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The political economy of fiscal deficits and government production

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ISSN 1502-8143 (online)
ISBN 978-82-7553-497-0 (online)

The Political Economy of Fiscal Deficits and Government Production

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30.03.2009

Abstract

This paper analyzes a framework where policymakers decide how to spend public resources on physical capital and labor in order to produce two public goods. Candidate policymakers disagree about which goods to produce, and may alternate in office due to elections. When capital and labor are complementary inputs to the production of public goods, the anticipation of political turnover reduces public savings in physical capital rather than financial assets. Political turnover renders the stock of physical capital for public production too low and inefficiently combined with labor.

Keywords: Political economics, budget deficits, public investment.

JEL Classification: E6, H4, H54, H6

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†I am particularly grateful to Steinar Holden. I also thank Nils-Henrik von der Fehr, Jon Fiva, John Hassler, Jo Thori Lind, Ole Christian Moen, Kjetil Storesletten and Tommy Sveen for comments, as well as Duke University where part of this paper was written. The paper has also benefitted from presentations at the University of Oslo, Norges Bank, NTNU, the 3rd NHH-UiO Macro Workshop, EEA 2008, EPCS 2008 and SMYE 2008. Any errors are my own responsibility. A previous version of this paper was circulated under the title "Voting on Government Production".

1 Introduction

How does disagreement between current and future governments influence policy outcomes? This issue is fundamental for understanding fiscal policy in democracies and has motivated a large number of studies. Cornerstones in this literature, and in political economics at large, are the analyses of Tabellini and Alesina (1990) (TA, hereafter) and Alesina and Tabellini (1990). They argue that when current and future policymakers disagree about which public goods government should provide, policy will be biased toward excessively high public deficits. Restricting fiscal policy through balanced budget rules are thus in order. However, these analyses treat the government as a consumer who buys public goods at fixed prices. In reality, on the other hand, governments produce many of the public goods they provide themselves.[1] Furthermore, such production generally requires inputs that differ by the flexibility with which they may be applied. This paper extends TA's model to account for these features. I assume that the production of public goods requires a combination of publicly owned capital that is slowly accumulated and purpose-specific, and labor which is freely determined at any point in time. I find that if physical capital and labor are complementary inputs to public production, expected political turnover will not generate a deficit bias as in TA, but too low investment in physical capital instead.

These results are interesting from both a positive and a normative perspective. On the positive side, several papers have investigated TA's prediction that an incumbent will accumulate more debt when re-election is less likely, including Lambertini (2004), Franzese Jr. (2001) and Petterson-Lidbom (2001). The general conclusion from these studies is a rejection of TA's hypothesis. My framework explains the absence of such a deficit bias, without refuting the politico-economic

[1] For instance, Cavallo (2005) documents that in the U.S. since World War II 63 percent of total government expenditure on consumption and investment was spent on labor, which arguably is best understood as an input to production rather than a final good. Only 21 percent was spent on privately produced goods and services, while 16 percent was spent on investment.

mechanisms in the established literature. The intuitive reason is that by installing purpose-specific capital today, an incumbent influences the allocation of labor chosen by his successor. This ability to influence his successor's spending increases the incumbent's valuation of future public wealth. The more capital and labor complement each other, the stronger is this effect. With an elasticity of substitution between capital and labor that is consistent with available empirical evidence, policymakers will not raise deficits in anticipation of future electoral defeat.

When it comes to the accumulation of capital to be used in public production, I show that it is likely to be reduced by political instability. This holds because a current policymaker about to invest realizes that his successor will allocate labor in a different way than what he, the incumbent, prefers. He therefore anticipates that the capital he builds to produce his most preferred good will be under-utilized relative to the capital he accumulates for production of the other good. Hence, the return to physical capital is reduced by anticipated political turnover. This result may be of relevance for the discussion of why public investment in physical capital has fallen relative to GDP in most OECD countries since the 1970s (Heinemann (2006), Roubini and Sachs (1989)), and whether it has become too low (Aschauer (1989)).[2] It is also consistent with the cross-country evidence in Darby, Li and Muscatelli (2004) that public investments in physical capital are low when political turnover is high.[3]

Furthermore, while a massive amount of research has analyzed public debt and physical capital accumulation separately, this paper treats these two issues jointly. It makes sense to analyze them together because financial assets and physical capital are two alternative means for storing public wealth, and one should therefore

[2] Aschauer (1989) argued that public capital contributes strongly to economic growth and that it was undersupplied in the US. These results have since been subject to an intense debate, surveyed in Romp and de Haan (2007). Importantly, this literature has focused only on parts of the public capital stock, especially infrastructures, whereas the focus of this paper is on public capital at large.

[3] Darby et al. (2004) measure turnover as the share of seats added or lost by each party in government at the previous election.

distinguish between aggregate public savings and the composition of public savings. An insight in my analysis is that the qualitative influence of political turnover on total savings, defined as the sum of bond and physical capital accumulation, is identical to what TA find in their model economy with only financial assets. However, political turnover influences the composition of public savings, as investment in physical capital is reduced relative to bond accumulation when policymakers expect to be replaced in the future.[4]

On the normative side, the model predicts that political turnover leads to resource waist in government production. *Ex post*, governments allocate labor efficiently in the sense that production is on the production frontier given by existing physical capital and technology. However, the allocation of public resources will not generally be on the *ex ante* possibility frontier. If the identity of the decision-maker changes, production of the good that the previous policymaker prefers more strongly than the current policymaker will be too capital intensive, while production of the good that the successor prefers more strongly will be too labor intensive. Hence, more of both goods could have been produced at no expense by reallocating second period capital and labor.

Importantly, this inefficiency is likely not to be influenced by a restriction on government's ability to accumulate debt. Hence, the conclusion in TA that disagreement over the provision of public goods motivates balanced budget rules does not generalize to an economy where these public goods are produced using predetermined and purpose-specific capital.

In addition to TA discussed above, several other studies analyze how strategic considerations influence policy choices when political agents disagree about which goods and services government should provide. Two studies are particularly closely related to this paper. Glazer (1989) shows how an incumbent may invest in durable

[4] Unless otherwise is explicitly stated, the term "capital" in this paper refers to capital used in production of public goods. To avoid confusion with financial capital, i.e. bond holdings in this paper, I will sometimes also use the term "physical capital" to describe capital used in public production.

public consumption so as to ensure that certain services are provided in the future when someone else is in charge. The framework I propose encompasses this as a special case where capital and labor are perfect substitutes in production. Peletier, Dur and Swank (1999) extend TA's analysis by granting governments the option to invest in an additional asset that yields purely financial returns. They show that while an optimal level of financial investments will be chosen if no restrictions on debt accumulation are in place, these investments will be too low if balanced budget requirements are present. Both these studies predict that policymakers accumulate more debt when re-election is less likely. A central contribution of my paper is to show how reasonable assumptions regarding the production technology of the public sector overturns the predictions regarding strategically motivated debt and capital accumulation in a political equilibrium, and potentially brings them closer to existing empirical evidence.[5]

The remainder of this paper is organized as follows. Section 2 presents the model and Section 3 describes its equilibrium. The main results are presented in Section 4, while Section 5 conducts robustness analysis. Section 6 concludes.

2 The Model

The economy is populated by a large number of atomistic individuals who differ by their preferences over two public goods g and f. Individual i's preferences for

[5] Two other analyses of how political considerations affect public investment decisions are Besley and Coate (1998) and Azzimonti (2005). These have in common that public capital is homogenous (and hence is not an object over which there is disagreement) and its role is to enhance private sector productivity and thereby future tax revenues. In their equilibria public investment is too low. Bassetto and Sargent (2006) analyze politically determined investment decisions in an overlapping generations model and show how imperfect altruism for the unborn generations leads to under-investment. Neither of these studies allow the political agents to disagree over different types of capital, or current investment to affect the relative price of different public goods in the future.

public goods in period t are given by

$$u\left(g_t, f_t|\alpha^i\right) = \frac{\left[\left(\alpha^i g_t^{\frac{\phi-1}{\phi}} + \left(1-\alpha^i\right) f_t^{\frac{\phi-1}{\phi}}\right)^{\frac{\phi}{\phi-1}}\right]^{1-1/\sigma}}{1-1/\sigma}, \tag{1}$$

where ϕ is the intratemporal elasticity of substitution between g and f within period t, and σ is the intertemporal elasticity of substitution for public goods measured in "efficiency units", $\left(\alpha^i g_t^{\frac{\phi-1}{\phi}} + \left(1-\alpha^i\right) f_t^{\frac{\phi-1}{\phi}}\right)^{\frac{\phi}{\phi-1}}$. The parameter α_i differs across households.

There are two periods. Each period an elected government receives a given income, normalized to one, in order to provide the two public goods. In period t these goods must be produced with the production functions

$$h_t = h\left(n_t^h, k_t^h\right) = \left(\gamma n_t^{h\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma) k_t^{h\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}} \tag{2}$$

where n_t^h and k_t^h are labor and capital used to produce good h, $h = g, f$, $\varepsilon > 0$ is the elasticity of substitution between capital and labor, and γ is the distribution parameter that determines the labor intensity of public production.

Both capital and labor are in infinitely elastic supply at unit cost one. The amount of labor employed is freely chosen each period. Physical capital, on the other hand, is less flexible as it is chosen one period in advance and specific to the production of each public good.

In period one the government chooses $\left\{n_1^g, n_1^f, k_2^g, k_2^f, b\right\}$, subject to the budget constraint

$$n_1^g + n_1^f + k_2^g + k_2^f = (1-\delta)\left(k_1^g + k_1^f\right) + 1 + b, \tag{3}$$

where δ is the depreciation rate of physical capital, which is identical in the two public production activities. In period two the government chooses $\left\{n_2^g, n_2^f\right\}$ only, subject to the budget constraint

$$n_2^g + n_2^f = 1 - b \tag{4}$$

where b is the amount borrowed in the first period. This asset is traded on the world market, which clears at a net interest rate of zero. Clearly, (4) builds on the assumption that debt is always honored, and it implies that $b \in [-1, 1]$. This budget constraint also implies that public capital is of no value in the second period, apart from its contribution to the production of public goods. Hence, capital is irreversible for the period 2 decision-maker. The initial capital stocks k_1^g and k_1^f are exogenously predetermined.

Representatives from either of two political parties, denoted D and R, can hold office. Their preferences for public goods have the same form as voters', i.e. equation (1), with preference weights α^D and α^R, for party D and R respectively. Party J's preferences for public goods over the two periods are given by

$$W^J = E \sum_{t=1}^{2} u\left(g_t, f_t | \alpha^J\right); \quad J = D, R \tag{5}$$

I restrict attention to cases where $\alpha^J \in \langle 0, 1 \rangle$, and ignore the extreme cases $\alpha^J = \{0, 1\}$.

A period is defined as a term of office. Before period 2 there is an election, which party R wins with probability p_R and party D wins with probability $1 - p_R$.[6] This electoral uncertainty may be due to a random participation rate, for instance due to fluctuating costs of voting or changes in the eligibility of the voting population, as discussed in TA. Alternatively, the source of uncertainty may be random fluctuations in the parties' relative popularity along dimensions of politics that are independent of the composition of public goods.[7]

[6] The period one government is of course also elected, but that election is unimportant for my analysis since I only study choices that are made later in time.

[7] My structure with exogenous re-election probabilities can be rationalized within a proba-

Compared to TA's framework, the crucial distinctions are that I allow for intratemporal non-separability between g and f in utility and that providing public goods requires labor and capital, where the latter is predetermined and hence enters the decision maker's problem as a state variable. Intratemporal separability is encompassed as the special case where $\sigma = \phi$.[8] An environment where public income is converted into public goods at constant unit cost, as considered in TA, is encompassed as the special case where $\gamma = 1$. Clearly, the assumption that capital is completely predetermined while labor is fully flexible is strong, as certain types of capital may be easily sold and rented in the market while some workers have no alternative employers to the public sector. However, the mechanisms in this paper are of a general nature. They only rely on some inputs to public production being more flexible than others.

