ON THE DYNAMICS OF GROWTH AND FISCAL POLICY

WITH REDISTRIBUTIVE TRANSFERS

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May 25, 1999

Abstract: This paper formalizes the effects of redistributive transfers on economic growth and the design of desirable fiscal policies. We make two contributions to the literature. First, we set up a dynamic general equilibrium model in which the society as a whole chooses distorting taxes to finance redistributive transfers as well as public goods. Second, we deliver analytic results for the long-run and the transitional dynamics of optimal (second-best) fiscal policies and endogenous growth. The focus is on uniqueness and determinacy, and how this is affected by distributive and allocative activities on the part of the government.

Keywords: Redistribution. Public goods. Economic growth. Dynamics.
JEL classification: H2, H4, O4, E62.

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***** We thank T. Moutos and H. Polemarchakis for discussions. All errors are ours.

I. INTRODUCTION

The link between inequality, redistribution and economic growth (efficiency) is a complex one. Concerning the effects of inequality on economic growth,[1] the conventional argument (see e.g. Sandmo [1995]) is that when inequality leads to redistribution to the less endowed, this has negative incentive effects at both the giving end (redistribution requires higher taxes which discourage investment) and the receiving end (moral hazard problems discourage effort). Recently, this argument has been combined with political economy models with voting. For instance, Persson and Tabellini [1994a], Alesina and Rodrik [1994] and Benabou [1996] show that in unequal societies, the less capital-endowed is the median voter relative to the average, the higher is his ideal capital taxation.[2] Thus, according to the conventional argument, since redistributive policies distort economic incentives, more unequal societies grow faster.[3]

This paper extends the above literature by formalizing the effects of redistributive transfers on economic growth and the design of desirable fiscal policies. We make two contributions to the literature. First, we set up a dynamic general equilibrium model in which the society as a whole chooses distorting taxes to finance redistributive transfers as well as public goods. Thus, we allow explicitly for both distributive and allocative activities on the

[1] For the effects from growth to inequality (i.e. the Kuznets hypothesis), see e.g. Aghion and Williamson [1998]. Here, we do not study this causal relationship. For empirical evidence about the two-way link between inequality and growth, see also Barro [1999].

[2] However, in most of these models, redistribution is not modelled explicitly. It just takes the form of taxes on capital. As Alesina and Rodrik [1994, p. 466] say, "taxes on capital must be interpreted as a metaphor for any kind of redistributive policy that transfers income to unskilled labor".

[3] This argument has been recently challenged (for a survey, see Aghion and Williamson [1998]). For instance, in the presence of capital market imperfections, redistribution can be good for growth because it creates opportunities, improves borrowers' incentives and reduces volatility (see Aghion and Bolton [1997] and Aghion and Howitt [1998]). Or inequality can lead to rent-seeking activities in a game between interest groups, and therefore equality is good for growth (see Benhabib and Rustichini [1996] and Benabou [1996]). Or, as Sandmo [1995] argues, the tradeoff between equity and efficiency ceases to exist once we introduce adverse selection issues. In this paper, we take redistribution as given without justifying it. This is because we want to focus on how redistributive transfers affect the dynamics of optimal growth and fiscal policies. If we do not want to introduce capital market imperfections, rent-seeking activities, etc (see above), then we could justify redistribution by assuming that an index of inequality (see below) provides direct disutility to households, or that this index exerts a negative production externality to private firms. Since this would also be ad hoc and would not affect our main results, we simply prefer to take redistribution as given.

part of the government.[4] Second, we deliver analytic results for the long-run and transitional dynamics of optimal (second-best) fiscal policies and endogenous growth. The focus is on uniqueness and determinacy, and how this is affected by distributive and allocative policies.

The model is as follows. A decentralized economy is populated by private agents (households and firms) and a government. Different households have different capital endowments. The government taxes capital income to finance transfer payments, public consumption services and public production services. Transfer payments redistribute from those who are endowed more than the average and give to those who are endowed less than the average. Public consumption services provide direct utility to households. Public production services raise the productivity of firms, and are the engine of long-run growth (see Barro [1990]).[5] These consumption and production services are pure public goods.

When economic policy is exogenous, the model has the following features: First, when households internalise the provision of redistributive transfers, moral hazard behavior reduces growth. The larger the number of individuals, the stronger the incentive to free ride on each other, and hence the stronger the moral hazard problem. Second, the relation between the economy's growth rate and the capital tax rate is an inverse U-curve. Thus, at low (resp. high) tax rates, an increase in the tax rate increases (resp. decreases) growth. This is as in e.g. Barro [1990] and Alesina and Rodrik [1994].

