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Abstract

This paper analyzes the consequences of redistribution of public funds to rent seekers. Therefore, it introduces redistribution to rent seeking agents into Barro's (1990) endogenous growth model with a productive public sector. It shows that the growth rate decreases in the share of the public funds that is redistributed. The public sector's relative sizes that maximize growth and welfare become also smaller in presence of redistribution. Further, if foreign aid is added to the model, the relationship between aid and growth turns out to be inverted-U shaped under reasonable policy assumptions, which is consistent with the finding of an Aid Laffer Curve by some recent empirical studies.

Key words: Rent seeking; Growth; Foreign Aid; Fiscal Policy

JEL classification: D72; D9; F35; H30

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1 Introduction

In many countries, public funds are partly used to provide public goods and services as well as to finance transfers to poor, sick, disabled and elderly people. In addition, transfer payments are often made "to farmers or agricultural interest, to protected producers of import substitutes, to college and university students and academic faculties, to consumers of municipal transport services, to airline passengers, to government workers, to various and sundry other groups that cannot qualify for inclusion under any meaningfully defined 'welfare state' rubric" (Buchanan 1988, 8-9). Of course, most of these payments are defended by the argument that they are necessary either to provide important public goods or to help people in need. But these payments are most likely primarily made to please persistent rent seekers. Since the output shares that governments all over the world redistribute to rent seekers seem to be far from negligible, the question arises how this redistribution to rent seekers affects economic growth and welfare.

This paper tries to answer this question. The analysis is based on the endogenous growth model of Barro (1990) in which the government collects taxes and converts the tax revenues into public services that are necessary for private production. To introduce rent seeking into this model, it is assumed that public funds are only partly used to provide public services. The other part of the public funds is redistributed to agents that engage in rent seeking. Hence, the agents decide not to use all of their time productively, but to devote some of it to rent seeking activities.

The main result of this rent seeking growth model is that an increase in the share of the tax revenues that is redistributed to rent seekers lowers the growth rate. In addition, the public sector's relative sizes that maximize growth and welfare become also smaller in presence of redistribution.

Further, if foreign aid is introduced into this model, the relationship between foreign aid and economic growth turns out to be inverted-U shaped under reasonable policy assumptions. This result is consistent with the finding of an Aid Laffer Curve by some recent empirical studies.

On the relationship between rent seeking and economic growth, there exists already a well-known theoretical literature that includes Tornell and Velasco (1992), Benhabib and Rustichini (1996), Lane and Tornell (1996), Tornell (1997) and Tornell and Lane (1999). A major difference between these contributions and this chapter here is that they assume common access to certain resources and abstract from the role that the government and the public sector play in the redistribution of these resources.

Contrariwise, Gelb et al. (1991) and the literature on corruption and growth directly model how the public sector is used for redistribution. However, they abstract from redistribution towards rent seeking private agents and focus only on redistribution towards rent seeking public employees and politicians.

Alesina and Rodrik (1994) and Persson and Tabellini (1994) directly model how the public sector is used for redistribution to private agents. However, redistribution serves to reduce inequality in their models. Therefore, it might be justifiable by "welfare state" arguments, which it is not in the subsequently presented model.

This model is presumably most closely related to Sturzenegger and Tommasi (1994) and Ehrlich and Lui (1999), which present also models of rent seeking and growth in which the public sector redistributes resources to please rent seeking agents that need not be publicly employed. However, Sturzenegger and Tommasi focus on the role of the distribution of political power.

In Ehrlich and Lui, agents can accumulate productive human capital as well as political capital. Political capital allows using public power to extract rents from those who have accumulated less political capital. A major difference between their model and the subsequently presented model is that political capital cannot be accumulated in the latter. Further, the public sector cannot play any positive role in the former. It solely organizes rent extraction. It is therefore not surprising that the growth rate decreases in the public sector's relative size and that growth would consequently be maximized if the public sector were shut down. In the subsequently presented model, this result does not hold since public services are necessary for private production.

This paper is structured as follows: Section 2 presents and solves the rent seeking growth model. Section 3 focuses on the interdependence between rent seeking, foreign aid and economic growth. First, it presents the findings of some recent empirical studies on foreign aid and growth. It then introduces foreign aid into the rent seeking growth model and discusses the results. Section 4 concludes.

2 The Rent Seeking Growth Model

This section presents the rent seeking growth model, which introduces redistribution to rent seeking agents into Barro's (1990) endogenous growth model with a productive public sector. The first part of this section presents the setup of the rent seeking growth model. The second derives how agents optimally allocate their time or their efforts, respectively, to rent seeking and productive activities. The third solves the agents' intertemporal optimization problem. The fourth discusses the resulting growth rate and its determinants. Thereby, the effects of different policies on the optimal effort choices are taken into account. The section ends with some welfare considerations.

2.1 The Setup

Given is also a closed economy with a government that provides public services necessary for private production and with many identical private agents. In particular, it is assumed that the economy is populated by a continuous mass n of infinitely living agents, where $n = 1$.[1]

[1] The assumption that $n = 1$ is not crucial. However, it simplifies the presentation since the average of any agent-specific variable thus coincides with its aggregate value.

Each agent i seeks to maximize her overall utility

$$U = \int_0^\infty \frac{c_{it}^{1-\sigma}}{1-\sigma} \exp(-\rho t)\, dt, \tag{1}$$

where c_{it} denotes her consumption in period t, $\rho > 0$ her discount rate and $\sigma > 0$ the inverse of the constant intertemporal elasticity of substitution. Further, each agent i can generate income m_{it} in each period t by producing output y_{it} and by seeking rents r_{it}. The current income m_{it} can either be consumed today or it can be used to accumulate capital k_{it}, where k_{it} represents a broad aggregate including physical as well as human capital. In the initial period, each agent i is endowed with the same capital stock, i.e., $k_{i0} = k_0 > 0$ for all i.

The government taxes away a fixed share τ, where $0 \leq \tau \leq 1$, of each agent's production y_{it} in each period t. The revenues from income taxation constitute the public funds p_t. Assuming further, as in the Barro model, that the government's budget must be balanced at all times leads to the government's budget constraint

$$p_t = \tau y_t, \tag{2}$$

where aggregate output y_t is given by $y_t = \int_0^1 y_{it} di$.

But, unlike in the Barro model, only the share θ of the public funds p_t is converted into public services g_t, where $0 \leq \theta \leq 1$. The public services $g_t = \theta p_t$ might either be rival and excludable or nonrival and nonexcludable.[2]

The rest of the public funds, i.e., $R_t = (1-\theta)p_t$, is redistributed. Given the absence of inequalities within the population of the given economy, there can be no redistribution to reduce poverty or to lower income inequalities. All redistributive activities are made to please rent seeking agents. Since this chapter focuses on explaining the consequences and not the causes of redistribution to rent seekers, the share θ is assumed to be exogenous. However, the reason for any $\theta < 1$ might well be some sort of a political struggle.[3]

Unless $\theta = 1$, there is a non-empty redistribution pot R_t that just waits to be exploited. Hence, agents have an incentive to seek rents. The time agent i devotes to rent seeking in period t, i.e., her rent seeking effort, is denoted by e_{Rit}. However, the agents' non-leisure time endowment is limited. Therefore, devoting time to rent seeking has the drawback that less time can be spent on productive activities. If the agents' non-leisure time endowment is normalized to one, the time agent i can use productively, i.e., her productive effort, is given by $e_{Yit} = 1 - e_{Rit}$.

Next, rent extraction and production technologies are introduced. The rent

[2] Since $n = 1$, the subsequently presented results are independent of the public services' type. If $n > 1$, the quality of the results would still be the same for both types. However, the resulting growth rate would in addition increase in n if public services were nonrival and nonexcludable.

[3] There is no rent seeking for public services g_t, just for the content of the redistribution pot R_t. If public services are assumed to be nonrival and nonexcludable, this assumption is particularly unrestrictive.

extraction technology is such that agent i can extract the rent[4]

$$\begin{aligned} r_{it} &= \frac{1}{n} R_t && \text{if } e_{Rit} = 0 \text{ for all } i \\ &= \frac{e_{Rit}}{\int_0^n e_{Rjt} dj} R_t && \text{otherwise.} \end{aligned} \tag{3}$$

Remember that $n = 1$. This rent extraction technology possesses the following reasonable properties: The rent r_{it} that agent i can extract in period t depends positively on her current rent seeking effort e_{Rit} and on the size of the redistribution pot R_t, but negatively on the aggregate rent seeking effort. Further, it holds that $r_{it} \geq 0$ for all i and t and that $\int_0^1 r_{it} di = R_t$ for all t.

As in the Barro model, the production technology has decreasing returns to capital k_{it} and public services g_t separately, but constant returns to scale. In addition, it is assumed that agents can only make use of their accumulated physical and human capital k_{it} during the time they devote to productive activities. That is, they can neither use their machines, nor their knowledge, their skills and their experience of how to produce well and fast while they are seeking rents. Thus, their production function, assuming a Cobb-Douglas type, is given by

$$y_{it} = A \left(e_{Yit} k_{it} \right)^{1-\alpha} g_t^{\alpha}, \tag{4}$$

where $0 < \alpha < \frac{1}{2}$.[5] This condition implies, speaking somewhat carelessly, that capital k_{it} is more important for private production than public services g_t are.

