Bureaucratic corruption and macroeconomic performance

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Contents

Abstract

The objective of this paper is to analyze the welfare impact of corrupt bureaucratic behavior within the framework of a growth model. This allows to disentangle the interaction between static and dynamic bureaucratic efficiency. The economy is described by the following conditions: (i) The bureaucracy determines the provision of an input to individual production. This input might be congested. (ii) There are distortionary and non–distortionary taxes to finance the public input. Corruption is introduced as the bureaucrat maximizes its own utility at the cost of the utility of the individuals. (iii) The tax system is exogenous to the bureaucracy and might be interpreted as attempt to discipline the bureaucracy as argued within the Leviathan models. (iv) The bureaucracy maximizes the available budget. As the formal frame is a dynamic model the budget may be maximized either in the short, intermediate or the long run. It turns out that there is a trade–off between short–run and long–run budget that is crucially influenced by the design of the tax system and the bureaucratic preferences but not by congestion. The feature of congestion gains importance with respect to the welfare implications of corrupt bureaucratic behavior.

1 Introduction

In recent years increasing attention has been paid to the phenomenon of corruption. Tanzi (1998) argues that although corruption is not new, it is not only the degree of attention paid to corruption but also the extent to which corruption takes place has been rising significantly after the end of the Cold War. Several reasons for this are mentioned, among them the increasing role of governments that is reflected by larger levels of taxation or public spendings together with rising governmental regulation and controls on economic activities. Tanzi and Davoodi (1997) argue that corruption is frequently tied to capital projects and in this context also with public investment. Introducing this aspect in a dynamic context the long–run consequences of corruption may be analyzed. Usually, corruption is assumed to be growth and welfare reducing and thus unqualifiably bad. This view neglects that larger growth does not automatically improve welfare as is shown e. g. in models in which negative external effects arise. This might be the consequence in the Schmumpeterian growth models that stand in the line of Grossman and Helpman (1991) or Aghion and Howitt (1992) or those in which the governmental input is subject to congestion as analyzed e. g. by Turnovsky and Fisher (1995), Fisher and Turnovsky (1998), Eicher and Turnovsky (2000) or Turnovsky (1997, 2000b). Some few economists argue that, within well defined circumstances, corruption may promote faster growth (see e. g.Braguinsky (1996)).

While there exists a variety of definitions of corruption (see e. g. Theobald (1990) or Bardhan (1993)), this paper uses a simple definition of corruption of the World Bank as 'the abuse of public power for private benefit' (cited by Tanzi (1998), p. 564). As within the paper of Shleifer and Vishny (1993), the focus lies on the consequences of corruption for resource allocation and thus welfare. The objective of this paper is to analyze the welfare impact of corrupt bureaucratic behavior within the framework of a growth model. This allows to disentangle the interaction between static and dynamic bureaucratic efficiency. The economy is described by the following conditions: (i) It is assumed that the bureaucracy determines the provision of an input to individual production. This input might be congested. (ii) There are taxes to finance the public input. The taxes differ with respect to their impact on intertemporal allocation and might be growth neutral or growth reducing. (iii) The tax system is exogenous to the bureaucracy and might be interpreted as attempt to discipline the bureaucracy as argued within the Leviathan models. (iv) The bureaucracy is

corrupt and maximizes the available budget. As the formal frame is a dynamic model the budget may be maximized either in the short, intermediate or the long run. It turns out that there is a trade–off between short–run and long–run budget that is crucially influenced by the design of the tax system and the bureaucratic preferences but not by congestion. The feature of congestion gains importance with respect to the welfare implications of selfish bureaucratic behavior.

Most growth models with a productive governmental input assume that government's task only consists of the efficient provision of the public input. This includes not only the amount but also the chosen financing mode that might be used to eliminate or alleviate externalities that arise e. g. if the input is subject to congestion. The growth impact of fiscal policy depends on the chosen instrument. Usually benevolent behavior of the government is assumed. It determines the levels of the fiscal instruments to realize the Pareto optimum as consequence of the decentral decisions (see e. g. Barro (1990), Fisher and Turnovsky (1998), Turnovsky (1999), Turnovsky (2000a), Eicher and Turnovsky (2000)). Independent from the degree of congestion the first–best optimum implies a constant relation between private and public sector over time. This contradicts empirical findings whereupon government has grown dramatically during the last century (see e. g. Holsey and Borcherding (1997) or Mueller (2003) chapter 16 for an overview). Several approaches argue that the growing public sector is the outcome of an increased demand for public services by the citizens. Other approaches focus on the supply side of governmental services and stand in the line of Niskanen (1971) or Romer and Rosenthal (1978, 1979, 1982). They constitute the budget's size via selfish behavior of bureaucrats who maximize the available budget. Bureaucrats form independent parts of the government and do not aspire to realize a first–best situation but pursue own interests. However, while the models mentioned there are static, the model here is dynamic. Within a dynamic context it turns out that not only the bureaucracy's preferences but also the time limit is important for the resulting governmental behavior.

While budget maximizing, bureaucrats underly several restrictions. Brennan and Buchanan (1980) e. g. develop a model in which the government as Leviathan is disciplined by constitutional constraints. Abstracting from governmental debt further restrictions result within this paper as the entire revenues might not exceed total output of the private sector. Generally, constitutional constraints might be realized by several specifications of the

tax systems (see e. g. Tanzi and Schuhknecht (2000)). In this paper, selfish behavior of bureaucrats is restricted by an exogenously given tax system that might consist of a certain relation between distortionary and non–distortionary revenues. With this the bureaucracy has to bear in mind that an increase of an income tax c. p. increases the short–run budget whereas it decreases the budget's growth rate and thus the budget in the long run. Selfish government thus would choose a high income tax rate only if it acted shortsightedly and reduce the level of this tax with an increase in the time horizon. The welfare effects of such a transition are ambiguous and crucially depend on the characteristics of the public input: while c. p. a reduction of the income tax is welfare enhancing if the public input is totally non–rival the opposite applies for proportionally congested inputs.

