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Business Perceptions, Fiscal Policy and Growth

by

Florian Misch, Norman Gemmell and Richard Kneller

Abstract
This paper develops endogenous growth models in which the government uses income taxation to finance different types of public services, public investment, or both. The paper then assesses the merits of business perceptions of alternative fiscal-policy related growth constraints as guides for imperfectly informed governments. The models demonstrate that business perceptions may be misleading except when firms compare different types of public services or different types of public capital. It is also shown that the theoretical predictions regarding how firms most likely rank constraints correspond fairly well to the ranking of constraints by firms in the World Bank's Enterprise Surveys.

JEL Classification: E62, H21, H50, O40

Keywords: Economic Growth, Productive Public Spending, Imperfectly Informed Governments, Optimal Fiscal Policy, Constraints to Growth, Investment Climate Assessments

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Outline

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1 Introduction

Since the original contribution of Devarajan et al. (1996) introduced several types of productive public expenditure into endogenous growth models, a number of subsequent papers have begun to explore optimal allocations of public spending in a variety of model specifications. For example, Agénor and Neanidis (2006), Agénor (2007), Monteiro and Turnovsky (2007) and Semmler et al. (2007) have identified numerous channels through which productive public spending impacts on long-run growth that in turn affect the growth-maximizing policies. They also generally derive rules for optimal fiscal policy in their respective models involving several productive public spending categories. The fiscal policy prescriptions that follow from these rules can be considered as first best. However, when applied to policy-setting in practice they typically require knowledge of complex and hard-to-observe relationships and parameters, about which governments might reasonably be expected to be imperfectly informed. Another strand of the literature, notably Hausmann et al. (2005), has argued that, when the full list of desirable policy changes is unknown or infeasible, removing the *most binding* constraint is most desirable. Business perceptions of constraints to growth such as those included in investment climate assessments represent a source of information that governments can easily use.

Therefore, this paper brings both of these literature strands together, firstly, to consider the extent to which growth is constrained by alternative fiscal policy instruments within endogenous growth models. Secondly, given imperfectly informed governments, how far can evidence on business perceptions of fiscal constraints to growth be used to guide growth-enhancing fiscal policy choices? Since most fiscal policy and growth models predict that fiscal policy affects growth via the impacts of various types of public spending on private sector firms' production, and/or through distorting taxes levied on firms, an interesting question concerns whether the perceptions of private sector firms regarding growth constraints can be expected to accord with the optimal policies that emerge from these growth models. To examine this issue we first consider how firms are predicted to perceive fiscal policy instruments within endogenous growth models. We then make use of the World Bank Enterprise Surveys (WBES) to test the models' predictions. This survey, covering a wide range of businesses in many countries, contains ratings of various aspects of fiscal policy by firm representatives. In particular, the WBES provides comprehensive information on how firms rate alternative fiscal instruments in terms of the severity of the constraints imposed on their performance. They therefore provide a useful indicator of business perceptions regarding binding constraints on growth.

This paper therefore extends the literature in two important ways. The first contribution is to show in which model contexts business perceptions of constraints to growth can be expected with certainty to align with first best optimal policies. To do this, we model business perceptions by exploiting a standard (but often implicit) assumption of endogenous models with public finance that dates back to Barro (1990). Namely, individual firms do not internalize the fact that increasing their output through private investment enables higher levels of productive public spending through increased public revenue. This follows from the assumption that, with a large number of firms, the impact of an increase in an individual firm's output on the amount of public inputs to its production is very small. Under the condition that firms' behavior is consistent in the sense that this assumption always applies, we show that the policy prescriptions that arise from the firms' ranking of constraints are often orthogonal to the 'correct' (i.e. growth-enhancing) policy recommendations. However, we also show that in some specific cases, firms are expected to rank constraints correctly, such that business perceptions provide a reliable guide for optimal fiscal policy choices.

The second contribution is to use the WBES Data to show that our predictions of firms' perceptions regarding fiscal-growth constraints is consistent with empirical observations. This is done by comparing theoretical predictions (derived analytically and numerically) regarding which constraint is likely to be perceived as most binding with WBES evidence. It is shown that regardless of model parameters and actual policies, it is likely that firms perceive the tax rate as a more severe constraint than public *spending*-related constraints, which in turn are likely to be perceived as more severe than public *capital*-related constraints. This model-based ranking provides a close match with the observed rankings of constraints in the World Bank Enterprise Surveys.

The results provide an alternative type of empirical evidence (to the usual regression-based approaches) that some of the specific predictions and assumptions of this class of endogenous growth models are consistent with empirical observations. In addition, they demonstrate those cases where imperfectly informed governments should (or should not) use business perceptions to guide growth enhancing fiscal policy adjustments. Finally, our results have implications for potential design changes in the Enterprise Surveys which could increase their value for policy making.

The paper is organized as follows. Sections 2 to 4 develop the models, derive the equilibrium of the market economy, and identify the first best growth-maximizing policies. Section 5 models business perceptions and assesses their value for policy making. Section 6 derives theoretical predictions regarding firms' ranking of fiscal policy-related constraints, and section 7 tests these against the ranking of constraints by firms in the WBES. Section 8 concludes.

2 The Models

The public finance growth framework we adopt in the paper is based on Devarajan et al. (1996). We assume that there is a large number of infinitely lived households that is normalized to one, and that population growth is zero. The household produces a single composite good which can be used for consumption or private capital accumulation.

Output is produced using private capital (k) which is broadly defined to encompass physical and human capital, and two public inputs, G_1 and G_2, based on CES technology:

$$y = (\theta k^{\upsilon} + \alpha_1 G_1^{\upsilon} + \alpha_2 G_2^{\upsilon})^{\frac{1}{\upsilon}} \qquad (1)$$

where θ, α_1 and α_2 are share parameters with $\theta = 1 - \alpha_1 - \alpha_2$. υ determines the elasticity of substitution which equals

$$s = \frac{1}{1-\upsilon} \tag{2}$$

With $\upsilon = 0$, the production technology is Cobb-Douglas. To capture the notion that factors of production are complements rather than substitutes, it is assumed that $\upsilon \leq 0$. Public inputs provided by the government fundamentally differ from private inputs, such that it may be very costly for firms to substitute for them. For example, poor performance of public law enforcement may require firms to install costly security and property protection systems. G_1 and G_2 are delivered via two different productive public spending categories, g_1 and g_2, and the government finances total public expenditure, $g_1 + g_2$, by levying a flat tax, τ, on income. Thus the government budget, which is assumed always to be balanced, is:

$$g_1 + g_2 = \tau y \tag{3}$$

Let ϕ_1 and ϕ_2 denote the share of the budget that is allocated to g_1 and g_2 so that

$$g_1 = \phi_1 \tau y \tag{4}$$

$$g_2 = \phi_2 \tau y \tag{5}$$

with $\phi_1 + \phi_2 = 1$.

