alesina and Rodrik (1994) and define

$$\sigma_i \equiv \frac{k(t)}{k_i(t)}, \tag{10}$$

where k is the per capita stock of capital. Thus, σ_i denotes the (inverse) relative wealth endowment of individual i. Observe that σ_i is constant as $\frac{\dot{k}(t)}{k(t)} = \frac{\dot{k}_i(t)}{k_i(t)}$ for all i. Hence, the distribution of wealth (capital) is time-invariant and predetermined.[11]

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 σ_i, and the equilibrium values of factor prices leads to the following expression for individual i's relative income share:

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

where $\frac{Af'(A)}{f(A)}$ is labors 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,

$$\frac{y_m(t)}{y(t)} = \sigma_m^{-1} + \frac{Af'(A)}{f(A)}\left(1 - \sigma_m^{-1}\right), \tag{11}$$

where σ_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, $w/y = \frac{Af'(A)}{f(A)} \equiv \alpha_L(A)$, 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.[12]

[10] 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).

[11] 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).

[12] See Acemoglu and Robinson (2008a) for a theory, which also assumes poor economic institutions are labor repressive. There are many examples of how poor institutions might manifest themselves in this way. Historically, slavery and serfdom would be examples; see Rodrik (1999) for examples of more contemporary relevance. Technically, 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. The implied positive link between labor's share and the income share of the middle class is supported empirically by Daudey and Peñalosa (2007).

3.4 The Economic Equilibrium

The model reduces to a simple AK-model:

$$y(t) = g(\tau) f(A) k(t). \tag{12}$$

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:

$$\gamma = g(\tau) f(A) [1 - \alpha_L(A)] - \tau - \rho, \tag{13}$$

which is positive if $g(\tau) f(A) [1 - \alpha_L(A)] - \tau > \rho$. 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, τ^*, 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, τ^*, represents the "growth-maximizing" level of taxation. Specifically, τ^* is given by

$$\frac{\partial \gamma}{\partial \tau} = 0 : g'(\tau^*) = \frac{1}{f(A)(1 - \alpha_L(A))}. \tag{14}$$

Notice that if A varies from country to country then τ^* varies too. In particular we have the following result

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

Proof. Differentiation of equation (14) yields $\partial \tau^* / \partial A = [A f''(A)] / g''(\tau^*) > 0$. ■

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): $\frac{\partial MP_K}{\partial \tau \partial A} = -g'(\tau) A f''(A) = g'(\tau) F''_{KL} > 0$. As we assume diminishing returns to τ ($g'' < 0$), it follows that the level of government intervention which maximizes the net return on investments becomes higher.

3.5 The Political Equilibrium

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 σ_i is constant we can abstract from issues of time inconsistency and strategic voting when it comes to the political equilibrium.[13]

[13] 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. Lindner and Strulik (2004) have demonstrated that the "Alesina

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

$$c_i(t) = \left[\frac{w(t)}{k_i(t)} + \rho\right] k_i(t) = [g(\tau) f(A) \alpha_L(A)\sigma_i + \rho] k_i(t), \tag{15}$$

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

$$c_i(t) = [g(\tau) f(A) \alpha_L(A)\sigma_i + \rho] k_i(0) e^{\gamma t}. \tag{16}$$

Note that the level of consumption is increasing in τ 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 γ (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 dynamic loss. The solution will depend on the individual's relative factor endowment, σ_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:

$$\max_{\tau} \frac{1}{\rho}\left(\ln c_i(0) + \frac{\gamma}{\rho}\right), \tag{17}$$

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

$$\frac{\partial c_i(0)}{\partial \tau}\frac{1}{c_i(0)} = \frac{\sigma_i g'(\tau) f(A) \alpha_L(A)}{\rho + \sigma_i g(\tau) f(A) \alpha_L(A)} = -\frac{1}{\rho}\frac{\partial \gamma}{\partial \tau} = \frac{1 - g'(\tau) f(A)(1 - \alpha_L(A))}{\rho}. \tag{18}$$

The semi-elasticity, $\frac{\partial c_i(0)}{\partial \tau}\frac{1}{c_i(0)}$, 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, τ^*. 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 σ_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,

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.