3 Political Equilibrium

The equilibrium objects of this economy are $\left\{n_1^g, n_1^f, k_2^g, k_2^f, b\right\}$ and $\left\{n_2^g, n_2^f\right\}$. Since first period choices are contingent on second period reactions, the model is solved by backward induction. Furthermore, to keep track of the policymaker's identity, define α_t^J as the preference weight of the party in office in period t.

3.1 The Second Period

In the second period the policymaker, identified by α_2^J, decides how much labor to assign to the production of each good. His problem is

$$\max_{n_2^g, n_2^f} u\left(g_t, f_t | \alpha_2^J\right)$$

bilistic voting model (Persson and Tabellini (2000), Lindbeck and Weibull (1993)), where voters share either of the two parties' preferences for public goods (i.e. $\alpha^i = \left\{\alpha^R, \alpha^D\right\}$), and in addition have a random preference, "ideology", for having a given party in office. Details are available upon request.

[8] Because I allow for intratemporal non-separability, the median voter theorem does not hold. With separability, the median voter theorem applies, as in TA.

subject to (2) and (4). The first-order condition is

$$u_g\left(g_2, f_2|\alpha_2^J\right) g_n\left(n_2^g, k_2^g\right) = u_f\left(g_2, f_2|\alpha_2^J\right) f_n(n_2^f, k_2^f) \tag{6}$$

Together with the budget constraint (4), this equation implicitly defines equilibrium choices $n_2^{g,J*}$ and $n_2^{f,J*}$ as functions of α_2^J, b, k_2^g and k_2^f. Define these functions as

$$n_2^{g,J*} = G\left(\alpha_2^J, b, k_2^g, k_2^f\right)$$

$$n_2^{f,J*} = F\left(\alpha_2^J, b, k_2^g, k_2^f\right)$$

For notational convenience I will hereafter refer to $G\left(\alpha_2^J, b, k_2^g, k_2^f\right)$ as G^J and $F\left(\alpha_2^J, b, k_2^g, k_2^f\right)$ as F^J. Under mild restrictions on the utility and production functions the partial derivatives satisfy $G^J_{\alpha_2^J} = -F^J_{\alpha_2^J} > 0$ and $G_b^J = -1 - F_b^J \epsilon$ $[-1, 0]$, as in TA. These restrictions are $\frac{u_{hh}\left(\cdot|\alpha_2^J\right)}{u_h\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_h\left(\cdot|\alpha_2^J\right)} < 0$, $0 < h_{n_2^{h,J}} < \infty$ and $-\infty < h_{n_2^{h,J} n_2^{h,J}} \leq 0$, for $h = g, f$. Further details are provided in the appendix.

The novelty of this framework relative to TA is that the labor choices depend on purpose-specific capital (k_2^g and k_2^f):

$$\begin{aligned} G^J_{k_2^g} &= -F^J_{k_2^f} \\ &= \frac{-\left[\left(\frac{u_{gg}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)}\right) g_{k_2^{g,J}} + \frac{g_{n_2^{g,J} k_2^{g,J}}}{g_{n_2^{g,J}}}\right]}{\left(\frac{u_{gg}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)}\right) g_{n_2^{g,J}} + \frac{g_{n_2^{g,J} n_2^{g,J}}}{g_{n_2^{g,j}}} + \left(\frac{u_{ff}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)}\right) f_{n_2^{f,J}} + \frac{f_{n_2^{f,J} n_2^{f,J}}}{f_{n_2^{f,J}}}} \end{aligned} \tag{7}$$

$$\begin{aligned} F^J_{k_2^f} &= -G^J_{k_2^f} \\ &= \frac{-\left[\left(\frac{u_{ff}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)}\right) f_{k_2^{f,J}} + \frac{f_{n_2^{f,J} k_2^{f,J}}}{f_{n_2^{f,J}} f_{k_2^{f,J}}}\right]}{\left(\frac{u_{gg}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)}\right) g_{n_2^{g,J}} + \frac{g_{n_2^{g,J} n_2^{g,J}}}{g_{n_2^{g,J}}} + \left(\frac{u_{ff}\left(\cdot|\alpha_2^J\right)}{u_f\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_g\left(\cdot|\alpha_2^J\right)}\right) f_{n_2^{f,J}} + \frac{f_{n_2^{f,J} n_2^{f,J}}}{f_{n_2^{f,J}}}} \end{aligned} \tag{8}$$

The signs of these reactions are ambiguous. To gain insight, it is useful to consider them under the specific functional forms for utility and production technology displayed in equations (1) and (2). With these functional forms the denominators in (7) and (8) are negative, while the numerators may be written as $\left[\frac{h\left(n_2^h,k_2^h\right)}{k_2^h}\right]^{1/\varepsilon}\left[\frac{1}{\phi}-\frac{1}{\varepsilon}\right]$ for $h=g,f$. Hence, it follows that $G_{k_g}^J>0$ if and only if the elasticity of substitution between the different goods in the utility function (ϕ) is larger than the elasticity of substitution between the inputs of g-production (ε), and vice versa. The intuition is that an extra unit of physical capital has two opposing effects on labor demand in period two. On the one hand, an extra unit of k_2^g increases the marginal productivity of labor in the production of g_2 to the extent that the two input factors are complementary in production. All else equal this motivates the second period policymaker to allocate labor to the g-sector. On the other hand, since the utility function is concave in any specific good, the increase in g-goods when k_2^g increases makes the marginal utility of g-goods fall. This motivates moving labor from g-production to f-production. Hence, the use of labor in g-production increases with the amount of capital installed there if and only if the degree to which k_2^g substitutes for n_2^g in production (ε) is lower than the degree to which g_2 substitutes for f_2 in consumption (ϕ).

The above result holds somewhat more generally, as summarized in the following proposition:

Proposition 1 *Assume that $u\left(g_t,f_t|\alpha_2^J\right)$ is homogenous in g and f, and that $h\left(n_t^h,k_t^h\right)$ is homogenous of degree one in n^h and k^h with $0<h_{n_2^h}<\infty$ and $-\infty<h_{n_2^h n_2^h}\leq 0$ ($h=g,f$). Then $\frac{dn_t^{h,J}}{dk_t^h}\gtreqless 0 \Leftrightarrow \Phi\left(g_t,f_t\right)\gtreqless\epsilon\left(n_t^h,k_t^h\right)$, where $\Phi\left(g_t,f_t\right)$ is the elasticity of substitution between g and f in utility and $\epsilon\left(n_t^h,k_t^h\right)$ is the elasticity of substitution between k_t^h and n_t^h in production of good h.*

Proof. See appendix. ■

3.2 The First Period

For convenience, introduce the notation $h_2^J = h\left(n_2^{h,J}, k_2^h\right)$, and assume, without loss of generality, that the office-holder in period one is from party R. The policymaker in period one solves the following problem:

$$\max_{n_1^g, n_1^f, k_2^g, k_2^f, b} u\left(g_1, f_1|\alpha^R\right) + p_R u\left(g_2, f_2|\alpha^R\right) + (1-p_R)\, u\left(g_2^D, f_2^D|\alpha^R\right)$$

subject to the production technology (2), the budget constraint (3) and the reaction functions (7) and (8). Thus, the first period decisionmaker acknowledges how his investment choices will influence second period outcomes. A solution to this problem must satisfy

$$u_g\left(g_1, f_1|\alpha^R\right) g_n\left(n_1^g, k_1^g\right) = u_f\left(g_1, f_1|\alpha^R\right) f_n(n_1^f, k_1^f) \tag{9}$$

$$\left\{\begin{array}{c} u_g\left(g_1, f_1|\alpha^R\right) g_n\left(n_1^g, k_1^g\right) \\ -p_R\left[u_g\left(g_2^R, f_2^R|\alpha^R\right) g_n\left(n_2^{g,R}, k_2^g\right)\right] \\ +\left(1-p_R\right)\left[\begin{array}{c} u_g\left(g_2^D, f_2^D|\alpha^R\right) g_n(n_2^{g,D}, k_2^{g,D}) G_b^D \\ +u_f\left(g_2^D, f_2^D|\alpha^R\right) f_n(n_2^{f,D}, k_2^{f,D}) F_b^D \end{array}\right] \end{array}\right\} = 0 \tag{10}$$

$$\left\{\begin{array}{c} -u_g\left(g_1, f_1|\alpha^R\right) g_n\left(n_1^g, k_1^g\right) \\ +p_R\left[\begin{array}{c} u_g\left(g_2^R, f_2^R|\alpha^R\right) g_k(n_2^{g,R}, k_2^g) \end{array}\right] \\ +\left(1-p_R\right)\left[\begin{array}{c} u_g\left(g_2^D, f_2^D|\alpha^R\right) g_n(n_2^{g,D}, k_2^g) G_{k_2^g}^D \\ +u_f\left(g_2^D, f_2^D|\alpha^R\right) f_n(n_2^{f,D}, k_2^f) F_{k_2^g}^D \\ +u_g\left(g_2^D, f_2^D|\alpha^R\right) g_k(n_2^{g,D}, k_2^g) \end{array}\right] \end{array}\right\} = 0 \tag{11}$$

$$
\left\{ \begin{array}{c} -u_g\left(g_1, f_1|\alpha^R\right) g_n\left(n_1^g, k_1^g\right) \\ +p_R\left[\begin{array}{c} u_f\left(g_2^R, f_2^R|\alpha^R\right) f_k(n_2^{f,R}, k_2^f) \end{array}\right] \\ (1-p_R)\left[\begin{array}{c} u_g\left(g_2^D, f_2^D|\alpha^R\right) g_n(n_2^{g,D}, k_2^g) G^D_{k_2^f} \\ +u_f\left(g_2^D, f_2^D|\alpha^R\right) f_n(n_2^{f,D}, k_2^f) F^D_{k_2^f} \\ +u_f\left(g_2^D, f_2^D|\alpha^R\right) f_k(n_2^{f,D}, k_2^f) \end{array}\right] \end{array} \right\} = 0 \qquad (12)
$$

in addition to the budget constraint (3). These are the first-order conditions for labor use, debt accumulation, investment in the g-sector and investment in the f-sector, respectively.

3.3 Solution of the Model and Parametrization

The model cannot be solved analytically, except under certain specific parametrizations of the production and utility functions. For instance, when $\varepsilon = \sigma = \phi = 1$, policymakers do not respond to variation in their re-election probability.[9] To obtain more general results I numerically solve the set of equations composed by the first-order conditions and budget constraints. This will allow us to study the political equilibrium under an empirically plausible set of parameter values, and to vary these parameters in order to understand the important mechanisms at work. The benchmark set of parameter values is given in Table 1. They are motivated by the following considerations.

One period in the model is to be interpreted a term of office, which typically is around 4 years. Hence, the value assigned to δ is consistent with a yearly depreciation rate slightly below 5 percent, which is within the range that Blanchard and Giavazzi (2004) and Kamps (2004) argue is empirically reasonable for public capital.[10] To quantify the elasticity of substitution between capital and labor, ε,

[9] Analytical details are available upon request.

[10] Blanchard and Giavazzi (2004) argue that a 5 percent yearly depreciation rate is reasonably consistent with observed public physical capital investment in Germany and Italy. Based on data on capital accumulation in 22 OECD countries, Kamps (2004) argues that the yearly depreciation rate on public capital has risen from 2.5 percent in 1960 to 4 percent in 2001.

I lean on estimates of macroeconomic production functions. Two recent examples using U.S. time series are Klump, McAdam and Willman (2007), who estimate the elasticity of substitution to be between 0.5 and 0.6, and Antràs (2004), who concludes more generally that the elasticity is "likely to be considerably less than one". A priori there is no reason believe that capital-labor substitutability is very different in the public sector. I therefore set ε to 0.7.

