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Using Surveys of Business Perceptions as a Guide to Growth-Enhancing Fiscal Reforms

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and Richard Kneller

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Non-Technical Summary

Good policy advice, in addition to requiring sound theoretical frameworks to identify growth-enhancing fiscal reforms, also needs a reliable evidence base. Much of this evidence base has traditionally come from applications of econometric methods to various fiscal aggregates. However, concerns have recently been raised over the merits of this type of evidence for policy reform advice in practice; see, for example, Rodrik (2005), Hausmann et al. (2008a). It seems therefore useful to question whether business perception data included for instance in the World Bank Enterprise Surveys (WBES) are a useful additional source of information to guide policy makers' choices. These surveys contain ratings of various factors regarded as 'obstacles' or 'constraints' on firms' growth performance as identified by firm owners or managers. With firms' investment decisions likely to be an important driver of aggregate economic growth, and these investment decisions likely to be affected by firms' perceptions, such perception indicators could potentially be a valuable source of information on actual growth constraints. Indeed, a number of authors have recently argued over the merits of such business survey information as a reliable identifier of actual constraints, and the policy reforms that might follow.

The objective of this paper is to examine whether, and when, subjective perceptions of firms may be a useful source of information to help identify growth-enhancing fiscal reforms. Specifically, adopting the standard theoretical framework for the analysis of fiscal policy and long-run growth, we demonstrate that firms' perceptions can be expected to suffer from particular biases. We show that while these biases can be expected to be important for some fiscal policy reform options, they are not for others. This suggests that it is important to distinguish between the specific contexts in which such business perception information is likely to offer reliable or unreliable guidance to growth-enhancing policy reforms. The essence of our argument is that, in part because of the way business survey questions are constructed, firms' responses can be expected to focus on the direct effects of policies alleviating particular constraints that they see as obstacles, while ignoring the externalities, or indirect effects of these policies. We exploit this assumption to model firm perceptions of fiscal policy-related constraints including taxation and public expenditures taking two different forms: flows of public services and stocks of public capital.

The paper makes two contributions. The first is to evaluate, based on a class of endogenous growth models, whether business perception data could be useful in identifying the optimal direction for fiscal policy reform. We show that, regardless of model parameters, it is likely that firms perceive the (distortionary) tax rate as a more severe constraint than public service-related constraints, which in turn are likely to be perceived as more severe than public capital-related constraints. Firms view fiscal constraints in this order even when taxes and spending are set at their optimal, growth-maximizing values (i.e. where changes to any fiscal parameters would result in declines of the growth rate). However, this framework also predicts that for comparisons of fiscal constraints involving similar types of public spending (e.g. between two public service-related, or two public capital-related, spending categories), business perception data do not suffer from such systematic biases vis-à-vis optimal policy responses.

The second contribution is to compare actual business perception data from the World Bank Enterprise Surveys, and in particular how firms rank fiscal policy-related constraints, with the ranking predicted by the endogenous fiscal-growth framework. We find that the WBES rankings of fiscal policy-related constraints closely match those predicted by the theoretical models.

Das Wichtigste in Kürze

Politikempfehlungen zur Förderung von Wirtschaftswachstum basieren idealerweise auf theoretischen Modellen und auf empirischer Evidenz. Letztere ist traditionell das Ergebnis statistischer Auswertungen von aggregierten fiskalpolitischen Daten mittels Regressionen. In der Literatur werden Politikempfehlungen, die auf dieser Art von empirischer Evidenz basieren, allerdings zunehmend kritisiert, siehe z.B. Rodrik (2005) und Hausmann et al. (2008a). Daher ist es wichtig zu evaluieren, ob Perzeptionen von Unternehmen, die beispielsweise im Rahmen von den Weltbank Enterprise Surveys (WBES) erhoben werden, möglicherweise eine zusätzliche Informationsquelle für fiskalpolitische Entscheidungen von Regierungen darstellen. In diesen Befragungen bewerten Eigentümern bzw. Manager verschiedene Faktoren, die möglicherweise die Performance von Unternehmen beeinträchtigen. Da Investitionsentscheidungen von Unternehmen zentral für makroökonomisches Wachstum sind und möglicherweise von den Perzeptionen der Unternehmen beeinflusst werden, sind perzeptions-basierte Indikatoren potentiell eine wichtige Informationsquelle für tatsächliche Wachstumshindernisse. Mehrere Studien haben in jüngster Vergangenheit den Wert von Unternehmensperzeptionen für wirtschaftspolitische Reformen untersucht.

Das Ziel dieser Studie besteht darin zu bewerten, ob und wann subjektive Perzeptionen von Unternehmen helfen können, spezifische wachstumsfördernde fiskalpolitische Reformen zu identifizieren. Mit Hilfe eines oft benutzten theoretischen Modells für die Analyse von Fiskalpolitik und langfristigem Wachstum zeigen wir, dass Unternehmensperzeptionen verzerrt sind. Diese Verzerrungen spielen eine große Rolle bei der Bewertung einiger, aber nicht aller, fiskalpolitischer Reformoptionen. Dies impliziert, dass es wichtig ist, Fälle, in denen Unternehmensperzeptionen eine verlässliche Informationsquelle darstellen, von anderen Fällen zu unterscheiden. Der Kern unseres Arguments besteht darin, dass Unternehmen vor allem die direkten Effekte bewerten, die aus der Beseitigung bestimmter wachstumshemmender Faktoren entstehen, aber gleichzeitig auftretende Externalitäten weitgehend ignorieren. Diese Modellannahme benutzen wir, um Unternehmensperzeptionen von mit Fiskalpolitik in Verbindung stehenden Wachstumshemmnissen modelltheoretisch abzubilden. Wir untersuchen Steuern, öffentliche Dienstleistungen und den öffentlichen Kapitalstock in unserem Modell.

Diese Studie zeigt erstens, dass Unternehmen unabhängig von Modellparametern verzerrende Steuern als das größte Wachstumshindernis sehen. Öffentliche Dienstleistungen werden von Unternehmen meist als größeres Wachstumshindernis gesehen als Wachstumshindernisse, die mit dem öffentlichen Kapitalstock zusammenhängen. Diese Reihenfolge in der Bewertung von Wachstumshindernissen ergibt sich auch, wenn die Höhe von Steuern und Ausgaben optimal, d.h. wachstumsmaximierend, ist. Gleichzeitig zeigen wir jedoch, dass Unternehmen die relative Wichtigkeit von gleichartigen Wachstumshindernissen (z.B. unterschiedliche Arten von öffentlichen Dienstleistungen) korrekt einschätzen können. Schließlich vergleichen wir die WBES-Daten mit den Vorhersagen unseres Modells. Wir zeigen, dass die beobachteten WBES-Rankings mit unserem Modell konsistent sind.

Using Surveys of Business Perceptions as a Guide to Growth-Enhancing Fiscal Reforms

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Abstract

This paper assesses the merits of using surveys of business perceptions of growth constraints as a guide to growth-enhancing fiscal policy reforms. Using endogenous growth models in which the government levies an income tax to provide public inputs to the production of private firms, the paper demonstrates that business perceptions of growth constraints are subject to systematic biases except when firms compare different types of public services or different types of public capital. In particular firms can be expected to systematically overestimate the growth-enhancing effects of lower tax rates, and underestimate the growth-enhancing effects of greater provision of public capital. It is then shown that these theoretical predictions regarding how firms rank constraints correspond closely to the observed ranking of constraints by firms in the World Bank's Enterprise Surveys.

JEL: D20, E62, O12

Keywords: Economic Growth, Fiscal Policy, Imperfectly Informed Governments, Business Perceptions, Diagnostics, Subjective Data

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1 Introduction

The seminal contributions of Barro (1990) and Devarajan et al. (1996) provided the foundation for what has become a 'standard' theoretical framework to analyze the impact of fiscal policy on long-run growth. Broadly, this involves modelling the distortionary effects of taxation via impacts on the private marginal product of capital, and the productivity-enhancing effects of different types of public spending.[1] Such models capture fiscal externalities in the form of private firm-level productivity effects from public spending and the deadweight costs of taxation. While such frameworks are helpful for thinking at a fairly high level about potential growth effects of fiscal policy, in practice, they provide only limited guidance to policy advisers seeking to identify which particular fiscal reforms (changes in individual tax rates or changes to specific categories of public spending for example) are likely to be growth-enhancing or have the smallest/largest impact. Recently a related but largely separate strand of research has begun to focus on specific policy-based and other constraints on growth; see, for example, Dixit (2007) and Hausmann et al. (2008b) and Rodrik (2010). This conceptual 'growth diagnostic' approach focuses on identifying the most binding constraints on growth in practice and thereby goes beyond the more abstract predictions and policy implications of highly stylized conceptual models.[2] However, good policy advice, in addition to requiring sound theoretical frameworks to identify growth-enhancing fiscal reforms, also needs a reliable evidence base. The objective of this paper is therefore to examine whether, and when, subjective perceptions of firms may be a useful source of information to help identify growth-enhancing fiscal reforms.