This paper links the aspects mentioned above: Selfish governmental behavior is introduced in the framework of a growth model with a single accumulable factor and a public input that might be congested. This is formalized via the introduction of a congestion function from the public good's literature in a growth model with a productive governmental input (see e. g. Edwards (1990) or Glomm and Ravikumar (1994)). Governmental preferences cover alternative time horizons and the agent is confronted by a tax system in which the relation between distortionary and non–distortionary revenues is exogenously given. Considering the welfare implications it turns out that efficient provision of the governmental input depends on several influencing factors. They include the time horizon of the optimizing governmental agent, the characteristics of the publicly provided input and the constitutional restrictions affecting the tax system. Static efficiency is a necessary condition for dynamic efficiency. It is only met if simultaneously the following conditions apply: the public input is proportionally congested, the income tax is the only source of governmental revenue and the bureaucracy maximizes the long–run budget. For all other parameter constellations the size of the government is suboptimally high whereas the growth rate might or might not be suboptimally small. With the suboptimal governmental size the static efficiency condition is violated and thus dynamic efficiency cannot be realized, too. Although constitutional constraints restrict selfish governmental behavior they are not apt to produce a welfare optimum.

The course of the paper is as follows: After describing the assumptions of the model in section 2, part 3 gives a brief overview over the first–best optimum, the market equilibrium and the corresponding optimal fiscal policy. Section 4 introduces exogenously given

3

constitutional constraints and their relation to the resulting governmental size. Part 5 introduces the bureaucrat's preferences and analyzes the consequences of this behavior for the macroeconomic performance depending on alternative planning horizons and constitutional restrictions. Above, the corresponding welfare implications are discussed. The paper closes with a short summary.

2   The model

The analysis' starting point is a model of endogenous growth with a productive governmental input. Each of the identical individuals is facing an infinite planning horizon and maximizes overall utility, W, as given by

(1) $W(0) = \int_0^\infty u(c)e^{-\beta t}dt$.

The function $u(c)$ relates the flow of utility to the quantity of individual consumption, c, in each period. The discount factor, $e^{-\beta t}$, involves the constant rate of time preference, $\beta > 0$. Utility of the representative household in each period is given by the isoelastic function

(2) $u(c) = \dfrac{c^{1-\sigma}}{1-\sigma}, \quad \sigma > 0, \quad \sigma \neq 1$.

Labor supply is assumed to be inelastic and the constant population consists of n individuals. As the feature of congestion is analyzed within this model it is necessary to distinguish between aggregate and individual quantities.

Each firm produces the homogeneous good, y, according to the individual production function

(3) $y = k \cdot f\left(\dfrac{G^a}{k}\right), \quad f'(\cdot) > 0, \quad f''(\cdot) < 0, \quad 0 < \dfrac{G^a}{k} < f(\cdot)$.

The production inputs are individual capital, k, and the individually available amount of the public input, G^a. $f(\cdot)$ may be interpreted as productivity function. It is assumed to be homogenous. Capital is depreciated at the rate δ. The marginal product of each input

is positive but diminishing and the production function is assumed to satisfy the Inada conditions. The last condition in eq. (3) guarantees that output exceeds the governmental input.

To determine the optimal consumption and accumulation decisions of the individuals, the nature of the public input and the restrictions, if any, of availability to the individuals have to be explained in a more detailed way. The individual's availability of the public input may be expressed by the congestion function[1]

$$(4) \qquad G^a = G \cdot k^{1-\varepsilon} K^{\varepsilon-1}, \quad \varepsilon \in [0,1] \quad ,$$

where $K \equiv nk$ denotes the aggregate stock of capital and ε measures the degree of congestion: The absence of any congestion is represented by $\varepsilon = 1$, in which case the public good is fully available to the representative agent. The other polar case, $\varepsilon = 0$, corresponds to proportional congestion.[2] An increase in G relative to aggregate capital, K, expands individually available amount of the public input and with this output per capita, y, in eq. (3) for a given amount of individual capital, k. On the other hand, an increase in K for given G lowers the public services available to the individual firms, reduces productivity $f(\cdot)$ and hence individual output.[3] If $0 < \varepsilon < 1$, eq. (4) just represents intermediate cases in which the public input is subject to partial congestion.

The government provides the productive input G. Governmental production does not exist, as the public sector buys a part of aggregate private production, $Y \equiv ny$, and makes it available to the individuals as a public input.[4] The provision of the public input G

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[1]This is a typical congestion function as used within the public's good literature (see e. g. Edwards (1990)).

[2]The discussion of (partially) congested public goods is not new as can be seen e. g. by the investigations of Buchanan (1965), Musgrave (1968), Samuelson (1969), Evans (1970) or Oakland (1969, 1972). An introduction into growth theory can be found in Barro (1990) and was further developed e. g. by Glomm and Ravikumar (1994), Turnovsky and Fisher (1995), **?** or Eicher and Turnovsky (2000). The term 'proportional congestion' is borrowed from **?**.