The instantaneous utility function of the household-producer is

$$u(c) = \frac{c^{1-\sigma}}{1-\sigma} \tag{6}$$

Three different versions of the model are considered that slightly differ with respect to how $G_{1,2}$ are derived. In particular, there has been some debate in the literature regarding whether private output is likely to be affected by the flow of public services (e.g. miles of highway constructed per year) or the stock of public capital (total miles of highway in existence).[1] In Model 1, which coincides with the Devarajan et al. (1996) model,

$$G_{1,2} = g_{1,2} = \phi_{1,2} \tau y \tag{7}$$

[1] See for example Barro (1990) and Futagami et al. (1993).

implying that G_1 and G_2 are two different productive public services.

In the second version of the model referred to as Model 2, G_1 denotes public services as above so that

$$G_1 = g_1 = \phi_1 \tau y \tag{8}$$

whereas G_2 denotes the stock of public capital implying that g_2 represents public investment:

$$\dot{G}_2 = g_2 = \phi_2 \tau y \tag{9}$$

With $\upsilon = 0$, this model corresponds to the one developed in Tsoukis and Miller (2003).

In the third version of the model referred to as Model 3, G_1 and G_2 represent two different types of public capital so that

$$\dot{G}_{1,2} = g_2 = \phi_{1,2} \tau y \tag{10}$$

As shown below, all results derived for Model 1 equally apply to Model 3. Table 1 in a later section of the paper includes a summary of the key features of the models described above.

3 The Equilibrium in the Market Economy

This section derives the equilibrium of the market economy in all models. The representative household chooses the consumption path to maximize lifetime utility U given by

$$U = \int_0^\infty u(c(t)) e^{-\rho t} dt \tag{11}$$

subject to the respective production function of the model as well as the household's resource constraint

$$\dot{k} = (1 - \tau) y - c \tag{12}$$

taking τ, G_1, G_2 and $k_0 > 0$ as given.[2] From the first order conditions, the growth rate of the economy can be written in familiar form as

$$\gamma = \frac{\dot{c}}{c} = \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{13}$$

In order to ensure that the transversality condition holds and does not constrain the choice of τ and $\phi_{1,2}$, it is assumed that $\sigma > 1$.[3] In Model 1, there are no transitional dynamics, and the economy is always on the balanced growth path where c, k and y all grow at the same rate. The Appendix shows that the equilibrium of Models 2 and 3 is saddlepoint stable within relevant parameter ranges, and that the balanced growth path is unique.

For simplification, without loss of generality, and to allow for closed-form solutions, Cobb-Douglas technology is assumed to derive the analytical results below (hence $\upsilon = 0$) so that the production function is

$$y = k^{\theta} G_1^{\alpha_1} G_2^{\alpha_2} \tag{14}$$

where $\theta = 1 - \alpha_1 - \alpha_2$.

The representative household producer computes the marginal product of private capital while holding constant the quantity of public inputs to private production received. This likely holds in practice: When there is a large number of tax-paying firms, the impact of raising the stock of the private capital and output of an individual firm on the level of total public spending is likely very small and can therefore safely be ignored. The marginal product of private capital is hence

$$y_k = \theta \left(\frac{G_1}{k}\right)^{\alpha_1} \left(\frac{G_2}{k}\right)^{\alpha_2} \tag{15}$$

so that from (13), the growth rate can be written as

$$\gamma = \frac{\dot{c}}{c} = \frac{1}{\sigma}\left((1-\tau)\theta \left(\frac{G_1}{k}\right)^{\alpha_1} \left(\frac{G_2}{k}\right)^{\alpha_2} - \rho\right) \tag{16}$$

[2] The time subscript is omitted whenever possible. A dot over the variable denotes its derivative with respect to time. In Models 2 and 3, the initial stock of public capital must also be greater than zero.

[3] The transversality condition can be written as $\lim_{t\to\infty}[\lambda k] = 0$ where λ is the costate variable.

4 Growth Maximizing Policies

This section derives the growth-maximizing tax rate, τ^*, and the growth-maximizing share of public resources allocated to each public input to private production ($G_{1,2}$), $\phi^*_{1,2}$, in all versions of the models. In order to find the growth-maximizing policies, $\frac{G_{1,2}}{k}$ must be expressed in terms of the fiscal policy parameters.

Model 1

Based on (4) and (5) public services are given by,

$$G_{1,2} = \tau\phi_{1,2}y \tag{17}$$

Substituting for $G_{1,2}$ in (14) and rearranging yields

$$\frac{y}{k} = \tau_1^{\frac{\alpha_1+\alpha_2}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\phi_2^{\frac{\alpha_2}{\theta}} \tag{18}$$

so that $\frac{G_1}{k}$ and $\frac{G_2}{k}$ can be written as

$$\frac{G_1}{k} = \tau^{\frac{1}{\theta}}\phi_1^{\frac{1-\alpha_2}{\theta}}\phi_2^{\frac{\alpha_2}{\theta}} \tag{19}$$

$$\frac{G_2}{k} = \tau^{\frac{1}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\phi_2^{\frac{1-\alpha_1}{\theta}} \tag{20}$$

Using (19) and (20), the growth rate (16) can be written as

$$\gamma = \frac{\dot{c}}{c} = \frac{1}{\sigma}((1-\tau)\theta\tau^{\frac{\alpha_1+\alpha_2}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\phi_2^{\frac{\alpha_2}{\theta}} - \rho) \tag{21}$$

Maximizing (21) with regard to τ and ϕ_1 yields the growth-maximizing tax rate, τ^*, and the growth-maximizing share of public resources allocated to G_1, ϕ^*_1, such that:

$$\tau^* = \alpha_1 + \alpha_2 \tag{22}$$

$$\phi^*_1 = \frac{\alpha_1}{\alpha_1+\alpha_2} \tag{23}$$

With $\phi_2 = 1 - \phi_1$, the growth-maximizing share of public resources allocated to G_2 is

$$\phi^*_2 = \frac{\alpha_2}{\alpha_1+\alpha_2} \tag{24}$$

Model 2

In this case, G_2 denotes the stock of public capital, and from (9),

$$\dot{G}_2 = \phi_2 \tau y \tag{25}$$

Along the balanced growth path, output can be expressed as

$$y = \frac{\dot{y}}{\gamma} \tag{26}$$

Using (26) to substitute for y in (25), and integrating, yields

$$G_2 = \frac{\tau \phi_2}{\gamma} y \tag{27}$$

Using (17) to substitute for G_1 in (14), using (27) to substitute for G_2 in (14), and rearranging yields:

$$\frac{y}{k} = \tau_1^{\frac{\alpha_1+\alpha_2}{\theta}} \phi_1^{\frac{\alpha_1}{\theta}} \left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} \tag{28}$$

Using (28) to substitute for $\frac{y}{k}$ in (17) and (27) yields expressions for $\frac{G_1}{k}$ and $\frac{G_2}{k}$ which are substituted in (16). It can then be shown that the growth rate in Model 2 has to satisfy the following equation:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)\theta\tau^{\frac{\alpha_1+\alpha_2}{\theta}} \phi_1^{\frac{\alpha_1}{\theta}} \left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} - \rho\right) \tag{29}$$

which is differs from Model 1 because γ appears on the RHS. However, using implicit differentiation, it can be shown that the growth-maximizing tax rate and the growth-maximizing spending share of G_1, τ^* and ϕ_1^*, respectively, are identical to Model 1 when Cobb-Douglas technology is assumed.