Much of the evidence base for policy advice to promote growth has traditionally come from applications of econometric methods to various fiscal aggregates. However, concerns have recently been raised over the merits of

[1] For recent contributions see, for example, Turnovsky (2004), Semmler et al. (2007), Agénor (2008a), Agénor (2008b), Monteiro and Turnovsky (2008).

[2] This strand of the literature argues that removing the most binding constraint of an economy has the largest growth effects; Misch et al. (2010) show that this proposition is indeed optimal under certain conditions in a more formal growth framework.

this type of evidence for policy reform advice in practice; see, for example, Carlin et al. (2010), Rodrik (2005), Hausmann et al. (2008a). It seems therefore useful to question whether business perceptions, such as those provided by the World Bank (World Bank Enterprise Surveys, WBES), are a useful additional source of information to guide policy makers' choices. These surveys contain ratings of various factors regarded as 'obstacles' or 'constraints' on firms' growth performance as identified by firm owners or managers. With firms' investment decisions likely to be an important driver of aggregate economic growth, and these investment decisions likely to be affected by firms' perceptions, such perception indicators could potentially be a valuable source of information on actual growth constraints. Recognizing the potential value of these data does not imply however that we would want to take a view that these data always provide 'useful' information to policy makers, although equally we do not want to take the view that they should never be used.

This type of 'balanced' view must be based on a framework through which to interpret these data. Indeed, a number of authors have recently argued over the merits of such business survey information as a reliable identifier of *actual* constraints, and the policy reforms that might follow.[3] Hallward-Driemeier and Aterido (2009) find that the ratings of a range of obstacles by firms correlate positively with objective measures of the same constraint; by contrast, Clarke (2010) finds that the rating of *specific* obstacles is affected by the managers' *overall* business confidence undermining the potential value for policy of business perceptions. Based on a static model where production requires private and public inputs, Carlin et al. (2007, 2010) mainly examine the ratings of the *same* constraint by *different* firms in different countries and show that ratings of public good-related obstacles are negatively correlated with country-level income and positively correlated with firm-level performance. By contrast, we take a different approach and adopt the standard theoretical framework for the analysis of fiscal policy and long-run growth of both the aggregate economy and a representative firm dating back to Barro

[3]Hausmann et al. (2008a) provide an overview of the general principles needed to identify the most binding constraint on the economy using different sources of data including business perceptions. They suggest that careful use of such perception data is potentially helpful.

(1990) and demonstrate that firms' perceptions, in particular the ranking of *different* fiscal policy-related constraints by the *same* firm, can be expected to suffer from particular biases. While this framework is based on a restrictive set of assumptions, we nevertheless argue that it is particularly well suited to model and assess firms' perceptions of growth constraints, in part due to its simplicity and the resulting clarity of the analysis. We show that these biases can be expected to be important for the evaluation of some fiscal policy reform options, but not for others. This suggests that it is important to distinguish between the specific contexts in which such business perception information is likely to offer reliable or unreliable guidance to growth-enhancing policy reforms.

The essence of our argument is that, in part because of the way business survey questions are constructed, firms' responses can be expected to focus on the *direct* effects of policies alleviating particular constraints that they see as obstacles, while ignoring the externalities, or indirect effects of these policies. Endogenous growth models with public finance involve a direct theoretical counterpart to this: private agents ignore the externalities that arise via the government budget constraint. For instance, they ignore positive externalities from private investment in the sense that increasing output raises public revenue which in turn gives rise to higher productive public spending. We exploit this assumption to model firm perceptions of fiscal policy-related constraints including taxation and public expenditures taking two different forms: flows of public *services* and stocks of public *capital*.

The paper makes two contributions. The first is to evaluate, based on a class of endogenous growth models, whether business perception data could be useful in identifying the optimal direction for fiscal policy reform. We show that it is likely that firms perceive the (distortionary) tax rate as a more severe constraint than public *service*-related constraints, which in turn are likely to be perceived as more severe than public *capital*-related constraints. Firms view fiscal constraints in this order even when taxes and spending are set at their optimal, growth-maximizing values (i.e., where changes to any fiscal parameters would result in declines of the growth rate). However, this framework also predicts that for comparisons of fiscal constraints involving

similar types of public spending (between two public service-related, or two public capital-related, spending categories for example), business perception data do not suffer from such systematic biases vis-à-vis optimal policy responses. Therefore, the perceived ranking of constraints may or may not be correlated with the actual severity of constraints. We show that our conclusions hold for a variety of model parameters such as those that determine the firms' reliance on public services and public capital; we thereby take into account that firms are heterogenous.

The second contribution is to compare actual business perception data from the World Bank Enterprise Surveys, and in particular how firms rank fiscal policy-related constraints, with the ranking predicted by the endogenous fiscal-growth framework. The WBES, covering a wide range of businesses in many countries, provides comprehensive information on how firms rate alternative fiscal instruments in terms of the severity of the constraints imposed on their (growth) performance. We find that the WBES rankings of fiscal policy-related constraints closely match those predicted by the theoretical models and therefore appear to mirror these biases. While based on the data we cannot rule out that the observed WBES ranking may in fact reflect the actual severity of constraints, we nevertheless argue that in the absence of the biases we identify in the model, such an average ranking would be unlikely to arise across a large number of firms.

The paper is organized as follows. Sections 2 and 3 develop the models, derive the equilibrium of the market economy, and identify the first-best growth-maximizing policies. Section 4 models business perceptions, assesses their merits for policy making, and derives theoretical predictions regarding firms' ranking of fiscal policy-related constraints. Section 5 tests the latter against the ranking of constraints by firms in the WBES. Section 6 concludes.

2 The Modelling Framework

The public finance growth framework we adopt in the paper is an extension of the well known model developed by Devarajan et al. (1996). We assume that there is a large number of infinitely lived households and a large number

of firms that are both normalized to one, that population growth is zero, and that there is no entry or exit of firms.

Given that we are not analyzing interactions between firms and focus on the ranking of different constraints by the *same* firm in subsequent sections, we only consider a single representative firm. However, by considering the robustness of the results under a variety of technology parameters, we account for the fact that firms are heterogeneous. The representative firm produces a single composite good 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 Cobb-Douglas technology:

$$y = k^{\theta} G_1^{\alpha_1} G_2^{\alpha_2} \tag{1}$$

where $\theta = 1 - \alpha_1 - \alpha_2$. The productivity of private capital used by the individual firm therefore positively depends on G_1 and G_2 which are provided free of charge by the government at the point of consumption. For instance, private vehicles can be used more productively when the quality of the road network increases.[4]

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:

$$g_1 + g_2 = \tau y \tag{2}$$

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

$$g_1 = \phi_1 \tau y \tag{3}$$

$$g_2 = \phi_2 \tau y \tag{4}$$

with $\phi_1 + \phi_2 = 1$.

[4]Obviously, most public services and types of public capital are subject to congestion which reduces the amount available to the individual firm. Given that modelling congestion complicates the analysis considerably and may prevent long-run growth from arising, we implicitly assume for simplicity, that G_1 and G_2 are non-rival and non-excludable. However, our results would continue to hold with some congestion effects.

The households own the firms and therefore receive all their output net of taxation which they either reinvest in the firms to increase their capital stock or which they use for consumption depending on their preferences and the returns on private capital.[5] Investment by the representative household can therefore be written as

$$\dot{k} = (1 - \tau)y - c \tag{5}$$

The instantaneous utility function of the household is

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

We develop three versions of the model to understand the robustness of the key result of the ranking of various fiscal policy constraints. These accord with different views about whether the productive public inputs (G_1 and G_2) are stocks or flows. 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 (miles of highway constructed per year for example) or the stock of public capital (total miles of highway in existence).[6] In Model 1, which coincides with the Devarajan et a. (1996) model,

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

implying that G_1 and G_2 are two different productive public services which are derived from the flow of public expenditure.

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:

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

[5] Alternatively, we could assume that firms and households are one entity commonly referred to as household producers in the literature.

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

Table 1: Model summary

Model	G_1	G_2
1	public service	public service
2	public service	public capital
3	public capital	public capital

This version corresponds to the model developed in Tsoukis and Miller (2003) for example.

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 includes a summary of the key features of the models described above. Alternatively, we could develop one model with two types of public services and two types of public capital that would allow us to gain exactly the same insights compared to the use of three models. However, while this model would be more realistic, the presentation would be also harder to follow, and there would be no immediate benefits.

