A Re-examination of Economic Growth, Tax Policy, and Distributive Politics*

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Abstract

We examine the relationship between economic growth, tax policy, and distribution of capital and labor ownership in a one-sector political-economy model of endogenous growth with productive government spending financed by a proportional tax on capital income. Our analysis shows that inequality in wealth and income can be positively or negatively related to the optimal tax rate. In either environment, higher inequality leads to a lower after-tax return to capital, thereby reducing the economy's growth rate.

Keywords: Economic Growth, Optimal Taxation, Political Economy.

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1 Introduction

Recently, there has been a renewed interest in exploring the macroeconomic effects of income inequality.[1] In particular, Alesina and Rodrik (1994) show that in a one-sector endogenous growth model with productive government spending and distributive conflict among agents, the more unequal is the distribution of wealth and income, the higher the rate of taxation, and the lower is the economy's growth rate.[2] These authors also present cross-country evidence that supports the negative relationship between inequality in income and land distribution and subsequent growth. This is an important contribution since it is one of the first studies that integrate the endogenous growth theory and the political-economy literature on majority voting.

This paper re-examines the relationship between economic growth, tax policy, and distribution of wealth and income in a modified Alesina-Rodrik model. Specifically, in Alesina and Rodrik's analysis, the government balances its budget at each point in time, and provides public services through a proportional tax on the economy's aggregate capital *stock*. However, this stylized formulation, which implicitly assumes a constant rental rate of capital, is not compatible with other salient features of their theoretical framework — a closed economy in which factor markets are perfectly competitive, and firms use a Cobb-Douglas production function to produce output. Here, we maintain the balanced-budget assumption, but postulate that government spending is financed by a proportional tax on capital *income*.[3] This departure introduces additional non-linearity to the analysis.

With this modification, we find a different result from Alesina and Rodrik (1994) regarding how distribution of wealth and income affects the tax rate selected by the median voter. This finding is obtained by solving the dynamic Ramsey problem in which a benevolent government chooses public spending and capital-income taxation to maximize the household's discounted lifetime utility. In computing the optimal fiscal policy, the government takes into account the rational responses of households and firms. It turns out that the optimal policy consists

[1] See, for example, Bertola (1993), Galor and Zeira (1993), Perotti (1993*a*), Persson and Tabellini (1994), Clarke (1995), Alesina and Perotti (1996), Benabou (1996), Benhabib and Rustichini (1996), Deininger and Squire (1996, 1998), Galor and Tsiddon (1997), Li, Squire and Zou (1998), Aghion, Caroili and Garcia-Penalosa (1999), Barro (2000), Forbes (2000), Chen (2002), among many others.

[2] On the contrary, Li and Zou (1998) show that inequality and growth can be positively correlated if government spending enters the household's utility function.

[3] We have also investigated the case in which government finances its spending with a proportional tax on *total income*, and obtained the same qualitative results reported in this paper.

of a constant capital tax rate over time. Moreover, we show that the sign of the correlation between inequality and the optimal tax rate is indeterminate because of the additional non-linearity incorporated into the government budget constraint. This is consistent with Perotti (1993*b*, 1994, 1996), Lindert (1996) and Keefer and Knack (2002) who have found that the empirical relationship between inequality and taxes/transfers is not positive as implied by the Alesina-Rodrik model.

On the other hand, we show that as in Alesina and Rodrik (1994), inequality in wealth and income distribution is negatively related to the rate of economic growth in a political equilibrium, regardless of how inequality and the optimal tax rate are correlated. The intuition for this result is straightforward. Start with a perfectly egalitarian society in which each household is endowed with the same share of capital stock and labor hours. When the distribution of factor endowment becomes unequal, as discussed above, the optimal (Ramsey) policy could result in a higher or lower tax rate on capital income. In either case, the corresponding after-tax return to capital is lower than that evaluated at the egalitarian benchmark, which in turn reduces the economy's growth rate. Hence, our analysis illustrates that a modification of the Alesina-Rodrik model can reconcile their main theoretical result that inequality is harmful for economic growth with the empirical findings of Perotti (1993*b*, 1994, 1996), Lindert (1996) and Keefer and Knack (2002).