The presented structure of the model implies that the income of agent i in period t is given by[6]

$$m_{it} = (1 - \tau) \, y_{it} + r_{it}. \tag{5}$$

Inserting the rent extraction technology (3) and the production technology (4) allows rewriting income as

$$m_{it} = (1 - \tau) \, A \left(e_{Yit} k_{it} \right)^{1-\alpha} g_t^{\alpha} + \frac{e_{Rit}}{e_{Rt}} R_t, \tag{6}$$

where $e_{Yit} = 1 - e_{Rit}$ and $e_{Rt} = \int_0^1 e_{Rit} di$.

In this model, each agent i has to take two different decisions in each period t. First, she has to choose how to allocate her time or her effort, respectively, to rent seeking and to productive activities in order to maximize her current income m_{it}. Second, she has to decide how much of her income m_{it} to consume today and how much of it to save or to invest, respectively. The agents' optimal effort choices are derived in section 2.2. Then, section 2.3 derives their optimal consumption-saving decisions by solving their intertemporal optimization problem.

[4]This rent extraction technology corresponds to Grossman's (2001) technology for appropriation from a common pool, which might well have been inspired by Tullock's (1980) rent seeking contest success function. The latter is discussed, among others, in Hirshleifer (1989).

[5]The results developed in this section, i.e., in section 2, would also hold in the more general case of $0 < \alpha < 1$. However, some results presented in section 3 would not hold if $\alpha \geq \frac{1}{2}$.

[6]As equation (5) implies, income m_{it} stands actually for disposable income.

2.2 The Effort Choices

This subsection derives each agent's effort choice that maximizes her income m_{it} in period t. This is done in three steps: First, solving her income maximization problem yields her optimal rent seeking effort as a function of the aggregate rent seeking effort e_{Rt}, her capital stock k_{it}, some public sector variables and some parameters. Second, it is shown that the optimal effort choice must be the same for all agents. This insight is then used in a third step to derive each agent's optimal rent seeking and productive efforts as functions of technology and policy parameters only.

When maximizing her income m_{it}, agent i is aware that her behavior does neither affect the aggregate rent seeking effort e_{Rt} nor the aggregate output y_t since she has measure zero. Therefore, she takes e_{Rt} and y_t as well as public funds p_t, public services g_t and the redistribution pot's content R_t as given. Hence, to maximize her income m_{it} in period t, which is given by equation (6), agent i must set her rent seeking effort e_{Rit} such that the first-order condition

$$\frac{\partial m_{it}}{\partial e_{Rit}} \stackrel{!}{=} 0 \Leftrightarrow \frac{R_t}{e_{Rt}} = (1-\tau)A\,(1-\alpha)\,(1-e_{Rit})^{-\alpha} k_{it}^{1-\alpha} g_t^{\alpha} \tag{7}$$

holds. This first-order condition ensures that the marginal return to rent seeking equals the marginal return to productive activities.

Solving this first-order condition for e_{Rit} implies that the optimal rent seeking effort of agent i in response to the aggregate rent seeking effort e_{Rt} as well as to her capital stock k_{it} and the public sector variables g_t and R_t is given by

$$e_{Rit} = 1 - \left[\frac{(1-\tau)A\,(1-\alpha)\,k_{it}^{1-\alpha} g_t^{\alpha} e_{Rt}}{R_t}\right]^{\frac{1}{\alpha}}. \tag{8}$$

Since the aggregate rent seeking effort e_{Rt} and the public sector variables g_t and R_t are independent of a single agent's effort choice and since all agents are endowed with the same initial capital stock $k_{i0} = k_0$, equation (8) implies that all agents choose the same rent seeking effort in period 0. Combined with $n = 1$, this implies $e^*_{Ri0} = e^*_{R0}$ for all i, where e^*_{Ri0} denotes the optimal rent seeking effort of agent i in period 0 and where $e^*_{R0} = \int_0^1 e^*_{Ri0} di$. Since all agents have in addition the same production technology, they all produce the same output in period 0. Combined with $n = 1$, this implies $y_{i0} = y_0 = A\left[(1-e^*_{R0})\,k_0\right]^{1-\alpha} g_0^{\alpha}$ for all i. Since the rent seeking technologies are identical too, all agents earn the same initial income m_{i0}. The identical preferences then ensure that all agents take the same consumption-saving decision such that their capital stocks are still of the same size in the subsequent period $t\prime$. Combined with $n = 1$, this implies $k_{it'} = k_{t'}$ for all i. Consequently, all agents choose again the same rent seeking effort in this period $t\prime$ such that $e^*_{Rit\prime} = e^*_{Rt\prime}$ for all i. This line of argument, which could be repeated ad infinitum, implies that $e^*_{Rit} = e^*_{Rt}$, $k_{it} = k_t$ and $y_{it} = y_t = A\left[(1-e^*_{Rt})\,k_t\right]^{1-\alpha} g_t^{\alpha}$ must hold for all i and t.

These insights allow to rewrite the first-order condition (7) as

$$\frac{R_t}{e^*_{Rt}} = \frac{(1-\tau)\,(1-\alpha)\,y_t}{1-e^*_{Rt}}.$$

Then, the government's budget constraint (2) and $R_t = (1-\theta)p_t$ allow further simplifying this condition to

$$\frac{(1-\theta)\tau}{e^*_{Rt}} = \frac{(1-\tau)(1-\alpha)}{1-e^*_{Rt}}.$$

Solving for e^*_{Rt} implies that each agent's optimal rent seeking effort is

$$e^*_R = \frac{(1-\theta)\tau}{(1-\tau)(1-\alpha)+(1-\theta)\tau} \tag{9}$$

at all times.

The optimal rent seeking effort e^*_R depends negatively on θ. Therefore, the higher the share of the public funds p_t that is redistributed, the more time the agents devote to rent seeking. Further, the optimal rent seeking effort e^*_R depends positively on the tax rate τ. Hence, the positive effects of a tax increase on e^*_R, which are due to the increases in the redistribution pot's content R_t and in the production share that is taxed away, exceed the negative effect, which is due to the higher amount of public services g_t provided. In addition, an increase in the technology parameter α also increases the optimal rent seeking effort e^*_R since it decreases the marginal return to productive activities.

Since the non-leisure time endowment is equal to one, each agent's optimal productive effort is

$$e^*_Y = \frac{(1-\alpha)(1-\tau)}{(1-\alpha)(1-\tau)+(1-\theta)\tau} \tag{10}$$

at all times. It increases in θ, but decreases in α and τ.

Finally, note that inserting $e^*_{Rit} = e^*_{Rt}$ and $n = 1$ into the rent extraction technology (3) implies $r_{it} = R_t$ for all i and t. That is, each agent i receives at all times a rent equal to the redistribution pot's content R_t.

2.3 The Consumption-Saving Decisions

The last subsection has derived the effort choice that maximizes the income m_{it} of agent i in period t. Agent i can either consume her income m_{it} in the current period t or she can use it to accumulate capital k_{it} such that her future consumption increases. This subsection solves her intertemporal optimization problem and derives thereby her optimal consumption-saving decision.

Thereby, rent seeking and productive efforts are assumed to be independent of time and the same for all agents such that $e_{Rit} = e_R$ and $e_{Yit} = e_Y$ for all i and t. Equations (9) and (10) imply that the optimal rent seeking effort e^*_R and the optimal productive effort e^*_Y satisfy this property.

Since all agents undertake the same rent seeking effort e_R and since $n = 1$, each agent i can extract the rent $r_{it} = R_t$ at all times. As equations (5) and (6) imply, the income of each agent i in period t can thus be written as either

$$m_{it} = (1-\tau)\,y_{it} + R_t \tag{11}$$

or

$$m_{it} = (1-\tau)\, A\, (e_{Yit} k_{it})^{1-\alpha}\, g_t^{\alpha} + R_t. \tag{12}$$

Since all agents further have the same preferences and access to the same technologies, it is sufficient to consider the consumption-saving decision of one single agent.[7] This representative agent maximizes her utility U subject to her initial capital endowment k_0 and the capital accumulation constraint[8]

$$\dot{k}_t = (1-\tau)\, A\, (e_Y k_t)^{1-\alpha}\, g_t^{\alpha} + R_t - c_t - \delta k_t. \tag{13}$$

Thereby, she takes the aggregate output y_t and, thus, the public funds p_t, the public services g_t and the redistribution pot's content R_t again as given.

The Hamiltonian of this maximization program is

$$H = \frac{c_t^{1-\sigma}}{1-\sigma} \exp(-\rho t) + \nu_t \left[(1-\tau) A\, (e_Y k_t)^{1-\alpha}\, g_t^{\alpha} + R_t - c_t - \delta k_t \right].$$

The corresponding first-order conditions are

$$c_t^{-\sigma} \exp(-\rho t) = \nu_t \tag{14}$$

and

$$\dot{\nu}_t = -\nu_t \left[(1-\tau)(1-\alpha)\, A e_Y^{1-\alpha} \left(\frac{g_t}{k_t} \right)^{\alpha} - \delta \right]. \tag{15}$$

The transversality condition, which forces the capital stock's value to be asymptotically zero, is

$$\lim_{t\to\infty} (\nu_t k_t) = 0. \tag{16}$$

Taking first logs of the first-order condition (14) and then the derivatives with respect to t yields

$$-\sigma \frac{\dot{c}_t}{c_t} - \rho = \frac{\dot{\nu}_t}{\nu_t}. \tag{17}$$

Substituting equation (17) into the first-order condition (15) yields

$$\gamma_t = \frac{1}{\sigma} \left[(1-\tau)(1-\alpha)\, A e_Y^{1-\alpha} \left(\frac{g_t}{k_t} \right)^{\alpha} - \delta - \rho \right], \tag{18}$$

where γ_t is defined as the consumption growth rate in period t, i.e., $\gamma_t \equiv \frac{\dot{c}_t}{c_t}$.[9]

The growth equation (18) has been derived without specifying the relationships between tax revenues τy_t, public funds p_t and public services g_t. However, it is already known that the government's budget constraint (2) and $g_t = \theta p_t$

[7] To economize on the notation, the i-subscripts are subsequently suppressed.