The assumption of Cobb-Douglas technology is convenient because it allows for closed-form solutions of optimal policies as shown below, but arguably, it may not be very realistic. In particular, factors of production may be complements, in part because 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. Therefore, in the Appendix, we show that the results also hold for the more general case of CES technology when the elasticity of substitution is smaller than one.

The representative household maximizes 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 given by (5) taking the initial capital stock

$k_0 > 0$ as well as τ, G_1 and G_2 as given.[7] The latter assumption, namely that private agents take all aspects of fiscal policy as given, is crucial for the remainder of the paper and directly follows from the fact that the model economy is populated by a large number of firms and households. From the first-order conditions, the growth rate of the household's consumption and of the economy can be written in familiar form as

$$\gamma = \frac{\dot{c}}{c} = \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{12}$$

The representative household computes the marginal product of private capital (which represents the returns on private capital) from (1) while holding constant the quantity of public inputs to private production that the representative firm it owns receives. Here we are assuming that when there are 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. Hence, the marginal product of private capital is

$$y_k = \theta\left(\frac{G_1}{k}\right)^{\alpha_1}\left(\frac{G_2}{k}\right)^{\alpha_2} \tag{13}$$

so that from (12), the growth rate can be written as

$$\gamma = \frac{1}{\sigma}\left((1-\tau)\theta\left(\frac{G_1}{k}\right)^{\alpha_1}\left(\frac{G_2}{k}\right)^{\alpha_2} - \rho\right) \tag{14}$$

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 $\sigma > 1$.[8] In Model 1, there are no transitional dynamics, and the economy is always on the balanced growth path. 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. Along the balanced growth path, c, k, G_1, G_2 and y all grow at the same rate. Obviously, in this class of models, long-run growth

[7] 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.

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

at the aggregate level is a result of the nature of the firms' production function: the firms' output grows in the long-run due to constant returns to scale in private capital and public inputs which expand in parallel to the firms' capital stock. The growth rate of the representative firm, $\frac{\dot{y}}{y}$, in turn corresponds to (12) and depends on the net return to private capital, $(1-\tau)y_k$, and on the owner's (i.e. the households') preferences represented by σ and ρ.

3 Optimal Fiscal Policy

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 ($G_{1,2}$), $\phi^*_{1,2}$. These growth-maximizing policies provide the benchmark against which business perceptions of policy are then compared below. For simplicity, we assume that the objective of the government is to maximize growth. We recognize that growth- and welfare-maximizing policies may differ in these models, although differences in outcomes are often relatively small as shown by Misch et al. (forthcoming). Firms only consider growth outcomes; for that reason we leave the consideration of welfare maximization to future analysis. In order to find the growth-maximizing policies, $\frac{G_{1,2}}{k}$ must be expressed in terms of the fiscal policy parameters in each model version.

Model 1 (two public services)

Using (7) to substitute for $G_{1,2}$ in (1) and rearranging yields

$$\frac{y}{k} = \tau^{\frac{\alpha_1+\alpha_2}{\theta}} \phi_1^{\frac{\alpha_1}{\theta}} \phi_2^{\frac{\alpha_2}{\theta}} \tag{15}$$

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

$$\frac{G_1}{k} = \tau^{\frac{1}{\theta}} \phi_1^{\frac{1-\alpha_2}{\theta}} \phi_2^{\frac{\alpha_2}{\theta}} \tag{16}$$

$$\frac{G_2}{k} = \tau^{\frac{1}{\theta}} \phi_1^{\frac{\alpha_1}{\theta}} \phi_2^{\frac{1-\alpha_1}{\theta}} \tag{17}$$

Using (16) and (17), the growth rate given by (14) can be re-written as

$$\gamma = \frac{1}{\sigma}((1-\tau)\theta\tau^{\frac{\alpha_1+\alpha_2}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\phi_2^{\frac{\alpha_2}{\theta}} - \rho) \tag{18}$$

Maximizing (18) with regard to τ and ϕ_1 and taking into account that $\phi_2 = 1 - \phi_1$ yields the growth-maximizing tax rate, τ^*, the growth-maximizing share of public resources allocated to G_1, ϕ_1^*, and the growth-maximizing share of public resources allocated to G_2, $(1 - \phi_1^*)$:

$$\tau^* = \alpha_1 + \alpha_2 \tag{19}$$

$$\phi_1^* = \frac{\alpha_1}{\alpha_1 + \alpha_2} \tag{20}$$

$$\phi_2^* = \frac{\alpha_2}{\alpha_1 + \alpha_2} \tag{21}$$

Model 2 (public services and public capital stock)

Using the condition along the balanced growth path:

$$y = \dot{y}/\gamma \tag{22}$$

to substitute for y in (9), and integrating, yields

$$G_2 = \frac{\tau\phi_2}{\gamma}y \tag{23}$$

Further, using (8) and (23) to substitute for G_1 and G_2, respectively, in (1), and rearranging yields:

$$\frac{y}{k} = \tau^{\frac{\alpha_1+\alpha_2}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} \tag{24}$$

Finally, using (24), (22), and (23) in combination with (14), it can then be shown that the growth rate in Model 2 has to satisfy the following equation:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)\theta\tau^{\frac{\alpha_1+\alpha_2}{\theta}}\phi_1^{\frac{\alpha_1}{\theta}}\left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} - \rho\right) \tag{25}$$

which 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 (two public capital stocks)

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 (23) as:

$$G_i = \frac{\tau \phi_i}{\gamma} y \tag{26}$$

such that the growth rate satisfies the following equation:

$$\gamma = \frac{1}{\sigma}\left((1-\tau)\,\theta \tau^{\frac{\alpha_1+\alpha_2}{\theta}} \left(\frac{\phi_1}{\gamma}\right)^{\frac{\alpha_1}{\theta}} \left(\frac{\phi_2}{\gamma}\right)^{\frac{\alpha_2}{\theta}} - \rho\right) \tag{27}$$

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 $\phi_{1,2}^*$ can be considered as optimal policies in a situation where the government is unconstrained and maximizes growth. However, governments are typically constrained in their ability to change various elements of fiscal policy due to legal requirements or commitments such as interest payments that depend on previous accumulated public debt, which generate 'budget rigidities'. More importantly, governments are inevitably imperfectly informed about the production technology parameters required to set τ and $\phi_{1,2}$ to their first-best values. Rather, governments generally face the challenge of identifying growth-enhancing policy changes or reforms that take existing policy as its starting point. The next section considers how far business (firms') assessments of fiscal policy-related constraints to growth can be expected to serve as a reliable guide to identify the direction of fiscal policy parameter changes that enhance growth.

4 Firms' Perceptions of Constraints: Theoretical Predictions

4.1 Modelling Business Perceptions

This sub-section models business perceptions of fiscal policy-related constraints to growth, and in particular the ratings of obstacles provided by

firms in the Enterprise Surveys. This will allow us to assess whether the fiscal policy adjustments they suggest raise or lower the long-run growth rate and thereby align with the first-best policy option chosen by a perfectly informed government that maximizes the growth rate. As part of the Enterprise Surveys, business owners or top managers are typically asked: "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".[9] The list of obstacles that firms are presented includes tax rates, various types of obstacles that relate to publicly provided services and one obstacle that relates to public capital.

We model the firms' perceptions of these types of constraints, namely the tax rate, public services and public capital, as equivalent to the firms' expectations about the impact of relaxing constraints on their growth rate. In our model, these constraints correspond to τ, and G_1 as well as G_2, which, depending on the model version, either represent public services and/or public capital. Note that these constraints are not equivalent to the policy parameters that the government can set, namely τ, ϕ_1 and ϕ_2.

The business perceptions of the severity of these constraints are potentially biased if the central assumption we make holds, namely that business respondents do not internalize the government budget constraint when they are asked to rate fiscal policy-related constraints. This assumption follows directly from the positive investment externality described above and thereby ensures consistency because firms are also assumed to ignore these externalities when they 'compute' the returns on their investment. This assumption is further justified in the presence of a large number of firms: individual firms are unlikely to internalize the positive externalities of private investment, where the latter arise because higher levels of private output result in higher public revenue, which in turn enables higher levels of productive public spending and thereby higher returns to all firms' private capital. Finally, since the way the survey question is framed makes no provision for the existence or the relevance of the government budget constraint, it might be

[9] This is the question asked in the standard survey design. The question may slightly differ for surveys in some countries.

expected to encourage firms to ignore the government budget constraint in the context of the survey.[10]

The rating of the severity of obstacles implies that firms take the public inputs to private production, G_1 and G_2, as given. While firms could in principle rate the severity of the constraints in terms of increases in current output, lifetime utility, or the growth rate, that result from their alleviation, we choose the latter as this is the measure implied by the question asked in the Enterprise Surveys.[11] A natural way to model the answers of the firms in the Enterprise Surveys is therefore to consider the growth effects of relaxing the constraints. We model this as the change in the growth rate that the representative firm expects as a result of raising G_1 and G_2 and lowering τ. We therefore use the derivatives of the growth rate with respect to G_1, G_2 and τ (denoted by μ_1^B, μ_2^B, and μ_τ^B, respectively) as simple measures of the firms' rating of the severity of the constraints; hence:[12]

$$\mu_{1,2}^B = \frac{\partial \gamma}{\partial G_{1,2}} \tag{28}$$

$$\mu_\tau^B = -\frac{\partial \gamma}{\partial \tau} \tag{29}$$

where, based on our assumptions, firms perceive the growth rate, γ^B, as:

$$\gamma^B = \frac{1}{\sigma}\left((1-\tau)\theta\left(\frac{G_1}{k}\right)^{\alpha_1}\left(\frac{G_2}{k}\right)^{\alpha_2} - \rho\right) \tag{30}$$

which corresponds to (14).