The remainder of this paper is organized as follows. Section 2 presents a modified version of the Alesina-Rodrik model. Section 3 analyzes the theoretical relationship between economic growth, tax policy, and distribution of capital and labor ownership in a political equilibrium. Section 4 concludes.

2 The Economy

This paper incorporates a different formulation of government budget constraint into an endogenous growth model with distributive politics developed by Alesina and Rodrik (1994). Specifically, we consider the empirically more relevant case of capital-income taxation, as opposed to taxation of the capital stock postulated in the original model. To facilitate comparison, we follow Alesina and Rodrik's notations as much as possible.

2.1 Firms

On the production side, there is a continuum of identical competitive firms, with the total number normalized to one. Each firm produces output y with a Cobb-Douglas production function[4]

$$y = Ak^{\alpha} g^{1-\alpha} l^{1-\alpha}, \ A > 0 \text{ and } 0 < \alpha < 1, \tag{1}$$

where A is a technology parameter, k is the aggregate stock of capital, and l is the aggregate labor hours. In addition, firms view g, which represents the aggregate level of government spending on productive services, outside their control.

Under the assumption that factor markets are perfectly competitive, the firm's profit maximization conditions are given by

$$r = \alpha \frac{y}{k}, \tag{2}$$

$$w = (1-\alpha)\frac{y}{l}, \tag{3}$$

where r is the rental rate of capital, and w is the real wage rate.

2.2 Households

There are a finite number of heterogenous infinitely-lived households in the economy. Household i maximizes its present discounted lifetime utility

$$\int_0^{\infty} (\log c_i)\, e^{-\rho t} dt, \ \ \rho > 0, \tag{4}$$

where c_i is consumption, and ρ is the discount rate. The budget constraint faced by household i is given by

$$\dot{k}_i = wl_i + (1-\tau)\, rk_i - c_i, \ \ k_i(0) \text{ given}, \tag{5}$$

where k_i and l_i are household i's capital stock (which does not depreciate) and labor hours, respectively. The variable τ denotes the proportional tax rate applied to capital income, which is taken as given by the household. Since labor is not an accumulative factor of production,

[4] For ease of notation, the time dependence of all variables is suppressed throughout the paper. For example, y represents $y(t)$ and so on for other variables.

all households are assumed to supply it inelastically each period. This in turn allows us to normalize the economy's aggregate labor endowment, l , to unity for all t. Moreover, household i's share of factor endowment ownership at the initial period is defined as

$$\sigma_i \equiv \frac{l_i(0)}{k_i(0)/k(0)}, \quad 0 \leq \sigma_i < \infty, \tag{6}$$

where $k(0) = \sum_{i=1}^{N} k_i(0)$, and N denotes the number of households in the economy. As a result, households are alike in all aspects except for their beginning endowments of capital stock and labor hours. Notice that the household with a high σ is capital-poor, whereas one with a low σ is capital-rich.

The first-order conditions for household i's optimization problem are

$$\frac{\dot{c}_i}{c_i} = r(1-\tau) - \rho, \tag{7}$$

$$\lim_{t\to\infty} e^{-\rho t}\frac{k_i}{c_i} = 0, \tag{8}$$

where (7) shows that the growth rate of consumption is determined by the difference between after-tax return to capital and the discount rate, and (8) is the transversality condition. Since households take r and τ as given, and ρ is a preference parameter, (7) implies that each household's consumption will grow at the same rate for all t, regardless of its initial relative factor endowments σ_i.

2.3 Government

The government chooses τ and balances its budget at each point in time. Hence, the instantaneous government budget constraint is[5]

$$g = \tau r k, \tag{9}$$

which, compared to Alesina and Rodrik's formulation with taxation of the capital stock, introduces additional non-linearity to the analysis.