[3]One could alternatively assume that G has to rise in relation to total output Y in order for G^a/k to remain constant. The results with respect to efficiency and optimal fiscal policy would be essentially the same (see e. g. Barro and Sala-I-Martin (1998), chapter 5, for a prove).

[4]It is assumed that the public input G and total output Y may be transformed in a ratio of 1:1. One could also suppose that the government disposes of the same production technology as the private firms and produces G at its own.

is financed by duties levied to the firms. Since both inputs, private capital as well as the public input, are essential for production the firms cannot renounce on the use of the public input and have to accept any financing scheme chosen by the government. It is supposed that the government levies proportional taxes on income and a lump sum tax. In contrast to the tax on income, the lump sum tax has no distortionary effect on the intertemporal allocation and hence is growth neutral whereas taxing the income reduces the decentrally resulting growth rate.[5] The budget is assumed to be balanced in each period.

3   Optimal fiscal policy

The *first–best optimum* is characterized by the welfare maximizing growth rate ϕ^* as well as the optimal expenditure ratio $(\frac{G}{ny})^*$ that must be realized simultaneously. Usually they are determined by an altruistic government. The central planning problem is to maximize the utility of the representative agent as given by eq. (1) and (2) subject to the individual accumulation constraint

$$(5) \qquad \dot{k} = kf(\cdot) - c - \frac{G}{n} - \delta k \quad .$$

As the omniscient planner knows that aggregate capital is composed of total individual capital, $K = nk$, the congestion function in eq. (4) simplifies to

$$(6) \qquad G^a = \frac{G}{n^{1-\varepsilon}} \quad .$$

The optimal amount of the public input is attained if the marginal benefits to productivity just match the unit resource costs of the additional government expenditure. This leads to the necessary condition

$$(7) \qquad f'(\cdot)n^\varepsilon = 1 \quad .$$

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[5]Instead of a lump sum tax a tax on consumption could be chosen to close the budget. If labor supply is inelastic the impact of the tax on the intertemporal allocation would be the same.

Maximizing over c and k and using the production function in eq. (3), the congestion function in eq. (6) as well as the optimality condition (7), the first–best growth rate attained by the benevolent government is given by

$$(8) \qquad \phi^* = \frac{1}{\sigma}\left[f(\cdot)^*\left(1-\frac{G}{ny}\right)-\delta-\beta\right], \quad \frac{\partial \phi^*}{\partial \varepsilon} > 0 \quad .$$

As the level of the productivity function, $f(\cdot)$, decreases with an increase in the rivalry, the optimal growth rate depends on the existing degree of congestion, ε, and is the lower the more the public input is characterized by congestion. Another central feature of ϕ^* is that it depends on the level of the expenditure ratio. Considering the changes of the growth rate with respect to the expenditure ratio leads to the relation

$$(9) \qquad \frac{\partial \phi^*}{\partial \frac{G}{ny}} = \frac{f(\cdot)}{\sigma(1-\eta)}[f'(\cdot)n^\varepsilon - 1] \gtreqless 0 \quad \Longleftrightarrow \quad \frac{G}{ny} \lesseqgtr \eta \qquad \forall \varepsilon \quad .$$

Independent of the existing level of congestion the growth rate has a maximum if the expenditure ratio equals partial production elasticity of the public input. The optimal expenditure ratio may be derived from equation (7) together with the relation $\frac{G^a}{k} = \frac{G}{ny}f(\cdot)n^\varepsilon$. If the production function is homogenous the expenditure ratio turns out to be constant

$$(10) \qquad \eta \equiv \frac{f'(\cdot)\frac{G^a}{k}}{f(\cdot)} = \left(\frac{G}{ny}\right)^* \quad \forall \varepsilon$$

with η denoting the partial production elasticity of the public input.[6] Then, production efficiency of the provision of the input G is realized for all levels of congestion. The first–best optimum thus may be characterized by eq. (8) and eq. (10). There are no transitional dynamics and the economy initially jumps into the steady state. In steady state consumption, capital, output as well as governmental expenditure grow at the same constant rate.

We now turn to the description of the *market equilibrium*. The existence of rivalry is not perceived by the individuals as they consider their own decisions as negligible at the economy–wide level. The individuals ignore that their capital accumulation increases the stock of total capital and thereby c. p. reduces the amount of the public input available

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[6]A graphical illustration of these relations can be found in figure 2 a–c.

to the others. This causes congestion as long as the amount of the public input does not increase to the same extent as private capital. A negative externality of capital accumulation arises. Based on the congestion function (4) the individuals decide on consumption and capital accumulation. Optimizing over c and k leads to the market equilibrium growth rate

$$(11) \qquad \phi^D = \frac{1}{\sigma}\left[(1-\tau)f(\cdot)(1-\epsilon\eta) - \delta - \beta\right], \quad \frac{\partial\phi^D}{\partial\epsilon} < 0, \quad \frac{\partial\phi^D}{\partial\tau} < 0$$

that includes two counteracting effects: An increase in the degree of congestion c. p. ends up in a higher growth rate whereas a higher income tax rate reduces the decentral growth rate. In a decentralized economy, the first–best optimum may be realized if the government levies taxes in an appropriate way.[7] The *optimal income tax* in this context internalizes the external effect of capital accumulation and with this reduces the decentrally high growth rate as long as congestion arises. The lump sum tax then is used in order to close the budget and to provide the efficient amount of the public input.