Model 3

In Model 3, G_1 and G_2 denote the stock of two different types of public capital and can be expressed by analogy to (27) as:

$$G_i = \frac{\tau \phi_i}{\gamma} y \tag{30}$$

such that the growth rate satisfies the following equation:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)\,\theta\tau^{\frac{\alpha_1+\alpha_2}{\theta}}\left(\frac{\phi_1}{\gamma}\right)^{\frac{\alpha_1}{\theta}}\left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} - \rho\right) \tag{31}$$

The growth-maximizing policies can then be derived in a similar manner to Model 2. With Cobb-Douglas technology, they are also identical to Model 1.

In all models, τ^* and $\phi^*_{1,2}$ are first best policies for a fully informed government. However, due to imperfect knowledge of the production technology parameters, the government may be unable to set τ and ϕ accordingly. The next section considers how far business (firms') assessment of fiscal policy-related constraints to growth can be expected to serve as a reliable guide.

5 Modelling and Assessing the Value of Business Perceptions of Constraints

The first part of this section models business perceptions of fiscal policy-related constraints to growth; the second part assesses whether the fiscal policy adjustments they suggest raise or lower the long-run growth rate. As stated above, firms take the public inputs to private production, G_1 and G_2, as given, and therefore consider each aspect of fiscal policy in isolation. We assume that the behavior of firms is consistent in the sense that this assumption applies both when firms compute the marginal return to private capital, and when they estimate the severity of relevant constraints. The growth rate perceived by firms, corresponding to (16), is therefore:

$$\gamma^B = \frac{1}{\sigma}\left((1-\tau)\theta\left(\frac{G_1}{k}\right)^{\alpha_1}\left(\frac{G_2}{k}\right)^{\alpha_2} - \rho\right) \tag{32}$$

The models presented above contain three fiscal policy-related constraints: τ, G_1 and G_2. The severity of the constraints as perceived by firms can be measured in terms of increases in output, in the growth rate, or in lifetime utility that result from their alleviation. The different measurements may yield conflicting results, especially when growth and welfare maximizing policies differ. Even though in these types of models, household-producers (which are here treated identically with 'firms') maximize lifetime utility (and not output levels or growth), we assume that firms' assessment of the severity of fiscal constraints is with regard to growth. We therefore use the marginal product of the growth rate with respect to G_1, G_2 and τ (denoted as μ_1^B, μ_2^B, and μ_τ^B) as simple measures of the severity of the constraint according to the perceptions of firms; hence

$$\mu_{1,2}^B = \frac{\partial \gamma^B}{\partial G_{1,2}} \tag{33}$$

$$\mu_\tau^B = -\frac{\partial \gamma^B}{\partial \tau} \tag{34}$$

Business perceptions of constraints can be assessed by evaluating the preferred fiscal policies they imply. If $\mu_{1,2}^B > 0$, the business perceptions imply that increasing $\phi_{1,2}$ or τ to raise $G_{1,2}$ has a positive effect on the growth rate. Note that μ_τ^B is defined above as the negative of $\frac{\partial \gamma^B}{\partial \tau}$, such that if $\mu_\tau^B > 0$, business perceptions imply that lowering τ has a positive effect on the growth rate. However, from (32), it is clear that firms always perceive that $\mu_{1,2}^B > 0$ and $\mu_\tau^B > 0$ so that the policy suggestions arising from business perceptions may be conflicting and misleading. The effect of changing $\phi_{1,2}$ or τ obviously depends on whether their current values are at, below, or above their growth-maximizing values, $\phi_{1,2}^*$ and τ^*. This is not surprising, given that the perceived growth rate (32) differs from the actual growth rates in the three models considered - in (21), (29) and (31).

In addition, the policy implications of business perceptions in relative terms can be evaluated. If $\frac{\mu_i^B}{\mu_j^B} > 1$ (with $i, j = 1, 2, \tau$ and $i \neq j$), the policy suggestion is to remove the constraint that is associated with i because it is more binding than the constraint that is associated with j. First, the policy implications of business perceptions of the tax-related constraint is evaluated in terms of the public spending-related constraint. From (33) and (34), $\frac{\mu_\tau^B}{\mu_1^B}$ can be written as

$$\frac{\mu_\tau^B}{\mu_1^B} = \frac{G_1}{(1-\tau)\alpha_1} \tag{35}$$

In Model 1, according to (17), $G_1 = \tau \phi_1 y$. This expression can be used to evaluate (35) in Model 1:

$$\frac{\mu_\tau^B}{\mu_1^B} = \frac{\tau\phi_1}{(1-\tau)\alpha_1}y \tag{36}$$

Suppose that the level of taxation is set at the growth-maximizing level ($\tau = \tau^*$), but the public resource allocation is suboptimal such that $\phi_1 = \frac{1}{2}\phi_1^*$. It is clear that in this case, G_1 represents the most binding constraint (because $\tau = \tau^*$ and $\phi_2 > \phi_2^*$). However, according to the business perception

$$\frac{\mu_\tau^B}{\mu_i^B} > 1 \tag{37}$$

if

$$y > \frac{(1-\tau)\alpha_i}{\tau\phi_i} \tag{38}$$

This condition likely holds true within endogenous growth models regardless of the composition of public spending because y (which constantly grows) is on the LHS. In other words, business perceptions may falsely suggest that the level of the taxation is the most binding constraint and that taxes must therefore be lowered so that there is no certainty if $\frac{\mu_\tau^B}{\mu_1^B}$ provides the 'correct' policy prescriptions. The same result arises in Models 2 and 3 when G_i denotes public capital.

