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PARTISAN PUBLIC INVESTMENT AND DEBT: The case for fiscal restrictions[°]

Roel M.W.J. Beetsma* and Frederick van der Ploeg**

Abstract

The political distortions in public investment projects are investigated within a bipartisan framework. The role of scrapping and modifying projects of previous governments receives special attention. The ruling party overspends on large *ideological* public investment projects and accumulates too much debt to bind the hands of its successor, especially if the probability of being removed from office is large and the possibility of scrapping is not ruled out. These political distortions have implications for the appropriate format of a fiscal rule. A deficit rule, like the Stability and Growth Pact, mitigates the overspending bias in ideological investment projects and improves social welfare. The optimal second-best restriction on public debt exceeds the socially optimal level of public debt. Social welfare is boosted more by investment restrictions on ideological projects. The government then perceives a larger benefit of debt reduction. In fact, if scrapping is forbidden, optimal investment restrictions can yield the socially optimal outcome. Finally, debt and investment restrictions are not needed if investment projects only have a *financial* return.

Keywords: political economy, bipartisan, public investment, ideological projects, market projects, scrapping public investment, golden rule, investment restriction, deficit rule.

JEL codes: E6, H6, H7.

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1. Introduction

The consensus view is that democracies are prone to excessive public deficits and debt levels. A popular explanation is based on the partisan political mechanism of Alesina and Tabellini (1990), where the government runs a deficit to leave fewer resources for a successor with potentially different preferences about public consumption.¹ Tabellini and Alesina (1990) derive similar results in a setting with voting about the budget (and its composition) and uncertainty about the future identity of the median voter. While these frameworks are based on politically motivated *public consumption*, in this paper we analyse deficits, debt and public spending allocations when political parties have partisan preferences about *public investment*. We believe that such differences are highly relevant in practice. By selecting their own pet projects, usually large, highly visible projects, politicians or their parties may be able to earn a lot of political credit. This is especially true for major infrastructure projects located in a geographical area represented by the politician (as is the case in the U.S.), but it is also true if different parts of the electorate have different preferences about the mode of transport (e.g., roads versus railways), energy provision (nuclear versus other types of power plants), etcetera.

We cast our analysis in a three-period framework with two rival political parties and two types of public investment projects that in principle can yield both financial returns and ideological returns. In contrast to the financial returns, the ideological returns on the two projects differ between the two parties. For example, one party may favour roads while the other party favours railways. Electoral uncertainty leads the governing party to overspend on its preferred investment project. In turn, this implies a deficit and debt bias. An important result of our paper is that the investment spending bias also produces a bias towards excessive current government spending, even though both parties have identical preferences towards public consumption (in contrast to the aforementioned papers). The logic is that the electoral uncertainty and, hence, the chance that resources will be spent in the future by a different government on an undesirable investment project, drives the current cost of public funds below the expected future cost of funds, leading not only to higher public investment, but also to higher current government consumption. This intertemporal political distortion in the dynamic efficiency condition for the optimal management of public debt is absent for public investment projects with pure financial returns and zero ideological returns.

Our analytical framework thus extends the standard bipartisan model of the debt bias to allow for public investment with an ideological component. We also allow for possible

¹ An alternative approach to explaining deficit and debt biases is based on a domestic common pool problem, where the minister of finance has insufficient credibility, no backing of the prime minister or lacks other institutional safeguards to resist the demands from the multitude of spending ministers and the pressure groups that push them (e.g., Von Hagen and Harden, 1994, 1995; Hallerberg and Von Hagen, 1999; Velasco, 1999, 2000; Krogstrup and Wyplosz, 2006).

complementarity between the two types of public investment projects and we introduce the possibility that part of the first-period investment project can be scrapped in the second period. Complementarity introduces a direct effect of the partisan ideological divide over the projects on first-period investment. It tends to make the latter more attractive, because it raises the future financial returns on the other project in the second period. However, first-period investment is held back to the extent that it induces higher future investment in the other project for ideological reasons.

With scrapping, the current cost of public funds is pushed further below the expected future cost of funds in the partisan outcome, implying an additional strategic reason for the current government to invest and borrow. Even when re-election is certain, there will now be excessive borrowing and overinvestment, *ceteris paribus*. These additional strategic reasons to invest too much can depress social welfare compared with the situation when scrapping is ruled out. Effectively, the incumbent government massively invests in its own pet project to discourage a future rival government from investing in its pet investment project. Once re-election is ensured, the incumbent scraps a substantial part of its own project. Obviously, this additional strategic inefficiency does not enhance social welfare.

While overspending on its own pet project is beneficial for the governing party given its chances of losing office, it is harmful for society at large. We consider deficit (or debt) and investment restrictions as possible ways to limit these social losses. Such restrictions are unnecessary if projects have only financial returns, since then the partisan and planner outcomes coincide. In the presence of ideological returns, however, these types of restrictions can bring the current cost of funds more in line with the expected future cost of funds, thereby weakening the strategic incentive for excessive borrowing. While a well-chosen deficit rule raises social welfare, we show that such a rule is dominated by appropriate restrictions on public investment. The reason is that the investment restriction is targeted at the origin of the distortions, namely the differences in the ideological valuation of the two investment projects by the two parties, while the debt restriction distorts the intra-temporal trade off between first-period consumption and investment. Crucially, a restriction on (future) investment in ideological projects raises the current government's perceived benefit of debt reduction, as the resources that are freed up for the future cannot be wasted on a project that yields no ideological return to this government. Debt will be thus lower and current ideological investment smaller. Moreover, less of the current investment will be scrapped in the future, while the time profile of government consumption is improved. In fact, if there is some rule to forbid scrapping and the incumbent thus knows *ex ante* that he cannot scrap, he will overinvest less. Combined with investment restrictions, such a scrapping rule can bring the economy to the social optimum.

Our work is related to Peletier, Dur and Swank (1999). They introduce public investment within the model of Tabellini and Alesina (1990) with partisan government consumption and show that the introduction of a balanced budget rule crowds out public investment. Their point is that such a rule is inefficient and needs to be supplemented with a rule to guarantee the optimal level of public investment. Our approach is more closely related to interesting earlier work by Glazer (1989), who shows that rational voters exhibit a consistent bias in favour of building durable projects that they would oppose were the decision theirs alone to make. The mechanisms are similar. Since current voters cannot sign contracts with next period's voters, the only way to limit future choices is to build durable projects. Apart from this commitment effect, there is also an efficiency effect. Voters might prefer to build a durable project now rather than no project and run the risk that next period a less efficient non-durable project is built. Although the work on the dynamic inefficiency of governments by Azzimonti-Renzo (2005) is concerned with disagreement about public consumption rather than investment, it should be mentioned as well. The struggle of short-sighted groups that alternate in power leads to overspending on public consumption, underinvestment in public capital and lower growth. Public investment is strategically reduced to limit public capital available for tomorrow's policymakers, who may have different preferences and are this way forced to spend less on their pet projects.

Earlier justifications of deficit rules rely on a multi-country, bipartisan framework with a common pool problem for the issue of government debt as well as time inconsistency problems arising from the erosion of the real value of nominal government debt (Beetsma and Uhlig, 1999). Our analysis abstracts from monetary policy and inflation targets, and offers an alternative rationale for deficit rules based on the political economy of investment in a partisan framework (cf., Persson and Svensson, 1989, and Alesina and Tabellini, 1990). We abstract from money and central bank behaviour, but conjecture that our rationale holds even for a single country where the central bank pre-commits to pre-announced inflation targets.