[10] Though this assumption seems reasonable in the context of responses to business surveys questions, the political economy literature assessing individuals' or voters' fiscal policy preferences has egun to examine the case where they recognize the government budget constraint; see, for example, Creedy (2008).

[11] The different measures can yield different results, especially where the models imply that growth- and welfare-maximizing policies differ. In Model 1, for example, the growth- and welfare-maximizing fiscal policies coincide under Cobb-Douglas technology because public capital is not included (see Futagami, Morita and Shibata (1993) for comparison).

[12] When we compute the partial derivatives, we implicitely ignore the subsequent change in the capital stock that is a consequence of the second-order response to a change in the change of the capital stock (i.e. a change in the rate of investment). These effects are likely to be small and qualitatively unimportant for our results.

4.2 Assessing Business Perceptions

Business perceptions of constraints can be assessed by evaluating the preferred fiscal policies they imply. If, for instance, $\mu_1^B > 0$, then business perceptions imply that increasing ϕ_1 or τ, in order to raise G_1, 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 $\mu_\tau^B > 0$, businesses perceive that lowering τ has a positive effect on the growth rate. Clearly then, business perceptions will suggest the direction of the appropriate policy response, but will not indicate the magnitude of the change necessary to reach the growth-maximizing point. While this is a limitation of the information that can be gained from business perception data compared to that found from calculating where the growth-maximizing point lies, in practice, budget rigidities and other information limitations often mean that fiscal policy adjustments require recognizing the correct direction, rather than end-point, of reform.

When all fiscal policy parameters are set at their growth-maximizing levels then, in the absence of any systematic bias, firms should perceive none of the constraints as binding, that is: $\mu_{1,2}^B = 0$ and $\mu_\tau^B = 0$. However, it is obvious from equation (30) 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 conflict with 'correct' first-best policy advice. Other things equal, firms always want more spending on productive public inputs and lower taxation.[13] The 'true' effects of changing $\phi_{1,2}$ or τ obviously depend on whether their current values are at, below, or above their growth-maximizing values, $\phi_{1,2}^*$ and τ^*. The source of this systematic bias of business perceptions relates to our assumption that firms ignore the government budget constraint: firms do not consider the negative effects (positive effects) of lowering taxes in terms of lower productive public spending (or increasing spending on public services and public capital in terms of higher taxation). From the models, this is not surprising, given that the expression for the perceived growth rate (30) differs from the growth rates in the three models considered as

[13]The only exception is of course the unrealisitc case when $\tau = 0$ so that $\mu_\tau = 0$ or when G_1 and G_2 are so large so that $\mu_{1,2}^B \approx 0$. Alternatively, $\mu_{1,2}^B \approx 0$ when α_1 and α_2 are very small.

assessed by a perfectly informed government - in (18), (25) and (27). By contrast, a fully informed government essentially assesses the severity of constraints associated with fiscal policy by computing the first derivatives of (18), (25) and (27), depending on the model, with respect to τ, ϕ_1 and ϕ_2. Where policy parameters are already set at their growth-maximizing levels, a fully informed government would not perceive them as binding, so that $\partial\gamma/\partial\phi_{1,2} = \partial\gamma/\partial\tau = 0$.

Comparing the optimal, i.e. first-best policy choices, with those suggested by business perceptions is in essence an analogy to comparisons between investment decisions taken by a central planner and by private agents in a decentralized economy. In both cases, differences arise because of positive investment externalities that are ignored by private agents: private investment raises the stock of private capital resulting in higher output and therefore higher public revenue. Given that the government budget is always assumed to be balanced, increased public revenue leads to higher levels of productive public expenditure which in turn increases private productivity. Ignoring this externality obviously distorts private investment.

We now attempt to correct business perceptions for this bias: instead of considering business perceptions in *absolute* terms, the policy implications of business perceptions are instead evaluated in *relative* terms; i.e. we compare perceptions of different obstacles, by the same firm. If constraint i is perceived as more binding than constraint j (so that $\frac{\mu_i^B}{\mu_j^B} > 1$ with $i, j = 1, 2, \tau$ and $i \neq j$), the policy implication is that removing constraint i raises the growth rate whereas alleviating constraint j enhances the growth rate less or may even lower the growth rate. The underlying rationale is that this may 'cancel out' the systematic bias due to ignoring the government budget constraint inherent in the perception of *all* obstacles. In particular, ignoring the government budget constraint essentially implies that firms ignore the indirect effects of alleviating fiscal policy constraints. In principle, if the indirect effects are approximately similar or are alternatively negatively correlated with the direct growth effects that result from alleviating constraints and that firms perceive (so that the observed direct effects are sufficient to determine the ranking of the constraints), this is a useful strategy. However,

we show in subsequent sub-sections that while our strategy to correct for the bias of business perceptions proves successful for similar types of constraints, some systematic bias may remain when different types of constraints are compared.

4.3 Firms' Comparisons of Different Types of Public Services or of Public Capital

We first turn to 'successful' cases and evaluate the policy implications of business perceptions of similar public spending-related constraints in relation to each other in Model 1 (two different public services) and in Model 3 (two different types of public capital). From (28), $\frac{\mu_1^B}{\mu_2^B}$ can be written as

$$\frac{\mu_1^B}{\mu_2^B} = \frac{G_2\alpha_1}{G_1\alpha_2} \tag{31}$$

A comparison of the perceptions of two types public services or two types of public capital eliminates the potential bias inherent in subjective firm data due to the firms ignoring the government budget constraint. To show this, we use (7) for the case of two public services (Model 1) and (26) for the case of two types of public capital (Model 2) to re-write (31) as

$$\frac{\mu_1^B}{\mu_2^B} = \frac{\alpha_1(1-\phi_1)}{\alpha_2\phi_1} \tag{32}$$

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

$$\frac{\mu_1^B}{\mu_2^B} = 1 \tag{33}$$

That is, firms perceive both constraints as equally binding when the allocation is growth-maximizing in Models 1 and 3. 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 (or vice versa). The conclusion from business perceptions would be to increase ϕ_1 which is obviously growth-enhancing, irrespective of the parameter values of the model. In this case, firm perceptions always align with that which would be suggested by a fully-informed government and therefore business perceptions are of value in this regard and the perceived ranking is correlated with

the actual ranking of growth constraints. Here, the strategy to eliminate the bias inherent in business perceptions by considering them in relative terms is hence successful. This analysis also shows that $\frac{\mu_1^B}{\mu_2^B}$ is determined by actual public spending allocation so that no general predictions regarding the probability that any of the constraints is perceived as more binding than the remaining one can be made.[14]

4.4 Firms' Comparisons of Public Services and Public Capital

This sub-section evaluates the policy implications of business perceptions of the public spending-related constraints in relation to each other in Model 2 (one public service and one type of public capital). In this case, comparing the perceptions of both types of constraints fails to correct the bias in business perceptions. The intuition is that public capital is accumulated over time and grows even in the absence of fiscal policy adjustments. By ignoring the government budget constraint, firms do not take into account these differences.

To show this formally, we substitute for G_1 and G_2 in (31) using (7) and (26):

$$\frac{\mu_1^B}{\mu_2^B} = \frac{\alpha_1(1-\phi_1)}{\gamma\alpha_2\phi_1} \tag{34}$$

That is, compared to (32), in Model 2 γ is added to the denominator of (34). In this model there is no closed-form solution of γ, so that (34) 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

[14] Using numerical examples, the Appendix shows that these results continue to hold when the elasticity of substitution between private and public inputs is smaller than in the case of Cobb-Douglas technology.

rise to the same result.