Secondly, the policy implications of business perceptions of the public spending-related constraints are evaluated in relation to each other. From (33), $\frac{\mu_1^B}{\mu_2^B}$ can be written as

$$\frac{\mu_1^B}{\mu_2^B} = \frac{G_2\alpha_1}{G_1\alpha_2} \tag{39}$$

In Models 1 (two public services) and Model 3 (two types of public capital), using (17) and (30), respectively, (39) can be expressed as

$$\frac{\mu_1^B}{\mu_2^B} = \frac{\alpha_1(1-\phi_1)}{\alpha_2\phi_1} \tag{40}$$

For the case where spending shares are set at the growth maximum ($\phi_1 = \phi_1^*$), it can be shown that:

$$\frac{\mu_1^B}{\mu_2^B} = 1 \tag{41}$$

That is, firms perceive both constraints as equally binding when the allocation is optimal in Models 1 and 3 (which is correct as any change in the allocation would lower the growth rate). If, on the other hand, $\phi_1 < \phi_1^*$, then $\frac{\mu_1^B}{\mu_2^B} > 1$ which suggests that G_1 is a greater constraint than G_2. The conclusion from business perceptions would be to increase ϕ_1 which is obviously growth-enhancing. Using numerical examples, the Appendix shows that these results continue to hold when the elasticity of substitution is smaller than in the case of Cobb-Douglas technology.

Third, the policy implications of business perceptions of the public spending-related constraints can be evaluated in relation to each other in Model 2 (one public service and one type of public capital). Using (17) and (30) to substitute for G_1 and G_2 in (39) yields

$$\frac{\mu_1^B}{\mu_2^B} = \frac{\alpha_1(1-\phi_1)}{\gamma\alpha_2\phi_1} \tag{42}$$

In Model 2, there is no closed-form solution of γ, so that (42) cannot be evaluated analytically. However, using numerical examples, it can be shown that in most instances, the policy preferences arising from business perceptions in this case can be expected to be growth-reducing. Suppose for instance $\alpha_1 = \alpha_2$ and $\phi_1 = \phi_1^* = 0.5$. Given that $\gamma < 1$, it can be seen that in this case, $\frac{\mu_1^B}{\mu_2^B} > 1$. This falsely suggests that the government should increase ϕ_1 further above its growth-maximizing value ϕ_1^*. The Appendix provides additional numerical examples with CES production technology that give rise to the same result.

Table 1 summarizes the assessment of business perceptions of different constraints in absolute and relative terms across all models and shows in which cases imperfectly informed governments may use them for policy making. This shows that while the policy implications of the perceived absolute values of each constraint may be growth-reducing, the relative value (ranking) of the public spending related constraints are correct in two of the three models considered. In all models, perceptions of tax-related constraints in terms of public spending related constraints may give rise to growth-reducing policy suggestions. Therefore, business perceptions on constraints to growth

Table 1: Model summary and evaluation of business perceptions

	Model 1	Model 2	Model 3
G_1	public services	public services	public capital
G_2	public services	public capital	public capital
μ_1^B, μ_2^B, μ_τ^B	possibly false	possibly false	possibly false
$\frac{\mu_\tau^B}{\mu_{1,2}^B}$	possibly false	possibly false	possibly false
$\frac{\mu_1^B}{\mu_2^B}$	correct	possibly false	correct

can only be used in limited cases to remedy imperfect knowledge of governments.

6 Firms' Ranking of Constraints: Theoretical Predictions

This section derives theoretical predictions of how firms rank fiscal policy-related constraints based on the models developed in the previous sections. First, the probability that tax rates are perceived as more binding than public spending-related constraints is assessed ($P(\frac{\mu_\tau}{\mu_{1,2}} > 1)$). From (36),

$$\frac{\mu_\tau^B}{\mu_i^B} > 1 \tag{43}$$

if

$$y > \frac{(1-\tau)\alpha_i}{\tau\phi_i} \tag{44}$$

As explained above, this condition likely holds true within endogenous growth models regardless of policy choices and exogenous parameters because y (which constantly grows) is on the LHS. This implies that the probability that taxation is perceived as the most binding constraint is very high in the long-run for all levels of taxation. It can be shown that the same results hold true for Models 2 and 3.

Second, we can compare business perceptions of both public services (Model 1) and public capital (Model 3). From the previous section,

$$\frac{\mu_1^B}{\mu_2^B} > 1 \tag{45}$$

if

$$\phi_1 < \phi_1^* \tag{46}$$

and vice versa. In other words, $\frac{\mu_1^B}{\mu_2^B}$ is determined by actual public spending allocation so that no general predictions regarding business perceptions can be made in these cases.

Third, using Model 2, which includes a productive public service and public capital, the probability that public service-related constraint are perceived as more binding than public capital-related constraints can be assessed. From (42), $\frac{\mu_1^B}{\mu_2^B}$ can be expressed as

$$\frac{\mu_1^B}{\mu_2^B} = \frac{\alpha_1}{\alpha_2}\frac{1}{\gamma}\frac{1-\phi_1}{\phi_1} \tag{47}$$

Using numerical examples, it is possible to assess the probability that $\frac{\mu_1^B}{\mu_2^B} > 1$ and that $\frac{\mu_1^B}{\mu_2^B} < 1$ by determining where in the fiscal policy space these conditions each hold.[4] The fiscal policy space is defined in terms of all possible combinations of both fiscal policy parameters, τ and ϕ, within reasonable ranges. Figures 1 to 3 display the policy space for different exogenous parameter values. The region where $\frac{\mu_1^B}{\mu_2^B} < 1$ is shaded, whereas in the remainder of the policy space, $\frac{\mu_1^B}{\mu_2^B} > 1$. In all cases, the size of the region where $\frac{\mu_1^B}{\mu_2^B} < 1$ (i.e. where firms perceive that public service-related constraints are less binding than public capital-related constraints) is relatively small and its location is relatively distant from ϕ_1^*. Assuming that either all combinations of τ and ϕ are equally likely or assuming that fiscal policies around the growth-maximizing values are more likely, it is quite *unlikely* that $\frac{\mu_1^B}{\mu_2^B} < 1$ provided that public capital is not highly productive and public services are not very weakly productive (α_2 is not extremely large in relation to α_1). In other words, it can be expected that public service-related constraints are likely to be perceived as more severe than public capital-related constraints. This conclusion emerges where 'probability' is assessed in terms of the combinations of τ and ϕ where $\frac{\mu_1^B}{\mu_2^B} > 1$ and $\frac{\mu_1^B}{\mu_2^B} < 1$, respectively.

[4] Again, this expression cannot be evaluated analytically because there is no closed-form solution for γ.