4   Constitutional constraints

Within the models of public choice theory benevolent behavior of political agents is generally doubted (see e. g. Mueller (2003) for an overview). Adopting this argumentation to the framework of a growth model the assumption of long–run welfare maximizing behavior of the government, represented by the social planner, now is relaxed. As the usual social planner within this type of growth models is not restricted by any electoral constraints he might be interpreted most suitable as bureaucrat.[8] Usually, his duty is it to provide services to the public and to eliminate or at least alleviate any existing external

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[7]For a discussion of the impacts of different fiscal instruments and the role of the public sector see e. g. Musgrave (1959), Atkinson and Stiglitz (1980), Stiglitz (1986), Myles (1995) or Cornes and Sandler (1996). A detailed derivation of the level and impact of the income tax rate and the corresponding lump sum tax can be found e. g. by Turnovsky (2000b), chapter 13.5 .

[8]Mueller (2003), p. 523 argues that 'governmental bureaucracies are an independent force (. . .).' Surveys of the bureaucracy literature can be found e. g. by Breton and Wintrobe (1974), Orzechowsky (1977), Moe (1997) and Wintrobe (1997). A recent paper that examines the feature of bureaucratic efficiency is given by Prendergast (2003).

effects. To finance the corresponding expenditures the bureaucrat disposes of revenues out of the tax system. The design of the tax system here may be interpreted in analogy to the restrictions within the Leviathan model. The central hypothesis there is that only con-stitutional constraints on the source of revenue or the level of expenditure can discipline any selfish government. This might be realized by a tax system that is exogenous to the bureaucracy.[9]

In the following course of the paper the constitutional constraints are formalized by the extent of income tax financing on total revenues. These constraints are characterized by the parameter $\mu = \tau/(G/ny) \in [0,1]$ and might be interpreted as *degree of distortion* of the tax system. It is modelled as continuum with $\mu = 0$ representing a situation in which a certain amount of the governmental input is exclusively financed via non–distortionary instruments. The other polar case is reflected by $\mu = 1$, in which case total amount of the governmental input is exclusively financed by the income tax. Intermediate levels of $0 < \mu < 1$ reflect situations consisting of a mixed financing scheme.[10] It is assumed that the degree of distortion is exogenous to the governmental agent as well as to the individuals. Given the preferences of the representative agent (1) and (2) together with the production technology (3) individual optimization over k and c leads to the market equilibrium growth rate

$$(12) \qquad \phi^{D\mu} = \frac{1}{\sigma}\left[(1 - \mu\frac{G}{ny})f(\cdot)(1 - \epsilon\eta) - \delta - \beta\right], \qquad \frac{\partial\phi^{D\mu}}{\partial\epsilon} < 0, \qquad \frac{\partial\phi^{D\mu}}{\partial\mu} < 0 \qquad .$$

It reflects the relation between expenditure ration and growth rate as perceived by the individuals for all levels of congestion and the exogenous constitutional constraint, μ. The growth rate c. p. increases with a rise in congestion whereas it decreases with an increase in distortion. This growth rate gains importance with respect to two issues: First, as usual within growth theory together with the first–best growth rate ϕ^*, it may be used to derive the optimal fiscal policy . Second, it represents individual behavior with respect to alternative environments and thus serves as base for selfish governmental behavior.

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[9]See e. g. Campbell (1994) for an application of this aspect.

[10]Tanzi and Schuhknecht (2000) provide empirical background with respect to size and composition of alternative taxes over the last century. They also analyze causes and consequences of these fiscal develop-ments.
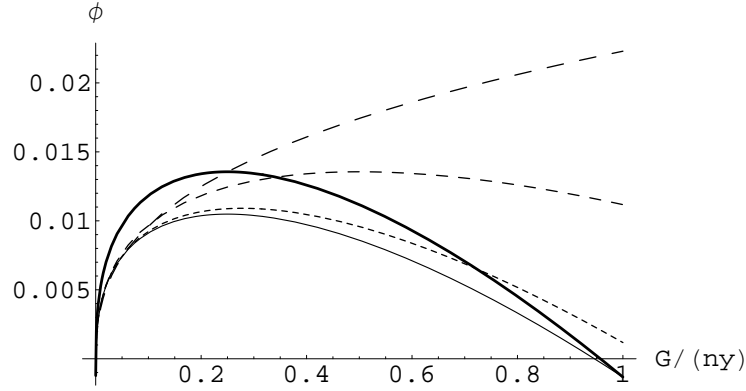
Figure 1: First–best optima and market equilibria for alternative degrees of distortions; The parameter settings are as follows: $\sigma = 2$, $\beta = .003$, $\delta = .05$, $n = 2$, $\eta = .25$.

A graphical illustration of ϕ^* and $\phi^{D\mu}$ can be found in figure 1 where the two growth rates are plotted for alternative degrees of congestion and distortion. The solid lines represent the relationships between ϕ^* and the expenditure ratio as given in eq. (8) for the benchmark cases of no congestion (upper curve) and proportional congestion (lower curve). Above, there are three more functions that reflect $\phi^{D\mu}$ for alternative extents of distortionary financing:[11] The upper dashed curve represents the relation between growth rate and expenditure ratio if total amount of the revenues is financed via a growth neutral instrument, $\mu = 0$, the medium and lower dashed curves reflect a mixed financing scheme with $\mu = .5$ and $\mu = .8$ respectively. Qualitatively, these relations hold for all levels of ε.