The value assigned to the distribution parameter γ is based on the evidence for US government expenditure in Cavallo (2005). He documents that in the post-war period wage expenditure has accounted for 63 percent of total government spending on consumption and investment, while investment has accounted for 16 percent. The remaining 21 percent has been purchases of privately produced goods and services. It is unclear whether this last component should be categorized as capital or labor in terms of my model, most likely it contains items of both input types. Thus, 63 percent seems a reasonable lower bound for the labor share in government production. I set γ equal to 0.7, which would be consistent with a labor share of slightly less than 65 percent if governments minimized costs of producing public goods with the benchmark value of ε.[11]

Finally, the intra- and intertemporal elasticities of substitution in utility, ϕ and σ, are both set to 1. This facilitates comparison with TA, since an implication of their analysis is that in this case policy choices are not influenced by political turnover, as explained in the next section. Hence the effects that are due to the public sector production technology are particularly clear in this case.

The model is too simplistic for a precise quantitative analysis. In what follows I will therefore analyze the model under a range values for γ, σ, ϕ and ε. Furthermore, in order to solve the model initial capital stocks $\left\{k_1^g, k_1^f\right\}$ must be

[11] The mapping between data and γ is complicated by the fact that cost minimization is inconsistent with the theoretical foundation of this paper where investment and employment choices are affected by strategic considerations. In addition to the measurement problem that public sector output is not observed, this implies that a public production function cannot be estimated in the same way as macro production functions conventionally are (f.ex. in Arrow, Chenery and Solow (1961) and Klump et al. (2007)).

specified. In the main analysis I will set these initial capital stocks at the levels that the incumbent would choose to maintain if he were certain to hold office also in the second period. Hence, $\left\{k_1^g, k_1^f\right\}$ are set so that if $p_R = 1$ it is optimal to choose $k_2^h = k_1^h$ for $h = g, f$. Analytical expressions for the equilibrium objects in this case are given in the appendix. In a robustness analysis I will show that the results of the paper are not driven by these initial conditions.

4 Results

4.1 Debt Accumulation

As a benchmark for comparison, it is useful to start with the main result of TA. They assume that utility is separable in g and f, and show that if the "concavity index" $\lambda(h) \equiv -u''(h) / [u'(h)]^2$, $h = g, f$, of the utility function is decreasing, an incumbent issues more government debt (b) when he expects to be replaced by someone with a different preference weight α in the second period.[12] With the CES utility function in (1) preferences are separable when $\phi = \sigma$, and the condition that $\lambda'(h) < 0$ is satisfied when $\sigma > 1$. Hence, the incumbent borrows ($b > 0$) if $\sigma > 1$, and saves ($b < 0$) if $\sigma < 1$. If $\sigma = 1$, the budget is balanced. The intuition behind this condition is as follows. When the incumbent realizes that the future basket of public goods will diverge from his own preferred composition, two effects shape his choice of debt accumulation. On the one hand, his subjective valuation of future public wealth is reduced by the fact that it will be spent in what the incumbent views as a sub-optimal way. This motivates him to run a deficit, so as to finance a higher provision of the consumption basket he prefers. On the other hand, if preferences are concave in consumption, the incumbent would like to derive the same level of utility from public goods consumption in both periods. When he realizes that the future basket of public goods is going to be sub-optimally

[12] The concavity index is discussed in Debreu and Koopmans (1982)

composed, the only way to achieve such a smoothing is to increase the wealth available for future spending, i.e. to save. With the CES utility function (1), the first of these effects dominates when $\sigma > 1$, in which case the office holder in period one favors a deficit.[13]

Figure 1 plots the deficit chosen by an incumbent from party R who is certain to be re-elected ($p_R = 1$), minus the deficit he chooses when he is certain to be replaced by a candidate from party D ($p_R = 0$). The magnitudes can be interpreted as share of government income per period. The solid line is computed with $\gamma = 1$, which implies that public goods are produced using labor only under constant returns to scale. Hence government essentially acts like a price-taking consumer, as in TA. We see that the relationship between the intertemporal elasticity of substitution and excess debt accumulation implied by their study also holds with a non-separable utility function.

The dotted curve in Figure 1 plots the deficit bias when the government must combine labor with capital using a Cobb-Douglas technology ($\varepsilon = 1$) with $\gamma = 0.7$ to produce public goods.[14] We see that introducing purpose-specific capital in this way rotates the deficit curve around the point of zero debt and brings it everywhere closer to zero. Hence, purpose-specific capital together with Cobb-Douglas production technology reduces the response of financial savings to political instability. Under the specific value of γ used in the figure, the impact of political turnover on financial savings is roughly halved.

Behind this effect lies the following mechanism. Because $\varepsilon = 1$, capital and labor complement each other. Hence, the assumption that the current capital stock

[13] Alternatively, the two effects may be considered as a "substitution" and an "income" effect, respectively. If we calculate public good provision in efficiency units as the utility equivalents that it generates for the office holder in period one, expected turnover is equivalent to a change in the relative price of public goods consumption in the two periods. Second period consumption becomes relatively more expensive, and the substitution effect entails the motivation to spend more in period 1 by saving less. The income effect is the motivation to smooth the efficiency units of consumption by saving.

[14] The results are qualitatively robust to different values of γ. Quantitatively, a higher γ brings the outcomes under a production economy toward the consumption economy, while a lower γ increases the difference.

is fixed implies decreasing returns to labor in period one, so that the marginal cost of raising current production, in terms of future production foregone, is increasing. This effect dampens the incentive that arises when $\sigma > 1$ to shift resources from the future to the present . Furthermore, when the incumbent shifts resources to the present period, he will do this not only by accumulating more debt, which implies less use of labor in period two, but also by accumulating less physical capital since the two inputs are complementary. Hence, the excess debt accumulation that arises when $\sigma > 1$ is reduced. Conversely, when $\sigma < 1$ what is now a deficit bias in TA is mitigated, as decreasing returns to labor increases the incentive to smooth labor expenditure, and because the incumbent increases savings in physical as well as financial capital.

While the Cobb-Douglas production function provides a useful starting point, it seems empirically more relevant with an elasticity of substitution between capital and labor that is substantially lower, as discussed above. Figure 1 therefore includes a final curve which shows the strategically induced deficit bias when $\varepsilon = 0.7$. We see that debt accumulation is now close to zero even when σ is relatively large. In part, this is due to the mechanism explained for the Cobb-Douglas case, since a higher complementarity between capital and labor dampens the returns to excessive first-period employment and motivates an incumbent to cut savings not only in financial capital, but in physical capital as well. However, we also see that the incumbent always chooses lower financial savings now than with a Cobb-Douglas technology. The reason is a composition effect in public savings. As consequence of Proposition 1, strong complementarity between capital and labor enables the incumbent to use the investment composition in period one to influence the labor allocation in period two. This increases the incumbent's valuation of future financial wealth. In addition, complementarity implies that the future return to physical capital depends on the labor it is combined with. As explained further in the next section, this tends to reduce the incumbent's valuation of physical capital.

Hence, the expectation of political turnover tilts the composition of public saving toward financial capital when $\varepsilon = 0.7$.

4.2 Physical Capital Accumulation

Figure 2 plots the difference between investment in physical capital when the incumbent is sure to be re-elected and investment in physical capital when he is sure not to be re-elected.[15] The dotted curve shows that with a Cobb-Douglas production function, political turnover increases investment in physical capital when $\sigma < 1$, but reduces it when $\sigma > 1$. This is similar to the deficit bias in Figure 1 above. Hence it is clear that with $\varepsilon = 1$, the incumbent responds to anticipated turnover by saving more in both physical and financial assets if $\sigma < 1$, while he cuts savings in both asset types if $\sigma > 1$.

However, this result does not hold when ε differs from unity. From the lower curve we see that with $\varepsilon = 0.7$, expected turnover tends to reduce accumulation of physical capital, and more so the higher is voters' willingness to substitute public consumption between periods and between the two goods. Comparing Figure 2 to Figure 1 gives the following insight: When capital and labor are complements in public production, political turnover tends to motivate under-accumulation of physical capital rather than financial assets.

The intuition behind this shift away from physical capital is as follows. When capital and labor complement each other, the future return to capital depends on the amount of labor it is combined with. Since the successor has different preferences over public goods than the incumbent, he will tend to allocate relatively more labor to production of the good the incumbent prefers relatively weakly (g in the numerical example) and less to the good the incumbent prefers more

[15] Because the initial capital stocks, k_1^g and k_1^f, are identical in the two cases, the curves in Figure 2 show the difference between the second period capital stock, $k_2^g + k_2^f$, under certain turnover and certain re-election. Since government revenues are set to 1 each period, the magnitudes along the vertical axis represent the share of total government revenues.

strongly (f). Hence, from the incumbent's perspective the capital he builds will be inefficiently combined with labor in the future. As consequence, the incumbent's valuation of physical capital available for future public production is reduced by expected turnover when ε is small. Since the opposite holds for financial assets, as discussed in last section, it follows that expected turnover tilts the composition of public savings away from physical capital and toward financial assets.

4.3 Total Public Savings

Because physical capital and bonds are two alternative means for storing public wealth, a relevant question is how political turnover influences total public savings, defined as accumulation of both two asset types summed together.

Figure 3 plots the difference between total savings under certain re-election and under expected political turnover, as a function of σ. We see that political turnover reduces total savings when $\sigma > 1$ while it increases savings when $\sigma < 1$.[16] This is exactly as in the TA-economy, where the only means of storage is bonds, displayed by the solid line for comparison. The intuition is also the same: When $\sigma < 1$, the incumbent cares strongly about smoothing his utility flow from public goods and therefore he saves *more* the less efficiently he expects public wealth (whether in physical capital or financial assets) to be spent in the future. When $\sigma > 1$, his major concern is to ensure that public resources are spent when they yield the highest returns, and hence he saves *less* the weaker he expects future spending to align with his own preferences.

We also see from Figure 3 that the extent to which capital and labor complement each other influences the bias in total savings quantitatively. Higher complementarity (i.e. lower ε) makes total savings respond less to political turnover.[17]

[16] While Figure 3 displays only the cases where $\varepsilon = 0.7$ and $\varepsilon = 1$, the conclusion that total savings is biased downward if $\sigma > 1$ and upward if $\sigma < 1$ holds for any value of ε.

[17] Though not evident in Figure 3, the bias in total savings in the production economy approaches that in the TA-model as ε grows large. This will be evident in the sensitivity analysis below.

This follows from the fact that for given capital stocks, the marginal return to labor expenditure is more strongly decreasing the lower ε is. As explained when analyzing the deficit bias above, this implies that shifting resources intertemporally becomes more costly in terms of public goods foregone.

4.4 The Costs of Political Turnover

When government production is homogenous of degree one, as with the specific production functions in (2), the highest level of public production attainable at a given cost is achieved for a unique capital-labor ratio $\kappa = \frac{k^h}{n^h}$, $h = f, g$.[18] Thus, as physical capital is fully reversible between periods, the production possibility frontier for the second period is linear from the viewpoint of period one, with capital-labor ratios always equal to κ along it. In a situation without political turnover preferences matter only by pinning down where along the ex ante possibility frontier production ends up.

However, if capital and labor are complements ($h_{nk}\left(n_2^h, k_2^h\right) > 0$), then ex post, when the capital stocks k_2^g and k_2^f are installed, the production possibility frontier is no longer linear, but concave. Hence, although the policymaker in this period allocates resources to achieve ex post efficiency, from an ex ante perspective the allocation may be inefficient. The following proposition states that if the office holder in period 2 has different preferences than the office holder in period 1, ex ante inefficiency will indeed result:

Proposition 2 *Assume that* $0 < h_{n_2^h} < \infty$, $-\infty < h_{n_2^h n_2^h} \leq 0$, $h_{k_2^h n_2^h} > 0$ *and* $\frac{u_{hh}\left(\cdot|\alpha_2^J\right)}{u_h\left(\cdot|\alpha_2^J\right)} - \frac{u_{gf}\left(\cdot|\alpha_2^J\right)}{u_h\left(\cdot|\alpha_2^J\right)} < 0$, *for* $h = g, f$. *Assume that the office holder in period* 1 *is of type R. Then* $\frac{g_k'(n_2^{g,D},k_2^g)}{g_n'\left(n_2^{g,D},k_2^g\right)} = \frac{f_k'(n_2^{f,D},k_2^f)}{f_n'\left(n_2^{f,D},k_2^f\right)} = 1$ *if and only if* $\alpha^R = \alpha^D$. *When* $\alpha^R < \alpha^D$, $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} > 1 > \frac{f_k\left(n_2^{f,D},k_2^f\right)}{f_n\left(n_2^{f,D},k_2^f\right)}$. *When* $\alpha^R > \alpha^D$, $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} < 1 < \frac{f_k\left(n_2^{f,D},k_2^f\right)}{f_n\left(n_2^{f,D},k_2^f\right)}$. *Hence, second-period production is not on the ex ante production possibility if there is*

[18] $\kappa = \left(\frac{1-\gamma}{\gamma}\right)^{\varepsilon}$ with the specific production function in (2).

political turnover.