Figure 1: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ in the policy space

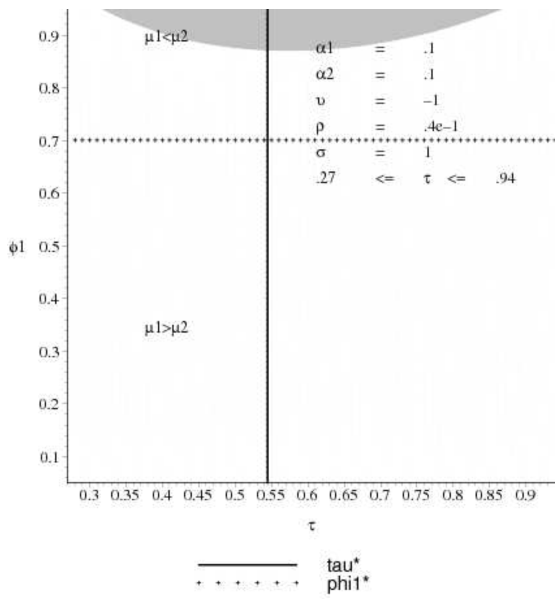


Figure 2: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ in the policy space

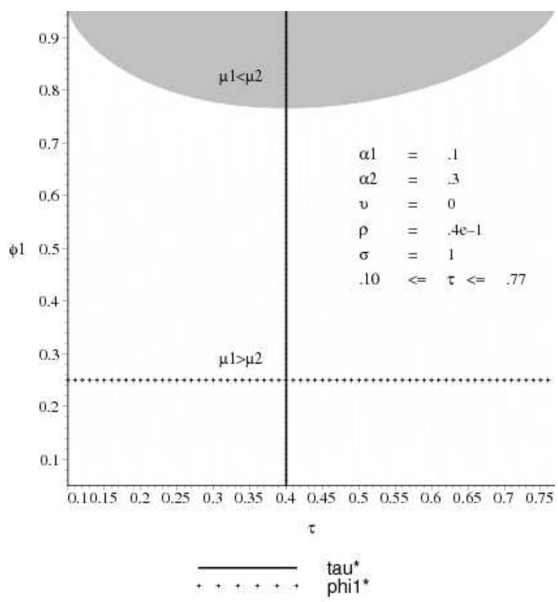
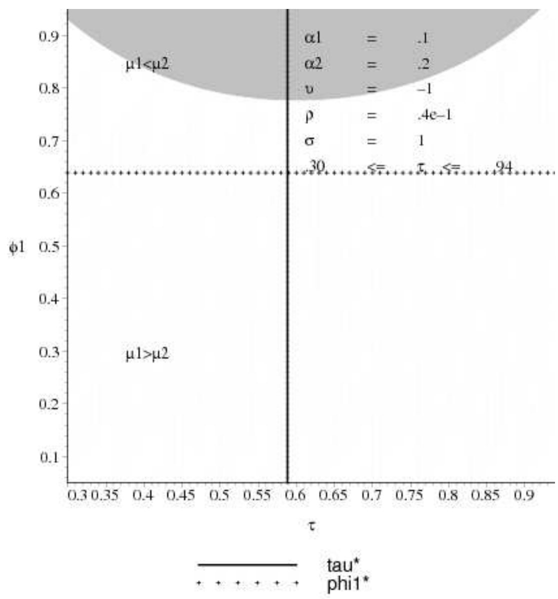


Figure 3: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ in the policy space



In summary, it is likely that firms perceive the tax-related constraint as more binding than public service-related constraints, which in turn, are perceived as more binding than public capital-related constraints ($\mu_\tau > \mu_{ps} > \mu_{pc}$). In contrast, no specific predictions can be made about the relation between two public service-related constraints and two public capital-related constraints. In the models, public capital may represent transportation infrastructure or electricity generation capacity (when undertaken by public entities). Especially transportation infrastructure requires relatively little recurrent spending and depreciates very slowly. Public services may represent education services and law enforcement which both require a large share of recurrent public spending. Table 2 summarizes the key predictions regarding how firms rank constraints.

While firms may rank constraints incorrectly, the way we model business perceptions still suggests that they are to some extent affected by actual policy choices in all cases and that they are hence not fully irrational even if their policy implications might be false. Therefore, our theoretical results do not necessarily contradict the empirical findings in Gelb et al. (2007) who show that there is some correlation between business perceptions and

Table 2: Model predictions regarding the ranking of constraints

	Model 1	Model 2	Model 3
G_1	public service	public service	public capital
G_2	public service	public capital	public capital
predictions	$\mu_\tau^B > \mu_{1,2}^B$, $\mu_1^B \lesseqgtr \mu_2^B$	$\mu_\tau^B > \mu_1^B > \mu_2^B$	$\mu_\tau^B > \mu_{1,2}^B$, $\mu_1^B \lesseqgtr \mu_2^B$

objective country and firm-level indicators.

7 Firms' Ranking of Constraints: Empirical Observations

This section compares the theoretical predictions of how firms rank fiscal policy-related constraints with empirical observations. The WBES data set we use is based on cross-section, firm-level data that covers 26,267 firms in 55 countries. Each of the countries included in the data set was surveyed once or twice between 2002 and 2007.

Though it is clearly difficult to 'test' the predictions from the fairly stylized models considered in this paper against empirical evidence, the Enterprise Surveys provide a potentially useful testing ground. They include a subjective rating of different fiscal policy-related constraints: firm representatives were presented with a list with obstacles which they had to evaluate on a scale that ranges from 0 (no obstacle) to 4 (very severe obstacle). The typical question asked was: "Please tell us if any of the following issues are a problem for the operation and growth of your business. If an issue poses a problem, please judge its severity as an obstacle on a four-point scale".[5] We treat firms' perceived constraints on 'the operation and growth of your business' as representative of their views on constraints to aggregate growth.

Some of the items in the list of obstacles are closely related to fiscal policy. They include transportation, electricity, skills and education of available workers, crime, theft and disorder, tax rates, and, to a lesser extent, tax administration as well as corruption. Governments undertake public investment

[5] This is the question asked in the standard survey design. However, the question may slightly differ for surveys in some countries.