We then study what happens when the society as a whole chooses economic policy. In particular, we endogenize policy by assuming that the government is benevolent and maximises the sum of all households' well-being. The main results along the optimal path are as follows: First, tax increases always reduce growth (compare it with the inverse U-curve relation above when policy is exogenous). Second, the government finds it optimal to redistribute income from the rich to the poor, only when it can also provide public production services (recall that it is the latter that generates long-run growth). Third, from the viewpoint of the poor (resp. rich) individual, taxes should increase (resp. decrease) with

[4] As Sandmo [1995] states, to access the role of the public sector in growth, we have to consider a somewhat wider role for fiscal policy. Specifically, he says that " …the main focus of the literature has been on cash transfers, whereas effects of the provision of social goods have not received the attention that they probably deserve… Tax financing of public expenditures will presumably increase the quality of the labor force, so that an assessment of the effects of the welfare state policy … in efficiency terms ought to consider these effects jointly".

[5] In Glomm and Ravikumar [1992] and Perotti [1993] the engine of growth is human capital. See also Fernandez and Rogerson [1995, 1996] for human capital and redistribution.

inequality. This happens because redistribution requires taxes. In turn, since the growth rate is negatively affected by the tax rate, it follows that unequal societies grow faster (see also the median-voter models of Alesina and Rodrik [1994] and Benabou [1996]). Fourth, provision of government consumption services implies that the optimal tax rate changes over time, and hence there are transitional dynamics. This enriches the results of Barro [1990] and Alesina and Rodrik [1994] who do not get transitional dynamics.

Concerning the long-run, we focus on a steady state in which all individuals are alike ex post (see also Bewley [1982]). Then, we find a sufficient condition on the parameter values under which there exists a unique long-run tax rate, and in turn a unique Balanced Growth Path (BGP) along which consumption and capital grow at the same positive rate. In this steady state, the relation between anticipated redistribution and BGP is an inverted U-curve. Namely, when the rate of redistribution is relatively small, growth increases with anticipated redistributive transfers, while when the rate of redistribution is relatively large, growth decreases with anticipated redistributive transfers (see also Benabou [1996]).

Finally, we study local stability properties around this steady state. We can claim that the anticipation of large redistributive transfers opens the door for indeterminacy. That is, there can be many possible equilibrium paths for tax policy, consumption and capital accumulation, each of which is consistent with a given initial condition and with convergence to a unique steady state. The channel for indeterminacy is moral hazard. Our results can also explain why individuals who start with similar endowments may consume and save at different rates over time; that is, the anticipation of redistributive transfers can itself generate income inequality. Furthermore, in combination with the result that high redistribution is associated with a low BGP along the optimal path, we can also explain why indeterminacy arises when redistribution has a detrimental impact on growth.

The rest of the paper is organised as follows. Section II presents the economic environment. Section III solves for second best policy. Sections IV and V study respectively the long-run and transitional dynamics. Section VI concludes.

II. THE ECONOMIC ENVIRONMENT

Consider a decentralized closed economy populated by private agents (households and firms) and a government. Households purchase goods for consumption and save in the form of capital.[6] We assume that there are $i = 1,2,\ldots,N$ households. Firms produce goods and make rental payments for capital input. For simplicity, there is a single firm. The government imposes taxes on households' capital income to finance public production services, public consumption services and redistributive transfer payments. We assume continuous time, infinite horizons and perfect foresight.

Different households have different initial capital stocks. Household i is indexed by its own capital stock, k^i, relative to the average capital stock, $\bar{k}$ (where $\bar{k} \equiv \frac{K}{N}$ and $K \equiv \sum_{i=1}^{N} k^i$ is the aggregate capital stock). This index, $(\bar{k} - k^i)$, can be also thought as a measure of inequality.

The role of economic policy

It is convenient to start with the role of economic policy. The government receives tax revenues qrk^i from each household i, where $0 \leq q < 1$ is the tax rate on capital income, r is the market return to capital, and k^i is household's i stock of capital. On the other hand, each household i receives a transfer payment d^i from the government. We assume that d^i is a linear function of relative capital ownership, $(\bar{k} - k^i)$. Thus, each household receives:[7]

$$d^i = d(\bar{k} - k^i)$$

(1)

[6] For simplicity, we do not include labor. This is because we want to focus on differences in capital endowments across individuals. Our results do not change if households supply inelastically their labor services. However, our results do change if households make labor/leisure choices (see e.g. Alesina and Rodrik [1994]). For details, see Park and Philippopoulos [1998].