[8] A dot over a variable denotes differentiation with respect to time. So, $\dot{k}_t = \frac{dk}{dt}$.

[9] Appendix A shows that the same consumption growth rate γ could also be derived within a market model.

must hold. Combining these relationships with the production function (4) implies

$$\frac{g_t}{k_t} = (A\theta\tau)^{\frac{1}{1-\alpha}} e_Y. \tag{19}$$

Inserting equation (19) into equation (18) yields the consumption growth rate

$$\gamma = \frac{1}{\sigma}\left[(1-\tau)(1-\alpha) A^{\frac{1}{1-\alpha}} (\theta\tau)^{\frac{\alpha}{1-\alpha}} e_Y - \delta - \rho\right], \tag{20}$$

which is exclusively determined by constant exogenous variables. It is thus independent of time.

As usual, it is assumed in all subsequent considerations that $\gamma \geq -\delta$. Further, it is assumed that the economy cannot be so productive that the agents' overall utility U can become unbounded. The condition for U to be bounded is[10]

$$\rho > (1-\sigma)\gamma. \tag{21}$$

Appendix B shows that capital k_t, output y_t, public funds p_t, public services g_t and the redistribution pot R_t must grow at the same rate as consumption c_t, i.e., at the constant rate γ. Further, there are no transitional dynamics and, hence, no convergence between economies that differ only in their initial capital endowments k_0. As it is well known, these results are common to all growth models of the AK type.

Equation (20) implies that the growth rate γ increases in the agents' productive effort e_Y. Hence, the economy grows faster if the agents spend most of their time using their capital k_t to produce output y_t than if they devote most of their time to rent seeking activities.

Note that any discussion of the growth effects of changes in the policy parameters θ and τ under the assumption that the agents' effort choices were exogenous would be exposed to a Lucas-like critique and would almost certainly lead to misleading conclusions. Therefore, discussing the growth effects of changes in these policy parameters requires to take the effects on the agents' effort choices into account. This is done in section 2.4.

2.4 The Growth Rate and its Determinants

This subsection combines the results of the two previous subsections. After highlighting a first policy implication, it analyzes how the preference, technology and policy parameters affect economic growth if their effects on the agents' effort choices are taken into account.

As seen in section 2.3, the growth rate γ decreases in the rent seeking effort e_R. But as seen in section 2.2, it is optimal for each single agent to choose at all times the rent seeking effort e_R^*, which is given by equation (9). This holds true even though all agents know that growth would be higher if the aggregate rent

[10]For U to be bounded, it must hold that $\lim_{t\to\infty}\left[c_t^{1-\sigma}\exp(-\rho t)\right] = 0$. Given that c_t grows at the constant rate γ such that $c_t = c_0\exp(\gamma t)$, this condition can be rewritten as $\lim_{t\to\infty}\exp\{[(1-\sigma)\gamma-\rho]\,t\}\,c_0^{1-\sigma} = 0$. This implies the condition $\rho > (1-\sigma)\gamma$.

seeking effort e_R were smaller. Hence, individual rationality does not lead to a socially optimal outcome with respect to economic growth. This might look like a case for a government intervention. However, the government's "intervention" should be to leave the business of paying rents, i.e., to set $\theta = 1$, such that it becomes optimal for each agent to devote her time exclusively to productive activities.

Before discussing the different parameters' effect on the growth rate γ, the optimal productive effort e_Y^*, which is given by equation (10), is inserted into the growth equation (20). This yields the growth rate

$$\gamma = \frac{1}{\sigma}\left[\frac{(1-\tau)^2 (1-\alpha)^2 A^{\frac{1}{1-\alpha}} (\theta\tau)^{\frac{\alpha}{1-\alpha}}}{(1-\alpha)(1-\tau) + (1-\theta)\tau} - \delta - \rho\right]. \tag{22}$$

As usual in AK models, the growth rate γ increases in the technology A and decreases in the depreciation rate δ. Further, it depends positively on the agents' willingness to sacrifice present consumption for future consumption. This willingness is the stronger, the lower the discount rate ρ is and (if and only if $\gamma > 0$) the higher the intertemporal elasticity of substitution, $\frac{1}{\sigma}$, is.

Equation (22) implies that the growth rate γ strictly increases in the share θ of the public funds p_t that is converted into public services g_t. A first reason is that an increase in the share θ directly raises the amount of public services g_t provided. Since this does not only increase current output y_t, but also the incentive to accumulate capital k_t, growth accelerates. Further, an increase in the share θ has an additional positive effect on the growth rate γ since it increases the productive effort e_Y^*, which makes capital accumulation even more attractive. Hence, setting $\theta = 1$ and leaving the redistribution pot R_t empty maximizes growth since, in this case, no agent devotes any time to rent seeking activities and since the amount of public services g_t provided is highest at each given tax rate τ. Contrariwise, the higher the share of the public funds p_t that is redistributed to rent seekers, the slower the economy grows. The positive dependence of the growth rate γ on the share θ is shown in figure 1.[11] Further, a tax increase has three different effects on the growth rate γ. First, a positive effect since it increases the amount of public services g_t provided, which makes capital accumulation more attractive as argued before. Second, a direct negative effect since it lowers the return on investments and, hence, the incentive to accumulate capital k_t. Third, an additional negative effect because it lowers the optimal productive effort e_Y^* unless $\theta = 1$.

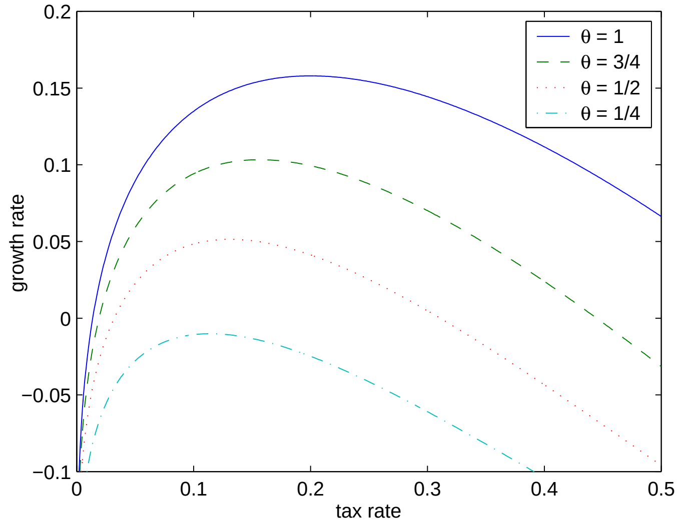
The growth rate γ, which is given by inserting the optimal productive effort e_Y^* into equation (20), is maximized by the tax rate that solves

$$\frac{\partial\gamma}{\partial\tau} = \frac{(1-\tau)(1-\alpha) A^{\frac{1}{1-\alpha}} (\theta\tau)^{\frac{\alpha}{1-\alpha}} e_Y^*}{\sigma}\left[\frac{\alpha}{(1-\alpha)\tau} - \frac{1}{1-\tau} + \frac{\partial e_Y^*}{\partial\tau}\frac{1}{e_Y^*}\right] \overset{!}{=} 0$$

$$\Leftrightarrow \quad \tau = \alpha + (1-\alpha)(1-\tau)\,\epsilon_\tau, \tag{23}$$

[11]The parameter values used to derive figure 1 are $\sigma = 1$, $\rho = 0.02$, $A = 1$, $\alpha = 0.2$ and $\delta = 0.25$.

Figure 1: Policy and Growth



where $\epsilon_\tau \equiv \frac{\partial e_Y^*}{\partial \tau}\frac{\tau}{e_Y^*}$. Equation (10) implies

$$\epsilon_\tau = \frac{-(1-\theta)\,\tau}{(1-\tau)\,[(1-\alpha)(1-\tau)+(1-\theta)\,\tau]}. \tag{24}$$

The three different growth effects of a tax increase mentioned above can be seen in the brackets in condition (23).

Remember that the growth maximizing tax rate τ^* equals the technology parameter α in the Barro model such that "roughly speaking, to maximize the growth rate the government sets its share of gross national product, g/y, to equal the share it would get if public services were a competitively supplied input of production" (Barro 1990, 109). However, the third of the abovementioned growth effects of taxation is absent in the Barro model, in which there is no redistribution and productive efforts are implicitly assumed to be exogenous.

Condition (23) implies that the growth maximizing tax rate τ^* equals α in this rent seeking growth model too if the productive effort e_Y^* is independent of taxation, i.e., if $\frac{\partial e_Y^*}{\partial \tau} = 0$ and hence $\epsilon_\tau = 0$. However, this requires absence of redistribution, i.e., $\theta = 1$. In this case, agents never devote any time to rent seeking and the model reduces to the Barro model.