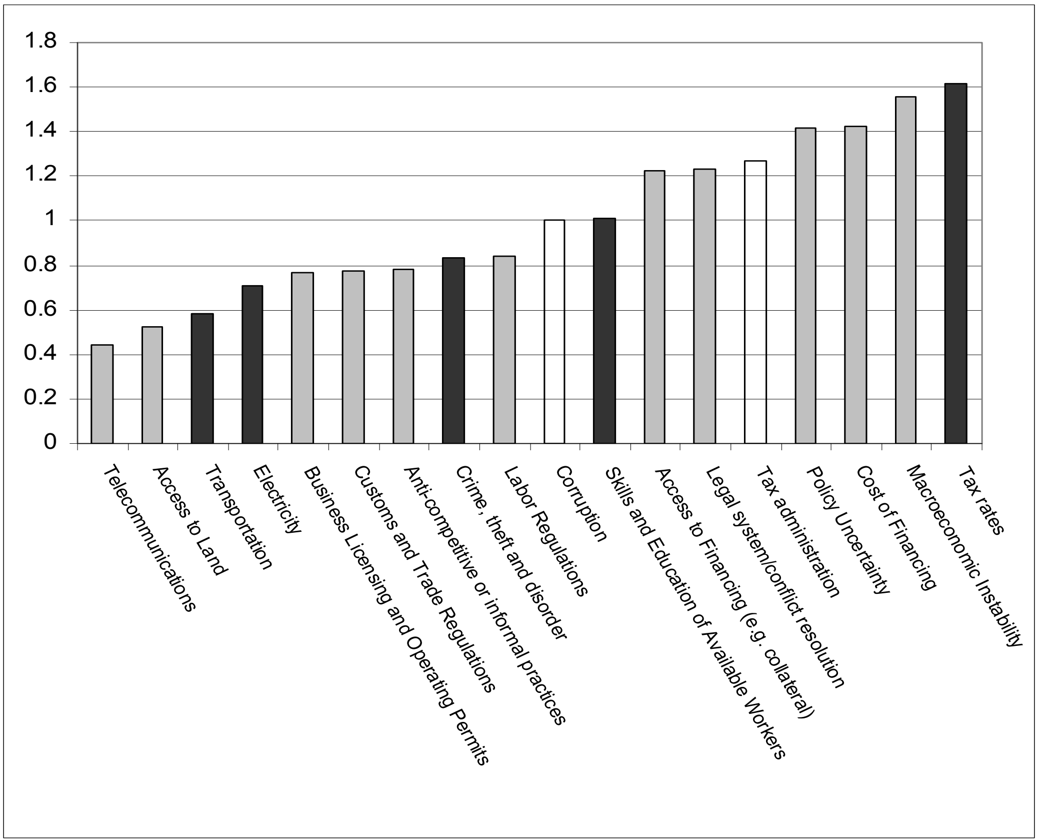
to built up transportation infrastructure and electricity generation capacity (especially in developing countries, electricity is often provided by public entities). Recurrent public spending in the education sector determines to a considerable extent the skills and the education level of available workers[6], and law enforcement by public agencies (which likewise requires recurrent spending to a large extent) determines crime rates. While tax rates are also a central parameter of fiscal policy, the quality of the tax administration as well as the level of corruption depend to some extent on recurrent public spending, but other factors are also likely to play an important role.

The subjective rating of these constraints can be converted into a ranking along the lines discussed in Carlin et al. (2006): The rating of the obstacles of every firm is divided by the mean rating of all obstacles for the same firm. Apart from the fact that the ranking of constraints is more interesting for the purpose of this paper, rankings are also easier to compare across countries and firms than ratings if tendencies to complain differ on average across firms or countries (Carlin et al. (2006)).

The means of these ratios across countries are displayed in Figure 4. It shows that transport and electricity are ranked lower than constraints that require a relatively high share of recurrent spending in order to be alleviated (education, crime and tax administration) which in turn are ranked lower than tax rates.

[6] We assume that the evaluation of the skills of available workers includes an implicit evaluation of public education services.

Figure 4: Mean business perception of fiscal policy-related obstacles



The same pattern emerges within the majority of countries. Figure 5 compares the average ranking of the six fiscal policy-dependent constraints (transportation, electricity, crime, education, tax administration and tax rates). It shows that in almost 60% of the countries, tax rates are ranked first, whereas in almost 70% of the countries, transport or electricity are ranked last.[7] In contrast, there are only a few countries where tax rates are among the four least important obstacles, and transportation is hardly ever ranked among the first three obstacles in any country. It can also be seen that there is no clear rank order between the two public service-related constraints: educa-

[7] It must be noted that for some countries, two or more Enterprise Surveys from different years are available. This is why it is more appropriate to use 'percentage of surveys' rather than 'percentage of countries'.

tion and crime.

Figure 5: Ranking of fiscal policy-dependent constraints by country

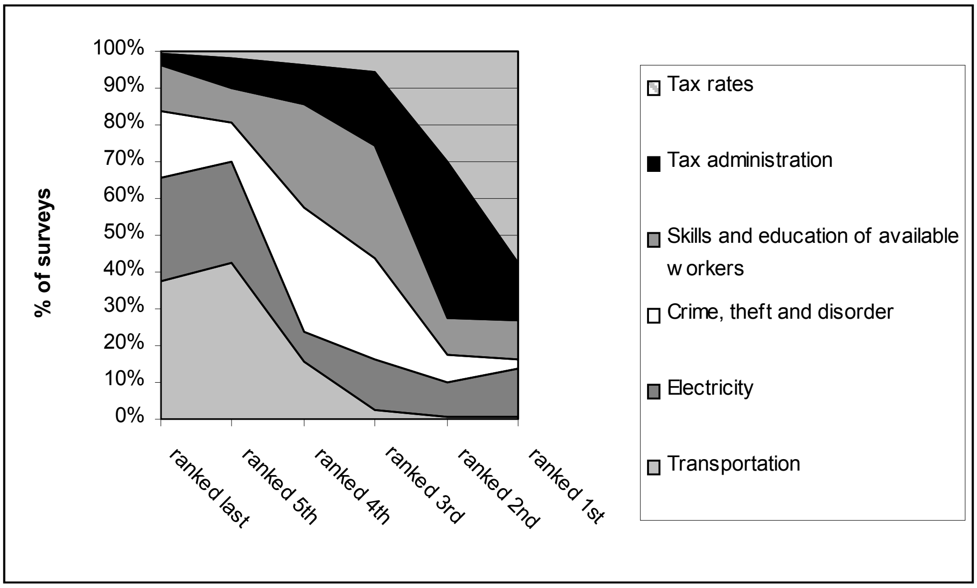
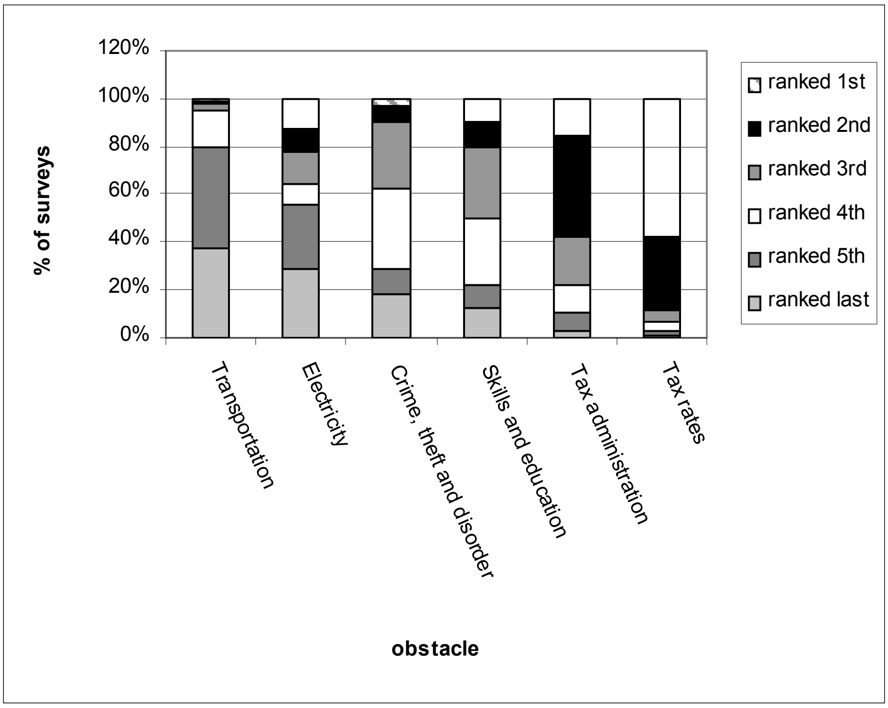