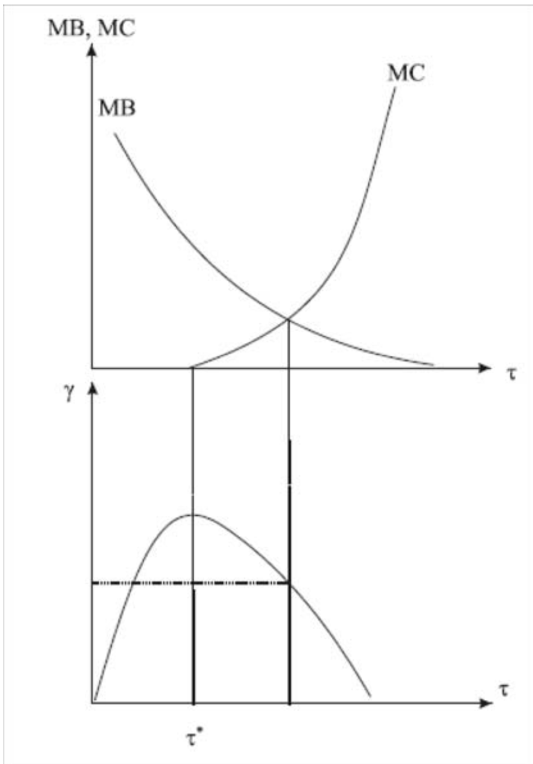

Figure 1: Determining the growth rate of the economy.

the implemented tax rate reflects the median wealth share, σ_m, assuming full participation at elections. In sum we have:

Proposition 2 ***Redistribution, 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. ■

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.

4 Resolving the Fiscal Policy Puzzle

4.1 Testable 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 σ_i given, stronger institutions (higher A), implies higher marginal benefits (MB) from taxation/redistribution, and lower marginal costs (MC).*

Proof. $MB = \frac{\sigma_i g'(\tau) f(A) \alpha_L(A)}{\rho + \sigma_i g(\tau) f(A) \alpha_L(A)}$. Under A1, and since $f'(A) > 0$ it follows immediately that $\partial MB / \partial A > 0$. $MC = -\frac{1}{\rho} \frac{\partial \gamma}{\partial \tau} = \frac{1}{\rho} [g'(\tau) f(A) \alpha_L(A)]$. 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 (γ, τ) 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. $\text{MB}_{\text{LOW A,UNEQUAL}}$) will be placed further to the right than illustrated in Figure 2. This is because a poorer median voter will prefer more redistribution

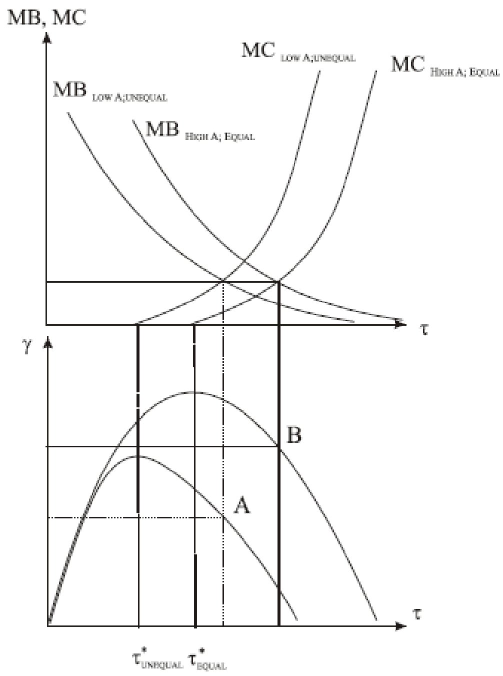

Figure 2: A possible configuration of income skewness, redistributive taxes and growth in a cross-section.

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.