It becomes obvious that the interaction between growth rate and expenditure ratio is also influenced by the design of the tax system: With respect to $\phi^{D\mu}$ in eq. (12) the relation between market equilibrium growth rate and expenditure ratio may be summarized as[12]

$$(13) \qquad \frac{\partial \phi^{D\mu}}{\partial \frac{G}{ny}} \gtreqless 0 \quad \Longleftrightarrow \quad \frac{G}{ny} \lesseqgtr \frac{\eta}{\mu} \quad .$$

The growth maximizing expenditure ratio thus is given by $\frac{G}{ny} = \frac{\eta}{\mu}$. It increases with the extent to which the public input is financed via a growth neutral instrument, i. e. with a

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[11] The functions here are plotted for the case of proportional congestion, $\varepsilon = 0$. If congestion is reduced there would be no qualitative changes of the run of the curves. There are only level effects.

[12] A derivation of that result can be found in the appendix.

reduction in μ. As from an economic point of view the maximally possible expenditure ratio is given by $\frac{G}{ny} = 1$, for all $\mu < \eta$ the growth maximizing expenditure ratio is then given by that corner solution where total output is transformed to the governmental input. This implies that for all $\mu < \eta$ the negative relation between growth rate and expenditure ratio becomes relaxed over the entire domain as growth rate and expenditure ratio are positively linked for all levels of the expenditure ratio. The *economic implication* for this interdependence might be illustrated by the counteracting effects between the intertemporal income and the intertemporal substitution effects that arise if an increase in the level of the public expenditure is income tax financed: An increase of the income tax rate reduces the after tax marginal product of capital thus inducing a negative substitution effect. Capital accumulation becomes less attractive and individuals increase current consumption at the cost of investment. The growth rate decreases. At the same time an increase in the income tax c. p. causes an increase of the amount of G thus increasing capital productivity, $f(\cdot)$. Accumulation is stimulated and the growth rate increases. The two effects exactly offset each other for an income tax rate that equals partial production elasticity of the public input. If now as a consequence of a reduction in μ the extent of income tax financing is reduced the growth enhancing effect of a higher G is employed. The growth rate increases. At the same time increases the growth maximizing expenditure ratio that equilibrates intertemporal income and substitution effect. These relations hold for all levels of congestion.

5 Bureaucratic preferences and welfare

We now turn to an analysis of the economic implication if the bureaucracy is assumed to behave in a selfish manner and disposes of own preferences that are borrowed from Niskanen (1971) or Romer and Rosenthal (1978, 1979,1982). Thus it is assumed that selfishness of the public agent can be modelled as maximizing the available budget.[13] Within the framework of a growing economy the budget can be maximized either in the

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[13]A similar discussion of a selfish government in the case of a completely excludable and not at all congested governmental input can be found in Ott (2000). In contrast to the paper here no constitutional restrictions are included in the argumentation and to realize a welfare optimum it is sufficient if the bureaucrat pursued the goal of long–run maximizing the budget.

short or in the long run. Maximizing the short–run budget is equivalent to maximizing the budget in relation to total output in each period, i. e. the expenditure ratio. The long–run budget increases with the budget's growth rate. In equilibrium the budget's growth rate equals the growth rate of consumption. Therefore, the growth rates ϕ^* in eq. (8) and $\phi^{D\mu}$ in eq. (12) will serve as a base for the following argumentation concerning the budget growth rate. A formal illustration of the government's utility function is given by eq. (14) and a detailed discussion of the impacts follows there.

Eq. (9) illustrates that for all levels of congestion the *optimal growth rate* is a function of the expenditure ratio: There exists a relationship between short–run and long–run budget. The growth rate increases with the expenditure ratio as long as the latter is suboptimally low. For expenditure ratios higher than η, an increase of the expenditure ratio goes along with a reduction of the growth rate and the trade–off between short–run and long–run budget becomes negative. The optimal growth rate has a maximum if the public input is efficiently provided with the expenditure ratio being equal to $\frac{G}{ny} = \eta$ (see eq. (10)). Because of $\frac{\partial \phi^*}{\partial \varepsilon} > 0$, the optimal growth rate decreases with a rise in rivalry whereas the growth maximizing expenditure ratio is independent from congestion (see eq. (9)). Hence, the negative trade–off holds for all levels of congestion whenever $\frac{G}{ny} > \eta$. There is also a relation between the short–run and long–run budget with respect to the *decentral growth rate*, $\phi^{D\mu}$. This relation is influenced by the constitutional constraints. If the input is exclusively financed via an income tax, $\mu = 1$, the negative trade–off results, as within ϕ^*, for all suboptimally high expenditure ratios, $\frac{G}{ny} > \eta$. Generally, the growth maximizing expenditure ratio increases with the extent of the non–distortionary revenues (see eq. (13)). Hence the negative trade–off between short–run and long–run budget results for a higher than the optimal expenditure ratio if a part of the governmental revenues is neutrally financed, $\mu < 1$. A conflict between maximizing short–run and long–run budget always arises if $\frac{G}{ny} > \frac{\eta}{\mu}$. If $\mu \leq \eta$, the negative trade–off does not apply at all. Short–run and long–run budget may be maximized simultaneously up to $\frac{G}{ny} = 1$.