Section 2 discusses the apolitical outcome, which serves as our benchmark. Section 3 sets up the main premises of our bipartisan framework of analysis. We characterise the political outcome and also offer some numerical results with respect to changes in crucial parameters such as the interest rate, the elasticity of demand for public consumption and the degree of polarisation of political preferences. We also explore how optimal debt management, public consumption and public investment respond to temporary and future changes in exogenous revenue. Section 4 contrasts the political and apolitical outcomes if governments can scrap past investment and a second-hand market for public capital exists. Section 5 analyses optimal second-best restrictions on public investment and government debt. In Section 6 we clarify the golden rule for government finance. Finally, Section 7 concludes.

2. Apolitical outcome in the absence of scrap

To have a benchmark for comparison, we first characterise the apolitical outcome that prevails in the absence of elections. There are three periods and two possible investment projects K and L. These projects may yield both financial and ideological returns. The ideological returns are the non-financial or ideological benefits from the project and these are assumed to differ across members of the population. In particular, a fraction λ of the population favours investment project K, while a fraction $1-\lambda$ favours project L. Investment in project K, i.e., I , occurs in the first period and comes to fruition in the second period. Investment in project L, i.e., J , takes place in the second period and pays off in the third period. Investments in project K may benefit project L.

The government is utilitarian and thus adds the preferences of its citizens and maximises the social welfare function presented in the first panel of Table 1 subject to the present-value budget constraint given in the second panel. We use italics to denote variables and roman capitals to indicate functions. Social welfare equals the discounted value of present and future government consumption, G_1 and G_2 , plus the discounted value of the ideological return on investment in project K, i.e., I , and in project L, i.e., J . We assume separable preferences and set the social rate of discount to the market rate of interest $\phi = 1/(1+r)$. The excess of present government consumption plus investment in project K over first-period revenues, i.e., G_1+I-R_1 , must be financed by issuing government debt, B_1 . The excess of debt service, government consumption and investment in project L over public revenue in the second period, $rB_1+G_2+J-R_2$, is financed by additional government debt, B_2-B_1 . In the final period the financial return on project L must cover principal and interest on accumulated debt.

The first set of optimality conditions in the third panel of Table 1 states that the marginal utility of consumption in each period must equal the cost of public funds η_U . Demand for public consumption in each period thus declines with the cost of public funds. Furthermore, public consumption is smoothed over time, i.e., $G_1 = G_2 = G(\eta_U)$, $G' < 0$, where from now on subscript “U” denotes the apolitical outcome. Since it is optimal to smooth public consumption, the present-value budget constraint implies the following level of public debt:

$$B_1 = \frac{R_2 - R_1 + I - J + \rho_K K + \rho_L L / (1+r)}{2+r} = (R_p - R_1) + (I - LOSSK) - LOSSL,$$

where $R_p \equiv \frac{(1+r)R_1 + R_2}{2+r}$, $LOSSK \equiv \left(\frac{1+r}{2+r}\right)(I - \phi\rho_K K)$ and $LOSSL \equiv \left(\frac{1}{2+r}\right)(J - \phi\rho_L L)$ are the permanent levels of exogenous public revenues and losses on public investment project K and L, respectively. Hence, if there is a temporary fall in public revenues ($R_I < R_P$), government debt is used to contain the fall in government consumption today in such a way that it matches the fall in future government consumption (cf., Barro, 1979). Similarly, the incumbent government runs up a government debt for public investment in as far as the project earns its initial outlays back in the future (i.e., with $\phi\rho_K K = I$, B_I is raised with an amount I , ceteris paribus).

The second optimality condition in the third panel of Table 1 implies that the future financial return on investment, i.e., $\rho_L L_J(J_U, I_U)$, plus the ideological return on project L must equal the return on government debt, $1+r$:

$$(1A) \quad [\rho_L + (1-\lambda)\psi/\eta_U] L_J(J_U, I_U) = 1+r \Rightarrow J_U = J(\eta_U, I_U, r, \rho_L, \psi, \lambda).$$

The ideological return on project L increases, of course, with the fraction of the population that is in favour of this type of investment $1-\lambda$. It needs to be deflated by the marginal cost of public funds, η_U , to convert from utility to resource units. The demand for public investment in the second period J_U thus declines with the cost of public funds and increases with the fraction $1-\lambda$ of people in the population that prefer project L rather than K. It also increases with the financial return (ρ_L). If the marginal return on future investment increases with current investment (i.e., $L_{JI} > 0$), demand for investment in project L rises with past investment in project K.

The third optimality condition, the first-order condition for investment in project K, states that the financial plus ideological return on project K plus the corresponding indirect returns on project L should equal the return on government debt:

$$(2A) \quad [\rho_K + \lambda\psi/\eta_U] K'(I_U) + \phi[\rho_L + (1-\lambda)\psi/\eta_U] L_I(J_U, I_U) = 1+r \Rightarrow I_U = I(\eta_U, J_U, r, \rho_K, \rho_L, \psi, \lambda).$$

Hence, public investment in project K, i.e., I_U , declines with the cost of public funds η_U and the cost of borrowing/the rate at which future utility flows are discounted r . Investment I_U increases with its own financial return ρ_K and the ideological return ψ . If public investment in

project K affects project L positively (i.e., $L_I > 0$), I_U also increases with the financial return ρ_L on project L. Further, if the future marginal return on project L is reinforced by investment in project K (i.e., $L_{JI} > 0$), I_U rises with future investment J_U in project L. The effect on I_U of an increase in the fraction of people in the population that prefers project K rather than L (i.e., λ) is ambiguous. On the one hand, a higher λ raises the fraction of the people that directly derives utility from project K. This has a positive effect on investment I_U . On the other hand, a smaller share of the population derives utility from I_U in an indirect way through its positive effect on L. This affects I_U negatively. If the direct effect dominates, then we have $dI_U/d\lambda > 0$.

If the ideological return ψ on public investment is zero, (2A) states that the direct and indirect financial return on project K equals the return on bonds, $\rho_K K'(I_U) + \phi \rho_L L_I(J_U, I_U) = 1+r$. However, if the ideological return on project K is positive, $\psi > 0$, (2A) indicates that the total marginal financial return on project K falls short of the market rate of return, $1+r$.

If $L(J, I)$ is separable, investment in project K does not depend on future investment in project L. If $L(J, I)$ is not separable, we solve (1A) and (2A) to give:

$$(3A) \quad I_U = I^U(\eta_U, r, \rho_K, \rho_L, \psi, \lambda) \quad \text{and} \quad J_U = J^U(\eta_U, r, \rho_K, \rho_L, \psi, \lambda).$$

Substituting (3A) together with the demand for current and future public consumption into the present-value government budget constraint and solving for the cost of public funds yields:

$$(4A) \quad (1+r)R_1 + R_2 = (2+r)G(\eta_U) + [(1+r)I^U(\cdot) - \rho_K K(I^U(\cdot))] + [J^U(\cdot) - \left(\frac{1}{1+r}\right)\rho_L L(J^U(\cdot), I^U(\cdot))] \\ \Rightarrow \eta_U = \eta^U(R_1, R_2, r, \rho_K, \rho_L, \psi, \lambda).$$

If the government has more public revenue R_1 or R_2 at its disposal, the cost of public funds is lower. The terms in the two sets of square brackets indicate the financial losses on project K and project L, respectively. If investments are at their break-even levels, these terms in square brackets are zero, public investment can be de-budgeted from the present-value government budget constraint, and the golden rule of public finance is satisfied. Then, if the government needs to issue additional debt to finance government consumption ($R_1 < G_1$), a higher interest rate r pushes up the cost of public funds. Conversely, if $R_1 > G_1$, higher r pushes down η_U .