Figure 6 shows the share of countries where on average, a particular obstacle is ranked first, second, third, fourth, fifth and last. The same pattern emerges: It can be seen that the share of countries where transport is ranked last or second last is 80%, whereas the share of countries where tax rates are ranked first is almost 60%.

Thus, the predictions derived from the theoretical models are generally consistent with these empirical observations. Based on the models considered above, we expect that the tax-related constraint is perceived as more binding than the public service-related constraints (crime and disorder, education and skills), which, in turn, are perceived as more binding than public capital related constraints (transportation and electricity). Figures 4 to 6 show that on average, the observed patterns follow these predictions. That is, in most countries, tax rates are perceived as the greatest constraint whereas public capital-related obstacles (transport and electricity) are often perceived as least important. Obstacles that require a higher share of recurrent spending are located in between these extremes. In addition, based on both the data and the models, there is no clear ranking of public spending-related constraints that are similar in terms of their capital or recurrent spending share (e.g. law enforcement for crime prevention and education, and, to a lesser extent electricity and transport).

Figure 6: Ranking of fiscal policy-dependent constraints by country



8 Conclusions

This paper has modelled business perceptions of alternative fiscal policy-related growth constraints. It then considered the merits of these perceptions as guides for policy making in practice, and compared the ranking of constraints by firms in the World Bank's Enterprise Surveys with the predictions of the models developed.

In most cases the models demonstrate that business perceptions may be misleading for policy making in the sense that there is no certainty that the fiscal policy prescriptions they imply are growth-enhancing in the long-run. However, the models examined suggest that firms may be expected to be better at distinguishing the growth-enhancing or retarding effects of similar public spending categories (different public services or different types of public capital). One inference that may be drawn from this is that surveys among firms may provide a more reliable guide to beneficial fiscal policy changes when these involve comparisons across different types of public services or different types of public capital.

Second, it was shown that the theoretical predictions regarding how firms most likely rank fiscal policy-related constraints correspond fairly well to empirical observations, provided that it is not assumed in the theoretical models that public capital is not significantly more productive than public services. A key assumption underlying the results of the paper is that firms treat the supply of public inputs as constant when they increase output. Based on this, the growth-enhancing policy prescriptions identified here appear to be consistent with the empirical data.

Though the results of this paper are derived from relatively abstract models, they have potentially important policy implications. First, they suggest that in some cases, business perceptions can provide a useful indicator where governments have imperfect knowledge regarding likely growth-enhancing fiscal policies. Nevertheless, a problem associated with the use of business perceptions is that they are based on existing firms, and not on potential entrants. Inevitably perceptions of the latter cannot readily be observed, so that surveys must rely on existing firms. Yet it is possible that the constraints on incumbents may differ from those of potential new entrants.

The results here also suggest possible options for the re-design of investment climate surveys. In particular, they suggest that firms's ranking of tax-related constraints may be exaggerated. In addition, they suggest that it would be useful to ask firms to compare different types of public capital, and, in a separate question, to ask firms to compare different types of public services. This would imply to provide firms with a more refined list of obstacles.

The models examined here, and compared with business perceptions, are limited to relatively simple public service/capital distinctions and the channels by which they impact on growth. Possible extensions could include adding additional channels that affect the choice of growth-maximizing fiscal policy, such as indirect effects of public services. Alternatively the framework might be usefully extended to allow for two sectors of production which are affected by productive public services in the spirit of Turnovsky and Monteiro (2007). In addition, it would be interesting to consider whether firms can correctly compare the growth impacts of different types of taxes.

A Appendix

A.1 Uniqueness and Stability in Model 2

Let $x = \frac{c}{k}$ and $z = \frac{G_2}{k}$. Together with the transversality condition, $\lim_{t\to\infty}[\lambda k] = 0$, and with the initial conditions, $x_0 > 0$ and $z_0 > 0$, the dynamics of the market economy can be expressed as a system of two differential equations:

$$\frac{\dot{x}}{x} = \frac{\dot{c}}{c} - \frac{\dot{k}}{k} \tag{A.1}$$

and

$$\frac{\dot{z}}{z} = \frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k} \tag{A.2}$$

From (13), (12) and (25), respectively,

$$\frac{\dot{c}}{c} = \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{A.3}$$

$$\frac{\dot{k}}{k} = (1-\tau)\frac{y}{k} - x \tag{A.4}$$

$$\frac{\dot{G}_2}{G_2} = \phi_2\tau\frac{y}{G_2} \tag{A.5}$$

Setting $\frac{\dot{x}}{x} = 0$ in (A.1) and solving for x yields its steady state value, $\tilde{x}$:

$$\tilde{x} = (1-\tau)\frac{y}{k} - \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{A.6}$$

Using (A.6) to substitute for x in (A.4), and using (A.4) and (A.5) to substitute for $(\frac{\dot{k}}{k})$ and $(\frac{\dot{G}_2}{G_2})$ in (A.2) yields

$$F = \phi_2\tau\frac{y}{G_2} - \frac{1}{\sigma}(1-\tau)y_k + \frac{\rho}{\sigma} \tag{A.7}$$

From (17) and (27),

$$\frac{G_1}{G_2} = \frac{\phi_1}{\phi_2}\gamma \tag{A.8}$$

From (1) and (A.8),

$$\frac{y}{G_2} = (\alpha z^{-\upsilon} + \alpha_1 \left(\frac{\phi_1}{\phi_2}\gamma\right)^{\upsilon} + \alpha_2)^{\frac{1}{\upsilon}} \tag{A.9}$$

Differentiating (1) for k, using (8) to substitute for G_1 and replacing $\frac{G_2}{k}$ by z yields

$$y_k = \left(\theta + \alpha_1 \left(\tau\phi_1 \frac{y}{k}\right)^{\upsilon} + \alpha_2 z^{\upsilon}\right)^{\frac{1}{\upsilon}-1} \theta \tag{A.10}$$

From (1) and (17),

$$\frac{y}{k} = \left(\frac{\theta + \alpha_2 z^{\upsilon}}{(1 - \alpha_1 \phi_1^{\upsilon} \tau^{\upsilon})}\right)^{\frac{1}{\upsilon}} \tag{A.11}$$

After using (A.11) to substitute in (A.10) and (A.9) and (A.10) to substitute in (A.7), it can be seen that if $\upsilon \leq 0$, $\frac{dF}{dz} < 0$ implying that F is a monotonically decreasing function of z so that there is a unique positive value of $\tilde{z}$ that satisfies $F = 0$. From (A.6), there is a unique positive value of $\tilde{x}$ as well. Thus, the growth path is unique.