As hinted by Figure 2, the implied relationship between growth and taxes may be a positive one. But 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. ■

The intuition is simple. On the one hand better economic institutions tend to increase growth; on the other hand they also tend to increase taxes, via the political mechanism, which serves to lower growth. In theory the net impact on growth is therefore ambigious. From a practical perspective, however, the net effect is likely positive. The reason is that a large literature on fundamental determinants to growth (e.g. Acemoglu et al. 2005) has recovered a clear positive impact from better economic institutions on long-run economic development. Seen through the lens of the proposed theory, this suggests that the direct effects of institiutions tend to swap the indirect effects via taxation. Accordingly, one would expect to see countries with better economic institutions simultanously displaying faster growth and opting for higher levels of taxation, ceteris paribus.

This purposed theoretical explanation for the "fiscal policy puzzle" can be confronted with data. According to the model, *within* any single country (i.e., holding institutions, A, constant) one should expect the "standard" interrelationships between income skewness, taxes and growth (Proposition 2). *Across* countries, however, one may observe a reversal of correlations due to variation in institutional quality (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.

4.2 Interpreting Existing Evidence

Consider the following regression specifications relating the middle class share of total income, m_i, to redistribution, τ_i

$$\tau_i = \beta m_i + \gamma \mathbf{X}_i + \varepsilon_i$$

where i denotes countries, and $\mathbf{X}$ is a vector of controls. In the much cited contribution by Perotti (1996a) the set of controls include GDP per capita, a 0/1 democracy indicator and the share of the population above 65. While the specification thus does contain a control for political institutions, it does not involve economic institutions, which the theory above suggest is crucial for the link between income skewness and redistribution.[14]

The standard political-economy model would predict $\beta < 0$. However, if economic institutions (I_i) are omitted, and works to elevate taxation as suggested by the theory above ($\tilde{\gamma} > 0$), OLS delivers

$$\hat{\beta} = \beta + \frac{cov\,(m_i, \tilde{\gamma} I_i)}{var\,(m_i)}.$$

The key observation is that $cov\,(m_i, \tilde{\gamma} I_i)$ arguably is positive: strong economic institutions both promote economic equality and taxation (Proposition 3). As a result $\hat{\beta}$ may well come out positive, or insignificant, as is indeed the case in Perotti (1996a).[15]

In order to overcome this identification problem economic institutions needs to be fully controlled for. This feat is plausibly accomplished in Milanovic (2000) who examine the link between income skewness and redistribution for a sample of OECD countries. Since the OECD group are relatively homogenous variations in economic institutions is likely minor. But Milanovic is also able to exploit the panel structure in his data and introduce country fixed effects, which should

[14] Acemoglu and Robinson (2008a) argue that changes in political institutions need *not* entail changes in economic institutions. While a move towards democracy would reduce the *de jure* power of the elite it might not affect the *de facto* power, which derives from its economic power base. That is, the elite might influence democratic outcome through e.g. corruption, lobbying etc. In this manner economic institutions might remain the same despite a move towards democracy. See Acemoglu and Robinson (2008b) for case studies. Hence it would appear important to control directly for economic institutions.

[15] One might object to this simple reconcilation by reference to the fact that Perotti (1996a) also provide 2SLS estimates. But as an instrument for m_i Perotti suggests using the PPP investment deflator. The problem is that the price of investments could be influenced, in general equilibrium, by the extent of distortionary taxation. Hence the validity of the instrument can be questioned, and thereby the results from the 2SLS exercise.

prune the data for the influence from economic institutions. In keeping with the reconciliation proposed above, Milanovic finds that a richer middle class is associated with less redistribution, as predicted by the standard theory.[16] Similarly supportive is the study by Krusell and Rios-Rull (1999), which shows that a calibrated dynamic median voter model is capable of accounting well for the extent of redistribution within the USA. As long as data within the US can be viewed as generated from a fairly stable set of economic institutions this is consistent with our explanation for the puzzling cross-country evidence. These calibration results for the US has recently been coroborated by econometric evidence, showing that within school districts or municipalities, rising income skewness (or inequality measured by the Gini index) has been associated with more taxation and redistributive expenditures over the period 1970-2000 (Corcoran and Evans, 2010; Boustan et al, 2012).