Proof. See appendix. ■

This proposition reflects that when there is turnover, the second-period policy-maker allocates too much labor to production of the good he prefers more strongly than his predecessor (good g if $a^D > \alpha^R$), and too little labor to the other purpose. With a different combination of the inputs into second period production more could have been produced of either good. I will later refer to this source of resource waste as "inefficient allocation of inputs". Note that this inefficiency is not driven by uncertainty about the election outcome, as it arises also when $p_R = 0$ and the incumbent thus has the information that enables him to invest in a way that supports efficiency in period 2. It is driven by the incumbent's motive to invest so as to push the composition of government production in the second period toward his own preferences rather than onto the ex ante possibility frontier.

There is a further cause of production inefficiency in this economy. This is the first-period decision-maker's choice of how much to save in physical relative to financial capital. As seen from the preceding analysis, the composition of savings is likely to be affected by anticipated political turnover. Hence, the total capital-labor ratio in the second period, $\frac{k_2^g+k_2^f}{n_2^g+n_2^f}$, will generally deviate from its first best level κ. I refer to this as "inefficient composition of savings".

The upper panel of Figure 4 illustrates the impact of the two inefficiency sources in the political equilibrium when $p_R = 0$. It shows how many more f-goods that could have been produced in the second period if public resources were used more efficiently than in the political equilibrium, without reducing g_1, $f_1$or g_2. The dashed line isolates the effect of the inefficient allocation of inputs. Hence it is computed holding savings in bonds $(-b)$ and capital $(k_2^f + k_2^g)$ at their political equilibrium levels, while capital and labor types are allocated so as to minimize the costs of producing g_2. The solid line shows how many more f-goods that would have been produced if the composition of savings were optimal as well. Thus, the distance between the dashed and solid line isolates the contribution of the suboptimal savings composition to production inefficiency.[19]

We see that a substantial portion of public goods may be lost due to a bad resource allocation in the political equilibrium. Furthermore, it is the inefficient allocation of inputs that contributes most to overall inefficiency, while the influence of the savings composition is negligible.[20]

The bottom panel in Figure 4 distinguishes between production inefficiency in the political equilibrium and in the situation where the incumbent behaves as if he were sure to decide both periods, but is replaced by someone else in the second period. The former is referred to as a "strategic politician" while the latter is referred to as a "naive planner" in the figure. We see that the two curves in the figure nearly coincide. Hence, whether the incumbent behaves strategically or naively is almost irrelevant.[21]

The small difference between the two inefficiency measures reflects two effects that almost completely cancel each other out in the political equilibrium. On the one hand, the incumbent who is aware of his successor's preferences may use this information by investing so as to support efficiency in period two production. On the other hand, the strategic politician has an incentive to invest so as to push the composition of second period production toward his own preferences. Figure 4 shows that the potential gain from the incumbent's knowledge about the successor's preferences is essentially eliminated by the strategic behavior.

[19] Details on these calculations are in the appendix.

[20] As is clear from Figures 1 and 2, the quantitative importance of inefficiently composed public savings will depend on σ. However, the conclusion that the bad composition of input expenditures is more severe than the bad composition of savings is robust to variations in σ. Sensitivity results are available upon request.

[21] This finding is robust to alternative parametrizations of the model.

5 Sensitivity Analysis

5.1 The Elasticity of Substitution Between Capital and Labor

A key insight from the above analysis is that the technology by which government produces public goods is decisive for how anticipated turnover influences public savings. This section therefore explores how the strategically induced biases to debt and physical capital accumulation, as well as total savings, vary with ε, the elasticity of substitution between capital and labor.

Figure 5 displays how the deficit bias varies with ε, holding the other parameters at their benchmark values in Table 1. We see that the relationship between ε and the deficit bias is non-monotonic, and that expected political turnover does not affect public savings when $\varepsilon = 0$ or when ε is large, in addition to the previously discussed case where $\varepsilon = \sigma = 1$.[22] Since $\sigma = 1$, we know from the last section that total savings will be unaffected by political turnover, and hence that the bias in physical capital accumulation will mirror the deficit bias, which also is clear from the solid curves in Figure 6. We may therefore conclude that when capital and labor complement each other relatively strongly ($\varepsilon < 1$ in the figure), expected turnover tilts the composition of savings toward financial assets and away from physical capital, while the opposite occurs when capital and labor are relatively close substitutes ($\varepsilon > 1$). The intuition behind the curve in Figure 5 is as follows.

With a "Leontief" production function ($\varepsilon = 0$), a policymaker's choice of how to allocate labor is fully determined by the composition of capital that he faces. Hence, an incumbent's investment will perfectly pin down the allocation of labor in period 2, independently of who actually is in charge in that period. Debt and physical capital accumulation are therefore unaffected by political turnover when $\varepsilon = 0$.

[22] For expositional purposes the maximum value of ε in Figure 5 is 8, but the deficit bias remains zero for larger values of ε.

Increasing ε has countervailing effects. On the one hand, a higher degree of substitutability loosens the link between the capital and labor composition, and allows the successor to allocate more labor to the purpose he prefers relatively strongly. From the incumbent's perspective this implies that physical capital will be sub-optimally combined with labor in period 2, and hence his subjective valuation of physical capital relative to financial assets falls as ε increases. This effect underlies the negative slope of the deficit bias for small values of ε (below 0.35) in Figure 5.

On the other hand, a higher value of ε makes capital returns less sensitive to the allocation of labor. Hence, the larger is ε, the less does a given mismatch between the composition of capital and labor reduce the value of physical capital. Furthermore, because higher substitutability between capital and labor reduces an incumbent's influence on the future labor allocation, his valuation of financial assets is falling in ε. Both these two last effects make the value of physical capital rise relative to the value of financial assets as ε increases, and together they underlie the increasing relationship between the deficit bias and ε in Figure 5. When $\varepsilon > 1$, they turn the strategically induced biases to debt and physical capital accumulation positive.

In the extreme case where capital and labor are perfect substitutes ($\varepsilon = \infty$), the production functions are linear with $h = \gamma n^h + (1-\gamma)\, k^h$, $h = g, f$. Hence an incumbent may in this case effectively pin down the composition of second period production by deficit financing investment in physical capital. However, when $\gamma > 0.5$, pursuing this strategy is costly since the marginal productivity of labor is always higher than the marginal productivity of capital while the two inputs cost the same. This explains why the deficit bias reverts to zero as ε grows large in Figure 5: When $\gamma = 0.7$ it is too costly to use capital instead of labor to produce public goods, hence capital is never used and equilibrium choices under high input substitutability are the same as they would be if the only input in public production was labor.[23] When $\sigma = 1$ these choices entail a zero deficit bias, as displayed in Figure 1.

Figure 6 shows how public savings vary with ε under three different values of σ. We see that the qualitative effect of ε does not depend on σ. When $\varepsilon = 0$, political turnover does not influence the incumbent's choices. When ε is large, physical capital is never accumulated and the deficit is determined by σ alone, as in TA. The lower curve confirms the insight from the section above that the total savings bias, defined as the difference between overinvestment in physical capital and the deficit bias, is qualitatively determined by σ, whereas a low value of ε dampens it.

5.2 The Intratemporal Elasticity of Substitution

In the analysis so far I have focused on the effect of the intertemporal elasticity of substitution because this is the parameter that determines the qualitative effect of political turnover on public savings without public capital (as in TA and Alesina and Tabellini (1990)). In order to explore the impact of the intratemporal elasticity of substitution on the results, Figure 7 displays the impact of turnover on public deficits, physical capital accumulation and total savings as ϕ varies. Apart from σ, for which 3 values are considered, all other parameters are held at their benchmark values in Table 1.

The central insight from Figure 7 is that the intratemporal elasticity matters mainly quantitatively for how anticipated turnover influences public saving. When ϕ approaches zero, the composition of public goods provided by the successor becomes independent of the incumbents' decisions. Hence the best an incumbent can do is to facilitate efficient production in the future, and invest as much as if

[23] Beetsma and van der Ploeg (2007) and Glazer (1989) argue that expected turnover yields excess investment. My model reveals that a key assumption for this result is that the return to public capital is independent of policy and that the costs of overinvestment are not too large. In this sense my model encompasses their analyses as the special case where capital and labor are close substitutes and γ is small (close to 0.5).

re-election were certain. When ϕ approaches infinity, the successor's composition of public goods becomes extremely sensitive to the incumbent's decisions (as follows from Proposition 1), and hence the incumbent has large control over future resource use even if he is not re-elected. Thus, in the polar cases with extremely low or extremely high substitutability between g and f, the biases induced by turnover are negligible. When ϕ is in an intermediate range, the aforementioned effects of political turnover on the composition of savings occur, as the accumulation physical capital relative to financial assets is reduced. The qualitative effect of anticipated turnover on total public savings is always determined by the intertemporal elasticity of substitution (σ), while the intratemporal substitutability determines how quantitatively important any such bias will be.

5.3 Initial Capital Stocks

All results above were obtained under the assumption that the initial capital stocks k_1^g and k_1^f were such that a planner would choose zero net investments in physical capital. Because this assumption was chosen solely for analytical convenience, Figure 8 shows the effects of relaxing it.

The two upper plots let the fraction $\frac{k_1^g}{k_1^f}$ vary from half to twice its value in the benchmark, holding the total amount of initial capital $(k_1^g + k_1^f)$ constant. We see that the strategically induced debt and investment biases both are unaffected by the initial composition of the capital stock. The two lower panels in Figure 8 hold the composition $\frac{k_1^g}{k_1^f}$ constant at the same level as in the benchmark, but instead let the total amount of capital vary from half to twice the level assumed before. Again the main results for excess debt and capital accumulation are robust, although there is a small tendency for the two biases to grow slightly as the total amount of physical capital increases.[24]

[24] While Figure 8 displays results only when $\sigma = 1$, the results are similar for other values of σ too. The only difference is when σ is large. In this case the relationship between the deficit bias and the total initial physical capital stock has a positive slope, but still the main qualitative conclusions are unaffected.

5.4 Polarization and the Re-election Probability

Central insights from TA and Alesina and Tabellini (1990) are that greater polarization and lower re-election probability both increase the strategically induced bias in public deficits. Not surprisingly, similar conclusions hold in the setting with physical capital studied in this paper. A higher degree of polarization, defined as $|\alpha^R - \alpha^D|$, monotonically increases the effect of turnover on debt and physical capital accumulation. A lower re-election probability, p_R, does the same. These effects of $|\alpha^R - \alpha^D|$ and p_R are purely quantitative.

6 Conclusion

Established theories in political economics claim that political turnover will generate a deficit bias in fiscal policy. This paper has shown how the presence of purpose-specific public capital is likely to mitigate and even remove this deficit bias, as the anticipation of turnover reduces saving in physical capital rather than in financial assets. The assumption behind this result is that in order to produce public goods, government must purchase capital which is complementary to labor in production.

A normative implication of my analysis is that political turnover makes government production less cost efficient. The potential welfare gains from knowledge about changing government preferences are dissipated in strategic behavior by the incumbent who is about to be replaced. In order to mitigate such inefficiencies due to strategic behavior, balanced budget rules are not likely help. What is required is instead institutions that make policymakers apply resources where the preconditions for public activity are good, even though these activities need no be what the current policymaker has strong preferences for. This would raise the returns to capital and thereby stimulate public investment.