[7] For similar state-contingent linear rules, see Aghion and Howitt [1998, chapter 9]. Of course, redistribution can take many forms in addition to transfers (e.g. progressive income taxation, regulations, minimum wage laws, etc). See Benabou [1996].

where $0 \le d < 1$ is a redistributive parameter. Equation (1) implies that the government subsidises those households who are endowed less than the average. Thus, if $\bar{k} > k^i$, household i is a receiver. If $\bar{k} < k^i$, household i is a donor.

The government uses its total tax revenues to finance the provision of aggregate public production services g, aggregate public consumption services h, and transfer payments to each household d^i. Thus, the government budget constraint at each instant of time is:[8]

$$g + h + \sum_{i=1}^{N} d^i = \sum_{i=1}^{N} qrk^i$$

(2)

For simplicity, we assume that a portion $0 < b < 1$ of total tax revenues is used to finance public production services, and a portion $0 < 1 - b < 1$ is used to finance public consumption services plus transfer payments.[9] Thus, (2) is decomposed to (3a) and (3b):

$$g = b \sum_{i=1}^{N} qrk^i$$

(3a)

$$h + \sum_{i=1}^{N} d^i = (1 - b) \sum_{i=1}^{N} qrk^i$$

(3b)

Households

Household i maximizes intertemporal utility:

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[8] For simplicity, there is no public debt.

[9] See also Turnovsky and Fisher [1995] for the exogenous decomposition of government expenditures between various services. We assume that b is exogenous in order to study how this decomposition affects optimal growth and tax policy.

$$\int_0^{\infty}[u(c^i, h)]e^{-rt}dt$$

(4a)

where c^i is household's i private consumption, h is aggregate public consumption services (which is a pure public good), and the parameter $r > 0$ is the rate of time preference. Note that all households discount utility by using the same factor, r (see below). The function $u(.)$ is increasing and concave in its two arguments, and also satisfies the Inada conditions. For simplicity, we assume that $u(.)$ is additively separable and logarithmic. Thus,

$$u(c^i, h) = \log c^i + n \log h$$

(4b)

where the parameter $n \geq 0$ measures the weight given to public consumption relative to private consumption.[10]

Households consume and save in the form of capital. When household i rents out k^i to firms, it receives a net capital income $(1-q)rk^i$. It also receives a profit share, p^i. Furthermore, it receives a transfer payment d^i from the government. Using equation (1) for d^i, household's i flow budget constraint is:

$$c^i + \dot{k}^i = (1-q)rk^i + p^i + d(\bar{k} - k^i)$$

(5)

where a dot over a variable denotes time derivative, and the initial capital stock is given.[11]

[10] This function allows for a balanced growth path.

[11] In Persson and Tabellini [1994], $q = d$ in equation (5).

Households take prices/profits (r, p^i), tax policy (q) and public goods (h) as given. The control variables are c^i and k^i, so that the first-order conditions for a maximum are equation (5) as well as the Euler condition:[12]

$$\dot{c}^i = c^i[(1-q)r - r - d(1-\frac{1}{N})]$$

(6)

The firm

Following Barro and Sala-i-Martin [1995, pp. 153-4] and Alesina and Rodrik [1994], technology at the firm's level takes a Cobb-Douglas form. Thus, the single firm faces the production function:

$$y = g^{1-a} K^a$$

(7)

where $0 < a < 1$ is a parameter, g is public production services (which is a pure public good) and K is the aggregate capital stock (there is a single firm).

At any point of time, the firm maximizes profits, p :

$$p = g^{1-a} K^a - rK$$

The firm acts competitively by taking prices (r) and public goods (g) as given. The control variable is K, so that the first-order condition for a maximum is simply:

[12] The necessary conditions (5) and (6) are completed with the addition of the transversality condition $\lim_{t\to\infty}[u_c(.)k^i e^{-rt}] = 0$. It is known that there exists a unique solution to this problem. The other argument in the utility function must also be bounded. This is taken as given by households (see below).

$$r = ag^{1-a}K^{a-1}$$

(8)

which equates the rate of return to the marginal product of capital.

Decentralized Competitive Equilibrium

We now characterize a Decentralized Competitive Equilibrium (DCE). This is for any given tax policy, q.