Substituting (9) into (2) and (3) leads to the following expressions for r and w, taking into account the effect of using capital taxation to finance government spending, as increasing functions of τ:

[5] By contrast, in the Alesina-Rodrik economy, the government budget constraint is $g = \tau k$, and the budget constraint for household i is given by $k_i = wl_i + (r-\tau)\,k_i - c_i$ (cf. equation 5).

$$r = \alpha^{\frac{1}{\alpha}} A^{\frac{1}{\alpha}} \tau^{\frac{1-\alpha}{\alpha}}, \tag{10}$$

$$w = (1-\alpha)\, \alpha^{\frac{1-\alpha}{\alpha}} A^{\frac{1}{\alpha}} \tau^{\frac{1-\alpha}{\alpha}} k. \tag{11}$$

3 Political Equilibrium

Following Alesina and Rodrik (1994), we examine the theoretical relationship between economic growth, tax policy, and distribution of capital and labor ownership in three steps. It turns out that as in the Alesina-Rodrik model, inequality in wealth and income distribution is inversely related to the economy's growth rate in a political equilibrium.[6] However, the result differs in terms of how distribution of factor endowment affects the optimal fiscal policy.

3.1 Economic Growth and Tax Policy

Our analysis begins by assuming that the tax rate τ remains constant over time. Using the budget constraint (5) and the transversality condition (8) for household i, it is straightforward to show that k_i and c_i will grow at the same constant rate for all t. Moreover, since $k = \sum_{i=1}^{N} k_i$, and the aggregate production function (1) is linearly homogeneous in capital and public services taken together, a steady-state growth path is characterized by

$$\frac{\dot{y}}{y} = \frac{\dot{k}}{k} = \frac{\dot{k}_i}{k_i} = \frac{\dot{c}_i}{c_i} \equiv \gamma = r(1-\tau) - \rho, \tag{12}$$

where the common economy-wide growth rate γ is independent of the initial distribution of factor endowment. This implies that σ_i is time-invariant along a balanced growth path.

Substituting (10) into (12) yields the following expression:

$$\frac{\partial \gamma}{\partial \tau} = \frac{1-\alpha}{\alpha} \alpha^{\frac{1}{\alpha}} A^{\frac{1}{\alpha}} (1-\tau) \tau^{\frac{1-2\alpha}{\alpha}} - \alpha^{\frac{1}{\alpha}} A^{\frac{1}{\alpha}} \tau^{\frac{1-\alpha}{\alpha}} \gtreqless 0 \quad \text{as} \quad \tau \lesseqgtr 1-\alpha, \tag{13}$$

which indicates that the relationship between the rate of economic growth and the tax rate on capital income is represented by an inverse-U curve (see Barro, 1990). In addition, when the tax rate is equal to $\tau^* = 1-\alpha$, the economy achieves its maximum attainable growth rate

[6] Notice that in this economy, distribution of wealth (factor endowment) is directly related to distribution of income. Using (6) and (11), it can be shown that that household i's disposable income, which is equal to $wl_i + (1-\tau)rk_i$, is negatively related to σ_i.

$$\gamma^* = \alpha^{\frac{1+\alpha}{\alpha}} A^{\frac{1}{\alpha}} (1-\alpha)^{\frac{1-\alpha}{\alpha}} - \rho. \tag{14}$$

With low (high) tax rates, the after-tax return to capital is an increasing (a decreasing) function of τ. Therefore, as τ is incrementally raised, the growth rate first rises, reaches its maximum γ^* when $\tau = \tau^*$, and then falls.

As an illustration, Figure 1 presents the inverted-U relationship between γ (in percentage) and τ for the parameterization of $\alpha = 1/3$ (capital share of national income), $A = 2$ (the technology parameter), and $\rho = 0.025$ (the discount rate).[7] Notice that when $\tau = 0$ (thus $g = y = 0$) and $\tau = 1$ (thus $k = y = 0$), the economy will not grow. Moreover, for $\tau < 0.364$ and $\tau > 0.895$, the after-tax return to capital is not sufficiently high to compensate the discount rate. In this case, the economy exhibits negative steady-state growth (see equation 12), thereby violating the transversality condition (8).