If the marginal financial return on public investment initially exactly matches the return on government debt, i.e., $\rho_K K'(I) + \rho_L L_I/(1+r) = 1+r$ and $\rho_L L_I(J, I) = 1+r$, a higher financial return on project K or L, i.e., higher ρ_K or ρ_L , always eases the government budget constraint and thus lowers the cost of public funds. If the marginal financial return on investment falls

short of the return on bonds, $\rho_K K'(I) + \rho_L L_I / (1+r) < 1+r$ and $\rho_L L_J(J, I) < 1+r$, the effects of higher financial returns on public investment on the cost of public funds are no longer unambiguous. On the one hand, an increase in ρ_K or ρ_L raises available resources for given investments in projects K, respectively L, thereby reducing the cost of funds. On the other hand, higher ρ_K or ρ_L boosts investment in these projects and thus pushes up the cost of funds. Also, if the marginal effect of I on L is large relative to that on K (more precisely, if $L_I > K'$), a higher fraction λ of people that prefers project K lowers the cost of public funds. A higher value of λ reduces the attractiveness of the project with the higher marginal return in I relative to that with the lower marginal return. Hence, this causes a reduction in I . On top of this, investment J in project L becomes less desirable. Both effects imply a fall in the demand for funds. Hence, the cost of funds shrinks. If the marginal effect of I on L is relatively small, the effect of λ on the cost of funds remains ambiguous.

If we substitute the cost of funds (4A) into (3A) and $G(\eta_U)$, we find the optimal levels of government consumption and investment. Alternatively, we can solve the social welfare problem with dynamic programming. The social planner then proceeds by backward recursion. It is easy to show that this yields the same outcome, since optimality requires that the cost of public funds in all periods must be the same, i.e. $\eta_{1U} = \eta_{2U} = \eta_U$.

Proposition 1: *In the apolitical outcome public consumption and the cost of funds are smoothed. Government debt is used to finance public investment until the marginal financial and ideological return on the project plus the indirect return via the complementarity with future projects equals the cost of issuing extra debt. Public investment is high if public revenues are high and the cost of funds is low or if the utility to the people and the financial return are high.*

3. Political outcome in the absence of scrap

3.1. A bipartisan framework with polarised preferences about public investment

Instead of a median voter approach (e.g., Bassetto and Sargent, 2006), we use a two-party partisan approach (cf., Alesina and Tabellini, 1990). The preferences and budget constraints are presented in the top two panels of Table 2. There are two political parties denoted by P and Q, respectively. They differ in their preference for the type of public investment projects (e.g., railroads versus roads). Only party P obtains an ideological return from investing in project K, whereas party Q obtains an ideological return from investing in project L (if $\psi > 0$). Both parties obtain the same financial returns from both projects. Subscript P indicates that the incumbent P secures re-election; subscript Q indicates that party Q gains office.

Without loss of generality, assume that party P is in power in the first period and chooses public consumption G_1 and public investment in the infrastructure of its choice I . It leaves a public debt to the next government B_1 equal to the excess of spending G_1+I over exogenous revenue R_1 . At the end of the first period, there are elections. Whoever gets into office in the second period, must repay the debt incurred during the first period plus interest. The incumbent P is re-elected with probability π and with probability $(1-\pi)$ party Q gets into office. Since elections depend on other variables than the type of public investment, the probability of re-election, π , can differ from unity (zero) even if the fraction λ of people in favour of project K is larger (smaller) than 50%.

The party that secures office in the second period pays off debt including interest, $(1+r)B_1$, cashes the financial return on public investment $\rho_K K(I)$ and uses the remaining funds for public consumption G_2 and investment J in project L. Investment in project L induces more capital, especially if investment has already taken place in the period before. For example, government P may be strong in province K and wish to build a railroad from the capital city to province K. Party Q, however, may have a strong base in province L and want to relay the original rail-track from province K to province L. It then makes sense to have $L_{JL}>0$. Each governing party cashes the financial returns from the operation of the railway.

In the closing period the financial return on project L pays for principal and interest on the debt left at the end of the second period. The present-value budget constraint states that the present value of current and future government spending cannot exceed that of current and future government revenue. We abstract from distorting taxes, so that financial investment is only possible by cutting government consumption today or, via an increase in government debt, in the future.

Each political party obtains utility from government consumption, $u(G_1)+\phi u(G_2)$, and from their own ideological capital stock, $\psi\phi K(I)$ or $\psi\phi^2 L(J,I)$. Ideological projects with no financial returns correspond to $\psi=1$ and $\rho_K=\rho_L=0$. Market projects with only a financial return correspond to $\psi=0$ and $\rho_K>0$ and $\rho_L>0$. In general, investment projects have both an ideological and a financial return. Note that, even if the incumbent is kicked out of office, it still receives the ideological return $\psi\phi K(I)$ in period 2 as the project is in existence then.

3.2. Strategic investment in face of political uncertainty

The timing of events is crucial for the political outcome. To ensure time consistency, we work backwards and start with the policies that have to be chosen after the election. The third panel of Table 2 presents the *post-election* outcomes. The party that gains office in the second period cashes the exogenous revenues plus financial returns on party P's earlier investment,

pays off principal and interest on public debt and spends the remaining funds on public consumption and investment in project L. If party i secures office, it chooses consumption G_{2i} and investment J_i to maximise second-period utility V_i subject to the budget constraints of the second and final period, where $i=P, Q$. This yields the following insights.

First, the marginal utility of public consumption must equal government i 's marginal cost of public funds η_i , $i=P, Q$. This yields the demand for public consumption as a negative function of the cost of public funds, $G_{2i} = G(\eta_i)$, $G' < 0$, $i=P, Q$.

Second, if party P gets into office in the second period, it sets investment in project L such that its marginal financial return equals the cost of capital (the purchase price plus the interest rate), i.e., $\rho_L L_J(J_P, I) = 1+r$. Party Q ensures that the total marginal return on investment, i.e., the marginal financial return plus the ideological return divided by the cost of funds, must equal the user cost of capital under Q's reign:

$$(1P) \quad (\rho_L + \psi / \eta_Q) L_J(J_Q, I) = 1+r.$$

The main difference with condition (1A) for the apolitical outcome is that party Q gives full ideological weight to investment in project L, so ignores the wishes of the people that do not care about investment in project L. These first-order conditions yield the second-period investment in project L under party P, respectively Q:

$$(5) \quad J_P = J^P(I, r, \rho_L) \quad \text{and} \quad J_Q = J^Q(I, \eta_Q, r, \rho_L, \psi).$$

Combining these with the second-period budget constraints of the respective parties, we obtain the cost of funds under the second-period rule of party P and Q, respectively:

$$(6) \quad \eta_P = \eta_P(I, R_2 - (1+r)B_1, r, \rho_K, \rho_L) \quad \text{and} \quad \eta_Q = \eta_Q(I, R_2 - (1+r)B_1, r, \rho_K, \rho_L, \psi).$$

Higher exogenous resources R_2 and a higher return ρ_K on investment in K reduce the cost of funds, but a larger stock of debt, B_1 , raises the cost of funds. Under Q's reign the effect of a higher interest rate r on the cost of funds is ambiguous. It depresses demand for investment in project L and the need for funds and thus lowers the cost of funds. But it also depresses the present value of the financial return on project L and thus pushes up the cost of funds. Also, the effect of a higher financial return on project L on the cost of funds is ambiguous. On the one hand, a higher financial return raises available resources and lowers the cost of funds. On

the other hand, it raises the demand for investment in project L, thus pushing up the cost of funds. Similarly, larger investment in K has an ambiguous effect on the cost of funds. With party Q in power, the need for funds and the cost of funds are high if the ideological value of investment projects (i.e., ψ) is high and thus the demand for public investment is high.