Turning to the economic mechanism, consider the following specification

$$y_i = \delta\tau_i + \theta\mathbf{Z}_i + u_i,$$

where y_i is GDP per capita growth, whereas τ_i (as above) is tax/redistribution. In Perotti (1996a) the control set involves initial GDP per capita, male and female schooling and the investment deflator. Standard theories would predict $\delta < 0$, yet Perotti (1996a) find $\delta > 0$ (if anything).

Again, the key drawback is that economic institutions are not controlled for. Accordingly, the OLS estimate for δ can be written

$$\hat{\delta} = \delta + \frac{cov(\tau_i, \tilde{\theta}I_i)}{var\,(\tau_i)},$$

with $\tilde{\theta} > 0$ if good economic institutions benefit growth. Provided $\tilde{\theta} > 0$, the theory predicts that $cov\left(\tau_i, \tilde{\theta}I_i\right) > 0$: better institutions tend to increase the desired tax rate and improve growth prospects in their own right. As a result, $\hat{\delta} > 0$ is possible, but the sign is in general ambiguous without economic institutions being fully controlled for. Hence, to eliminate the basis for this bias institutions need to be in the control set.[17]

This is likely accomplished in the time series study by Kocherlakota and Yi (1997), who examine data spanning more than a century for US and UK. In keeping with the reconciliation offered above, the authors find a significant negative impact of taxation on growth. Similarly, exploring a panel of OECD countries Keller et al. (1999) report a significantly negative impact from taxes on wealth, profits and labor on growth. This study appears particularly well suited for presented purposes, partly because of the sample considered but also because the authors include country fixed effects, thereby controlling for economic institutions.

[16] With the right explicit controls for economic institutions a similar result should arise, of course. Iversen and Soskice (2006) find a negative link between inequality and redistribution, as noted in the Introduction. However, once they control for a variety of measures of economic institutions (e.g., unionizations) the correlation changes sign, consistent with the proposed reconciliation.

[17] Again, one may appeal to Perotti's 2SLS results, where the middle class' share is used as an instrument. Notice that the identifying assumption is that equality only influences growth via taxes. If, for instance, economic inequality matters to the evolution of institutions (Acemoglu et al., 2005), this assumption is violated. Hence, it seems possible to quibble with the identification strategy in the context of the economic mechanism as well.

Another interesting aspect of the study is that the authors also try to control for the *use* of the revenue in their regressions. In this manner the distortionary impact from taxes on growth is better disentangled from the potential beneficial uses of the revenue (e.g. for infrastructure, education and the like). Again, these findings provide corroborative evidence in favor of the reconciliation offered above.[18]

5 Conclusion

In this paper we have suggested a theoretical explanation for the fiscal policy puzzle. The theoretical model demonstrates how slow-moving structural characteristics which matter for both long-run productivity and the distribution of income – chiefly economic institutions – 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.

The theory is that poor economic institutions serve to increase inequality, and lower productivity. Hence, in a setting with poor institutions a median voter may prefer a comparatively low level of taxation, since the marginal costs of taxation is comparatively higher, and marginal benefits are lower, than in societies featuring stronger economic institutions. In a cross-section of countries, where economic institutions differ, it might therefore appear as if a poorer middle class prefers less redistribution; cf. (1). Moreover, since countries with a comparatively poor institutional infrastructure will grow slowly for this reason alone, it might also appear as if lower taxes lower growth, in a cross-section of countries; cf. (2).

A key prediction of the model, however, is that 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 appropriately controlled for. For institutions constant, the model predicts that 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.

We use the theory to interpret the existing conflicting evidence on the links between inequality/redistribution and redistribution/growth. On the whole it appears that existing studies support our reconciliation; when identification is sought in the time series dimension of the data, where economic institutions likely are constant, the fiscal policy approach indeed fares much better. While more empirical work on the topic would be welcome, 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.

[18] See also the recent work of Gemmel et al (2011), which follows a similar approach and corroborates the overall findings of Kneller et al (1999).