Using numerical examples, it is also possible to assess the probability that firms perceive public services as a greater constraint than public capital and vice versa by determining where in the fiscal policy space $\frac{\mu_1}{\mu_2} > 1$. The fiscal policy space is defined in terms of all possible combinations of both fiscal policy parameters, τ and ϕ, within certain ranges. Figure 1 displays the fiscal policy space for different exogenous parameter values. It is assumed that $0.05 \leq \phi_1 \leq 0.95$ and that $0.05 \leq \tau \leq 0.94$. The region where $\frac{\mu_1^B}{\mu_2^B} < 1$ is shaded, whereas in the remainder of the policy space, $\frac{\mu_1^B}{\mu_2^B} > 1$. 'Probability' can be 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. The probability then corresponds to the share of the policy space where $\frac{\mu_1^B}{\mu_2^B} > 1$ which has been approximated numerically for each figure.[15] In all cases, $P(\frac{\mu_1}{\mu_2} > 1)$ (i.e. the probability that firms perceive public service-related constraints as more severe than public capital-related constraints) is relatively high and significantly greater than 0.5. This holds even though the output elasticity of public capital, α_2, is three times larger than the output elasticity of public services, α_1, in our simulation, but this may not hold as α_2.increases much further.[16] While these numerical simulations cannot be regarded as representative, they nevertheless demonstrate that in many cases, it can be expected that $\frac{\mu_1}{\mu_2} > 1$ except for relatively high values of ϕ_1.

Now suppose the opposite (and unlikely) case, namely that

$$\frac{\mu_1^B}{\mu_2^B} < 1 \tag{35}$$

implying that firms perceive G_2 (public capital) as more binding than G_1

[15]The area where $\frac{\mu_1^B}{\mu_2^B} > 1$ can be approximated by using the Trapezoidal Rule with an interval length of 0.001 and then divided by the total area of the policy space.

[16]These measures of probability should be considered as a lower bound because the location of the region where $\frac{\mu_1^B}{\mu_2^B} < 1$ is relatively distant from ϕ_1^*. When considering fiscal policy changes around the growth-maximizing values, it is even more *unlikely* that $\frac{\mu_1^B}{\mu_2^B} < 1$ than the overall numerical measures suggest.

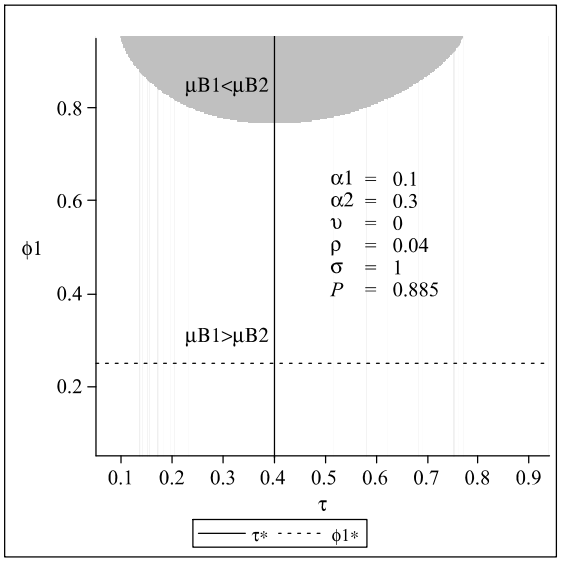

Figure 1: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ in the policy space

(public service). From (34), this implies that

$$\frac{\alpha_1(1-\phi_1)}{\gamma\alpha_2\phi_1} < 1 \tag{36}$$

Rearranging (36) yields

$$\phi_1 > \frac{\alpha_1}{\alpha_1 + \gamma\alpha_2} \tag{37}$$

In turn, if the RHS of (37) is larger than ϕ_1^* so that

$$\frac{\alpha_1}{\alpha_1 + \gamma\alpha_2} > \frac{\alpha_1}{\alpha_1 + \alpha_2} \tag{38}$$

then $\phi_1 > \phi_1^*$. Again, assuming that $0 < \gamma < 1$, then (38) is fulfilled.

In other words, when firms perceive that G_2 (public capital) is a greater constraint than G_1 (public service), then the policy implications of business perceptions of the public service-related constraint in terms of the public capital-related constraint (namely to lower ϕ_1) are growth-enhancing. It follows that when public services are ranked as a more severe constraint to growth than public capital, then according to our model business perception data are not a reliable guide to policy, whereas if public capital is identified as the more severe constraint they are.

4.5 Firms' Comparisons of Taxes and Public Spending-Related Constraints

This sub-section evaluates the policy implications of business perceptions of the tax-related constraint in terms of the public spending-related constraints. From (28) and (29), $\frac{\mu_\tau^B}{\mu_i^B}$ with $i = 1, 2$ can be written as

$$\frac{\mu_\tau^B}{\mu_i^B} = \frac{G_i}{(1-\tau)\alpha_i} \tag{39}$$

This clearly illustrates the problem of comparing the perceptions of the tax-related and the public services-related constraints: the comparison is essentially between the growth effects of an increase in the tax rate by one percentage point with those resulting from an increase in G_i by one unit. As we model the responses of firms in existing business surveys and have to take the questionnaire design as given, normalizing the constraints and measuring them on identical scales as done in Misch et al. (2010) and then asking firms to assess their severity is desirable but not feasible for us.

In order to more rigorously evaluate the merits of this comparison, we substitute for G_i using (7) according to which $G_i = \tau\phi_i y$:

$$\frac{\mu_\tau^B}{\mu_i^B} = \frac{\tau\phi_i}{(1-\tau)\alpha_i} y \tag{40}$$

Suppose that the level of taxation is set at the growth-maximizing level ($\tau = \tau^*$), but that the public resource allocation is suboptimal such that $\phi_i = \frac{1}{2}\phi_i^*$. It is clear that in this case, raising ϕ_i and keeping τ constant would be growth-enhancing. However, according to the business perception

$$\frac{\mu_\tau^B}{\mu_i^B} > 1 \tag{41}$$

if

$$y > \frac{(1-\tau)\alpha_i}{\tau\phi_i} \tag{42}$$

This condition is likely to hold true within endogenous growth models regardless of the composition of public spending and the level of taxation because y (which constantly grows) is on the LHS. Therefore, the probability that tax

rates are perceived as more binding than public spending-related constraints ($P(\frac{\mu_\tau}{\mu_{1,2}} > 1)$) approaches one as time approaches infinity irrespective of the units of measurement of y. As a result, it is uncertain that $\frac{\mu_\tau^B}{\mu_i^B}$ provides the 'correct' (first-best) policy prescriptions. Business perceptions of the appropriate policy response, to lower taxation, may match the first-best policy prescription, but firms support this policy response even when it is not optimal. Separating the occasions in which firm perceptions are correct and when they are incorrect is not possible in this case; hence perception data are not a reliable guide to policy when $\mu_\tau^B > \mu_i^B$.

Given that comparing the tax- and the public services-related constraints to correct for the bias in business perceptions is not feasible due to differences in measurement, an obvious alternative would be to use business perceptions to compute perceived growth elasticities with respect to τ and G_i because elasticities are unit-free. Using (29), (28), and (39) to compute the perceived growth elasticities and dividing yields

$$\frac{\mu_\tau^B}{\mu_i^B}\frac{\tau}{\gamma}\frac{\gamma}{G_i} = \frac{\tau}{(1-\tau)\alpha_i} \tag{43}$$

When the level of taxation is set at the growth-maximizing level ($\tau = \tau^*$), (43) can be rewritten as

$$\frac{1}{(1-\alpha_i)} > 0 \tag{44}$$

which is again greater than zero falsely suggesting that lowering taxation raises the growth rate. The bias therefore remains even in case when perceived elasticities are compared. This implies that the underlying source of the bias is therefore primarily related to firms ignoring the government budget constraint which cannot be corrected by considering business perceptions relative to each other when the constraints are measured on different scales.