It is now analyzed how a budget maximizing bureaucracy fixes the available budget depending on its own preferences. With this the planning horizon of the government becomes an important determinant. While maximizing the *long–run* budget is equal to a maximum growth rate the bureaucrat would fix the expenditure ratio at the level $\frac{G}{ny} = \frac{\eta}{\mu}$ (see eq. (13)). Independent from the level of congestion the growth rate increases with

the extent of the non–distortionary instrument. The other polar case is given by a bureaucracy that maximizes the *short–run* budget, i. e. the expenditure ratio. This implies that the bureaucracy taxes entire output and uses it as governmental input. The expenditure ratio then equals $\frac{G}{ny} = 1$ and the corresponding level of the growth rate is determined by the prevailing degree of distortion, μ. One may imagine that the government maximizes the budget over an *intermediate time horizon* and is ready to accept a lower than the maximally possible expenditure ratio if at the same time the budget growth rate increases. On the contrary it would accept a slower budgetary growth if it strongly preferred a high level of the short–run budget. The preferences then may be described by a Cobb–Douglas utility function in which the relative importance of long–run vs. short–run time horizons are expressed by the exponents φ and $1 - \varphi$. The level of the exponents, $0 < \varphi < 1$, may be interpreted as intermediate time horizon with an increase in φ reflecting a stronger preference for the long–run budget as the budget growth rate becomes more important.

The utility function of the selfish bureaucrat could be described to depend on the growth rate (long–run budget) and the expenditure ratio (short–run budget) as

$$(14) \qquad \mathcal{U}_e\left(\phi_o, \frac{G}{ny}\right) \equiv \phi_o^{\varphi} \cdot \left(\frac{G}{ny}\right)^{1-\varphi}, \quad 0 \leq \varphi \leq 1 \quad,$$

with ϕ_o in this function being equal to

$$(15) \qquad \phi_o \equiv \frac{1}{\sigma}\left[\left(1 - \mu\frac{G}{ny}\right)f(\cdot)(1 - \varepsilon\eta)\right] \geq 0 \quad \forall \quad \varepsilon \quad.$$

It is achieved by a linear transformation of the market equilibrium growth rate in equation (12) through the addition of the constant $\frac{\beta+\delta}{\sigma}$. This modification allows for an explicit solution of the maximization problem of the selfish government given by eq. (14) while the qualitative interdependencies between short–run and long–run budget remain unchanged. Above, the resulting growth rate is positive for all expenditure ratios, $\frac{G}{ny} \in [0, 1]$.[14]

Maximizing the utility function $\mathcal{U}_e$ over $\frac{G}{ny}$ leads to the expenditure ratio chosen by the egoistic bureaucracy

$$(16) \qquad \left(\frac{G}{ny}\right)_e = \frac{\varphi\eta + (1-\eta)(1-\varphi)}{\mu[(1-\eta)(1-\varphi) + \varphi]} \quad, \in \left[\frac{\eta}{\mu}, \frac{1}{\mu}\right], \quad \frac{\partial(\frac{G}{ny})_e}{\partial\varphi} < 0, \quad \frac{\partial(\frac{G}{ny})_e}{\partial\mu} < 0 \quad.$$

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[14]Note the the graphical illustration in figures 1 and 2 represent the original growth rates and expenditure ratios that are not transformed.

It is influenced by the planner's time horizon, φ, and the constitutional restriction, μ, but not by the degree of congestion, ε. For a given level of distortion, the government chooses a lower expenditure ratio with rising importance of the long–run budget and vice versa. Besides, for a given time horizon the expenditure ratio increases with a decrease in the degree of distortion. The independency from the degree of congestion reflects a fact that a selfish bureaucracy is not per se interested in internalizing any external effect but only takes care about his own budget.

Concerning the *welfare implications* the level of the expenditure ratio together with the degree of congestion, ε, becomes crucial. Alternative decisions of the bureaucracy may be evaluated by comparison with the first–best optimum given by eq. (8) and (10) that must be realized simultaneously. The optimal expenditure ratio is given by $\frac{G}{ny} = \eta$ and is independent from ε and μ. It is realized if the public input is efficiently provided as marginal revenues and marginal costs are equilibrated. A departure from the optimal expenditure ratio induces efficiency losses that are the bigger the higher $\frac{G}{ny}$. The wedge between marginal revenues and marginal costs increases and the welfare loss increases with the expenditure ratio or equivalently the more important the short–run budget is to the bureaucrat. While the degree of distortion influences the resulting growth rate indirectly via the expenditure ratio, the degree of congestion directly enters the growth rate. Hence, with respect to the welfare impact of the bureaucrat's growth rate the existing level of rivalry gains importance in the following manner: If congestion arises the decentrally resulting growth rate is suboptimally high. Then, from a welfare economic point of view a growth reducing income tax rate should be used to internalize the external effect. The optimal level of the income tax rate increases with the degree of congestion.

The welfare implications of the interdependencies between selfish bureaucratic behavior and congestion now are discussed for the benchmark case of *pure income tax financing*, $\mu = 1$, and alternative time horizons of the selfish bureaucracies. Given the preferences in eq. (14), a selfish bureaucrat would choose the optimal expenditure ratio whenever the aim is to maximize the *long–run budget* ($\varphi = 1$). Total amount of the governmental input then is financed via the income tax, $\tau = \eta$, and the first–best expenditure ratio is achieved. This financing mode reduces the resulting growth rate unequivocally for all levels of congestion. The welfare effects depend on the degree of rivalry: In case of pro-portional congestion the welfare maximum results because the distortionary income tax

$\tau = \eta$ reduces the suboptimally high growth rate and exactly offsets the negative external effect arising from capital accumulation. On the contrary, in case of no congestion the growth reducing effect of the distortionary income tax also reduces welfare because the resulting growth rate is suboptimally low. For intermediate cases of partial congestion the realized growth rate also is suboptimally low. If $\tau = \eta$, the wedge between optimal and realized growth rate thus increases with a decreasing level of congestion. These welfare losses increase with a reduction of congestion because the growth reducing effect of the proportional income tax overshoots the optimal level the more the less congestion exists. That is, although for all levels of congestion $\varepsilon < 1$ the income tax rate basically is apt to internalize the external effect of capital accumulation the extent of the tax rate is too big for all levels of partial congestion. In doing so the welfare loss increases with a reduction of congestion as this increases the wedge between optimal and actual expenditure ratio. A welfare optimum thus results if, and only if, congestion is proportional, the bureaucrat is a long–run budget maximizer and the income tax is the only source of governmental revenues. The income tax rate then reduces the suboptimally high growth rate and the revenues out of the tax are sufficient to realize the optimal expenditure ratio.