The fourth panel of Table 2 presents the *pre-election* outcomes. The incumbent government maximises its expected utility fully aware of the after-election consequences of party Q possibly taking over power on the level of government consumption and the capital it has invested in project K. The optimal level of public consumption follows from setting the marginal utility of government consumption $u'(G_I)$ equal to the pre-election marginal cost of public funds, η_I . Investment by the incumbent government follows from:

$$(2P) \quad (\pi\eta_P\rho_K+\psi) K'(I) + \phi\pi\eta_P \rho_L L_1^P + (1-\pi)\eta_Q [\rho_K K'(I) + (\phi\rho_L L_1^Q - 1)J_1^Q + \phi\rho_L L_1^Q] \xi = (1+r)\eta_I,$$

where the magnitude of the intertemporal political distortion can be seen from

$$0 < \xi \equiv \frac{G'(\eta_Q)}{G'(\eta_Q) + (\phi\psi/\eta_Q)L_1^Q J_1^Q} \leq 1$$

and $L_1^P \equiv \partial L(J_P, I)/\partial I$, $J_1^Q \equiv \partial J(\cdot)/\partial \eta_Q$, etcetera. The total marginal return of investment to the incumbent government must equal the user cost of capital in the first period times the gross interest rate, i.e., $(1+r)\eta_I$. The total marginal return of investment equals the marginal financial return of investing in public capital plus the marginal ideological return. The latter component is given by $\psi K'$. The *direct* marginal financial returns are $\pi\eta_P\rho_K K'$ and $(1-\pi)\eta_Q\rho_K K'$ weighted with the respective re-election probabilities and the respective costs of public funds. The present values of the *indirect* marginal financial returns are $\phi\pi\eta_P\rho_L L_1^P$ and $(1-\pi)\eta_Q\phi\rho_L L_1^Q$ due to the positive effect of first period investment on the financial return on project L (under both government types, weighted with the likelihood of their appearance and the relevant cost of public funds). These indirect returns obviously depend on second-period investment. There are two additional indirect components of the marginal financial return. The first of these, $(1-\pi)\eta_Q\phi\rho_L L_1^Q J_1^Q$ captures the positive effect of first-period investment on second-period investment and, thereby, on the financial return on L. The second one is negative and concerns the drain on resources J_1^Q caused by the higher outlay on J . The future marginal financial returns under government Q are diluted by Q's excessive investment (from P's perspective) in J when it values project L for ideological reasons.

Party Q thus attaches ideological utility to the project L that is not valued by the incumbent government P and that drives a wedge between the valuation of parties P and Q of this project (i.e., pushes ξ down). This crucial effect thus manifests itself by a value of the key coefficient ξ that is less than one if $\psi > 0$. Consequently, holding all costs of funds constant and assuming that an increase in I has a positive net marginal financial benefit under Q's reign,² the incumbent party P invests less in project K to discourage a possible future government under the rule of party Q to invest in project L.

Finally, the dynamic efficiency condition for the optimal level of public debt is:

$$(7) \quad \pi \eta_P + (1-\pi) \eta_Q \xi = \eta_I.$$

The marginal benefit of extra public debt at the end of the first term must equal the expected marginal cost in the second term (the left-hand side of the equation). The weight given to the future cost of public funds under a possible future rule of party Q is driven below one, because of Q's incentive to invest in a project to which party P does not attach any ideological value. This political distortion implies $\xi < 1$ and that the incumbent government P cares less about containing debt. Effectively, the current cost of funds is reduced below the expected future cost of funds and this encourages the incumbent government to spend and borrow more.

3.3. Comparison of apolitical and partisan outcomes

In the sequel we use the terms 'debt bias' and 'investment bias' when (for given parameters) public debt and investment, respectively, under the partisan government exceed their levels chosen by the social planner under the apolitical outcome.

3.3.1. Special case: party P faces no electoral uncertainty ($\pi=1$)

It is instructive to study first the case where party P faces no electoral uncertainty ($\pi=1$). If in the Alesina and Tabellini (1990) framework electoral uncertainty vanishes, the debt bias also vanishes. Knowing that future resources can no longer be 'lost' to a type of public good that the current government does not value, the governing party no longer has an incentive to overspend at the cost of future spending. In our set-up, matters are more complicated. With $\pi=1$, the conditions (2P) and (7) that determine investment I and public debt B_I simplify to:

$$(8) \quad (\rho_K + \psi / \eta_P) K'(I) + \phi \rho_L L_1^P = 1+r \text{ and } \eta_P = \eta_I.$$

² That is, the term in square brackets in (2P) should be positive.

The second condition implies that public consumption must be the same in both periods, just like under a social planner. Equation (2P) needs to be compared with (2A). Holding the cost of funds equal in the two cases ($\eta_P = \eta_U$), then if $\lambda = 1$, the investment outcomes under the partisan and the planner case are equal. However, in general, debt and also first-period investment differ from the apolitical outcome. With $0 < \lambda < 1$, the comparison between party P's investment in K and the planner's investment in K becomes ambiguous. The partisan government attaches a higher ideological weight to project K than the planner, inducing it to invest more (higher I). However, the zero ideological weight that the partisan incumbent attaches to future investment L induces it to invest less (lower I).

3.3.2. Absence of complementarity between investment in project K and L

In this case equation (2P) simplifies to $(\pi \eta_P \rho_K + \psi) K'(I) + (1 - \pi) \eta_Q \rho_K K'(I) = (1 + r) \eta_I$. Using (7), this reduces further to $(\rho_K + \psi / \eta_I) K'(I) = (1 + r)$. Clearly, holding the cost of funds constant ($\eta_I = \eta_U$), investment I is larger under a partisan government than under the planner (compare with (2A) with $L_I = 0$). We also see that party Q's ideological attachment to project L only affects investment I indirectly via the cost of funds η_I .

3.3.3. Numerical comparison between planner and partisan government

To better understand the political economy of public investment, we present some numerical results in Table 3. We adopt an iso-elastic utility function for government consumption. Parameter ε is the coefficient of relative risk aversion while δ regulates the welfare share of public consumption relative to investment. The demand functions for public consumption have an elasticity with respect to the cost of funds equal to $-1/\varepsilon = -0.67$. We want that before- and post-election investment projects reinforce each other, but are not perfect substitutes in order to avoid a degenerate solution. The specified Cobb-Douglas production function creates future capital out of past and present investment. We set the interest rate and the rate of time preference at 0.2. Preferences are completely polarised ($\lambda = \pi = 0.5$). Table 3 presents the results, assuming decreasing returns to scale of project L in past and future investment (i.e., $\sigma + \theta < 1$).³ In the apolitical case, there is no uncertainty and social welfare is given in Table 1. In the political case, utilitarian social welfare aggregates all individual utilities and is calculated as:

³ We avoid a constant returns specification (as is often used), because if we introduce scrap in Section 5 and $\sigma + \theta = 1$, the cost of funds η_Q will be fixed by party Q's first-order conditions and thus becomes independent of party P's actions in the first period. In fact, numerical comparison of outcomes under constant and decreasing returns to scale did not reveal any qualitative differences.

$$u(G_I) + \phi\pi u(G_{2P}) + \phi(1-\pi) u(G_{2Q}) + \lambda \phi\psi K(I) + (1-\lambda)\phi^2\psi[\pi L(J_P, I) + (1-\pi)L(J_Q, I)].$$

The first three terms capture current and expected future discounted utility from public consumption and are the same for all individuals. The fourth term stands for the ideological benefit from project K and is only valued by a fraction λ of the population. The final term captures the ideological benefit from project L and is only valued by the other part of the population. This final term consists of two components, which capture the probability-weighted outcomes of L under the two possible types of government in the second period.