To investigate the dynamics in the vicinity of the unique steady state equilibrium, equations (A.1) and (A.2) can be linearized to yield

$$\begin{bmatrix} \dot{x} \\ \dot{z} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x - \tilde{x} \\ z - \tilde{z} \end{bmatrix} \tag{A.12}$$

where $\tilde{x}$ and $\tilde{z}$ denote the steady state values of x and z. From (A.1) and (A.2), $\dot{x}$ and $\dot{z}$ can be rewritten as follows:

$$\dot{x} = \left(\frac{\dot{c}}{c} - \frac{\dot{k}}{k}\right)\tilde{x} \tag{A.13}$$

and

$$\dot{z} = \left(\frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k}\right)\tilde{z} \tag{A.14}$$

with $\frac{\dot{c}}{c}$, $\frac{\dot{k}}{k}$ and $\frac{\dot{G}_2}{G_2}$ defined according to (A.3), (A.4) and (A.5). Saddlepoint stability requires that the determinant of the Jacobian matrix of partial derivatives of the dynamic system (A.12) must be negative:

$$\det J = a_{11}a_{22} - a_{12}a_{21} \tag{A.15}$$

Given the complexity of the matrix, it is easier to verify numerically that this condition holds. For most sensible examples with sensible parameter values that we used, this condition is satisfied.

A.2 Uniqueness and Stability in Model 3

With $x = \frac{c}{k}$, $z = \frac{G_2}{k}$ and $w = \frac{G_1}{G_2}$, the dynamics of the market economy can be expressed as a system of three differential equations:

$$\frac{\dot{x}}{x} = \frac{\dot{c}}{c} - \frac{\dot{k}}{k} \tag{A.16}$$

$$\frac{\dot{z}}{z} = \frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k} \tag{A.17}$$

$$\frac{\dot{w}}{w} = \frac{\dot{G}_1}{G_1} - \frac{\dot{G}_2}{G_2} \tag{A.18}$$

From (30), w can be written as

$$w = \frac{\phi_1}{\phi_2} \tag{A.19}$$

Therefore, as long as $\phi_{1,2}$ are constant, $\dot{w} = 0$ and $\frac{\dot{w}}{w} = 0$. This means that in terms of its dynamic properties, Model 3 is identical to Model 2, and it can be shown in the same way as for Model 2 that Model 3 has likewise a unique and saddlepath stable steady state equilibrium.

A.3 The Business Perception of Public Spending-Related Constraints

When the elasticity of substitution is smaller then in the case of Cobb Douglas technology ($\upsilon < 0$), there are mostly no closed-form solutions of the the growth-maximizing policies, τ^* and ϕ^*. Therefore, this appendix evaluates the policy implications of $\frac{\mu_1^B}{\mu_2^B}$ in Models 1, 2 and 3 using numerical examples. Figure 7 which refers to both, Models 1 and 3, confirms that with $\upsilon < 0$, the policy implications of $\frac{\mu_1^B}{\mu_2^B}$ are growth-enhancing when policies are not set at the growth maximum. In contrast, Figure 8 provides a numerical example with CES technology which shows that business perceptions of the public service and public capital related constraints in relation to each other may be misleading (Model 2). Consider the case where $\phi_1 > \phi_1^*$ so that G_2 is more binding than G_1. Figure 8 shows that in this case, it is possible that $\frac{\mu_1^B}{\mu_2^B} > 1$ which suggests increasing ϕ_1 even further.

Figure 7: Models 1 and 3

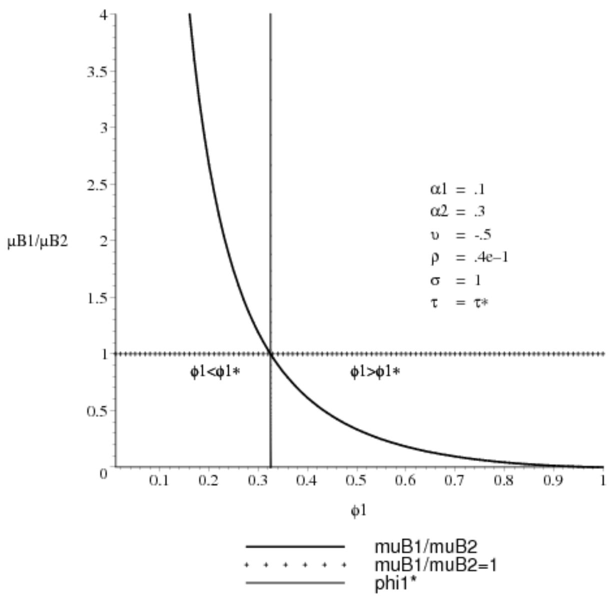
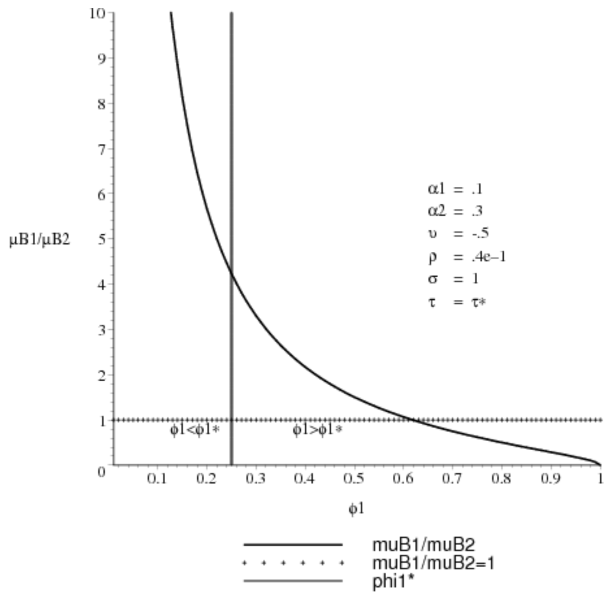


Figure 8: Model 2



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