The governmental budget is positively linked to the level of the income tax rate, $G = \tau ny$. Ceteris paribus the expenditure ratio increases with the level of the income tax and with this maximizing the *short–run budget* equals maximizing the income tax rate, $\tau > \eta$. The maximal expenditure ratio would be realized if total output is transferred to governmental revenue. For $\varphi = 0$, the government chooses an expenditure ratio equal to $(\frac{G}{ny})_e = 1$.[15] It departs from the point of production efficiency as for $\frac{G}{ny} > \eta$ the marginal costs of provision exceed the marginal revenues of the governmental input (see eq. (7)). This induces an overprovision of the public input and the public sector becomes suboptimally large. The growth rate becomes zero and the economy is stationary. As consequence welfare

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[15]These parameter combinations result for the transformed growth rate ϕ_0 given in eq. (15). The actually resulting growth rate must be re-transformed by subtracting $\frac{\delta+\beta}{\sigma}$. The corresponding expenditure ratio is smaller than one but cannot be determined explicitly. However, in a dynamic context this is not a feasible solution as this implied a negative growth rate and in the long run a collapse of the economy (see equation (11)). If the growth rate becomes negative the gross investment is not sufficient to compensate the loss of capital as a consequence of depreciation. The economy then enters recession. An egoistic governmental agent who maximizes the short–run budget would make sure that the growth rate does not to become negative. For that, sensible solutions require an income tax rate that at least allows for zero growth. Graphically this is given by the intersection of the lower curve with the horizontal axes in figure 2a–c.

declines because the individuals are not able to realize their optimal intertemporal consumption plans. If the bureaucrat's time horizon is *intermediate*, $0 < \varphi < 1$, the described relations hold equivalently: The expenditure ratio becomes suboptimally high thus inducing reductions of the growth rate. The welfare optimum cannot be realized but the extent of the welfare loss is less than in case of a short–run time horizon, $\varphi = 0$.
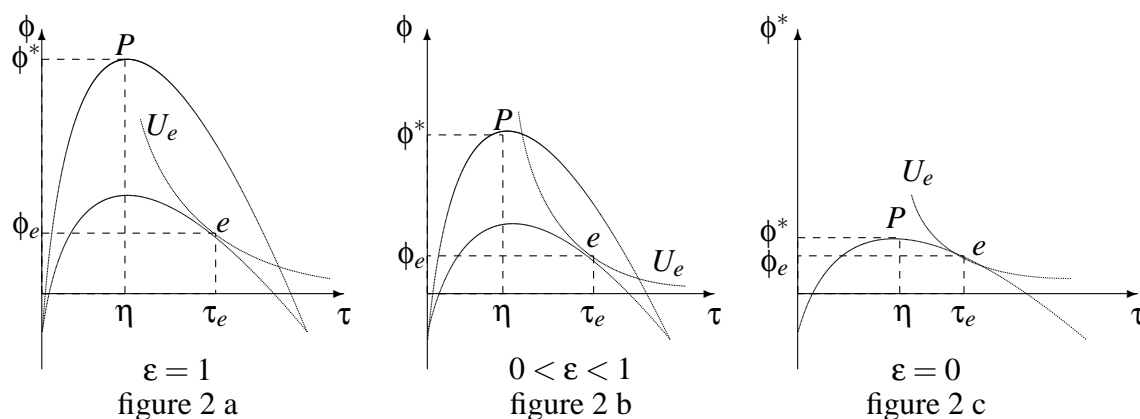

Figure 2: Welfare implications of intermediate time horizons, $0 < \varphi < 1$

A graphical illustration of the interdependencies explained up to here can be found in figures 2 a–c. They cover the Pareto optimal relations between ϕ^* and $\frac{G}{ny}$ (upper curves), the decentrally resulting relations $\phi^{D\mu}(\frac{G}{ny})$ (lower curves)[16] and an indifference curve out of $\mathcal{U}_e$ for intermediate time horizons of the government, $0 < \varphi < 1$. The point P depicts the first–best optimum including the optimal growth rate, ϕ^*, and the optimal expenditure ratio, $(\frac{G}{ny})^* = \eta$, whereas the point e describes expenditure ratios and the corresponding growth rate chosen by the egoistic government and given the utility function (14). If $0 \le \varphi < 1$, in point e the expenditure ratio is fixed at a suboptimally high level, $\frac{G}{ny} > \eta$. The consequences of egoistic governmental behavior unequivocally go along with welfare

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[16]In figure 2c 'upper' and 'lower' functions coincide and hence are illustrated by one unique function.