Using (3a) into (8), the return to capital is:

$$r = a^{\frac{1}{a}}(bq)^{\frac{1-a}{a}} \equiv \Delta(q)$$

(9)

which is the return to capital perceived by private agents in a DCE. This is the return that drives private agents' consumption/capital decisions in equilibrium (see (5) and (6)). In the presence of externalities, this return is smaller than the realized one (see below). This can also justify economic policy in the next section.

Using (9) into (3a), (3b) and (7), the economy-wide public production services (g), public consumption services (h) and output (y) are respectively:

$$g = (abq)^{\frac{1}{a}}K$$

(10a)

$$h = (1-b)q\Delta(q)K - \sum_{i=1}^{N} d(\bar{k} - k^{i})$$

(10b)

$$y = (abq)^{\frac{1-a}{a}}K$$

(10c)

where (as we said above) each household's i capital, k^i, and hence aggregate capital, K, have been chosen by private agents who ignored externalities.[13]

We next calculate aggregate profits, $p \equiv \sum_{i=1}^{N} p^i$. The law of Walras implies $y = RK + p$, where R is the realized return to aggregate capital, K. This is an accounting relationship, which simply states that realized capital payments and profits exhaust total output. But since (10c) implies $R \equiv \frac{¶y}{¶K} = (abq)^{\frac{1-a}{a}}$, we simple have for aggregate profits:

$$p = 0$$
(10d)

so that, at an economy-wide level, all realized income goes to capital.[14]

We summarize. We have characterized a Decentralized Competitive Equilibrium (DCE). This is for any tax policy q on behalf of the government. In this equilibrium: (i) Private decisions maximize households' utility and firms' profits (see (5) and (6), where r follows (9) and p follows (10d)). (ii) The government budget constraint is satisfied (see (10a) and (10b)).

In the next section, the government chooses its tax policy, q.[15] Before we choose the optimal q, we point out the following results for given q. First, (6) and (9) imply that the economy's growth rate is $G_c \equiv [(1-q)\Delta(q) - r - d(1-\frac{1}{N})]$. The last term, i.e.

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[13] (10c) shows that our model is a variant of Rebelo's [1991] model, i.e. at an aggregate level, output is linear in capital.

[14] This is because the model is a variant of Rebelo's [1991] AK model. Thus, if capital is paid its realised marginal product, there is nothing left for profits or labor. As Barro and Sala-i-Martin [1995, pp. 141-2] say, this is because in the AK model, "capital encompasses human capital, knowledge and public infrastructure", while "the zero wage rate can be thought as applying to raw labor which has not been augmented by human capital". Also note that: (i) Since $0 < a < 1$ and $q > 0$, $R > r$. Thus, the economy-wide return exceeds the return perceived by private agents. (ii) R and r coincide only when there are no externalities. (iii) The similarity of realised returns to socially optimal returns obscures an important difference between them: realised returns are based on private decisions that ignored externalities.

[15] Here, d is exogenous. Alternatively, d could be chosen optimally. The assumption that d is exogenous is deliberate: it helps us to study how commonly used redistributive policies, as in (1), affect optimal growth and tax policy.

$\delta(1-\frac{1}{N})>0$, is the "effective" redistributive parameter. It arises because households internalise the provision of redistributive transfers, and implies that moral hazard behavior reduces growth. Observe that when there is a large number of households (i.e. $N\rightarrow\infty$), the effective redistrubutive parameter increases, so that free-riding incentives - and hence the moral hazard problem - become stronger. By contrast, when there is only one household (i.e. $N=1$), the effective redistributive parameter becomes zero and there are no moral hazard problems. Second, $\frac{\partial G_c}{\partial\theta}=\frac{(1-\alpha-\theta)\Delta(\theta)}{\alpha\theta}$. Thus, $\frac{\partial G_c}{\partial\theta}>0$, if $0<\theta<1-\alpha<1$; on the other hand, $\frac{\partial G_c}{\partial\theta}<0$, if $1-\alpha<\theta<1$. In other words, when policy is exogenous, the relation between the economy's growth rate and the capital tax rate is an inverse U-curve. At low tax rates, $0<\theta<1-\alpha<1$, an increase in the tax rate increases growth. At high tax rates, $1-\alpha<\theta<1$, the growth rate declines with the tax rate. This result is similar to that in e.g. Barro [1990] and Alesina and Rodrik [1994].