But if there is redistribution, i.e., if $\theta < 1$, the rent seeking effort e_R^* is strictly positive and increasing in the tax rate τ. The third growth effect of taxation mentioned above is therefore present too. Hence, the growth maximizing tax rate τ^* must become lower than α in this case. Condition (23) confirms that $\tau < \alpha$ if $\theta < 1$ and hence $\epsilon_\tau < 0$.[12]

[12] Note that $\theta < 1$ only implies $\epsilon_\tau < 0$ if $\tau > 0$. But, if $\tau = 0$, $\tau < \alpha$ holds anyway.

So, condition (23) implies that the growth maximizing tax rate τ^* is a function of the parameters α and θ with the range $0 < \tau^* \leq \alpha$. It increases in the technology parameter α, i.e., roughly speaking, in the importance of public services g_t for private production. Further, the growth maximizing tax rate τ^* also increases in the share θ of the public funds p_t that is converted into public services g_t, as it can be seen in figure 1.

So, the implication of the Barro model that growth is maximized by setting the relative size of the public sector, which is $\frac{p_t}{y_t} = \tau$, equal to the share it would get if public services g_t were supplied competitively does not hold in general. It only holds if no tax revenues are redistributed to rent seekers. Otherwise, the growth maximizing relative size of the public sector is smaller than it would be if public services g_t were supplied competitively.

2.5 Welfare Considerations

So far, the focus has been on the effects of rent seeking and different policy parameters on the growth rate γ. However, agents do by assumption not primarily care about growth, but about their overall utility U. Therefore, this section analyzes how the utility U depends on rent seeking and on the different policy parameters. Thereby, note that the utility U serves as a reasonable welfare measure for the given economy since there is no heterogeneity among the different agents.

As appendix C shows, the agents' utility U increases in the growth rate γ as well as in the initial income m_0. Further, equation (11), the government's budget constraint (2) and $R_t = (1-\theta)p_t$ imply that the initial income equals

$$m_0 = [(1-\tau) + (1-\theta)\,\tau]\, y_0 = (1-\theta\tau)\, y_0.$$

The production function (4) and equation (19) allow rewriting the initial income as

$$m_0 = (1-\theta\tau)\, A^{\frac{1}{1-\alpha}}\, (\theta\tau)^{\frac{\alpha}{1-\alpha}}\, e_Y k_0, \tag{25}$$

where the productive effort e_Y, if chosen optimally, is given by equation (10). These results are subsequently used to analyze how rent seeking and the policy parameters θ and τ affect the agents' utility U and, hence, welfare.

First, consider how utility U depends on the agents' effort choices. Equation (25) implies that the initial income m_0 increases in the productive effort e_Y. Since the growth rate γ also increases in e_Y, utility U must be increasing in e_Y too. As growth, welfare would thus also be highest if the aggregate time devoted to rent seeking activities were equal to zero.

Second, consider how utility U depends on the tax rate τ and on the share θ of the public funds p_t that is converted into public services g_t. As seen above, the growth rate γ is maximized if $\theta = 1$ and $\tau = \alpha$. Equation (25) implies that maximizing the initial income m_0 requires

$$\begin{aligned}\frac{\partial m_0}{\partial \theta\tau} &= \left[\frac{\alpha}{(1-\alpha)\,\theta\tau} - \frac{1}{(1-\theta\tau)} + \frac{\partial e_Y^*}{\partial \theta\tau}\frac{1}{e_Y^*}\right] m_0 \stackrel{!}{=} 0 \\ &\Leftrightarrow \quad \theta\tau = a + (1-\theta\tau)(1-\alpha)\frac{\partial e_Y^*}{\partial \theta\tau}\frac{\theta\tau}{e_Y^*}.\end{aligned}$$

This condition implies that any combination of the share θ and the tax rate τ that satisfies $\theta\tau = \alpha$ would maximize the initial income m_0 if $\frac{\partial e_Y^*}{\partial \theta\tau} = 0$. However, the optimal productive effort e_Y^* is not independent of policy. It increases in θ and decreases in τ. Combined with the positive effect of the productive effort e_Y on m_0, this implies that the initial income m_0 is also maximized if $\theta = 1$ and $\tau = \alpha$. Hence, absence of redistribution and a public sector whose relative size equals the share it would get if public services g_t were supplied competitively maximizes not only growth, but also utility U and welfare.

However, the institutions or the political agents, respectively, that determine tax policies often differ in reality from those that determine the allocation of the public funds. Therefore, the focus is next on the tax rate τ and on the share θ that maximize utility U given that the other of these policy parameters is fixed.

Consider first how utility U depends on taxation given a certain share θ. Remember that the growth maximizing tax rate τ^* equals the technology parameter α if $\theta = 1$, but becomes smaller than α if $\theta < 1$ since the optimal productive effort e_Y^* decreases in the tax rate τ in this case.

Equation (25) implies that the tax rate that maximizes the initial income m_0 must satisfy

$$\begin{aligned}\frac{\partial m_0}{\partial \tau} &= \left[\frac{\alpha}{(1-\alpha)\,\tau} - \frac{\theta}{(1-\theta\tau)} + \frac{\partial e_Y^*}{\partial \tau}\frac{1}{e_Y^*}\right] m_0 \stackrel{!}{=} 0 \\ &\Leftrightarrow \quad \tau = \frac{1}{\theta}\left[\alpha + (1-\alpha)(1-\theta\tau)\,\epsilon_\tau\right].\end{aligned} \tag{26}$$

This condition and equation (25) both imply that a tax increase has basically the same three effects on the initial income m_0 as it has on the growth rate γ. First, a positive effect since it increases the provision of public services g_t. Second, a direct negative effect since a higher income share is taxed away. Third, an indirect negative effect since the optimal productive effort e_Y^* decreases in the tax rate τ. The last of these effects is absent if and only if $\theta = 1$, which implies $\frac{\partial e_Y^*}{\partial \tau} = 0$ and hence $\epsilon_\tau = 0$. Condition (26) indicates that the tax rate that maximizes initial income m_0, which is subsequently denoted by τ^m, equals α in this case, i.e., in absence of redistribution. However, in presence of redistribution, the initial income maximizing tax rate τ^m becomes lower than α since the third effect is present too. Condition (26) indeed implies that $\tau^m < \alpha$ if $\theta < 1$.[13]

In addition, it holds that $\tau^m > \tau^*$ if $\theta < 1$ since the direct negative effect of taxation on the growth rate γ is larger than the corresponding negative effect

[13] Appendix D proves that a tax rate $\tau < \alpha$ is required for condition (26) to hold if $\theta < 1$.

on the initial income m_0. The reason is that the incentive to accumulate capital decreases in all taxes while incomes decrease only in those taxes that are not paid back to the private agents in the form of rents.

Since utility U increases in the growth rate γ and in the initial income m_0, the tax rate that maximizes utility U and welfare, τ^u, must be a weighted average of τ^* and τ^m. Thus, it holds that $0 < \tau^* < \tau^u < \tau^m < \alpha$ if $\theta < 1$ and, as in the Barro model, that $\tau^* = \tau^u = \tau^m = \alpha$ if $\theta = 1$.

Finally, consider how utility U depends on the share θ of the public funds p_t that is converted into public services g_t. Remember that the growth rate γ strictly increases in θ. Thus, a sufficient condition for the utility U to be strictly increasing in θ too is that the initial income m_0 is non-decreasing in θ, i.e., that

$$\begin{aligned} \frac{\partial m_0}{\partial \theta} &= \left[(\alpha - \theta\tau)\, e_Y^* + (1-\alpha)\,(1-\theta\tau)\,\theta \frac{\partial e_Y^*}{\partial \theta} \right] \tau \geq 0 \qquad (27) \\ &\Leftrightarrow \quad \theta\tau \leq \alpha + (1-\alpha)\,(1-\theta\tau)\,\frac{\partial e_Y^*}{\partial \theta}\,\frac{\theta}{e_Y^*}. \end{aligned}$$

Consequently, a necessary, but not sufficient condition for more redistribution, i.e., a decrease in the share θ, to increase welfare is that inequality (27) does not hold. Since $\frac{\partial e_Y^*}{\partial \theta} > 0$, this requires a relatively high share θ and a relatively high tax rate τ that must certainly exceed α and, thus, the rates that maximize growth and welfare. In this case, the marginal return to public services g_t becomes so small that giving some tax revenues back to the agents in the form of rents could increase utility U even though it lowers the productive efforts e_Y^*. Casual observations suggest that redistribution to rent seekers is seldom rare in countries where taxes are high. Hence, scaling down redistribution might increase not only growth, but also welfare in most countries. However, some limited redistribution could have positive welfare effects in countries in which taxes are suboptimally high.

3 Rent Seeking and the Aid Laffer Curve

This section discusses the effect of foreign aid on economic growth. Section 3.1 summarizes the findings of some recent empirical studies on aid effectiveness. Several of these studies found evidence for the existence of a so-called Aid Laffer Curve, i.e., an inverted-U shaped relationship between foreign aid and economic growth. So far, no theoretical growth model has been able to predict an Aid Laffer Curve, except a model proposed by Lensink and White (2001) in which the technology is assumed to decrease in foreign aid.

Section 3.2 introduces foreign aid into the rent seeking growth model that has been presented in section 2. Given particular assumptions concerning the aid pattern and the policy in the aid recipient country[14], this modified model

[14] As customary, the expression of the aid recipient country is used throughout this section. However, Bauer (1991) rightfully asks us to keep in mind at all times that the recipients of official foreign aid are always governments.

predicts an inverted-U shaped relationship between foreign aid and the growth rate. Hence, it might reveal parts of the mechanisms that lead to the observed Aid Laffer Curve.