	$\varepsilon = 0$	$\varepsilon > 0$
$\varphi = 1$	$\tau = \eta, \quad \phi = \phi^*$ $\implies \mathcal{U}_e^{max} = W^{max}$	$\tau = \eta, \quad \phi < \phi^*$ $\implies \mathcal{U}_e^{max} \neq W^{max}$
$\varphi < 1$	$\tau > \eta, \quad \phi = \phi^*$ $\implies \mathcal{U}_e^{max} \neq W^{max}$	$\tau > \eta, \quad \phi < \phi^*$ $\implies \mathcal{U}_e^{max} \neq W^{max}$

Table 1: Welfare implications of alternative parameter settings if $\mu = 1$

losses as the government departs from an efficient provision of the public input. In figures 2a–c this is reflected via the movement along the lower function until one reaches the egoistic planner's optimum as indicated by the point e. This point lies the more 'south–east' the lower φ. For decreasing φ the wedge to the optimal expenditure ratio and optimal growth rate increases.

To sum up: If income taxes are the only source of governmental revenues, $\mu = 1$, a bureaucracy that seeks to maximize the growth rate of its budget would choose in any case the optimal expenditure ratio. Financing the provision of the public input exclusively via the income tax rate reduces the growth rate unequivocally. This goes along with welfare losses whenever the public input is not proportionally congested. In case of a proportionally congested input the welfare maximum results as the income tax, while internalizing the external effect of capital accumulation, reduces the suboptimally high growth rate to the optimal level. At the same time the revenues exactly correspond to the optimal amount of the governmental input. Static efficiency and also dynamic efficiency are met. Table 5 summarizes the main results with respect to the tax system that only consists of income taxes.

In case of a *mixed tax system*, $\mu < 1$, the argumentation with respect to the interaction of bureaucratic preferences and the budget is similar. Finally the bureaucrat's time horizon determines the chosen budget. The main difference is that the static efficiency condition (7) is always violated because of the growth maximizing expenditure ratio that is suboptimally high. Hence it is impossible to realize a welfare optimum as consequence of selfish bureaucratic behavior. Even constitutional constraints are not apt to discipline the bureaucracy.

6 Summary

This paper analyzes the effects on the growth rate and the size of government together with the welfare implications in the context of a selfish bureaucracy that provides a congested production input and is confronted by alternative constitutional constraints. The constitutional restriction is modelled as exogenously given relation between distortionary and non–distortionary governmental tax revenues. It is assumed that the bureaucrat maximizes the available budget. Within a dynamic context the budget might be interpreted either in the short, intermediate or long run. With this the time horizon of the bureaucracy gains importance. The short–run budget might be interpreted as expenditure ratio whereas the long–run budget is correlated with the budget's growth rate. There exists a relation between the budgets in the short and the long run that is crucially influenced by the constitutional constraints. The first–best optimum consisting of the optimal growth rate together with the optimal expenditure ratio serves as benchmark to assess the equilibrium in a market economy as well as the decisions of a selfish government. If the governmental input is characterized by congestion a growth reducing income tax internalizes the negative external effect of capital accumulation. It is analyzed under which conditions selfishness of the government might be apt to internalize any external effects. It turns out that a welfare optimum results only under very specific assumptions that must be met simultaneously: a tax system consisting only of income taxes, a productive input that is proportionally congested and a government that maximizes the long–run budget. Under these assumptions the income tax internalizes the negative external effect arising from individual capital accumulation and reducing the excessive growth rate to the optimum. At the same time the amount of revenues coincides with the optimal amount of the public input. All other combinations concerning the tax system, the degree of congestion, the constitutional constraints as well a the time horizon of the planner violates at least one of the two dimensions that characterize the first–best optimum: On the one hand, a reduction in the time horizon leads to a suboptimally high expenditure ratio and with this the static efficiency condition concerning the provision of the public input is not met. Independent of the degree of congestion government in relation to the private sector becomes suboptimally large. If on the other hand the bureaucrat maximizes his long–run budget he also departs from an efficient provision and chooses an inefficiently high expenditure ratio that increases with a reduction in the part of the non–distortionary revenues. Again the

governmental sector becomes suboptimally large. The government then fits the Leviathan hypothesis but might not be disciplined, even by constitutional constraints.

Appendix

Proof of equation (13):

The first derivative of the growth rate $\phi^{D\mu}$ in eq. (12) with respect to the expenditure ratio is given by

(17) $\qquad \dfrac{\partial \phi^{D\mu}}{\partial \frac{G}{ny}} = \dfrac{1-\varepsilon\eta}{\sigma} \left[-\mu f(\cdot) + \left(1 - \mu \dfrac{G}{ny}\right) \dfrac{\partial f(\cdot)}{\partial \frac{G^a}{k}} \cdot \dfrac{\partial \frac{G^a}{k}}{\partial \frac{G}{ny}} \right] \qquad .$

If the productivity function $f(\cdot)$ is homogenous the partial production elasticity of the governmental input may be represented as

(18) $\qquad \eta = \dfrac{G}{ny} f'(\cdot) n^{\varepsilon} \qquad .$

For the production function (3) and the congestion function (4) the relation between the expenditure ratio and the argument in the productivity function, $\frac{G^a}{k}$ is given by

(19) $\qquad \dfrac{\partial \frac{G}{ny}}{\partial \frac{G^a}{k}} = \dfrac{1-\eta}{f(\cdot) n^{\varepsilon}} \qquad .$

Using these relations eq. (17) may be rewritten as

(20) $\qquad \dfrac{\partial \phi^{D\mu}}{\partial \frac{G}{ny}} = \dfrac{(1-\varepsilon\eta)f(\cdot)}{\sigma(1-\eta)} \left[f'(\cdot) n^{\varepsilon} - \mu \right] \qquad .$

Introducing the expenditure ratio as given by eq. (18) into eq. (20) the relation between growth rate $\phi^{D\mu}$ and the expenditure ratio in eq. (13) results.

19

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