3.2 Tax Policy and Wealth Distribution

In this subsection, we study the relationship between household i's preferred tax policy, denoted as τ_i, and its beginning share of factor endowment σ_i. Consider the dynamic Ramsey problem in which a benevolent government chooses a program of public spending and distortionary taxes on capital income to maximize the discounted utility of household i given by (4). In computing the optimal fiscal policy, the government takes into account the rational responses of private agents, as summarized by equations (1)-(3), (5), (7)-(8), and (10)-(12). The government's first-order condition with respect to τ_i is

$$\alpha(\alpha + \tau_i - 1)[(1-\alpha)\alpha^{\frac{1-\alpha}{\alpha}} A^{\frac{1}{\alpha}} \tau_i^{\frac{1-\alpha}{\alpha}} \sigma_i + \rho] = \rho(1-\alpha)^2 \sigma_i. \tag{15}$$

Since we focus on a steady-state growth path along which σ_i remains fixed, (15) implies that the optimal (Ramsey) policy includes a time-invariant tax rate on capital income. Hence, results from the previous subsection based on a constant τ are consistent with the equilibrium outcome.

To provide a useful benchmark for the subsequent analysis, consider a "pure capitalist" who has no labor income, thus $\sigma_k = 0$, where the subscript k identifies this type of household.

[7] Different combinations of empirically plausible α, A and ρ have no impact on the shape of the inverted-U curve.

Plugging $\sigma_k = 0$ into (15) shows that the optimal tax rate for a pure capitalist is identical to that maximizes the economy's growth rate, that is,

$$\tau_k = 1 - \alpha = \tau^*. \tag{16}$$

Next, we take total differentiation on both sides of (15), and obtain

$$\frac{\partial \tau_i}{\partial \sigma_i} = \frac{\overbrace{\frac{\rho(1-\alpha)^2}{\alpha}}^{\text{positive}} - \overbrace{A^{\frac{1}{\alpha}}\alpha^{\frac{1-\alpha}{\alpha}}(1-\alpha)(\alpha+\tau_i-1)\tau_i^{\frac{1-\alpha}{\alpha}}}^{\text{positive / negative}}}{\underbrace{A^{\frac{1}{\alpha}}\alpha^{\frac{1-\alpha}{\alpha}}(1-\alpha)\tau_i^{\frac{1-\alpha}{\alpha}}\sigma_i + \rho}_{\text{positive}} + \underbrace{(1-\alpha)^2\alpha^{\frac{1-2\alpha}{\alpha}}A^{\frac{1}{\alpha}}(\alpha+\tau_i-1)\tau_i^{\frac{1-2\alpha}{\alpha}}\sigma_i}_{\text{positive / negative}}}, \tag{17}$$

whose sign is indeterminate because of the additional non-linearity incorporated into the government budget constraint. By contrast, inequality and the optimal tax rate are positively correlated ($\frac{\partial \tau_i}{\partial \sigma_i} > 0$) in Alesina and Rodrik's framework in which government spending is financed by a proportional tax on capital stock. Notice that Perotti (1993*b*, 1994, 1996), Lindert (1996) and Keefer and Knack (2002) obtain a negative $\frac{\partial \tau_i}{\partial \sigma_i}$ in their cross-country studies, and it has been commonplace to view this empirical evidence as rejecting the Alesina-Rodrik model. However, the next subsection shows that the possibility of a negative $\frac{\partial \tau_i}{\partial \sigma_i}$ does not affect Alesina and Rodrik's main theoretical result.

Combining equations (16) and (17) implies that when τ_i is increasing (decreasing) in σ_i, any household with positive labor income (hence $\sigma_i > 0$) will prefer a capital tax rate that is higher (lower) than τ^*. In either case, this leads to a rate of economic growth that falls short of the maximum attainable level γ^* because the corresponding after-tax return to capital is lower than that evaluated at τ^* (Figure 1). Therefore, the tax rate that maximizes the representative household's well-being is not the same as that maximizes the economy's growth rate, that is, $\tau_i \neq \tau^*$, except in the limiting case of a pure capitalist.