Now again suppose the opposite (and unlikely) case, namely that

$$\frac{\mu_\tau^B}{\mu_i^B} < 1 \tag{45}$$

so that

$$y < \frac{(1-\tau)\alpha_i}{\tau\phi_i} \tag{46}$$

Rearranging (46) yields

$$\tau < \frac{\alpha_i}{\phi_i y + \alpha_i} \tag{47}$$

In turn, if the RHS of (47) is smaller than τ^* so that

$$\frac{\alpha_i}{\phi_i y + \alpha_i} < \tau^* \tag{48}$$

then $\tau < \tau^*$. Provided that τ^* is not extremely small, (48) is likely to hold if $\frac{\mu_\tau^B}{\mu_i^B} < 1$. The reason is that the LHS of (48) is decreasing over time (since y which grows indefinitely is in the denominator). (48) together with (47) then implies that $\tau < \tau^*$ is likely. Rearranging (46) yields

$$\phi_i < \frac{(1-\tau)\alpha_i}{\tau y} \tag{49}$$

Again, provided that ϕ_i^* is not extremely small, the RHS of (49) is likely smaller than ϕ_i^* since y, which grows over time, is in the denominator so that

$$\frac{(1-\tau)\alpha_i}{\tau y} < \phi_i^* \tag{50}$$

Therefore, if $\frac{\mu_\tau^B}{\mu_i^B} < 1$, $\phi_i < \phi_i^*$. In other words, the policy implications of $\frac{\mu_\tau^B}{\mu_i^B} < 1$ (i.e. firms perceive that G_i is a greater constraint than τ) are likely to be growth-enhancing in most cases. If public services are ranked as a more severe constraint than taxation, the business perception of the appropriate policy response is identical to the one suggested by a perfectly informed government which maximizes growth. Business perception data contain therefore useful information when $\mu_\tau^B < \mu_i^B$. All results presented here also hold for Models 2 and 3.

4.6 Summary

Table 2 summarizes the assessment of business perceptions of different constraints in relative terms across all models and shows in which cases imperfectly informed governments may regard them as consistent with first-best advice. Perceptions-based rankings of similar types of constraints (i.e. different public services or different types of public capital) give growth-enhancing

policy suggestions, whereas perceptions-based rankings of different types of constraints (tax-related constraints and public spending-related constraints, or public service-related constraints and public capital-related constraints) may give rise to growth-reducing policy suggestions depending on how firms rank them.

The last column of Table 2 summarizes the key predictions regarding how firms rank constraints. 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 ($\mu_{\tau}^{B} > \mu_{ps}^{B} > \mu_{pc}^{B}$). Firms perceive the tax rate as a more severe constraint than public spending-related constraints because whereas public services and public capital enter the expression of the growth rate (14) as absolute values, the tax rate enters (14) as a relative value (i.e. from (2), $\tau = (g_1 + g_2)/y$). The intuition to explain the prediction that firms perceive public service-related constraints as more binding than public capital-related constraints is that public capital grows over time so that the stock of public capital will typically be larger than the flow of public services (i.e. $G_2 > G_1$ in Model 2). With decreasing marginal returns and when $G_2 > G_1$, it is therefore clear that $\mu_{ps}^{B} > \mu_{pc}^{B}$. These biases arise because firms ignore the government budget constraint. In contrast, no specific predictions can be made about the relation between two public service-related constraints and two public capital-related constraints. Table 2 shows, for example, that the probability of firms *falsely* ranking tax constraints as a greater growth constraint than public service or public capital constraints, is high. At the same time, in the unlikely case that firms perceive public services or public capital as a greater constraint than the tax rate, the policy implications of the firms' ranking are likely 'correct' (i.e. growth-enhancing).

5 Firms' Ranking of Constraints: Empirical Observations

This section compares the theoretical predictions of how firms rank fiscal policy-related constraints with the World Bank Enterprise Surveys to identify

Table 2: Evaluation of business perceptions and model predictions with respect to the ranking of constraints

Model	Constraint i	Constraint j	Firm's ranking of i and j	Policy implication of ranking	Ranking probability
1,2	tax	public service	$\mu_i^B > \mu_j^B$ $\mu_i^B < \mu_j^B$	possibly false* correct**	high low
2,3	tax	public capital	$\mu_i^B > \mu_j^B$ $\mu_i^B < \mu_j^B$	possibly false* correct**	high low
1	public service	public service	$\mu_i^B > \mu_j^B$ $\mu_i^B < \mu_j^B$	correct correct	policy dependent policy dependent
2	public service	public capital	$\mu_i^B > \mu_j^B$ $\mu_i^B < \mu_j^B$	possibly false*** correct	high low
3	public capital	public capital	$\mu_i^B > \mu_j^B$ $\mu_i^B < \mu_j^B$	correct correct	policy dependent policy dependent
* assumes that (42) holds; ** assumes that (48) and (50) hold; *** for most plausible numerical values					
(Model 1: two public services; Model 2: one public service and one type of public capital; Model 3: two types of public capital)					

the extent to which these data contain information of use to policy makers. This allows us to assess whether the systematic bias in the ranking of growth constraints by the same firm appears to be present in the data. The WBES dataset we use is based on cross-section, firm-level data that covers almost 94,000 firms in 148 countries that rate at least one of the relevant constraints. Each of the countries included in the dataset was surveyed up to five times between 2002 and 2010 giving a total of 235 different surveys.[17]

The Enterprise Surveys provide a potentially useful testing ground against which the model predictions with respect to the behavior of private agents can be compared. The data includes a subjective rating of different fiscal policy-related constraints: firm representatives were presented a list of obstacles which they had to evaluate on a scale that ranges from 0 (no obstacle) to 4 (very severe obstacle). Some of the items in the list of obstacles are closely related to fiscal policy. They include transportation, skills and education of

[17]The data was downloaded from www.enterprisesurveys.org on July 30th 2010.

available workers, crime, theft and disorder, tax rates, and, to a lesser extent, tax administration. Governments undertake public investment to built up transportation infrastructure.[18] Recurrent public spending to provide public services in the education sector determines to a considerable extent the skills and the education level of available workers[19], and law enforcement by public agencies (which likewise requires especially recurrent spending and only to a lesser extent public investment) determines crime rates. The quality of the tax administration depends to some extent on recurrent public spending, but other factors are also likely to play an important role. In the models, transportation infrastructure which requires relatively little recurrent spending and depreciates very slowly is represented by public capital. Education services, law enforcement and to a lesser extent tax administration may be represented by public services which both require a large share of recurrent public spending. However, the WBES does not contain actual information on deviations of fiscal policy from the growth-maximizing level of taxation, public services and public capital. We turn to this issue at the end of this section.

In general, there are several difficulties involved in the use of subjective data including the reference point bias (i.e. respondents may use different benchmarks against which obstacles are assessed), differences in the overall tendencies to complain, and the performance bias (i.e. whether ratings actually reflect the firm's performance in the environment rather than the environment in which it operates) (Hallward-Driemeier and Aterido (2009) and Clarke (2010)). We address these concerns by converting the subjective rating of constraints into a ranking: the rating of the obstacles of every firm is divided by the mean rating of all obstacles by the same firm.

The means of these ratios across all firms and countries are displayed in

[18] While in some countries, the government builds up electricity generation capacity using public revenue, the role of the government is typically more that of a regulator, and whether electricity is a major obstacle is to a larger extent determined by exogenous shocks such as droughts than in the cases of the other obstacles. We therefore do not consider electricity generation capacity as a fiscal-policy related obstacle.

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

Figure 2. As anticipated by the model it shows that transport is 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. Note also that the three public service categories are rated similarly.

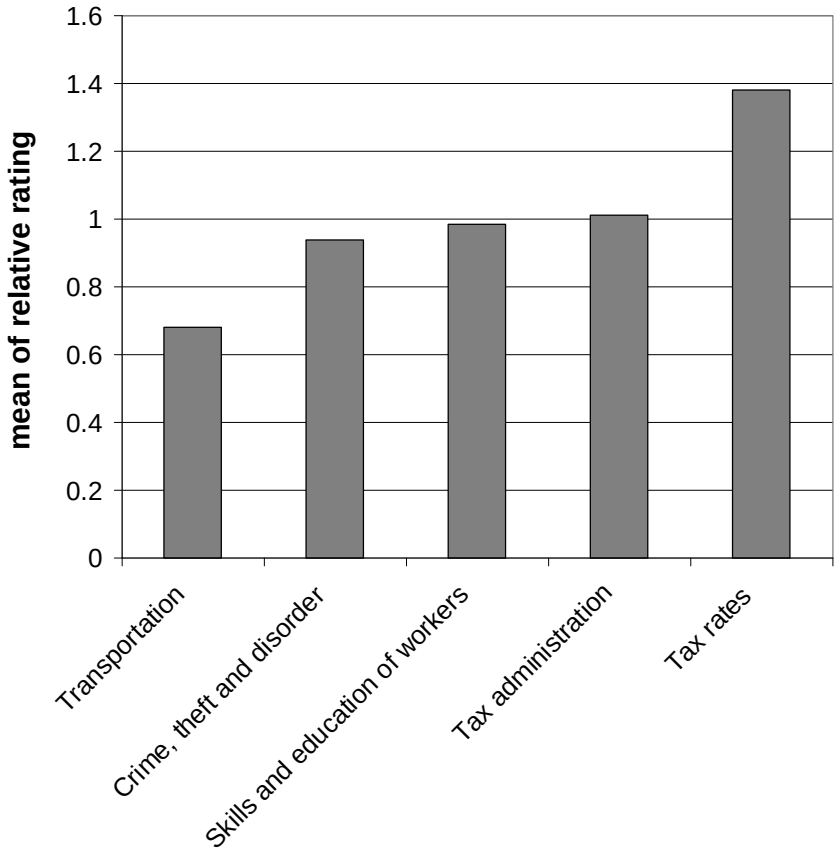

Figure 2: Mean business perception of fiscal policy-related obstacles

While the mean rankings suggest that taxation is usually ranked as the most severe obstacle to growth of the six considered, of greater interest is the distribution of mean rankings across countries. Figure 3 compares the average ranking of the five fiscal policy-dependent constraints (transportation, crime, education, tax administration and tax rates). It shows that in almost 60 percent of the countries, tax rates are ranked first, and in over 50 percent

of the countries, transport is ranked last.[20] In contrast, there are only a few surveys where tax rates are among the three least important obstacles, and transportation is rarely ranked among the first three obstacles. It can also be seen that, as we would predict, there is no clear rank order between the public service-related constraints: education, crime and tax administration.