Section 3.3 discusses the importance of the two abovementioned assumptions for the model's prediction of an Aid Laffer Curve. It suggests alternative assumptions and shows whether and how they would alter the results.

3.1 Empirical Evidence on Foreign Aid and Growth

This subsection gives an overview of the recent empirical literature on the relationship between foreign aid and economic growth.[15] First, it briefly summarizes the influential contribution of Burnside and Dollar (2000) and their main findings. It then presents different empirical studies that challenge the findings of Burnside and Dollar. Some of these studies find evidence for an Aid Laffer Curve.

Burnside and Dollar focus on the interdependence between aid, policy and economic growth. They construct a policy index containing the budget surplus, the inflation rate and a measure of trade openness. Beside aid and this policy index, they add the interaction term between aid and policy to the independent variables.[16] The inclusion of this interaction term makes the relationship between aid and growth non-linear. The main findings of Burnside and Dollar are the following: First, policy has a significantly positive effect on the growth rate. Second, foreign aid has no significant effect on the growth rate on average. Third, the aid-policy interaction term has a significant effect on the growth rate. Combining the last two findings implies that foreign aid has a positive effect on growth, but only in countries with a good policy environment. The result that good policies do not only have a direct positive effect on growth, but make in addition aid payments work has attracted a great deal of attention in the public discussion and has strongly influenced the views of policymakers and multinational aid agencies such as the World Bank.[17]

However, the Burnside-Dollar study has been questioned for different reasons. First, Dalgaard and Hansen (2001) and Easterly (2003), both using the same data as Burnside and Dollar, doubt the robustness of the Burnside-Dollar findings. In particular, Dalgaard and Hansen find that the significance of the aid-policy interaction term depends crucially on the exclusion of a certain set of outliers. Easterly, on the other hand, finds that this interaction term becomes insignificant for alternative definitions of aid, of policy and of growth that seem equally plausible as the definitions used by Burnside and Dollar.

Second, Easterly et al. (2004) extend the data set of Burnside and Dollar and show that the aid-policy interaction becomes insignificant if they use this

[15] See Hansen and Trap (2000) for an overview and a discussion of the empirical literature on foreign aid and economic growth since the beginning of the 1970s.

[16] In all empirical studies mentioned, the aid term refers to official foreign aid payments as a share of GDP.

[17] Easterly (2003) provides some examples of how policymakers, aid agencies and the media have referred either explicitly or implicitly to the findings of Burnside and Dollar.

extended data set.

Third, Dalgaard and Hansen, Hansen and Tarp (2001) and Lensink and White (2001) consider a different non-linear relationship between foreign aid and the growth rate than Burnside and Dollar. They include aid squared as independent variable instead of the aid-policy interaction term. They all find that this alternative model formulation is statistically preferable to the formulation of Burnside and Dollar. Given this formulation including aid squared, each of the three abovementioned studies finds that the marginal growth effect of an increase in aid is initially positive, but decreasing. Further, the turning point for which the marginal growth effect becomes negative is found to be within the sample range in each of these studies.[18] Hence, Lensink and White argue that there is evidence for an Aid Laffer Curve.

Further, Dalgaard and Hansen as well as Lensink and White challenge also another finding of Burnside and Dollar. They find that on average foreign aid has a significant positive effect on growth. However, Boone (1996) and Svensson (1999) also fail to find a significant growth effect of foreign aid on average.

3.2 Foreign Aid and the Rent Seeking Growth Model

In this subsection, foreign aid is introduced into the rent seeking growth model. Therefore, suppose that a foreign country or a multinational organization such as the World Bank decides to make some aid payments F_t to the government of the economy presented in section 2. More general, F_t could stand for any kind of windfall gains that increase the public funds p_t.

Since the economy is still assumed to be closed, these aid payments F_t are the only connection between the aid recipient country and the outside world. This assumption is, of course, somewhat restrictive. However, many aid recipient countries, particularly in Sub-Sahara Africa, are indeed poorly integrated into the global trading system and their access to the global capital markets seems often limited.[19]

The aid payments F_t are assumed to be fungible such that the government in the aid recipient country can decide how to use them. This can either mean that the aid payments are unconditional or that the donor cannot or does not want to enforce the conditions. In addition, aid payments that are used for the intended projects can have the same impact as fungible aid payments if the aid recipient country channels other resources away from this project. The assumption that aid payments are fungible is consistent with the findings of Feyzioglu et al. (1998) and the World Bank's (1998) "Assessing Aid" report, which concludes that aid appears to be largely fungible.

Of course, the pattern of the aid payments F_t over time could take many

[18]However, the turning points, i.e., the aid values at which the Aid Laffer Curve peaks, differ substantially among these three studies.

[19]Note that foreign trade and international capital markets are for simplicity ruled out in most standard growth models even though the majority of these models focuses on growth in developed countries, which are in general far more integrated into global markets than developing countries.

different forms. However, assume that the aid payments F_t the recipient country receives in period t are proportional to its current output y_t. Thus,

$$F_t = fy_t$$

for all t, where the constant aid ratio $f > 0$. The main reason for choosing this particular aid pattern is that it allows solving the model analytically. Furthermore, it satisfies the more recent claim that donors should reward aid recipient countries that promote growth seriously and successfully.[20] Section 3.3.1 discusses how the subsequently derived results might change if aid payments F_t were not proportional to output y_t.

Fungible aid payments F_t primarily change the budget of the government in the aid recipient country. If the budget must still be balanced at all times, the government's budget constraint becomes

$$p_t = (\tau + f)\, y_t. \tag{28}$$

This new budget constraint, the production function (4) and $g_t = \theta p_t$ imply

$$\frac{g_t}{k_t} = [A\theta\,(\tau + f)]^{\frac{1}{1-\alpha}}\, e_Y. \tag{29}$$

Inserting this expression into the growth equation (18), which has been derived without any specific assumption about the government's budget, yields the consumption growth rate

$$\gamma = \frac{1}{\sigma}\left\{(1-\tau)\,(1-\alpha)\,A^{\frac{1}{1-\alpha}}\,[\theta\,(\tau+f)]^{\frac{\alpha}{1-\alpha}}\, e_Y - \delta - \rho\right\}. \tag{30}$$

Since the consumption growth rate γ is constant, it can be shown that capital k_t, output y_t, public funds p_t, public services g_t and the redistribution pot R_t grow at the same rate γ.[21]

Equation (30) implies that the growth rate γ would be strictly increasing in the aid ratio f if the productive effort e_Y were independent of f. However, the agents' effort choices depend of course on the (marginal) returns to rent seeking and productive activities. Therefore, consider how the private agents allocate their non-leisure time endowment to rent seeking and productive activities in presence of foreign aid.

Each single agent's income m_t is still given by equation (6), but public services g_t and the redistribution pot R_t are now financed by the tax revenues τy_t and by the aid payments F_t. Since equation (6) still determines each agent's income m_t, each agent still chooses her rent seeking effort such that the first-order condition (7) holds. Then, by following closely the argumentation outlined

[20] See, e.g., Easterly (2001, 119): "As countries' incomes rise because of their favorable policies, aid should increase in matching fashion. ... (Granted, at the beginning of a new aid regime, the poor countries should be the ones designated to be eligible for aid.)"

[21] See again appendix B.

in section 2.2, it can be shown that each single agent's optimal rent seeking effort must be given by

$$e_R^{f*} = \frac{(1-\theta)(\tau+f)}{(1-\alpha)(1-\tau)+(1-\theta)(\tau+f)} \tag{31}$$

at all times. It increases in the aid ratio f unless $\theta = 1$, i.e., unless there is no redistribution. The increase in the optimal rent seeking effort e_R^{f*} that foreign aid causes is the larger, the lower the share θ is, i.e., the more the government redistributes to rent seeking agents.

Equation (31) and the agents' non-leisure time endowment of one imply that each agent's optimal productive effort in presence of foreign aid is

$$e_Y^{f*} = \frac{(1-\alpha)(1-\tau)}{(1-\alpha)(1-\tau)+(1-\theta)(\tau+f)} \tag{32}$$

at all times. It decreases in the aid ratio f unless $\theta = 1$.

Inserting the optimal productive effort e_Y^{f*} into equation (30) yields the growth rate

$$\gamma = \frac{1}{\sigma}\left\{\frac{(1-\alpha)^2(1-\tau)^2 A^{\frac{1}{1-\alpha}}\left[\theta(\tau+f)\right]^{\frac{\alpha}{1-\alpha}}}{(1-\alpha)(1-\tau)+\beta(1-\theta)(\tau+f)} - \delta - \rho\right\}. \tag{33}$$

In the following discussion on aid effectiveness, it is assumed that not only technology and preference parameters, but also policy parameters are independent of foreign aid or of the ratio f, respectively. The assumption that foreign aid does not affect policy in the aid recipient country is consistent with recent evidence. Dollar and Svensson (2000) find that foreign aid does not seem to influence policy. Feyzioglu et al. (1998, 27) find "that a dollar given in official development assistance to developing countries does not lead to a tax relief effect; instead, it causes government spending to increase by a dollar." Nevertheless, section 3.3.2 discusses how the results would change under alternative assumptions about the government's behavior.

Given that policy is aid independent, foreign aid has two different effects on the growth rate γ. A positive effect, since aid payments F_t add resources to the public funds p_t such that the amount of public services g_t provided increases. Consequently, private production y_t increases and capital accumulation becomes more attractive such that economic growth accelerates. This is the reason why equation (30) implies that the growth rate γ would be strictly increasing in the aid ratio f if the productive effort e_Y were held constant. Equation (30) further shows that the marginal growth effect of foreign aid decreases even in this case in the aid ratio f since $\alpha < \frac{1}{2}$.