We first compare the apolitical (planner's) and partisan outcomes presented in Table 3. In all cases debt is higher under the partisan government. Also first-period investment is always higher than under the planner as the partisan government gives full weight to investment I while the planner only attaches a weight corresponding to the population share in favour of project K.

We now discuss the effects of perturbations in the various parameters of the model:

- A higher utility weight for public spending δ raises public spending and reduces investment. Because public spending is not subject to a partisan bias, the debt level falls with a higher δ .
- A higher elasticity of demand for public consumption with respect to the cost of funds (higher $1/\varepsilon$) marginally raises demand for public consumption by the incumbent P in period 1. Also, it is more attractive for P to invest in project K. These two effects result in higher public debt. Under both parties second-period consumption is lower than under the baseline, while investment in project L is higher, reflecting the positive effect that the higher level of first-period investment has on the marginal contribution of investment J to project L.
- A lower interest rate r boosts investment by the incumbent P. The reason is that the market interest rate also corresponds to the subjective discount rate of party P. Since the returns on P's investment in project K only materialise in the second period and a lower discount rate raises the relative weight of future utility terms, P will make a bigger investment in K.
- A lower interest rate r also makes debt issuance less expensive and thus leads to an increase in public debt. It also leads to a drop in public consumption (under the social planner and in the partisan case of party P in both periods and party Q in period 2). This may seem surprising, but the reason is that the drop in public consumption is necessary to make possible the increase in investment engendered by the lower interest rate. The drop in public consumption in the second period under P is the result of higher debt servicing costs that are only partly offset by more financial return on project K. In case of party Q taking over in the second period, the drop in consumption is reinforced by the higher investment in project L.

- An increase in the financial return ρ_K on project K boosts both investment in project K and project L, because of the complementarity of the projects and the more generous availability of resources in the second period. Similarly, an increase in ρ_L boosts investment in both project L and in K, because of the higher indirect return via the complementarity with project L. Obviously, consumption smoothing and the need to finance those additional investments producing higher future returns, require higher public debt. The effects on government consumption are ambiguous for the various cases, since a larger amount of available resources allows for more government consumption (an “income effect”) while the higher return on the investment project (which contributes to utility) leads to a shift from government consumption to investment (a “substitution effect”).
- Higher government revenue R_1 or R_2 raises party P’s public consumption in both periods as well as investments in projects K and L. Higher revenue during P’s first reign of office R_1 corresponds to a temporary increase in public revenue, so it is optimal to save for the next period of government by reducing debt. However, the reduction in the public debt is rather small compared to the rise in investment I . While consumption under party P is higher in the second period, consumption under party Q is actually (slightly) lower than under the baseline, the reason being that the due to the reinforcing character of investments I and J , investment J is so much higher that this dominates the effect of the higher financial return on K and the lower debt servicing costs in period 2. Similar results obtain when R_2 is raised, although in that case public debt goes up substantially in order to smooth public consumption.
- Less ideological return on government investment projects (i.e., $\psi=0.1$) leads to less investments in both projects while government consumption is boosted. As a result, there is less accumulation of government debt. Interestingly, the polarisation becomes less severe and thus the level of government consumption is less affected by whether party P or party Q gains office. The welfare loss arising from the partisan bias is much less than before.

We summarise the results of this section in the following proposition:

Proposition 2: *Ideological attachment by a rival successor to investment projects that are not valued by the incumbent drives the cost of funds to the incumbent below the expected future cost of funds. This induces the incumbent to issue more debt and to invest more in its pet investment project. Furthermore, the lower cost of funds for the incumbent boosts demand for government consumption so that there is no smoothing of public consumption. These political distortions are particularly large if the probability of being removed from office is high. The partisan government invests more in its pet project than the planner, since the planner also cares about the other investment project.*

4. Analysis with scrap

We now allow the government to scrap part of investment in project K in the second period. We denote the amount of scrap by S . Scrapping yields βS at the second-hand market, which can be used for public consumption or investment in Q's own favourite project. The capital production function for project L is now written $L(J, I-S)$. For example, think of a road that at extra cost can be converted into a railway. Part of the original road may be dismantled and sold for its land value, implying a shorter railway track and thus a smaller L. We first analyse the outcomes under the planner and then turn to the case of the partisan government.

4.1. Social planner with scrap

Again, the planner smoothes consumption over time, $G_1 = G_2 = G(\eta_U)$, $G' < 0$, and thus:

$$B_1 = (R_p - R_1) + (I - LOSSK) - LOSSL + \beta S / (2 + r).$$

The final term is new and shows that the government borrows more if it anticipates more scrap revenue. This way the revenues from scrap are smoothed over time. The first-order condition for investment in project L is still given by (1A), with the term $I_U - S_U$ replacing I_U . In addition, the planner sets the marginal financial plus ideological losses of scrapping to the scrap price times the rate of interest:

$$(9A) \quad [\rho_L + (1-\lambda) \psi / \eta_Q] L_I(J_U, I_U - S_U) = (1+r) \beta.$$

The planner weighs the marginal ideological loss by the share $1-\lambda$ of the population that attaches value to project L. Combining (1A) and (9A), we see that the marginal rate of substitution between past and future investment must equal the scrap price of past investment, $L_I/L_J = \beta$. Conditions (1A) and (9A) can be solved together for scrapping and investment:

$$(10A) \quad J = J^{US}(\eta_Q, r, \beta, \rho_L, \psi, \lambda) \text{ and } S = S(I, \eta_Q, r, \beta, \rho_L, \psi, \lambda) = I + S^{US}(\eta_Q, r, \beta, \rho_L, \psi, \lambda).$$

Higher past investment I leads one-for-one to scrapping in the second period. A higher cost of public funds, a higher interest rate and a lower financial or ideological return on project L reduces the demand for investment by government Q and induces more scrapping. A higher scrap price β implies that it is more attractive to scrap past investments of government P. As a

result, if investments in the two projects reinforce each other (i.e., $L_{IJ} > 0$), the productivity of investment J falls and thus there is a decline in investment in project L.

The first-order condition for investment in the first period is still given by (2A), with the term $L(J_U, I_U - S_U)$ replacing $L(J_U, I_U)$, so that the sum of the present discounted marginal financial plus ideological returns (directly via K and indirectly through the effect of I on J and, hence, on L) should equal the cost of funds. If we use (9A), condition (2A) becomes:

$$(2A') \quad [\rho_K + \lambda \psi / \eta_U] K'(I_U) + \beta = 1 + r.$$

Hence, the marginal return in the second period of an additional unit of investment in project K consists of the marginal financial and ideological return plus the marginal revenue of scrapping one unit (recall that one additional unit of I leads to one more unit of scrap).