The analysis motivates empirical exploration along several dimensions. In particular, a testable prediction from the model is that public investment drops when politicians view re-election as less likely. It is natural to explore this prediction similarly to what Petterson-Lidbom (2001) and Lambertini (2004) do for public debt. Second, the elasticity of substitution between capital and labor in the public production function determines the model's qualitative predictions for strategically induced debt and capital accumulation. Estimates of this parameter would therefore be valuable.

More generally, the analysis raises several interesting questions. When voting is endogenous, how will policymakers invest so as to maintain power? When during an election period should we expect high investment? Which institutions will bring public production towards its efficiency frontier? These questions call for further research on models with government production.

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A Appendix

A.1 The Reaction Functions

Implicitly differentiating the first-order condition (6), and taking into account the budget constraint (4), yields the following general expressions for $G^J_{\alpha^J_2}$ and G^J_b:

$$G^J_{\alpha^J_2} = \frac{\frac{u_{f\alpha}\left(\cdot|\alpha^J_2\right)}{u_f\left(\cdot|\alpha^J_2\right)} - \frac{u_{g\alpha}\left(\cdot|\alpha^J_2\right)}{u_g\left(\cdot|\alpha^J_2\right)}}{L\left(n^{g,J}_2, n^{f,J}_2, k^g_2, k^f_2\right)} \tag{13}$$

$$G^J_b = \frac{-\left[\left(\frac{u_{ff}\left(\cdot|\alpha^J_2\right)}{u_f\left(\cdot|\alpha^J_2\right)} - \frac{u_{gf}\left(\cdot|\alpha^J_2\right)}{u_g\left(\cdot|\alpha^J_2\right)}\right) f_n\left(n^{f,J}_2, k^f_2\right) + \frac{f_{nn}\left(n^{f,J}_2, k^f_2\right)}{f_n\left(n^{f,J}_2, k^f_2\right)}\right]}{L\left(n^{g,J}_2, n^{f,J}_2, k^g_2, k^f_2\right)} \tag{14}$$

where $u_g\left(\cdot|\alpha^J_2\right) \equiv u_g\left(g^J_2, f^J_2|\alpha^J\right)$, $u_{gg}\left(\cdot|\alpha^J\right) \equiv u_{gg}\left(g^J_2, f^J_2|\alpha^J\right)$, and

$$L\left(n^{g,J}_2, n^{f,J}_2, k^g_2, k^f_2\right) = \left(\frac{u_{gg}\left(\cdot|\alpha^J_2\right)}{u_g\left(\cdot|\alpha^J_2\right)} - \frac{u_{gf}\left(\cdot|\alpha^J_2\right)}{u_f\left(\cdot|\alpha^J_2\right)}\right) g_n\left(n^{g,J}_2, k^g_2\right) \tag{15}$$
$$+\frac{g_{nn}\left(n^{g,J}_2, k^g_2\right)}{g_n\left(n^{g,J}_2, k^g_2\right)} + \left(\frac{u_{ff}\left(\cdot|\alpha^J_2\right)}{u_f\left(\cdot|\alpha^J_2\right)} - \frac{u_{gf}\left(\cdot|\alpha^J_2\right)}{u_g\left(\cdot|\alpha^J_2\right)}\right) f_n\left(n^{f,J}_2, k^f_2\right) + \frac{f_{nn}\left(n^{f,J}_2, k^f_2\right)}{f_n\left(n^{f,J}_2, k^f_2\right)}$$

The budget constraint (4) implies that $G^J_{\alpha^J_2} = -F^J_{\alpha^J_2}$ and $G^J_b = -1 - F^J_b$. Assume that the utility and production functions are such that the following conditions always hold:

Condition 1: $\frac{u_{gg}(\cdot|\alpha)}{u_g(\cdot|\alpha)} - \frac{u_{gf}(\cdot|\alpha)}{u_f(\cdot|\alpha)} < 0$ and $\frac{u_{ff}(\cdot|\alpha)}{u_f(\cdot|\alpha)} - \frac{u_{gf}(\cdot|\alpha)}{u_g(\cdot|\alpha)} < 0$.

Condition 2: $0 < h_n < \infty$ and $-\infty < h_{nn} \leq 0$, for $h = g, f$.

Because $u_{f\alpha}\left(\cdot|\alpha^J_2\right) < 0$ and $u_{g\alpha}\left(\cdot|\alpha^J_2\right) > 0$, these two properites imply that $G^J_{\alpha^J_2} > 0$. They also imply that $G^J_b \epsilon \ \langle -1, 0]$. Note that Property 1 holds when the utility function is homogenous in g and f (this is clear from Lemma 1 below). With Leontief production functions, Property 2 will not hold.

A.2 Proof of Proposition 1

To simplify notation, this section ignores the preference and party indexes α^J and J. G_{k_g} may then be written as

$$G_{k_g} = \frac{-\frac{g_k}{g}\left[z\left(g,f\right)+\frac{g_{nk}g}{g_n g_k}\right]}{\left(\frac{u_{gg}(g,f)}{u_g(g,f)}-\frac{u_{gf}(g,f)}{u_f(g,f)}\right)g_n+\frac{g_{nn}}{g_n}+\left(\frac{u_{ff}(g,f)}{u_f(g,f)}-\frac{u_{gf}(g,f)}{u_g(g,f)}\right)f_n+\frac{f_{nn}}{f_n}}, \tag{16}$$

where $z\left(g,f\right) \equiv \left(\frac{u_{gg}(g,f)}{u_g(g,f)}-\frac{u_{gf}(g,f)}{u_f(g,f)}\right)g$.

Note first that when $g\left(n,k\right)$ is homogenous of degree 1, its elasticity of substitution $\epsilon\left(n,k\right)$ equals $\frac{g_n' g_k'}{g_{nk}'' g2}$(see f. ex. Sydsæter, Strøm and Berck (2005)). For $z\left(g,f\right)$, the following applies:

Lemma 1 *If $u(g,f)$ is homogenous of any degree k, then $z\left(g,f\right)=-1/\Phi\left(g,f\right)$, where $\Phi\left(g,f\right)$ is the elasticity of substitution between g and f in $u(g,f)$.*

Proof. *For any function $u(g,f)$, $\Phi\left(g,f\right)=\frac{-u_g u_f\left(gu_g+fu_f\right)}{gf\left[\left(u_f\right)^2 u_{gg}+\left(u_g\right)^2 u_{ff}-2u_g u_f u_{gf}\right]}$ (see f. ex. Sydsæter et al. (2005)). The term $z\left(g,f\right)$ in (16) may be written as*

$$z\left(g,f\right)=\frac{\overbrace{\left(u_{gg}u_f g-u_{gf}u_g g\right)\left(gu_g+fu_f\right)}^{N}}{u_g u_f\left(gu_g+fu_f\right)}$$

The following shows that the numerator of $z\left(g,f\right)$, denoted P, equals the denominator of $\Phi\left(g,f\right)$. By adding and subtracting $fgu_{ff}''\left(u_g'\right)^2$ we may rewrite P as

$$P=fgu_{gg}\left(u_f\right)^2+fgu_{ff}\left(u_g\right)^2+u_g g\left[u_{gg}gu_f-u_{ff}fu_g-u_{gf}\left(gu_g+fu_f\right)\right]$$

If $u\left(g,f\right)$ is homogenous of degree k, then $u_{gg}g=\left(k-1\right)u_g-u_{gf}f$. Inserting this *inside the brackets of the expression above and rearranging gives:*

$$
\begin{aligned}
P &= fgu_{gg}\left(u_f\right)^2 + fgu_{ff}\left(u_g\right)^2 + u_g g \left[\begin{array}{c} \left(\left(k-1\right)u_g - u_{gf}f\right)u_f \\ -\left(\left(k-1\right)u_f - u_{gf}g\right)u_g - u_{gf}\left(gu_g + fu_f\right) \end{array} \right] \\
&= fgu_{gg}\left(u_f\right)^2 + fgu_{ff}\left(u_g\right)^2 + u_g g\left[-u_{gf}fu_f + u_{gf}gu_g - u_{gf}\left(gu_g + fu_f\right)\right] \\
&= fg\left[u_{gg}\left(u_f\right)^2 + u_{ff}\left(u_g\right)^2 - 2u_{gf}u_g u_f\right],
\end{aligned}
$$

which is identical to the denominator in $\Phi(g,f)$. Thus, $z(g,f) = -1/\Phi(g,f)$. ■

Hence, if $u(g,f)$ is homogenous of degree k and the production functions are homogenous of degree 1, we can express the reaction G_{k_g} as

$$
G_{k_g} = \frac{-\frac{g_k}{g}\left[1/\Phi(g,f) - 1/\epsilon(n,k)\right]}{\frac{g_{nn}}{g_n} - \frac{g_n}{g}1/\Phi(g,f) + \frac{f_{nn}}{f_n} - \frac{f_n}{f}1/\Phi(g,f)}
$$

Under Condition 2 this expression implies that $G_{k_g} \gtreqless 0$ if $\Phi(g,f) \gtreqless \epsilon(n,k)$ as stated in the proposition. The same argument holds for F_{k_f}.

A.3 Planner Problem

Define a planner as an agent with preference weight α who holds office in both periods with certainty. Hence, the planner problem is to maximize $\sum_{t=1}^{2} u\left(g\left(n_t^g, k_t^g\right), f\left(n_t^f, k_t^f\right)|\alpha\right)$, subject to (3) and (4). The first-order conditions are

$$
\alpha u_g\left(g_2, f_2|\alpha\right) g_n'\left(n_2^g, k_2^g\right) = u_f\left(g_2, f_2|\alpha\right) f_n\left(n_2^f, k_2^f\right) \tag{17}
$$

$$
u_g\left(g_1, f_1|\alpha\right) g_n'\left(n_1^g, k_1^g\right) = u_f\left(g_1, f_1|\alpha\right) f_n\left(n_1^f, k_1^f\right) \tag{18}
$$

$$
u_g g_n\left(n_1^g, k_1^g\right) = u_g(g_2) g_n\left(n_2^g, k_2^g\right) \tag{19}
$$

$$
g_n\left(n_2^g, k_2^g\right) = g_k\left(n_2^g, k_2^g\right) \tag{20}
$$

$$
f_n\left(n_2^f, k_2^f\right) = f_k\left(n_2^f, k_2^f\right) \tag{21}
$$

Note that (20) and (21) imply that $g_n(n_2^g, k_2^g) = f_n(n_2^f, k_2^f)$. Furthermore, when the production functions are identical and homogenous of degree one, $\frac{k_2^g}{n_2^g} = \frac{k_2^f}{n_2^f} \equiv \kappa$.