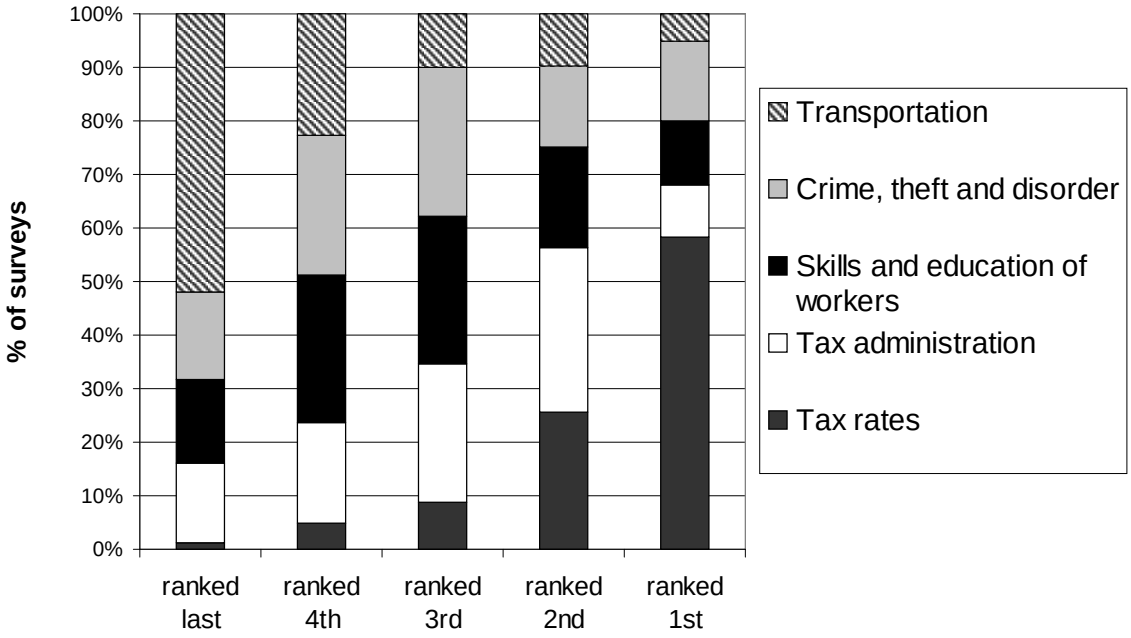

Figure 3: Ranking of fiscal policy-dependent constraints by country

Carlin et al. (2010) also report that tax rates are typically rated as the most severe obstacle in most countries. Based on the endogenous growth models considered above we anticipated that the tax-related constraint would be perceived as more binding than the public service-related constraints (crime and disorder, education and skills), which, in turn, would be perceived as more binding than public capital-related constraints (transportation). Figures 2 and 3 show that on average, the observed patterns follow these predictions, and it is likely that these patterns are not mainly driven by actual fiscal policies but rather by a bias in the perception of firms. For

[20]For some countries, two or more Enterprise Surveys from different years are available. Hence we use 'percentage of surveys' rather than 'percentage of countries'.

these observations the model suggests that there is little reliable information for policy makers. There are however a sufficiently large number of occasions in which fiscal constraints are not in that order to suggest that there is some information within the data. At the simplest level there are for example 40 percent of countries in which taxation is not ranked as the most severe constraint. Indeed there are 104 occasions out of 235 in which one of the remaining five fiscal constraints is rated as more severe than taxation. Or focusing on transportation which is closely related to the stock of public capital, there are 120 occasions out of 235 when this is not ranked as the least important obstacle on growth. The model also suggests that the rankings across different types of public service or different types of public capital are informative.

Given that we are only able to assess the firms' ranking based on the model predictions but not based on objective data on deviations of actual fiscal policy parameters from their growth-maximizing values, we cannot fully rule out that the observed average ranking pattern is driven by the actual severity of constraints. However, this seems unrealistic: on the one hand, if one assumes for simplicity and in the absence of other information that the severity of constraints is equally distributed across constraints (i.e. that on average, the severity of each constraint is identical), such a ranking would not emerge. On the other hand, many policy documents, for instance by international development banks, routinely identify infrastructure as a bottleneck to economic growth, or recommend increasing infrastructure investment. Assuming that on average, this analysis is correct, firms should perceive transport infrastructure as a much more severe constraint if their views were unbiased. However, this is not the case, which makes us confident that our model-based conclusions are correct.

6 Conclusions

This paper has modelled business perceptions of alternative fiscal policy-related growth constraints using an endogenous growth model with public finance. It has 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 model.

The models demonstrate that a 'careful' use of business perceptions of different constraints relative to each other to identify growth-enhancing fiscal policy reforms is possible. According to our framework, business perceptions are not useful to infer the optimal level, the optimal composition and the optimal *magnitude* of policy adjustments. However, it is the *direction* of the policy change which is often most important for policy in practice due to budget rigidities. In this case, business perceptions can provide some useful information. 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). However, the models demonstrate that business perceptions may be misleading when firms are asked to compare taxes, public services and public capital with each other in the sense that there is no certainty that the fiscal policy prescriptions they imply are growth-enhancing in the long run. One exception is that the policy implications from the comparison of different aspects of fiscal policy are likely to be growth-enhancing when they are ranked contrary to the general prediction that taxes are ranked as a more severe constraint than public expenditures, and that public services are likely to be ranked as more severe than public capital.

The theoretical predictions regarding how firms are most likely to rank fiscal policy-related constraints correspond fairly well to empirical observations. While we do not observe the actual ranking of constraints and are therefore unable to compare this to the perceived ranking, we argue that it is likely that the overall pattern we observe is driven by the biases we identify in our models. When constraints are ranked according to the predictions of the model, business perceptions are not reliable for policy analysis. However there are a sufficiently large number of observations for which the model suggests that business perceptions are a useful guide. Therefore, this has been a worthwhile exercise, and our analysis does not suggest that business perceptions never contain useful information.

The results of this paper may also help to interpret findings of empiri-

cal papers that use business perception data as explanatory variables. For instance, Balchin and Edwards (2008) find that business perceptions of infrastructure are mostly not a significant determinants of export participation even though they find that objective infrastructure indicators are to some extent significant. The results of this paper suggest that these findings are not surprising because on average and in comparisons to other constraints, firms do not perceive infrastructure as an important obstacle irrespective of the actual state of the infrastructure.

The results here also suggest possible options for the re-design of investment climate surveys. In particular, they suggest that the firms' 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 provide firms with a more refined list of obstacles, and make their resulting comparisons more meaningful.

Our results only hold within the standard modelling framework we use and the assumptions it is based on. One implication of this framework is that firms in fact do not learn from past mistakes and revise their perceptions accordingly. This is likely to correspond to firm behavior in practice because this would require firms to systematically record their perceptions and fiscal policy changes and compare them to their own growth and investment behavior. However, firms are unlikely to do this because learning would entail cost but no benefits in terms of better firm performance.

While we recognize that alternative frameworks to interpret business perceptions data may be available, we believe our results suggest that endogenous growth models with public finance are a natural 'framework' to provide first steps to understand the value of perception data. Establishing the robustness of those conclusions to alternative frameworks is an obvious next step. 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 for instance include adding further channels that affect the growth-maximizing fiscal policy.

We have shown that business perceptions in absolute terms do not contain useful information for governments. However, we have compared the rating of *different* constraints by a single firm and have shown that such a ranking may be useful for governments. Future research could therefore usefully discuss other types of comparisons. For instance, our framework could be used to compare the rating of the *same* constraint across firms in different sectors or countries more in the spirit of Carlin et al. (2010). This would require models with at least two sectors of production that are affected by productive public services as in Monteiro and Turnovsky (2008). A final extension would be to include other types of business perceptions in the discussion which would require a more complex modelling framework.