But unless there is no redistribution to rent seekers, i.e., unless $\theta = 1$, foreign aid has also a negative effect on the growth rate γ since it increases the optimal rent seeking effort e_R^{f*} and decreases, consequently, the optimal productive effort e_Y^{f*} decreases. Even though Bauer (1981, 1991) has repeatedly pointed at this negative growth effect of foreign aid, it has often been ignored by supporters of generous aid schemes.[22,23]

Taking the derivative of the growth rate γ, which is given by inserting the optimal productive effort e_Y^{f*} into equation (30), with respect to the aid ratio f yields

$$\frac{\partial \gamma}{\partial f} = \frac{1}{\sigma}\left[\frac{\alpha}{(1-\alpha)(\tau+f)} + \frac{\partial e_Y^{f*}}{\partial f}\frac{1}{e_Y^{f*}}\right](1-\tau)(1-\alpha)A^{\frac{1}{1-\alpha}}\left[\theta(\tau+f)\right]^{\frac{\alpha}{1-\alpha}} e_Y^{f*}. \tag{34}$$

Equation (32) implies

$$\frac{\partial e_Y^{f*}}{\partial f}\frac{1}{e_Y^{f*}} = \frac{-(1-\theta)}{(1-\alpha)(1-\tau)+(1-\theta)(\tau+f)}. \tag{35}$$

The two countervailing growth effects of foreign aid mentioned above can be seen in the first brackets in equation (34).

The equations (34) and (35) imply that the marginal growth effect of foreign aid is the higher at each given aid ratio f, the lower the tax rate τ is and the less the government redistributes, i.e., the higher θ is.[24]

Further, they imply that growth is maximized if $f = f^*$, where

$$f^* = \frac{\alpha(1-\alpha)(1-\tau)}{(1-2\alpha)(1-\theta)} - \tau. \tag{36}$$

The growth maximizing aid ratio f^* decreases in the tax rate τ, but increases in the share θ of the public funds p_t that is converted into public services g_t as well as in the technology parameter α, which measures, roughly speaking, the importance of public services g_t for private production. It depends on these parameters whether the growth maximizing aid ratio f^* is positive or negative.

Moreover, the equations (34) and (35) imply that $\frac{\partial \gamma}{\partial f} > 0$ if $f < f^*$ and that $\frac{\partial \gamma}{\partial f} < 0$ if $f > f^*$. Hence, the first, positive of the abovementioned effects typically dominates if the aid ratio f is relatively small whereas the second,

[22]See, e.g., Bauer (1981, 104): "Foreign aid has done much to politicize life in the Third World. ... People divert their resources and attention from productive economic activity into other areas. ... This direction of people's activities and resources must damage the economic performance and development of a society."

[23]Another reason why transfer payments can have a negative effect on the recipient country is discussed in the literature on the so-called transfer problem: Transfer payments can lead to a change in the terms of trade that is unfavorable for the recipient country. Leontief (1936) first mentioned the possibility that the negative consequences of this change in the terms of trade could even exceed the transfer payments' direct positive effect such that "real wealth might be transferred ... in the opposite direction" to the transfer payments (Leontief 1936, 91).

[24]Since this model implies that the growth effect of foreign aid tends to be positive if and only if taxes are not too high and redistribution to rent seekers not too widespread, it might seem to be compatible with the Burnside-Dollar finding that aid works, but only within a good policy environment. However, they measure good policy by fiscal and monetary stability and by trade openness. But here, the budget is balanced by assumption, money is absent and trade ruled out. Therefore, it can hardly be argued that the Burnside-Dollar finding is met.

negative effect typically dominates if f is relatively high. As f increases, the marginal and even the total growth effect of foreign aid must become negative at some point unless $\theta = 1$, i.e., unless there is no redistribution.

Hence, the two countervailing effects of foreign aid lead to a relationship between the aid ratio f and the growth rate γ that is inverted-U shaped. Therefore, this rent seeking growth model predicts an Aid Laffer Curve if $f^* > 0$, given that aid payments F_t are proportional to the current output y_t and that they do not affect policy in the aid recipient country.

In spite of these reservations, this model might reveal parts of the mechanisms that lead to the Aid Laffer Curve found by Dalgaard and Hansen (2001), Hansen and Tarp (2001) and Lensink and White (2001). Foreign aid might promote growth if given in small dosages since it allows providing more public services that support private production. However, large dosages of foreign aid might harm growth since it induces people to allocate most of their time and of their resources to rent seeking activities in order to channel some of the aid inflows towards themselves.

Further, the model implies that even small dosages of foreign aid might slow down growth in some aid recipient countries, namely in those in which $f^* < 0$. These countries would actually grow faster if foreign aid took the form of taking away parts of the public funds p_t instead of adding resources to them. This would be true even if it included proportional theft of public services g_t. In these countries, the negative growth effect of the increase in rent seeking that the first aid dollar causes exceeds already the positive growth effect of increasing public services g_t by θ dollars.

Finally, note that the relationship between the agents' overall utility U and the aid ratio f is also inverted-U shaped if $\theta < 1$. The aid ratio f that maximizes utility U depends also positively on the share θ, but negatively on the tax rate τ. However, it exceeds the growth maximizing aid ratio f^*. Nevertheless, it might still be negative if redistribution is widespread and taxes high. In this case, the first aid dollar already harms the agents in the aid recipient country. Otherwise, relatively small aid payments F_t or a relatively low aid ratio f, respectively, increase the agents' utility U and, hence, welfare. But huge aid payments F_t can rarely be in the interest of the private agents in the aid recipient country. However, they might well be in the interest of the agents in the donor countries if these payments are directly subtracted from the public funds p_t or even from the redistribution pots R_t and if the governments in the donor countries redistribute extensively.

3.3 The Role of Some Assumptions

In section 3.2, it has been assumed that aid payments are proportional to private production and that policy parameters are aid independent. Given these assumptions, the relationship between foreign aid and economic growth turned out to be inverted-U shaped such that it could be described by an Aid Laffer Curve if it peaked at a positive aid ratio. It is next analyzed whether and how this result changes given alternative assumptions.

3.3.1 The Role of the Aid Pattern

This subsection briefly discusses how the results derived in section 3.2 change if aid payments F_t are not proportional to current output y_t, i.e., if the aid ratio $f_t = \frac{F_t}{y_t}$ varies over time.

If the aid ratio f_t varies over time, the consumption growth rate γ_t as well as the optimal effort choices vary over time too. As the consumption growth rate γ_t is no longer constant, the growth rates of capital k_t, output y_t and, hence, the public sector variables p_t, g_t and R_t differ in general from the consumption growth rate γ_t.

But the consumption growth rate γ_t still increases (decreases) in the aid payments F_t if $f_t < (>) \, f^*$. Thus, neither the prediction of an inverted-U shaped relationship between the aid ratio f_t and the consumption growth rate γ_t, nor the finding that it peaks at a positive aid ratio f_t if and only if $f^* > 0$ depends on the assumption that aid payments F_t are proportional to current output y_t. The relationship between foreign aid and the output growth rate, on the other hand, might not be inverted-U shaped since output y_t does in general not grow at the same rate as consumption c_t if f_t is non-constant.

Unfortunately, solving the model analytically becomes impossible if the aid ratio f_t and, consequently, the consumption growth rate γ_t are non-constant.

3.3.2 The Role of the Government's Response to Aid

In section 3.2, the growth effect of foreign aid has been assessed under the assumption that aid inflows do not affect policy in the aid recipient country. The relationship between aid and growth has turned out to be inverted-U shaped. This subsection highlights that this result depends crucially on the assumed government behavior. It shows that aid payments would unambiguously accelerate growth under the assumption that the aid recipient country's government responded to these payments in the way that promotes growth best. It then argues that such an assumption poorly approximates the behavior of most aid recipient countries' governments.

Suppose the government in the aid recipient country responds to foreign aid in the way that promotes growth best. In this case, the growth rate γ is still determined by equation (33), which has been derived without any specific assumption about government behavior. Nevertheless, the implications of this growth equation change dramatically. The growth rate γ becomes strictly increasing in the aid ratio f. For this, the government in the aid recipient country only has to adjust the tax rate τ accurately in response to foreign aid.

Foreign aid allows to decrease the tax rate τ or to revert it even into a subsidy and, at the same time, to provide more public services g_t. Lower taxes decrease the rent seeking effort e_R^{f*}. Higher productive efforts e_Y^{f*} and higher public services g_t both raise private production y_t. Therefore, foreign aid makes accumulating capital k_t unambiguously more attractive such that the growth rate γ in the aid recipient country increases. In addition, aid inflows also increase the agents' utility U and, hence, welfare if the government adjusts the tax rate

τ as described above.

However, such a favorable adjustment of the tax rate τ requires, among others, that the government is willing to implement a new and most likely lower tax rate τ. Given that the government and the public employees might prefer a large public sector for reasons outlined by, e.g., Niskanen (1968, 1971), the government's willingness to reduce the public sector's relative size by cutting taxes might be limited. Furthermore, adequate tax reductions also require that the government has the relevant information as well as the power to enforce them. Given that foreign aid is mostly paid to poor and slow growing countries, governments of aid recipient countries might in general not be simultaneously benevolent, well-informed and powerful.