A.3.1 Planner Solution with Specific Functional Forms and $k_2^h = k_1^h$, for $h = g, f$

With the specific utility and production functions in (1) and (2), and under the assumption $k_2^h = k_1^h$ for $h = g, f$, the first-order conditions (17) - (21) and the resource constraint (4) may be solved for the choice variables as follows

$$n^g = \left[1 + \frac{\delta}{2}\left(\frac{1-\gamma}{\gamma}\right)^{\varepsilon}\right]^{-1}\left[1 + \left(\frac{1-\alpha}{\alpha}\right)^{\phi}\right]^{-1}$$

$$n^f = \left[1 + \frac{\delta}{2}\left(\frac{1-\gamma}{\gamma}\right)^{\varepsilon}\right]^{-1}\left[1 + \left(\frac{\alpha}{1-\alpha}\right)^{\phi}\right]^{-1}$$

$$k^g = \left[\left(\frac{\gamma}{1-\gamma}\right)^{\varepsilon} + \frac{\delta}{2}\right]^{-1}\left[1 + \left(\frac{1-\alpha}{\alpha}\right)^{\phi}\right]^{-1} \tag{22}$$

$$k^f = \left[\left(\frac{\gamma}{1-\gamma}\right)^{\varepsilon} + \frac{\delta}{2}\right]^{-1}\left[\left(\frac{\alpha}{1-\alpha}\right)^{\phi} + 1\right]^{-1} \tag{23}$$

$$b = \frac{\delta}{2}\left(k^g + k^f\right) = \left[\frac{2}{\delta}\left(\frac{\gamma}{1-\gamma}\right)^{\varepsilon} + 1\right]^{-1} \tag{24}$$

A.4 Proof of Proposition 2

The first-order conditions (10), (11) and (6) imply:

$$\frac{g_k\left(n_2^{g,R}, k_2^g\right)}{g_n\left(n_2^{g,R}, k_2^g\right)} = 1 + \frac{(1-p_R)}{p_R}\frac{u_g\left(g_2^D, f_2^D|\alpha^R\right)}{u_g\left(g_2^R, f_2^R|\alpha^R\right)}\frac{g_n\left(n_2^{g,D}, k_2^g\right)}{g_n\left(n_2^{g,R}, k_2^g\right)} \times \tag{25}$$

$$\left[1 - \frac{g_k\left(n_2^{g,D}, k_2^g\right)}{g_n\left(n_2^{g,D}, k_2^g\right)} + \left(\frac{u_f\left(g_2^D, f_2^D|\alpha^R\right)u_g\left(g_2^D, f_2^D|\alpha^D\right)}{u_f\left(g_2^D, f_2^D|\alpha^D\right)u_g\left(g_2^D, f_2^D|\alpha^R\right)} - 1\right)\left(1 + G_b^D + G_{k_2^g}^D\right)\right]$$

Equations (7) and (14) imply that $1+G_b^D+G_{k_2^g}^D$ is given by:

$$
\begin{aligned}
&1+G_b^D+G_{k_2^g}^D \qquad (26)\\
=\ &\frac{g_{n_2^{g,D}}\left(\frac{u_{gg}\left(\cdot|\alpha_2^D\right)}{u_g\left(\cdot|\alpha_2^D\right)}-\frac{u_{gf}\left(\cdot|\alpha_2^D\right)}{u_f\left(\cdot|\alpha_2^D\right)}\right)\left(1-\frac{g_{k_2^g}}{g_{n_2^{g,D}}}\right)-\frac{1}{g_{n_2^{g,D}}}\left(g_{n_2^{g,D}k_2^g}-g_{n_2^{g,D}n_2^{g,D}}\right)}{L\left(n_2^{g,D},n_2^{f,D},k_2^g,k_2^f\right)},
\end{aligned}
$$

where $L\left(n_2^{g,D},n_2^{f,D},k_2^g,k_2^f\right)$ is given in (15), $u_g\left(\cdot|\alpha_2^D\right)\equiv u_g\left(g_2^D,f_2^D|\alpha_2^D\right)$ and $u_{gg}\left(\cdot|\alpha_2^D\right)\equiv u_{gg}\left(g_2^D,f_2^D|\alpha_2^D\right)$. Combining equation (25) with (26) and rearranging terms yields the following expression:

$$
\frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)}=1+\frac{1-p_R}{p_R}N\left(\alpha^R,\alpha^D\right)+\left[1-\frac{g_k(n_2^{g,D},k_2^g)}{g_n(n_2^{g,D},k_2^g)}\right]\frac{1-p_R}{p_R}M \qquad (27)
$$

where

$$
\begin{aligned}
M=\ &\frac{u_g\left(g_2^D,f_2^D|\alpha^R\right)g_n\left(n_2^{g,D},k_2^g\right)}{u_g\left(g_2^R,f_2^R|\alpha^R\right)g_n\left(n_2^{g,R},k_2^g\right)}\times\\
&\left[1+\frac{\left(\frac{u_f\left(g_2^D,f_2^D|\alpha^R\right)u_g\left(g_2^D,f_2^D|\alpha^D\right)}{u_f\left(g_2^D,f_2^D|\alpha^D\right)u_g\left(g_2^D,f_2^D|\alpha^R\right)}-1\right)\left(\frac{u_{gg}\left(\cdot|\alpha_2^D\right)}{u_g\left(\cdot|\alpha_2^D\right)}-\frac{u_{gf}\left(\cdot|\alpha_2^D\right)}{u_f\left(\cdot|\alpha_2^D\right)}\right)g_{n_2^{g,D}}}{L\left(n_2^{g,D},n_2^{f,D},k_2^g,k_2^f\right)}\right]
\end{aligned}
$$

and

$$
N\left(\alpha^R,\alpha^D\right)=\left(1-\frac{u_f\left(g_2^D,f_2^D|\alpha^R\right)u_g\left(g_2^D,f_2^D|\alpha^D\right)}{u_f\left(g_2^D,f_2^D|\alpha^D\right)u_g\left(g_2^D,f_2^D|\alpha^R\right)}\right)\frac{\frac{u_g\left(g_2^D,f_2^D|\alpha^R\right)g_{n_2^{g,D}}}{u_g\left(g_2^R,f_2^R|\alpha^R\right)g_{n_2^{g,R}}}\frac{g_{n_2^{g,D}k_2^g}-g_{n_2^{g,D}n_2^{g,D}}}{g_{n_2^{g,D}}}}{L\left(n_2^{g,D},n_2^{f,D},k_2^g,k_2^f\right)}.
$$

Assume that the utility and production functions satisfy Conditions 1 and 2. It then follows that $M>0$. Furthermore, because $u_{g\alpha}>0$ and $u_{f_\alpha}<0$, the term $1-\frac{u_f\left(g_2^D,f_2^D|\alpha^R\right)u_g\left(g_2^D,f_2^D|\alpha^D\right)}{u_f\left(g_2^D,f_2^D|\alpha^D\right)u_g\left(g_2^D,f_2^D|\alpha^R\right)}\gtreqless 0\Leftrightarrow\alpha^R\lesseqgtr\alpha^D$. Assume that Conditions 1 and 2 hold, and that $g_{n_2^{g,D}k_2^g}>0$. It then follows that $N\left(\alpha^R,\alpha^D\right)\gtreqless 0\Leftrightarrow\alpha^R\lesseqgtr\alpha^D$.

Finally, in order to conclude we also need the following lemma:

Lemma 2 *If $g_{nk} > 0$ and Conditions 1 and 2 hold, then* $\frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)} \lesseqgtr \frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)}$ $\Leftrightarrow \alpha^R \lesseqgtr \alpha^D$.

Proof. *Under Conditions 1 and 2 $G^J_{\alpha_2^J} > 0$, which implies $n_2^{g,R} \lesseqgtr n_2^{g,D}$, when $\alpha^R \lesseqgtr \alpha^D$. Thus, the inequality holds since $g_{nk} \geq 0$ and $g_{nn} < 0$.* ■

Consider the situation with $p_R = 1$. It follows directly from (27) that $\frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)} = 1$. Lemma 2 then implies that $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} \gtreqless 1 \Leftrightarrow \alpha^R \lesseqgtr \alpha^D$.

Consider the situation with $\alpha^R < \alpha^D$ and $0 < p_R < 1$. If $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} < 1$, Lemma 2 implies that $\frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)} < 1$ as well, and hence equation (27) holds only if $N\left(\alpha^R, \alpha^D\right) < 0$. However, $\alpha^R < \alpha^D$ implies $N\left(\alpha^R, \alpha^D\right) > 0$, a contradiction. If $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} > 1$, (27) holds with $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} > \frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)}$. Hence, when $\alpha^R < \alpha^D$ and $0 < p_R < 1$, equation (27) holds only if $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} > 1$.

Consider the situation with $\alpha^R > \alpha^D$ and $0 < p_R < 1$. If $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} > 1$, Lemma 2 implies that $\frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)} > 1$ as well, and hence equation (27) holds only if $N\left(\alpha^R, \alpha^D\right) > 0$. However, $\alpha^R > \alpha^D$ implies $N\left(\alpha^R, \alpha^D\right) < 0$, a contradiction. If $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} < 1$, (27) holds with $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} < \frac{g_k\left(n_2^{g,R},k_2^g\right)}{g_n\left(n_2^{g,R},k_2^g\right)}$. Hence, when $\alpha^R < \alpha^D$ and $0 < p_R < 1$, equation (27) holds only if $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} < 1$.

Consider the situation with $p_R = 0$. Equation (27) then implies that $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} \gtreqless 1 \Leftrightarrow N\left(\alpha^R, \alpha^D\right) \gtreqless 0$. It follows that when $p_R = 0$, $\frac{g_k\left(n_2^{g,D},k_2^g\right)}{g_n\left(n_2^{g,D},k_2^g\right)} \gtreqless 1 \Leftrightarrow \alpha^R \lesseqgtr \alpha^D$.

In the same way it may be shown that $\frac{f_k\left(n_2^{f,D},k_2^f\right)}{f_n\left(n_2^{f,D},k_2^f\right)} < 1$ when $\alpha^R < \alpha^D$, that $\frac{f_k\left(n_2^{f,D},k_2^f\right)}{f_n\left(n_2^{f,D},k_2^f\right)} > 1$ when $\alpha^R > \alpha^D$, and that $\frac{f_k\left(n_2^{f,D},k_2^f\right)}{f_n\left(n_2^{f,D},k_2^f\right)} = 1$ when $\alpha^R = \alpha^D$.

A.5 Two Measures of Inefficiency

This section shows how the inefficiency measures in Figure 4 are calculated.

The first measure, termed "Inefficient allocation of inputs", is calculated by maximizing the production of f_2 with respect to $\left\{n_2^g, n_2^f, k_2^g, k_2^f\right\}$ holding $\left\{n_1^g, n_1^f, b\right\}$ and g_2 constant at the same levels as in the political equilibrium. A solution to this problem must satisfy

$$k_2^g + k_2^f = k_2^{g,pe} + k_2^{f,pe} \tag{28}$$

$$\left(\gamma {n_2^g}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma)\, {k_2^g}^{\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}} = g_2\left(n_2^{g,pe}, k_2^{g,pe}\right) \tag{29}$$

$$n_2^g + n_2^f = 1 - b^{pe} \tag{30}$$

$$\frac{k_2^g}{n_2^g} = \left(\frac{1-\gamma}{\gamma}\right)^{\varepsilon} \equiv \kappa \tag{31}$$

where the superscript pe indicates that the variables are set to their political equilibrium values. The last equation indicates that production of g-goods is efficient. The solution to (28) - (31), superscripted by $*$, is then used to calculate

$$\frac{f\left(n_2^{f,*}, k_2^{f,*}\right) - f\left(n_2^{f,pe}, k_2^{f,pe}\right)}{f\left(n_2^{f,pe}, k_2^{f,pe}\right)} \tag{32}$$

The second measure in Figure 4, termed "Total inefficiency", is calculated by maximizing the production of f_2 holding only$\left\{n_1^g, n_1^f\right\}$ and g_2 constant at the same levels as in the political equilibrium. The solution $\left\{n_2^g, n_2^f, k_2^g, k_2^f, b\right\}$ to this problem satisfies

$$\frac{k_2^g}{n_2^g} = \frac{k_2^f}{n_2^f} = \left(\frac{1-\gamma}{\gamma}\right)^{\varepsilon} \equiv \kappa$$

$$\left(\gamma {n_2^g}^{\frac{\varepsilon-1}{\varepsilon}} + (1-\gamma)\, {k_2^g}^{\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}} = g_2\left(n_2^{g,pe}, k_2^{g,pe}\right)$$

$$n_1^{g,pe} + n_1^{f,pe} + k_2^g + k_2^f = 1 + b + (1-\delta)\, k_1^g + (1-\delta)\, k_1^f$$

$$n_2^g + n_2^f + b = 1$$

which differs from (28) - (31) because production of f_2 is also efficient, not only the production of g_2. This is feasible because b is not fixed at its political equilibrium level. The solution to these equations is then used to calculate the same measure as in (32).