3.3 Economic Growth and Wealth Distribution

Following Alesina and Rodrik (1994), we postulate that the rate of capital income tax is determined by majority voting. Since voting takes on a single issue, household preferences are single-peaked, and there exists a monotonic relationship between a voter's relative factor endowments and his/her preferred tax policy, the median-voter theorem is applicable in this

environment.[8] Consequently, the tax rate selected by the majority rule coincides with the median voter's choice τ_m, which solves

$$\alpha(\alpha+\tau_m-1)[(1-\alpha)\alpha^{\frac{1-\alpha}{\alpha}}A^{\frac{1}{\alpha}}\tau_m^{\frac{1-\alpha}{\alpha}}\sigma_m+\rho]=\rho(1-\alpha)^2\sigma_m, \tag{18}$$

where σ_m denotes the factor endowment share of the median voter. Notice that it does not matter when and how often voting takes place in that the optimal tax rate remains constant over time, and the distribution of factor endowment is also time-invariant. Furthermore, following the same discussion of the preceding subsection, the sign of $\frac{\partial\tau_m}{\partial\sigma_m}$ can be positive or negative.

Using (13), (17) and the chain rule leads to the following relationship between economic growth and wealth distribution in a political equilibrium:

$$\frac{\partial\gamma}{\partial\sigma_m}=\underbrace{\frac{\partial\gamma}{\partial\tau_m}}_{\text{negative / positive}}*\underbrace{\frac{\partial\tau_m}{\partial\sigma_m}}_{\text{positive / negative}}. \tag{19}$$

When $\frac{\partial\tau_m}{\partial\sigma_m}$ is positive (negative), the median voter chooses a tax rate τ_m that is above (below) τ^*. Moreover, Figure 1 shows that $\frac{\partial\gamma}{\partial\tau_m}$ is negative (positive) when τ_m is higher (lower) than τ^*. Plugging these sign combinations into (19) shows that as in the Alesina-Rodrik model, $\frac{\partial\gamma}{\partial\sigma_m}$ is always negative in our economy, no matter how inequality and the optimal tax rate are correlated. Hence, a higher inequality in wealth and income distribution is harmful for economic growth.[9]

The intuition for this result is straightforward. Start with a perfectly egalitarian society in which each household is endowed with the same share of capital stock and labor hours, $\sigma_m=\sigma_i=1$, for all i. When the distribution of factor endowment becomes unequal ($\sigma_m>1$), the median voter now could choose a higher or lower tax rate on capital income τ_m. However, regardless of the sign of $\frac{\partial\tau_m}{\partial\sigma_m}$, the after-tax return to capital under both circumstances is lower than that evaluated at $\sigma_m=1$. That is, inequality in wealth and income distribution leads to

[8] Equation (17) shows that in general, the relationship between τ_i and σ_i could be non-monotonic. However, τ_i is monotonically increasing in σ_i for each empirically plausible parameterization of $\{\alpha, A, \rho\}$ that we have investigated. Therefore, the median-voter theorem can be applied here.

[9] We rule out the case of $\frac{\partial\gamma}{\partial\sigma_m}=0$ since this implies, unrealistically, that the median voter is a pure capitalist with $\sigma_m=\sigma_k=0$, hence $\tau_m=\tau^*=1-\alpha$ and $\gamma=\gamma^*$.

redistributive tax policies that reduce the net return to capital accumulation. As a result, the economy's growth rate falls.

4 Conclusion

Alesina and Rodrik (1994) show that in a one-sector political-economy model of endogenous growth, inequality in wealth and income distribution leads to a higher rate of taxation and a lower growth rate. Our analysis illustrates that with a different formulation of government budget constraint, the relationship between distribution of factor endowment and the optimal fiscal policy becomes indeterminate. Nevertheless, these authors' main theoretical result remains intact — inequality is conducive to the adoption of redistributive policies that discourage capital accumulation, thereby reducing the rate of economic growth. Overall, this paper reconciles Alesina and Rodrik's theoretical model and the empirical findings of Perotti (1993*b*, 1994, 1996), Lindert (1996) and Keefer and Knack (2002).

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Figure 1: Economic Growth and Tax Policy (α=1/3, A=2 and ρ=0.025)