As an example, consider the model economy presented in section 2. It grows slow and is thus relatively poor in the long run if most of the public funds are given to rent seekers and if taxes are either very high or very low. Such an economy is hardly blessed with a government that is simultaneously benevolent, well-informed and powerful.

Further, there is no reason to believe that the inflow of fungible aid payments should substantially change the characteristics of the government.

Hence, it might be more appropriate to base the discussion about the growth effects of foreign aid on assumptions that are not incompatible with governments that are either selfish, weak or lack good information and that do, consequently, not respond to foreign aid in the way that would be best for the private agents in their country.

The previously used assumption that the government is completely passive such that policy is aid independent, which is consistent with some recent evidence, is such an assumption. It corresponds to a weak government that may lack good information.

4 Conclusions

In the introduction, the question has been posed how the transfer payments that governments all over the world make to please rent seekers might affect economic growth and welfare. To answer this question, rent seeking has been introduced into the endogenous growth model of Barro (1990), which leads to a production decrease and makes accumulating physical and human capital less attractive. Thus, redistribution to rent seekers decelerates economic growth and tends to lower welfare.

Before discussing some results and implications of this rent seeking growth model, notice that it can capture coordination failures states can solve as well as coordination failures they frequently create.[25] It is often claimed that a reason for the existence of states is that they help to escape prisoners' dilemma-like situations. In the presented model, the public sector can indeed serve this

[25] These "wealth-creating and wealth-impeding dimensions" of the state are discussed in Brunner (1985). See Buchanan (1975) for a related and more extensive discussion.

purpose if public services are nonrival and nonexcludable such that too few would be produced in absence of a state or a government, respectively.

But furthermore, government interventions can also create coordination failures. Especially, but not exclusively, if these interventions contain transfer payments that cannot be justified by meaningfully defined "welfare state" arguments. Today, this drawback is still often ignored even though Bastiat wrote already over 150 years ago that "the state is the great fictitious entity by which everyone seeks to live at the expense of everyone else" (Bastiat 1995, 144). In the presented model, the redistribution to rent seekers creates such a coordination failure. As soon as the government redistributes some of its public funds, it becomes optimal for each single agent to devote her time partly to rent seeking activities even though each agent knows that all agents would be better off if they all devoted less time to rent seeking activities. Therefore, a benevolent government should not engage in redistribution to rent seekers. This is the government's only possibility to avoid the creation of such a coordination failure.

In the presented model, economic growth and welfare depend further on taxation and the public sector's size. In absence of redistribution, a tax increase affects growth positively since it increases the provision of public services, but negatively since it makes capital accumulation less attractive. It is known since Barro (1990) that, given a Cobb-Douglas production function, growth and welfare are maximized in absence of redistribution if the public sector's relative size equals the share it would get if public services were a competitively supplied production input. However, if there is redistribution, a tax increase has an additional negative effect since it increases the agents' rent seeking efforts. Therefore, the public sector's relative sizes that maximize growth and welfare become smaller in presence of redistribution to rent seekers.

In addition, introducing foreign aid into the rent seeking growth model leads to the prediction of an inverted-U shaped relationship between foreign aid and economic growth if the government in the aid recipient country responds passively to foreign aid. This model might therefore reveal parts of the mechanisms that lead to the Aid Laffer Curve for which some recent empirical studies provide evidence. Foreign aid might promote growth if given in small dosages since it increases the provision of public services that are supportive for private production. However, large dosages of foreign aid might harm growth since they induce agents to allocate most of their time and their resources to rent seeking activities in order to channel aid inflows towards themselves.

Further, the model implies that foreign aid tends to be less useful or more harmful, respectively, if taxes are high and redistribution widespread. Hence, large aid payments to countries in which the public sector is already relatively large might be useless or even destructive. Moreover, foreign aid should primarily be paid to countries where redistribution to rent seekers is rare. Unfortunately, it is often difficult in reality to distinguish rents form payments that are necessary to provide public services. As an example, big investment projects that lead to the provision of some public goods or services involve in many countries often favors to rent seekers.

Furthermore, applying this model to the current enlargement of the European Union yields an interesting hypothesis: The transfer payments will only support economic development in the new Central and Eastern European member states if these states succeed in limiting redistribution to rent seekers. But if they set high taxes and redistribute widely, the transfer payments will retard their development.

Due to the similarity between aid windfalls and natural resource windfalls, the model also offers a potential explanation of why many resource-rich countries grow slowly: Natural resources could lower growth in countries with widespread redistribution since they cause rent seeking in such countries.

As a corollary of the question posed at the beginning, this model explicitly focuses on the effects of redistribution and rent seeking on economic growth and welfare. The tax rate and the allocation of the public funds are therefore assumed to be exogenous. But policies are of course not exogenous to a society, at least in the long run. Future research might therefore advance this model or any other model that assesses the interactions between rent seeking, policies and growth in such a way that it can explain policies too.

Most interesting might be to model policies as the explicit outcome of a political struggle between different (interest) groups. However, it seems difficult to introduce this approach into a growth model such as the one presented in this paper in which policy is multidimensional.[26]

Thus, a shortcut could be taken by making ad hoc assumptions about how policy variables are related to some other characteristics of the economy. As an example, the share of the public funds that is redistributed to rent seekers could be increasing in the public sector's size. Alternatively, this share might increase in the aggregate rent seeking effort. In both cases, the negative effects of high taxes and large public sectors would become stronger in the presented model. In addition, foreign aid would tend to be less beneficial or more harmful, respectively.

[26] The models of Tornell and Velasco (1992), Benhabib and Rustichini (1996), Lane and Tornell (1996) and Tornell and Lane (1999) could be interpreted as models in which the struggle between different interest groups determines policy. However, policy just contains one dimension - the redistribution of common access resources - in these models.

5 Appendices

5.1 Appendix A

In section 2.3, the consumption growth rate γ is derived under the assumption that the private agents produce at home. This appendix shows that the same results can be derived by assuming that production is done by firms that rent capital from the private agents.

The private agents maximize their overall utility U subject to k_0 and the dynamic constraint

$$\dot{k}_t = \omega k_t - c_t - \delta k_t,$$

where ω is the return to their capital k_t.[27] They take ω as given. The representative private agent's dynamic optimization program written as Hamiltonian is

$$H = \left(\frac{c_t^{1-\sigma}}{1-\sigma} \right) \exp\left(-\rho t\right) + \nu_t \left(\omega k_t - c_t - \delta k_t\right).$$

The corresponding first-order conditions are condition (14), which can again be modified to get equation (17), and

$$\dot{\nu}_t = -\nu_t \left(\omega - \delta\right). \tag{37}$$

Then, equation (17) and the first-order condition (37) imply

$$\gamma = \frac{1}{\sigma} \left(\omega - \delta - \rho\right), \tag{38}$$

where γ is again defined as the consumption growth rate.

Firms are assumed to produce output y_t with the production function

$$y_t = A \left(k_t'\right)^{1-\alpha} g_t^{\alpha},$$

where $k_t' = e_Y k_t$. For the firms, the capital variable k_t' rather than k_t is relevant since they cannot use the private agents' capital, especially their human capital, while the private agents are seeking rents. Each firm takes the return on k_t', ω', as given and maximizes its profit $(1-\tau)y_t - \omega' k_t'$. The first-order condition of the firms' problem is

$$\omega' = \left(1-\tau\right)\left(1-\alpha\right) A \left(\frac{g_t}{k_t'}\right)^{\alpha}. \tag{39}$$

In equilibrium, it must hold that $\omega k_t = \omega' k_t'$ and, hence, that $\omega = e_Y \omega'$. The first-order condition (39) can thus be rewritten as

$$\omega = \left(1-\tau\right)\left(1-\alpha\right) A e_Y^{1-\alpha} \left(\frac{g_t}{k_t}\right)^{\alpha}. \tag{40}$$

[27]Note that the private agents' wealth might also include bonds besides their capital. But because the economy is closed, the net supply of bonds is zero.

Inserting condition (40) into equation (38) yields again the growth equation (18).

Thus, the consumption growth rate γ turns out to be exactly the same in this market model as in the model in which the private agents produce at home.

5.2 Appendix B

This appendix proves that the capital stock k_t, output y_t, public funds p_t, public services g_t and the redistribution pot R_t grow at the same rate as consumption c_t, i.e., at the constant rate γ. Since this result holds in section 2 as well as in section 3.2, the proof is made for the more general case. Thus, the aid ratio f is included. Just set $f = 0$ to get the proof that corresponds to the model specification in section 2.[28]

To start, note that the government's budget constraint (28) [constraint (2)], $R_t = (1-\theta)p_t$ and equation (29) [equation (19)] allow rewriting the capital accumulation equation (13) as

$$\dot{k}_t = (\Psi - \delta)\, k_t - c_t, \tag{41}$$

where

$$\Psi \equiv \varphi A^{\frac{1}{1-\alpha}} \left[\theta\left(\tau + f\right)\right]^{\frac{\alpha}{1-\alpha}} e_Y$$

and

$$\varphi \equiv (1-\tau) + (1-\theta)(\tau + f) = 1 + (1-\theta) f - \theta\tau.$$

Since the consumption growth rate γ, which is given by equation (30) [equation (20)], is constant, it holds that

$$c_t = c_0 \exp(\gamma t) = c_0 \exp\left[\frac{1}{\sigma}\left(\Omega - \delta - \rho\right) t\right], \tag{42}$$

where

$$\Omega \equiv (1-\tau)(1-\alpha)\, A^{\frac{1}{1-\alpha}} \left[\theta\left(\tau + f\right)\right]^{\frac{\alpha}{1-\alpha}} e_Y.$$

Note that $\varphi > (1-\tau)(1-\alpha)$ since $\alpha > 0$, $f \geq 0$ and $\theta \leq 1$. Hence, it must hold that $\Psi > \Omega$.