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A Appendix

A.1 The Models with CES technology

With CES technology, the production function is

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

where θ, α_1 and α_2 are share parameters with $\theta = 1 - \alpha_1 - \alpha_2$. The elasticity of substitution, s, is determined by υ:

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

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 $\upsilon \leq 0$.

A.2 Uniqueness and Stability in Model 2 with CES Technology

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:

$$\frac{\dot{x}}{x} = \frac{\dot{c}}{c} - \frac{\dot{k}}{k} \tag{A.3}$$

and

$$\frac{\dot{z}}{z} = \frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k} \tag{A.4}$$

From (12), (5) and (9), respectively,

$$\frac{\dot{c}}{c} = \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{A.5}$$

$$\frac{\dot{k}}{k} = (1-\tau)\frac{y}{k} - x \tag{A.6}$$

$$\frac{\dot{G}_2}{G_2} = \phi_2 \tau \frac{y}{G_2} \tag{A.7}$$

Setting $\frac{\dot{x}}{x} = 0$ in (A.3) and solving for x yields its steady state value, $\tilde{x}$:

$$\tilde{x} = (1-\tau)\frac{y}{k} - \frac{1}{\sigma}\left((1-\tau)y_k - \rho\right) \tag{A.8}$$

Using (A.8) to substitute for x in (A.6), and using (A.6) and (A.7) to substitute for $(\frac{\dot{k}}{k})$ and $(\frac{\dot{G}_2}{G_2})$ in (A.4) yields

$$F = \phi_2 \tau \frac{y}{G_2} - \frac{1}{\sigma}(1-\tau)y_k + \frac{\rho}{\sigma} \tag{A.9}$$

where F is a function. From (8) and (23),

$$\frac{G_1}{G_2} = \frac{\phi_1}{\phi_2}\gamma \tag{A.10}$$

From (A.1) and (A.10),

$$\frac{y}{G_2} = (\alpha z^{-\upsilon} + \alpha_1 \left(\frac{\phi_1}{\phi_2}\gamma\right)^{\upsilon} + \alpha_2)^{\frac{1}{\upsilon}} \tag{A.11}$$

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

$$y_k = \left(\theta + \alpha_1 \left(\tau\phi_1 \frac{y}{k}\right)^{\upsilon} + \alpha_2 z^{\upsilon}\right)^{\frac{1}{\upsilon}-1} \theta \tag{A.12}$$

From (1) and (8),

$$\frac{y}{k} = \left(\frac{\theta + \alpha_2 z^{\upsilon}}{(1 - \alpha_1 \phi_1^{\upsilon} \tau^{\upsilon})}\right)^{\frac{1}{\upsilon}} \tag{A.13}$$

After using (A.13) to substitute in (A.12), and (A.11) and (A.12) to substitute in (A.9), 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.8), 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.3) and (A.4) can be linearized to yield

$$\begin{bmatrix} \dot{x} \\ \dot{z} \end{bmatrix} = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix} \begin{bmatrix} x - \tilde{x} \\ z - \tilde{z} \end{bmatrix} \tag{A.14}$$

where $\tilde{x}$ and $\tilde{z}$ denote the steady state values of x and z. From (A.3) and (A.4), $\dot{x}$ and $\dot{z}$ can be rewritten as follows:

$$\dot{x} = \left(\frac{\dot{c}}{c} - \frac{\dot{k}}{k} \right) \tilde{x} \tag{A.15}$$

and

$$\dot{z} = \left(\frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k} \right) \tilde{z} \tag{A.16}$$

with $\frac{\dot{c}}{c}$, $\frac{\dot{k}}{k}$ and $\frac{\dot{G}_2}{G_2}$ defined according to (A.5), (A.6) and (A.7). Saddlepoint stability requires that the determinant of the Jacobian matrix of partial derivatives of the dynamic system (A.14) must be negative:

$$\det J = a_{11}a_{22} - a_{12}a_{21} \tag{A.17}$$

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.3 Uniqueness and Stability in Model 3 with CES Technology

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:

$$\frac{\dot{x}}{x} = \frac{\dot{c}}{c} - \frac{\dot{k}}{k} \tag{A.18}$$

$$\frac{\dot{z}}{z} = \frac{\dot{G}_2}{G_2} - \frac{\dot{k}}{k} \tag{A.19}$$

$$\frac{\dot{w}}{w} = \frac{\dot{G}_1}{G_1} - \frac{\dot{G}_2}{G_2} \tag{A.20}$$

From (26), w can be written as

$$w = \frac{\phi_1}{\phi_2} \tag{A.21}$$

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.

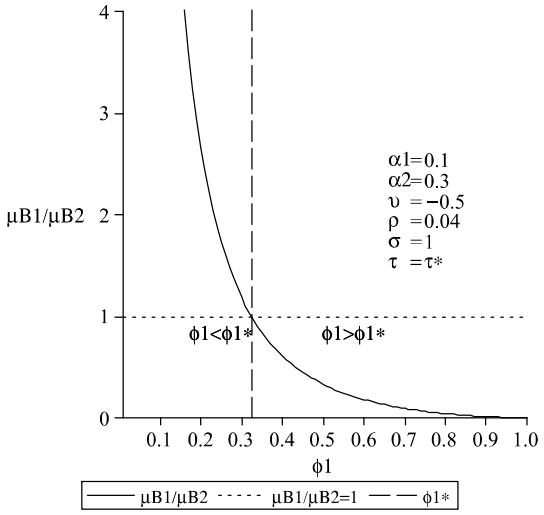

Figure 4: Models 1 and 3 - $\frac{\mu_1^B}{\mu_2^B}$ as a function of ϕ_1

A.4 Business Perceptions of Public Spending-Related Constraints with CES Technology

When the elasticity of substitution is smaller than 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 A.1 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 A.2 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 $\phi_1 > \phi_1^*$. Figure A.2 shows that in this case, it is possible that $\frac{\mu_1^B}{\mu_2^B} > 1$ which suggests increasing ϕ_1 even further.

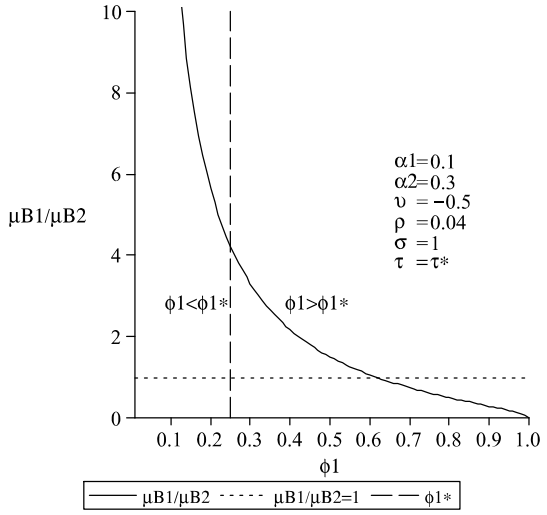

Figure 5: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ as a function of ϕ_1

A.5 The Ranking Probabilities of Public Service- and Public Capital-Related Constraints with CES Technology

This appendix presents numerical examples to derive the probability that $\mu_1^B > \mu_2^B$ in Model 2 (the probability that firms perceive public services as a greater constraint than public capital) in analogy to Figure 1. In Figure A.3, the production technology is CES (with $\upsilon = -1$) which requires that $\tau \geq 0.3$ in order that output is positive. It shows that the probability that $\mu_1^B > \mu_2^B$ (denoted by P) is likewise very high.

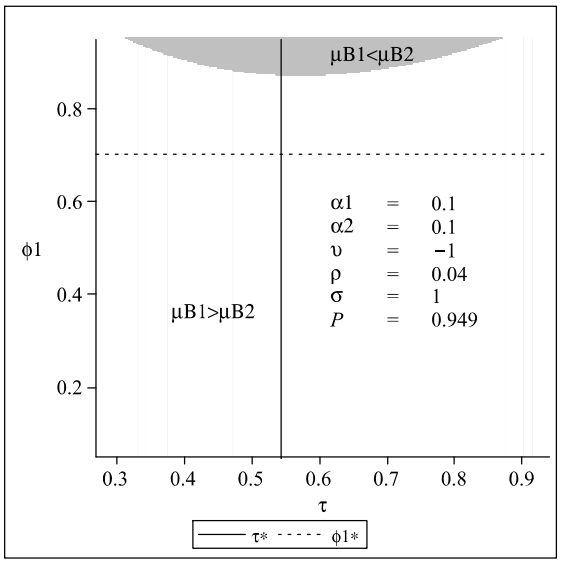

Figure 6: Model 2 - $\frac{\mu_1^B}{\mu_2^B}$ in the policy space