4.2. Partisan outcome with scrap

The parties trade off scrap value against the marginal return on investment in project L. For party P, the marginal return on investment in project L only involves a financial return, but for party Q it is both a financial and an ideological return. In the second period both parties choose government consumption, investment in project L and now also the amount of scrap. The first-order conditions for public spending are again $u'(G_{2i}) = \eta_i$, $i = P, Q$. The optimality conditions for investment in L by parties P and Q are changed to, respectively:

$$(1P') \quad \rho_L L_J(J_P, I - S_P) = 1 + r \quad \text{and} \quad (\rho_L + \psi / \eta_Q) L_J(J_Q, I - S_Q) = 1 + r.$$

The first-order conditions for scrapping are, respectively, for P and Q:

$$(9P) \quad \rho_L L_I(J_P, I - S_P) = (1+r) \beta \quad \text{and} \quad (\rho_L + \psi / \eta_Q) L_I(J_Q, I - S_Q) = (1+r) \beta.$$

Given that the ideological returns on project L are zero for party P, this party sets the marginal revenue β of one more unit of scrap equal to the discounted marginal financial cost associated with the fall in public capital L. Party Q gives full weight to the ideological return while the planner attaches only a weight $1 - \lambda$ to the ideological return – compare (9P) with (9A). Combining (1P') and (9P), we obtain for party P, respectively party Q:

$$(10P) \quad S_P = I + S^{\text{PS}}(r, \beta, \rho_L) \quad \text{and} \quad J_P = J^{\text{PS}}(r, \beta, \rho_L)$$

$$S_Q = I + S^{QS}(\eta_Q^+, r^+, \beta^+, \rho_L^-, \psi^-) \text{ and } J_Q = J^{QS}(\eta_Q^-, r^-, \beta^-, \rho_L^+, \psi^+).$$

As under the planner, scrap increases one for one with the investment made in the first period. Also the signs of the partial derivatives of scrap with respect to the interest rate, the second-hand price of scrap and the marginal financial return on L are the same as under the planner. Since P only scraps for financial reasons, only scrap under party Q depends on the cost of funds and the ideological value it attaches to capital L, where the signs of the partial derivatives are as under the social planner.

Substituting demand for government investment and scrapping (10P) as well as demand for government consumption into the post-election budget constraints of the two parties and solving for the cost of funds yields:

$$(6') \quad \eta_P = \eta_P^S(I, R_2, -(1+r)B_1, r^+, \beta^-, \rho_K^-, \rho_L^-) \text{ and } \eta_Q = \eta_Q^S(I, R_2, -(1+r)B_1, r^?, \beta^-, \rho_K^?, \rho_L^+).$$

The cost of public funds is high if the debt plus interest inherited from party P is high, exogenous revenues are low, first-period investment (and, thus, its financial revenues) are low and the scrap value of party P's investment project is low. Not surprisingly, the cost of funds is also high if the financial return on project K is low as available resources are comparatively low. However, with party Q in power, the need for revenue and the cost of funds are high if the ideological value it attaches to project L (i.e., ψ) is high and thus the demand for public investment is high. Also, under Q, the effect of a higher interest rate r on the cost of funds is ambiguous. The interest rate affects the cost of funds in three ways. It reduces the present value of the financial return on a project L of given size. This pushes up the cost of funds. It also depresses demand for investment in project L. The resulting cash saving exceeds the resulting fall in the financial return on L, because, when evaluated at its equilibrium outcome, the marginal return on J is dominated by the market interest rate. The third effect is that an increase in the interest rate raises scrap. The marginal cash revenue on the second-hand market for scrap exceeds the induced reduction in the financial revenue on L. The second and third effects contribute to a negative effect of the interest rate on the cost of funds. These two effects disappear if P is in power, so that under P an increase in r has an unambiguous positive effect on the cost of funds. Finally, under Q the consequences of a higher marginal return on L are ambiguous. On the one hand, a higher value of ρ_L raises the financial return for given values of scrap and investment J . On the other hand, the increase in ρ_L induces more investment J , which at the margin fails to earn back its cash outlay, and less scrap, for which

the foregone cash revenue dominates the financial return on the increased capital stock L . With P in power these last two effects vanish and the effect of a change in ρ_L on the cost of funds is unambiguous.

The fourth panel of Table 2 presents the *pre-election* outcome in this bipartisan framework. The incumbent government maximises its expected utility being fully aware of the after-election consequences of party Q taking over power on the level of government consumption and the capital it has invested in project K . The optimal level of public consumption follows from setting the marginal utility of government consumption $u'(G_I)$ to the pre-election cost of public funds, η_I . Investment by the incumbent follows from:

$$(11) \quad (\rho_K + \psi / \eta_I) K'(I) + \beta = 1 + r.$$

The marginal ideological plus financial return (payback plus scrap) on investment should equal the user cost of capital. Finally, the dynamic efficiency condition for public debt is:

$$(7') \quad \pi \eta_P + (1 - \pi) \eta_Q \xi^S = \eta_I \quad \text{where} \quad 0 < \xi^S \equiv \frac{G'(\eta_Q)}{G'(\eta_Q) + (\phi \psi / \eta_Q)(L_I^Q J_\eta^{QS} - L_I^Q S_\eta^{QS})} \leq 1.$$

Again, the marginal benefit of public debt equals the expected future marginal cost. The weight given to the future cost of public funds under a possible future rule of party Q is now driven more severely below one due to the extra term in the denominator than when there is no scrapping, again provided that Q has an incentive to invest in a project to which party P does not attach any ideological value (cf., the definition of ξ after equation (2P)). If the ideological return on project L is positive, the optimal scrapping condition (9P) implies that the scrap value exceeds the discounted value of future financial returns. With scrapping, the current cost of funds is therefore driven even more below the expected future cost of funds and this encourages the incumbent government to invest and borrow even more.

4.3. Comparison of planner with partisan government when there is scrapping

4.3.1. Special case: party P faces no electoral uncertainty ($\pi=1$)

If there is no electoral uncertainty, the dynamic efficiency condition for public debt under party P becomes $\eta_P = \eta_I$. We thus have equal government consumption in the two periods. Holding first-period government consumption constant across the planner's and partisan cases (thus, $\eta_P = \eta_I$), the partisan case will be characterised by over-investment and a debt bias.

4.3.2. Numerical comparison between planner and partisan government

For our numerical comparison between the planner and the partisan government with scrapping, we use the same specifications and parameter choices as before. The computation of social welfare now takes account of the effect of scrapping on project L. A couple of the results reported in panel (b) of Table 3 stand out.⁴ First, as long as there are full ideological returns, the planner finds it optimal not to scrap any of the investment done in the first period,⁵ thereby making optimal use of the complementary nature of earlier investment with the new investment in project L. Only if the ideological return becomes small ($\psi=0.1$), scrapping gets positive as the benefit from investment in project L gets small. The extra return from scrapping induces party P to substantially increase investment (compared to the case without scrapping). Indeed, if party P remains in office in the second period, it scraps virtually all earlier investment as the benefit from leaving some of the investment in place only results in some additional financial return on project L. Investment in project K is thus always higher under party P than under the planner. Moreover, as suggested by Proposition 1, government debt is also always larger than under the planner. Furthermore, in line with Proposition 2, investment in project K and government debt is for each case higher when the government is allowed to scrap than when scrapping is not permitted (compare with panel (a) in Table 3). This is not necessarily true for government consumption. A lower scrap value ($\beta=0.35$) leads, not surprisingly, to less scrapping and less scrap revenues. As a result, a potential rival government needs to be constrained less, and thus the incumbent invests less and runs up less government debt. The smaller political distortions allow a higher level of current government consumption for the incumbent and also a higher level if re-elected. If the rival gets re-elected, it spends less on government consumption but invests more in its pet project, since it scraps less of the complementary investment done in the first period. The following proposition summarises the main results of this section:

Proposition 3: *With scrapping, there is an extra reason for the current cost of public funds to fall short of the expected future cost of funds in the partisan outcome. As a result, there is an extra strategic reason for the incumbent government to invest and borrow.*

Scrapping may even reduce social welfare even though scrapping yields financial revenues – compare last columns of panels (a) and (b) of Table 3. If the incumbent P is re-elected, it scraps almost all of its original investment in project K, thereby lowering the ideological

⁴ We left out many of the perturbations in Table 3(b), since they are qualitatively similar to the ones in Table 3(a).

return on investment in project L that part of the population receives. From the perspective of this part of the population, most of the massive earlier investment in K is simply wasted. This indicates that scrapping gives a reason for substantial strategic over-investment in the pet project of the incumbent to tie the hands of a potential rival, only to be scrapped again once re-election is ensured. In other words, in a partisan context, giving a political party more margins for freedom may actually be harmful, as it may exacerbate a pre-existing strategic inefficiency. Further numerical analysis (not reported in Table 3) shows that if the share λ of the population that prefers project K is sufficiently large, social welfare under scrapping exceeds that when scrapping is not allowed.

5. Fiscal restrictions

The partisan allocation rarely coincides with that under the social planner. In this section, we examine whether appropriate fiscal rules and constraints are able to bring the partisan solution closer to the social optimum. In particular, we explore the benefits of restrictions on public investment and a deficit rule. Throughout this section, we allow for scrapping (part of) the investment in project K during the second period.

5.1. Restrictions on public investment

Let us turn to the partisan outcomes if investments by both parties are restricted to some values $I = I^R > 0$ and $J = J^R > 0$. The demand function for public consumption if i ($=P, Q$) gets into office is given by $G_{2i} = G(\eta_i)$, $G' < 0$. Without scrapping, the costs of funds are given by:

$$\eta_P = \eta_P^R(I^R, J^R, R_2 - (1+r)B_1, r, \rho_K, \rho_L) \text{ and } \eta_Q = \eta_Q^R(I^R, J^R, R_2 - (1+r)B_1, r, \rho_K, \rho_L).$$

The main difference with (6) is that the restricted future investment level J^R now appears as an exogenous parameter determining the second-period cost of funds. Its effect is ambiguous. When $\phi_{\rho_L L_J} < 1$, an increase in J^R enhances second period resources and lowers the costs of funds. The opposite occurs when $\phi_{\rho_L L_J} > 1$, while for $\phi_{\rho_L L_J} = 1$, the effect of J^R on the costs of funds is nil. The dynamic efficiency condition for public debt becomes:

$$\pi \eta_P + (1-\pi) \eta_Q = \eta_I.$$

⁵ Solving the model yields a negative solution for the optimal level of scrapping. As we rule out

Substituting the investment restrictions into the second-period budget constraints under the two types of governments, we find $G_{2P} = G_{2Q}$. Combined with the optimality condition for the public debt, we conclude that $\eta_P = \eta_Q = \eta_Q$, which implies perfect consumption smoothing over time, irrespective of who is in office in the second period. Setting the investment restrictions at the planner's investment levels, the planner's allocation is fully replicated and social welfare is maximised, as can also be seen from panel (a) of Table 4.

When scrapping is allowed, the optimal scrapping conditions are as before, except that investments in those conditions are restricted to the indicated levels. Hence, we have:

$$(10P') \quad S_P = I^R + S^{PR}(\bar{J}^R, r^+, \beta^+, \rho_L^-) \text{ and } S_Q = I^R + S^{QR}(\bar{J}^R, \eta_Q^+, r^+, \beta^+, \rho_L^-, \Psi).$$

Also, the costs of funds if P, respectively Q, gains office in the second period are:

$$(6'') \quad \eta_P = \eta_P^{RS}(\bar{I}^R, \bar{J}^R, R_2 - (1+r)B_1, r^-, \beta^-, \rho_K^-, \rho_L^-) \text{ and } \eta_Q = \eta_Q^{RS}(\bar{I}^R, \bar{J}^R, R_2 - (1+r)B_1, r^-, \beta^-, \rho_K^-, \rho_L^-, \Psi).$$

The dynamic efficiency condition for the optimal level of public debt (7') and the demand function for consumption by government P are unaffected, but the wedge between the valuation of parties P and Q of project L becomes:

$$0 < \xi^{RS} = \frac{G'(\eta_Q)}{G'(\eta_Q) - (\phi\Psi/\eta_Q)L_1^Q S_\eta^{QR}} \leq 1.$$

Again, if public investment is ideologically motivated and scrapping is allowed, there is a wedge between the valuations of parties P and Q of project L (i.e., $0 < \xi^{RS} < 1$). More importantly, *ceteris paribus*, the wedge with investment restrictions is smaller than without such restrictions (i.e., $\xi^{RS} > \xi^S > 0$). Effectively, the investment restriction brings the current cost of funds more in line with the expected future cost of funds and thus weakens the strategic incentive to borrow.

Panel (b) in Table 4 reports the outcomes with restrictions on public investment when scrapping is permitted. Investments are restricted to the levels chosen by the planner. Debt levels are still higher and welfare levels are lower than under the planner. The higher debt levels reflect the (higher) expected future revenue from scrapping, because party P benefits

negative scrapping as economically meaningless, we resolve the model restricting scrapping to zero.

less from the complementarity between projects K and L than the planner and thus has an incentive to scrap more of its original investment. However, compared with the partisan solution in the absence of restrictions (see panel (b) of Table 3), debt is lower and welfare is higher under these investment restrictions. With future investment restricted to a certain level, any future resources freed up by a debt reduction now will be channelled towards higher future public consumption. For any given level of future investment this induces the incumbent to issue less debt. This is the key channel by which investment restrictions remove a political distortion and increase welfare.

Social welfare is maximised by relaxing the restriction on I somewhat and tightening the restriction on J – see the final line of panel (b) in Table 4. This result is not robust, however. For sufficiently low values of β we find that it is optimal to tighten the restrictions on both investment projects relative to the planner’s investment levels. The restriction on investment in project L is always tighter than under the planner, because if party P comes to power the return on the investment in L is relatively small as P scraps most of the original investment in project K. Given that the restriction does not discriminate between who is in power after the election, in selecting its optimal level this scenario has to be taken into account. The tightening of the restriction on investment in project L (relative to the planner’s investment) frees up resources that can be used for more investment in project K or for public consumption. Relaxing the restriction on I is relatively rewarding if the financial revenue β from scrapping is sufficiently high, because more investment I leads to more scrapping. If the financial revenue from scrapping is low, the incentive of party P to scrap when the planner would optimally not scrap dominates in setting the optimal restriction on I . A tighter restriction brings P’s choice of scrapping closer to the planner’s choice of zero scrap. If financial returns on public investment become relatively more important than ideological returns, the investment restrictions need to be less tight. In the absence of ideological returns, no investment restrictions are needed at all. We summarise our results for investment restrictions in the following proposition:

Proposition 4: *In a partisan framework, when scrapping is not allowed, the optimal investment restrictions coincide with the planner’s investment choices and yield the social optimum. With scrapping, this is no longer the case. The restrictions bring the current cost of funds more in line with the expected future cost of funds and thus diminish the strategic incentive to borrow too much. Investment restrictions therefore raise social welfare. Such restrictions are not needed if projects only have financial returns, since then the partisan and planner outcomes coincide.*