Table 1: Parametrization

Parameter	Value	Parameter	Value	Parameter	Value
δ	0.2	ϕ	1	α^R	0.4
ε	0.7	σ	1	α^D	0.6
γ	0.7				

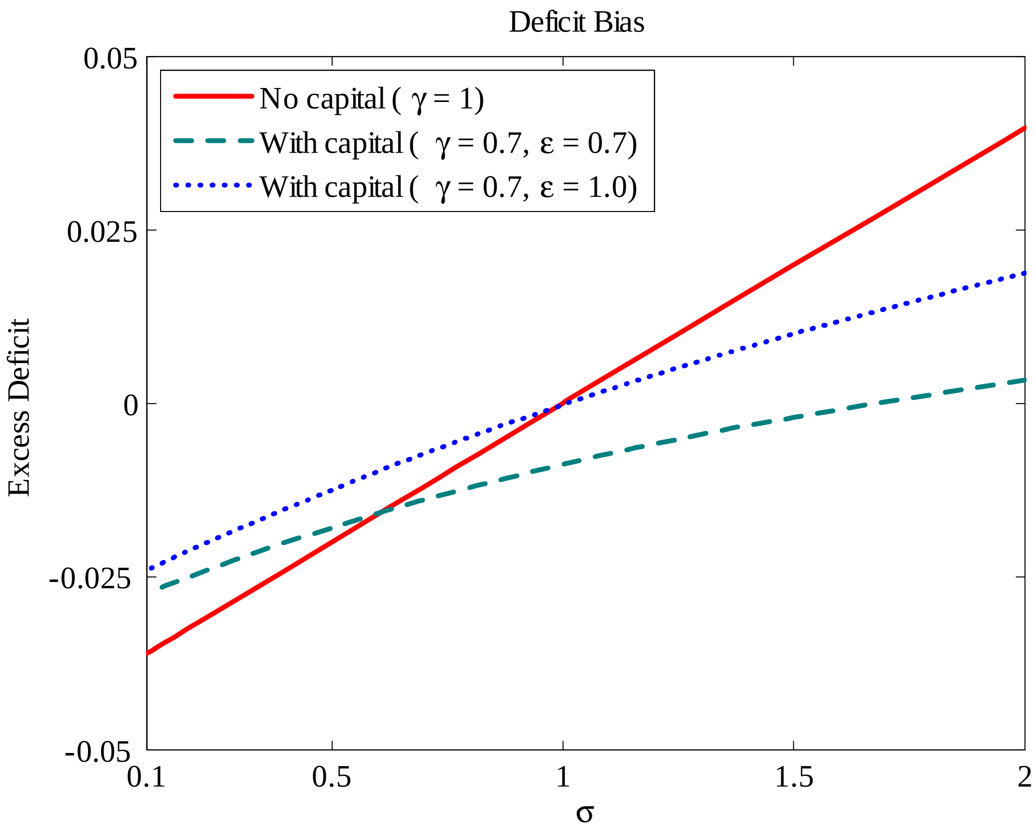

Figure 1: The public deficit under certain political turnover ($p_R = 0$) minus the deficit when the policymaker stays in office with certainty ($p_R = 1$). The solid line displays the case when public goods are produced using labor only ($\gamma = 1$), which is equivalent to government being a consumer as in TA. The two other curves display cases where government uses capital to produce public goods ($\gamma = 0.7$) for different values of the elasticity of substitution between capital and labor, ε. Fixed parameter values: $\delta = 0.2$, $\phi = 1$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.

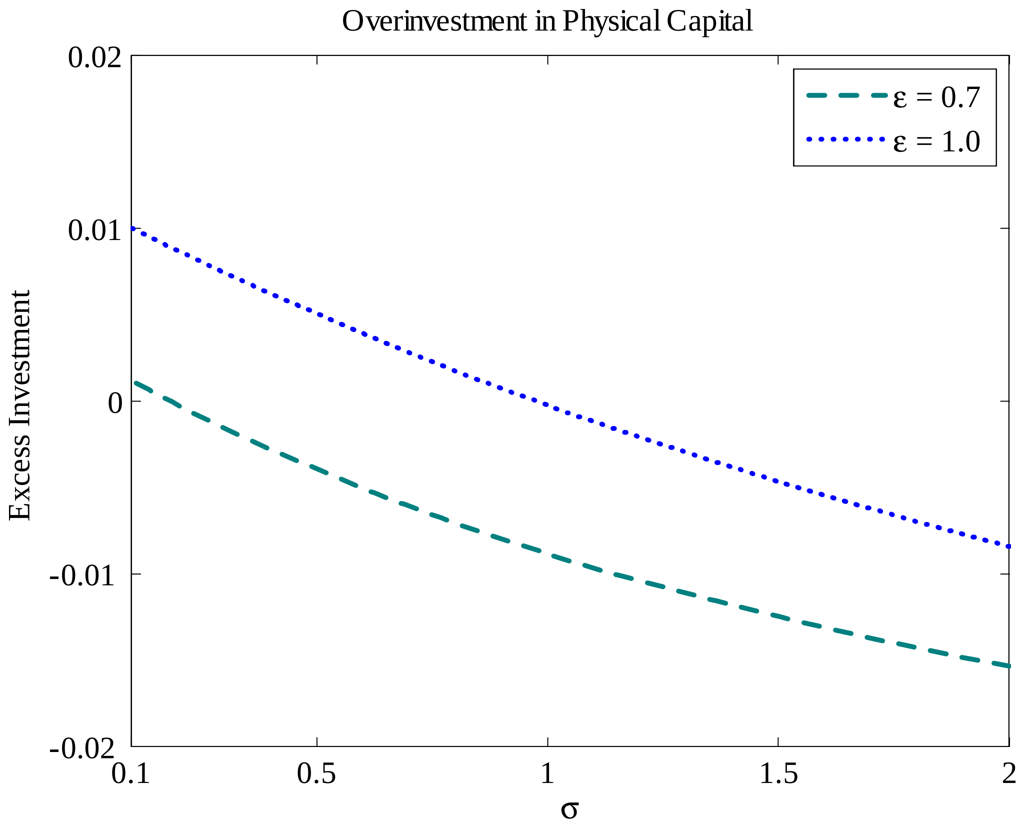

Figure 2: Accumulation of physical capital under certain political turnover ($p_R = 0$) minus accumulation of physical capital when the policymaker stays in office with certainty ($p_R = 1$). ε is the elasticity of substitution between capital and labor in production. Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\phi = 1$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.

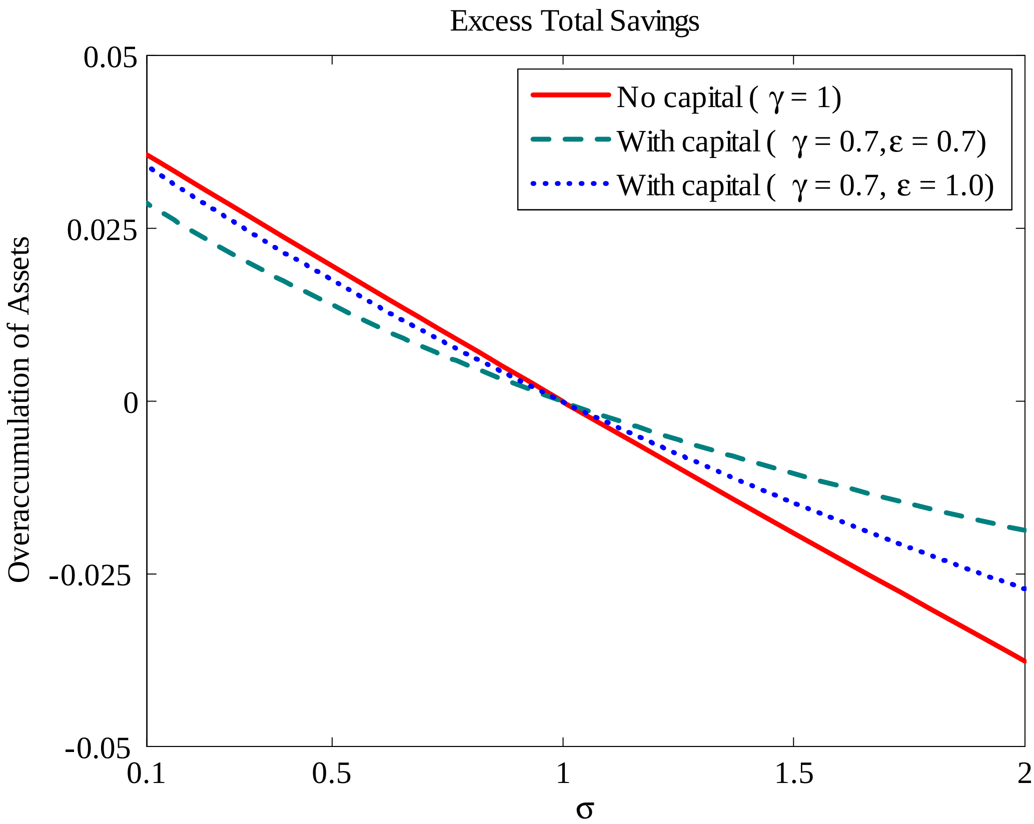

Figure 3: Total savings is defined as the sum of physical and financial capital accumulation. The plots present the gap between total savings under certain political turnover ($p_R = 0$) and total savings when the policymaker stays in office with certainty ($p_R = 1$). Fixed parameter values: $\delta = 0.2$, $\phi = 1$, $\alpha^R = 0.4$ and $\alpha^D = 0.6$

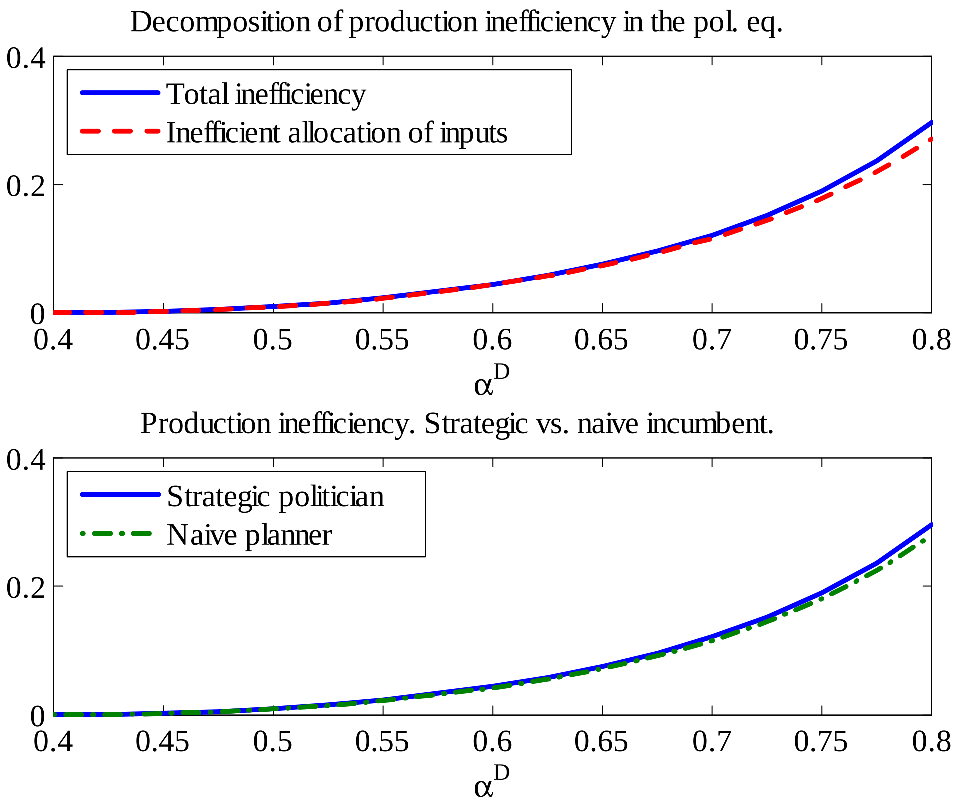

Figure 4: Inefficiency measured as how much f_2 could be increased by applying the resources in second period production differently. The upper panel separates how much the allocation of inputs and the composition of savings contribute to total inefficiency. The lower panel compares total inefficiency in the political equilibrium to total inefficiency when the first-period policymaker naively behaves as if he were certain to be re-elected. Details are in the appendix. Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\sigma = 1$, $\phi = 1$, $\varepsilon = 0.7$, $\alpha^R = 0.4$, $p_R = 0$.