A Proofs

A.1 Proposition 2

(i) Assuming majority voting the selected tax rate fulfills $\frac{\sigma_m g'(\tau)Af'(A)}{\rho+\sigma_m g(\tau)Af'(A)} = -\frac{1}{\rho}\frac{\partial\gamma}{\partial\tau}$; differentiation shows that the left hand side is increasing in σ^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 $\frac{\sigma_i g'(\tau)Af'(A)}{\rho+\sigma_i g(\tau)Af'(A)} = 0 = -\frac{1}{\rho}\frac{\partial\gamma}{\partial\tau}$. The last equality is fulfilled by τ^*. Observe that $\frac{\sigma_i g'(\tau)Af'(A)}{\rho+\sigma_i g(\tau)Af'(A)}$ is monotonically increasing in σ_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 $y_m^{g\tau}$ denote gross tax median income, while $y^{g\tau}$ denotes mean income)

$$\begin{aligned} y^{g\tau} - y_m^{g\tau} &= rk - ra_i, \\ &= rk\left(\frac{\sigma_m - 1}{\sigma_m}\right) \\ &\Updownarrow \\ \frac{y^{g\tau} - y_i^{g\tau}}{y^{g\tau}} &= \alpha_K(A)\left(\frac{\sigma_m - 1}{\sigma_m}\right), \end{aligned} \tag{19}$$

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

$$\begin{aligned} y^{n\tau} - y_m^{n\tau} &= y^{g\tau} - y_m^{g\tau} - \tau k + \tau a_m \\ &= y^{g\tau} - y_m^{g\tau} - \left[1 - \frac{a_m}{k}\right]\tau k \\ &\quad \text{using (19)} \\ &= (r-\tau)k\left(\frac{\sigma_m - 1}{\sigma_m}\right). \end{aligned}$$

In relative terms

$$\begin{aligned} \frac{y^{n\tau} - y_m^{n\tau}}{y^{n\tau}} &= \left[\frac{(r-\tau)k}{w+(r-\tau)k}\right]\left(\frac{\sigma_m - 1}{\sigma_m}\right) \\ &= \left(\frac{1}{\frac{w}{(r-\tau)k}+1}\right)\left(\frac{\sigma_m - 1}{\sigma_m}\right). \end{aligned}$$

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

$$\frac{\partial\left(\frac{w}{rk}\right)}{\partial A}=\frac{\partial\left(\frac{\alpha_L(A)}{\alpha_K(A)}\right)}{\partial A}>0$$

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 γ both directly, and indirectly through the selected tax rates. Total differentiate equation (13) :

$$d\gamma=\left(g'(\tau)\left(f(A)-Af'(A)\right)-1\right)d\tau-g(\tau)Af''(A)\,dA.$$

Hence, the impact on γ from an incremental increase in A is

$$\frac{\partial\gamma}{\partial A}=\left(g'(\tau)\left(f(A)-Af'(A)\right)-1\right)\frac{\partial\tau}{\partial A}-g(\tau)Af''(A).$$

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 $MB=\frac{\sigma_i g'(\tau)Af'(A)}{\rho+\sigma_i g(\tau)Af'(A)}=MC=-\frac{1}{\rho}\frac{\partial\gamma}{\partial\tau}=-\frac{1}{\rho}\left[g'(\tau)\left(f(A)-Af'(A)\right)-1\right]>0$, implying that $1-g'(\tau)\left(f(A)-Af'(A)\right)>0$ at an interior solution for taxes. Since proposition 3 establishes that $\partial\tau/\partial A$ is positive, the net effect on growth will, in general, depend on the absolute size of $\frac{\partial\tau}{\partial A}$. If the indirect effect is small – either because $\frac{\partial\tau}{\partial A}$ is "small" or because the economy is close to its τ^* (implying $g'(\tau)\left(f(A)-Af'(A)\right)\approx 1$) – then $\frac{\partial\gamma}{\partial A}>0$. As a result, one should expect a positive relationship between the selected tax rate, and γ, when looking across countries that differ with respect to A. However, if $\left|\frac{\partial\tau}{\partial A}\right|$ is sufficiently large, the implied covariation between γ and τ could be negative.

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