Inserting equation (42) into the modified capital accumulation equation (41) yields

$$\dot{k}_t = (\Psi - \delta)\, k_t - c_0 \exp\left[\frac{1}{\sigma}\left(\Omega - \delta - \rho\right) t\right]. \tag{43}$$

The general solution to this first-order, linear differential equation is next derived in six steps.[29] First, equation (43) is rewritten as

$$\dot{k}_t - (\Psi - \delta)\, k_t = -c_0 \exp\left[\frac{1}{\sigma}\left(\Omega - \delta - \rho\right) t\right].$$

[28] It is referred to some equations of section 3.2. In these cases, the equivalent equations of section 2, where $f = 0$, are given in brackets.

[29] The derivation of this general solution follows Barro and Sala-i-Martin (2004).

Second, both sides are multiplied by $\exp\left[-\left(\Psi-\delta\right)t\right]$. This yields

$$\left[\dot{k}_t-\left(\Psi-\delta\right)k_t\right]\exp\left[-\left(\Psi-\delta\right)t\right]=-c_0\exp\left(-Wt\right),$$

where

$$W\equiv\frac{1}{\sigma}\left[\rho-\Omega+\sigma\Psi+\left(1-\sigma\right)\delta\right].$$

Note that W is constant. Third, both sides are integrated such that

$$\int\left[\dot{k}_t-\left(\Psi-\delta\right)k_t\right]\exp\left[-\left(\Psi-\delta\right)t\right]dt=-c_0\int\exp\left(-Wt\right)dt. \qquad (44)$$

Fourth, note that the integral on the left-hand side of equation (44) is the integral of the derivative of a function. Thus, it equals the function itself, i.e.,

$$\int\left[\dot{k}_t-\left(\Psi-\delta\right)k_t\right]\exp\left[-\left(\Psi-\delta\right)t\right]dt=\exp\left[-\left(\Psi-\delta\right)t\right]k_t+q_1,$$

where q_1 is an arbitrary constant. Fifth, solving for the right-hand side of equation (44) yields

$$-c_0\int\exp\left(-Wt\right)dt=\frac{c_0}{W}\exp\left(-Wt\right)+q_2,$$

where q_2 is also an arbitrary constant. Thus, equation (44) can be rewritten as

$$\exp\left[-\left(\Psi-\delta\right)t\right]k_t+q_1=\frac{c_0}{W}\exp\left(-Wt\right)+q_2.$$

Finally, solving for the capital stock k_t yields

$$k_t=Q\exp\left[\left(\Psi-\delta\right)t\right]+\frac{c_0}{W}\exp\left[\left(\Psi-\delta-W\right)t\right],$$

where $Q=q_2-q_1$. This equation can be rewritten as

$$k_t=Q\exp\left[\left(\Psi-\delta\right)t\right]+\frac{c_0}{W}\exp\left[\frac{1}{\sigma}\left(\Omega-\delta-\rho\right)t\right]. \qquad (45)$$

Equation (45) is the general solution to the first-order, linear differential equation (43).

Further, the first-order condition (15) and equation (29) [equation (19)] imply

$$\nu_t=\nu_0\exp\left[-\left(\Omega-\delta\right)t\right]. \qquad (46)$$

Inserting equations (45) and (46) into the transversality condition (16) yields

$$\lim_{t\to\infty}Q\exp\left[\left(\Psi-\Omega\right)t\right]+\lim_{t\to\infty}\frac{c_0}{W}\exp\left\{\frac{1}{\sigma}\left[\left(1-\sigma\right)\left(\Omega-\delta\right)-\rho\right]t\right\}=0. \qquad (47)$$

The bounded utility condition (21) implies $\rho>\left(1-\sigma\right)\left(\Omega-\delta\right)$. Thus, the second term of condition (47) converges towards zero. Consequently, this condition requires that the first term converges towards zero too. Since $\Psi > \Omega$, this requires $Q = 0$.

Given $Q = 0$, equations (42) and (45) imply

$$k_t = \frac{1}{W} c_t.$$

Since W is constant, the growth rate of the capital stock k_t must equal the consumption growth rate γ.

Further, equation (29) [equation (19)] implies that public services g_t must grow at the same rate as k_t. Then, the production function (4) implies that output y_t must also grow at this rate γ. Finally, the government's budget constraint (28) [constraint (2)] implies that public funds p_t and, consequently, the redistribution pot R_t must grow at the rate γ as well.

5.3 Appendix C

This appendix proves that the agents' utility U increases in the growth rate γ and in the initial income m_0.

Since the consumption growth rate γ is constant such that $c_t = c_0 \exp(\gamma t)$ and since the bounded utility condition (21) holds, the agents' overall utility U, which is given by equation (1), can be rewritten as

$$U = \frac{c_0^{1-\sigma}}{(1-\sigma)[\rho - (1-\sigma)\gamma]}. \tag{48}$$

The capital accumulation equation (13), equation (12) and the result that capital k_t grows at the rate γ imply that initial consumption must be given by

$$c_0 = m_0 - (\gamma + \delta) k_0. \tag{49}$$

Hence, the utility function (48) can be rewritten as

$$U = \frac{[m_0 - (\gamma + \delta) k_0]^{1-\sigma}}{(1-\sigma)[\rho - (1-\sigma)\gamma]}. \tag{50}$$

The derivative of this utility function with respect to the initial income m_0 is given by

$$\frac{\partial U}{\partial m_0} = \frac{[m_0 - (\gamma + \delta) k_0]^{-\sigma}}{\rho - (1-\sigma)\gamma}.$$

The bounded utility (21) condition implies that the denominator must be positive. It follows from equation (49) that the numerator is also positive unless $c_0 \leq 0$. But any $c_0 < 0$ is infeasible and $c_0 = 0$ cannot maximize utility U since it would lead to $c_t = 0$ for all t. Hence, it must hold that $c_0 > 0$ and that the numerator is positive too. Therefore, $\frac{\partial U}{\partial m_0} > 0$.

The derivative of the utility function (50) with respect to the growth rate γ is given by

$$\frac{\partial U}{\partial \gamma} = \frac{[m_0 - (\gamma + \delta) k_0]^{1-\sigma} - [\rho - (1-\sigma)\gamma][m_0 - (\gamma + \delta) k_0]^{-\sigma} k_0}{[\rho - (1-\sigma)\gamma]^2}.$$

Note that $\frac{\partial U}{\partial \gamma} \leq 0$ if and only if

$$m_0 - (\gamma + \delta)\, k_0 \leq [\rho - (1 - \sigma)\, \gamma]\, k_0 \Leftrightarrow \frac{m_0}{k_0} \leq \rho + \sigma\gamma + \delta. \tag{51}$$

The growth equation (20) implies that

$$\rho + \sigma\gamma + \delta = (1 - \tau)\,(1 - \alpha)\, A^{\frac{1}{1-\alpha}}\, (\theta\tau)^{\frac{\alpha}{1-\alpha}}\, e_Y$$

and equation (25) that

$$\frac{m_0}{k_0} = (1 - \theta\tau)\, A^{\frac{1}{1-\alpha}}\, (\theta\tau)^{\frac{\alpha}{1-\alpha}}\, e_Y.$$

These two equations allow rewriting the weak inequality (51) as

$$1 - \theta\tau \leq (1 - \tau)\,(1 - \alpha)\,.$$

Since $\alpha > 0$ and $\theta \leq 1$, this weak inequality does not hold. Consequently, there is a contradiction and it must hold that $\frac{\partial U}{\partial \gamma} > 0$.

5.4 Appendix D

This appendix proves that a tax rate $\tau < \alpha$ is required for condition (26) to hold if $\theta < 1$.

Suppose condition (26) is satisfied by a tax rate $\tau \geq \alpha$ if $\theta < 1$. In this case, it must hold that

$$\frac{1}{\theta}\,[\alpha + (1 - \alpha)\,(1 - \theta\tau)\,\epsilon_\tau] \geq \alpha \Leftrightarrow (1 - \alpha)\,(1 - \theta\tau)\,\epsilon_\tau \geq -\,(1 - \theta)\,\alpha.$$

After inserting equation (24), this condition can be rewritten as

$$-\,(1 - \theta)\,(1 - \alpha)\,(1 - \theta\tau)\,\tau \geq -\,(1 - \theta)\,\alpha(1 - \tau)\,[(1 - \alpha)\,(1 - \tau) + (1 - \theta)\,\tau]\,.$$

Dividing both sides by the negative term $-\,(1 - \theta)$ yields

$$(1 - \alpha)\,(1 - \theta\tau)\,\tau \leq \alpha(1 - \tau)\,[(1 - \alpha)\,(1 - \tau) + (1 - \theta)\,\tau]\,.$$

Straightforward, but tedious algebra allows rewriting this condition as

$$(1 - \theta\tau)\,(\tau - \alpha) + (1 - \tau)^2\,\alpha^2 \leq 0.$$

Given $\tau \geq \alpha$ and $\theta < 1$ this condition cannot hold. Hence, there is a contradiction. Consequently, a tax rate $\tau < \alpha$ is required for condition (26) to hold if $\theta < 1$.

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