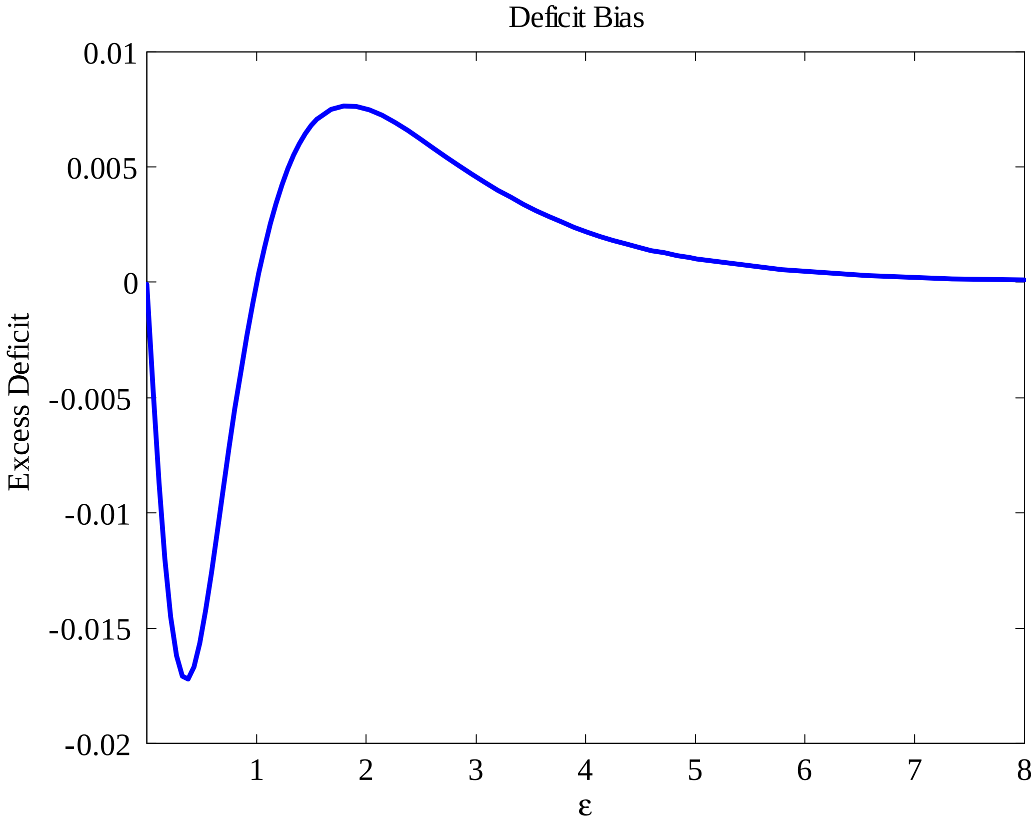

Figure 5: The public deficit under certain political turnover ($p_R = 0$) minus the deficit when the policymaker stays in office with certainty ($p_R = 1$). Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\sigma = 1$, $\phi = 1$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.

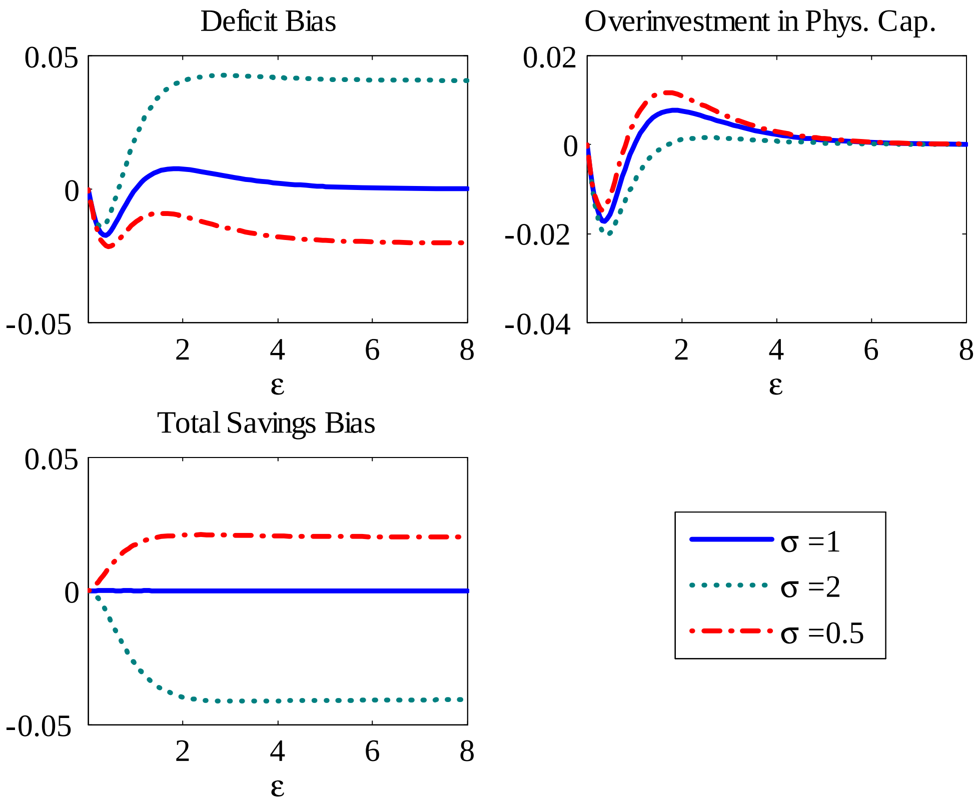

Figure 6: The public deficit and physical capital investment under certain political turnover ($p_R = 1$) minus the deficit and physical capital investment when the policymaker stays in office with certainty ($p_R = 0$). Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\phi = 1$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.

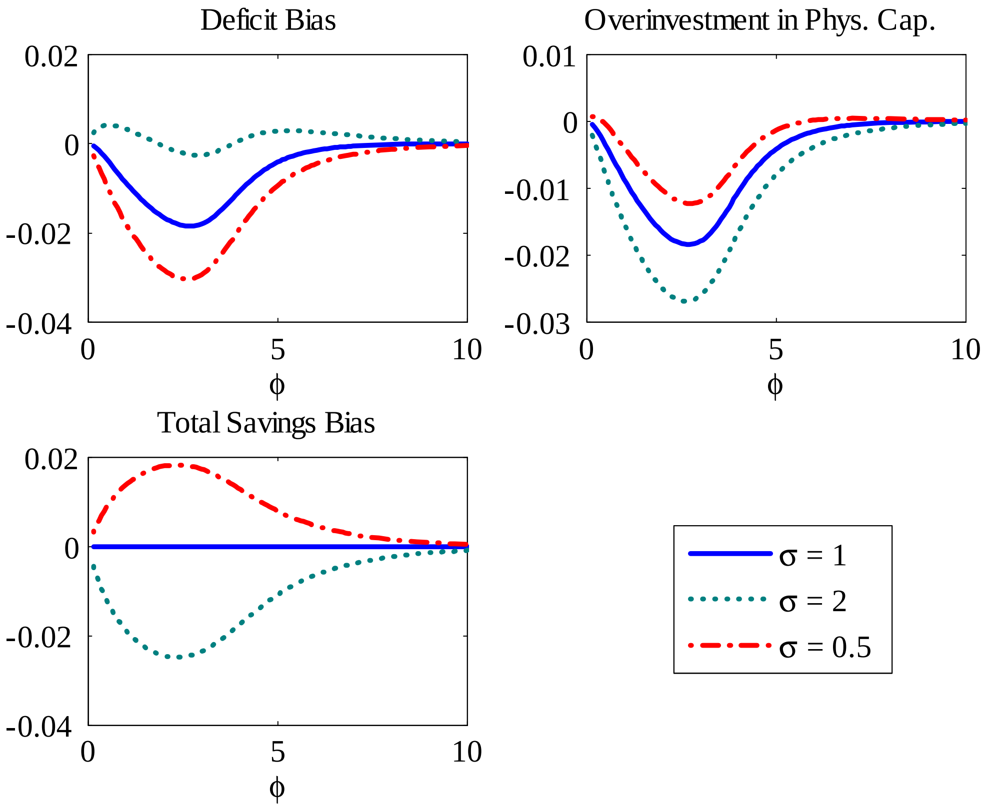

Figure 7: The public deficit and physical capital investment under certain political turnover ($p_R = 1$) minus the deficit and physical capital investment when the policymaker stays in office with certainty ($p_R = 0$). Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\varepsilon = 0.7$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.

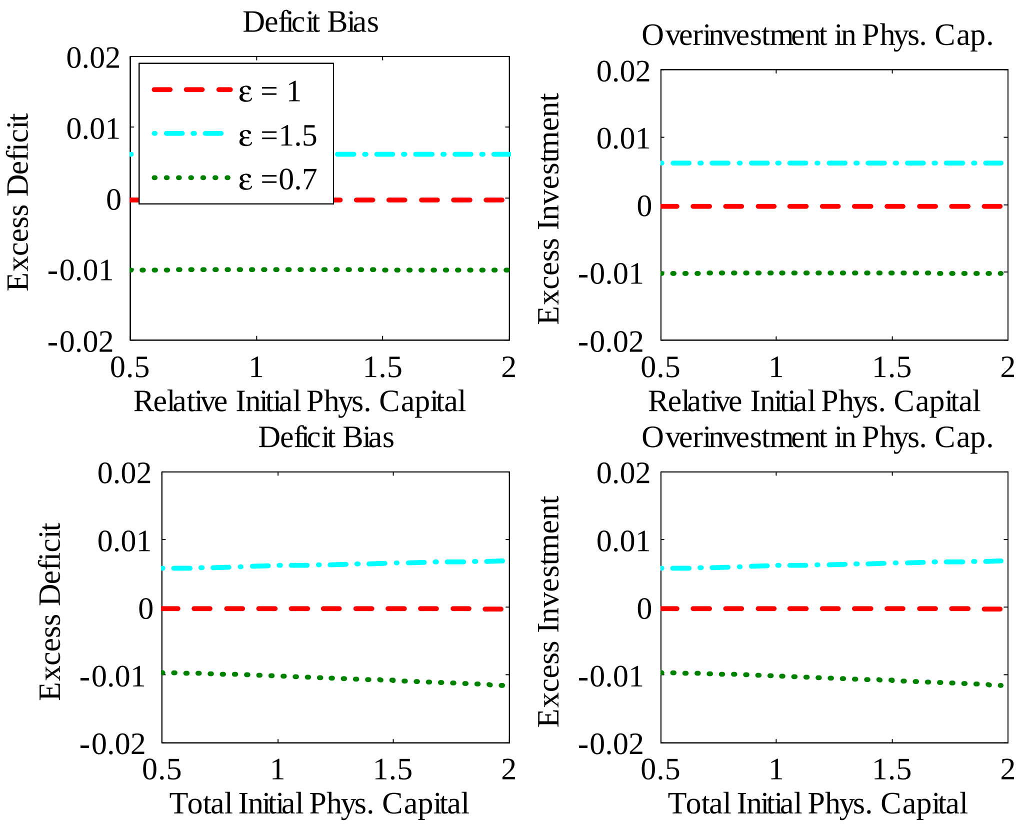

Figure 8: Deficit and physical capital investment under certain political turnover ($p_R = 0$) minus deficit and physical capital investment when the policymaker stays in office with certainty ($p_R = 1$). The horizontal axes vary the initial physical capital stock relative to the benchmark where initial physical capital stocks are as large and have the composition that would be maintained if there were no political turnover. The value 1 implies that initial physical capital stocks are at the benchmark levels. The two upper panels vary $\frac{k_1^g}{k_1^f}$ relative to the benchmark case. The two lower panels vary $k_1^g + k_1^f$ relative to the benchmark case. Fixed parameter values: $\delta = 0.2$, $\gamma = 0.7$, $\sigma = 1$, $\phi = 1$, $\alpha^R = 0.4$, $\alpha^D = 0.6$.