5.2. A debt restriction

Now we consider a debt (or deficit) restriction. A special case arises if the debt/deficit level is restricted to zero. A more general rule requires that debt should not exceed a certain fraction of government revenues R_1 . We simply assume that debt is restricted to some level B_1^R . Because the results are qualitatively the same under no scrap and scrap, we focus mostly on the latter case. Conditional on B_1^R , the after-election outcomes are the same as without the restriction. The dynamic efficiency condition for the optimal public investment becomes:

$$(12) \quad \pi (\eta_p/\eta_I)[\rho_K K'(I) + \beta] + (\psi/\eta_I) K'(I) + (1-\pi)(\eta_Q/\eta_I)[\rho_K K'(I) + \beta] \xi^{BS} = 1+r,$$

where ξ^{BS} is given by the same expression as ξ^S , but evaluated at the equilibrium obtained at the restricted debt level. At the optimum, the expected discounted marginal return of investment in the second period should equal the cost of investment. The former consists of a probability-weighted average of the marginal returns under each of the two possible future governments. In turn, the future marginal return on I under party P is the sum of the marginal financial return on K , the marginal increase in scrap (both suitably modified by the relative costs of funds) and the marginal ideological return (transformed in terms of the single good by dividing by the cost of funds). The latter component is also present under party Q in the second period. The future marginal return on I under party Q further consists of the sum of the marginal financial return on K and the additional scrap (both suitably modified by the relative costs of funds), taking account of the fact that the additional financial return is diluted by ideologically motivated overspending on J , resulting in $\xi^{BS} < 1$.

Panels (c), for no scrap, and (d), for scrap, of Table 4 report the outcomes when public debt is restricted to the level chosen by the social planner. Because party Q in period 2 would optimally choose negative scrap, in the latter case we resolve the model under the additional restriction $S_Q=0$. In all cases, social welfare is higher than without this debt restriction (compare with Table 3, panel (b)), but lower than under the planner. The debt restriction alters the intra-temporal trade-off to party P. With full ideological returns ($\psi=1$), first-period government consumption is too high and investment in project K too low, reflecting that party Q may profit from investment I by boosting the investment in project L . Indeed investment in project L under party Q exceeds the planner's investment in L , which reflects the larger ideological weight Q places on his pet project.

Even under the optimal debt restriction (see the final line in Table 4), social welfare is lower than under the planner. The optimal debt restriction exceeds the planner's debt level, since it makes a trade-off between over-investment in K and over-investment in L . Setting the

restriction above the planner's debt level, induces party P to invest more in K. The additional debt-servicing costs in the second period then restrain investment in L when party Q comes to power and push its investment closer to the planner's level.

Social welfare under the optimal debt restriction is also lower than social welfare under the optimal investment restriction (compare with the final line in panel (a) of Table 4). This reflects the fact that the investment restriction is more directly targeted at the origin of the distortions, namely the differences in the ideological valuation of the two investment projects by the two parties. We summarise our results for debt restrictions as:

Proposition 5: *The optimal restriction on public debt exceeds the planner's optimal debt level, because it needs to make a trade-off between over-investment in the two different public investment projects. Although restrictions on public debt are welfare improving, they are dominated by the optimal investment restrictions, which are targeted directly at the origins of the distortions. Again, restrictions on public debt are not necessary if investment projects only have financial returns.*

6. Political problems with the Golden Rule for debt-finance of public investment

The golden rule is often advocated as a guide to running public deficits. It states that the government should finance consumption out of current revenues and only be allowed to borrow for public investment projects. The future returns will then pay for interest and principal.⁶ Most US states follow this rule today and many other governments followed this rule in the eighteenth and nineteenth centuries. Although the golden rule is simple, it gives strong incentives for majorities in democracies to choose an efficient mix of public goods in democratic economies with growing populations of overlapping generations of finitely-lived agents (Bassetto and Sargent, 2006). In the limiting case with Ricardian debt neutrality, the golden rule does not enhance efficiency. US evidence suggests that the golden rule affects government policies (Bohn and Inman, 1996; Poterba, 1995; Poterba and Rueben, 2001).

Our political economy approach departs from the median voter setting of Bassetto and Sargent (2006) and focuses on the implications of parties having partisan preferences about the type of public investment rather than about the type of public consumption or size of the

⁶ Under those circumstances, capital spending can be de-budgeted. Such a rule would not generally be optimal. First, for purely financial reasons, it would be optimal to invest up to the point where the marginal financial return is equal to the market interest rate. Second, the golden rule does not take into account the ideological return on public investment. This would push the optimal level of public investment beyond that which maximises financial revenues and possibly even beyond the break-even level of public investment (if the ideological attachment to public investment is sufficiently large).

public sector. We show that there is a bias for too much public investment and government borrowing. We also show that a deficit rule can raise social welfare. Still, the deficit and debt rules of the Stability and Growth Pact need not improve welfare. They are ad hoc and are the same for all economies of the EMU irrespective of their size or starting conditions (see the critique of Buiter (1985, 2003) and fail to recognise that reform of budgetary institutions is required (e.g., Wyplosz, 2002; Fabrizio and Mody, 2006).

Restrictions on public investment and deficit rules can correct for a bias towards over-investment and excessive government debt. However, it is crucial how tight the restrictions are set. If limits on deficits are too tight, one may end up with too little public investment, especially if countries attempt to meet the targets by cutting government investment and forsaking future returns. Indeed, the Stability and Growth Pact may have the undesirable effect of reducing public investment relatively more than unproductive government spending (e.g., Blanchard and Giavazzi, 2004; Beetsma and Debrun, 2004, 2007), but the empirical evidence that the Pact has crowded out public investment is not very convincing (Galí and Perotti, 2003; Turrini, 2004). With the Stability and Growth Pact countries are also tempted to shift expenditure below the line and use creative accounting, fiscal gimmickry, privatisation and other one-off operations to meet the fiscal targets especially if the deficit is in danger of rising above its target (e.g., Dafflon and Rossi, 1999; Easterly, 1999; Milesi-Ferretti, 2003; Miles-Ferretti and Moriyama, 2004; Alt and Lassen, 2005; von Hagen and Wolf, 2005; Koen and van den Noord, 2006; Buti, Martins and Turrini, 2006). Of course, there may be good efficiency grounds for privatisation but meeting tough deficit targets is a bad rationale for privatisation. If the targets are too loose and make an exception for public investment, countries will try to push all kinds of so-called investment projects with dubious financial returns under this heading. In that case, an independent fiscal council or a committee of wise persons may be called to take on the task of a more comprehensive fiscal surveillance comprising both government assets and liabilities and to reduce the incentives to manipulate the data to meet the targets. It also helps if the minister of finance is given the power to set the agenda (e.g., Hallerberg and von Hagen, 1999).

7. Concluding remarks

We have arrived at four main conclusions. First, in a bipartisan political economy framework the incumbent government has an incentive to borrow excessively and overspend on large public investment projects in order to bind the hands of its successor, especially if the probability of being removed from office is large and the scrap value of public investment is considerable. The point is that ideological attachment by a rival successor to investment projects that are not valued by the incumbent drives the cost of funds to the incumbent below

the expected future cost of funds. This induces the incumbent to invest more in its pet investment project and to issue more debt, especially if the probability of being removed from office is high. With scrapping, there is an extra reason for the current cost of public funds to fall short of the expected future cost of funds in the partisan outcome. This introduces an additional strategic inefficiency to invest and borrow too much, which may well lower social welfare compared with the situation when scrapping is ruled out. The incumbent may massively invest in its pet project to dissuade a potential future rival political party from investing in its pet investment project. Once re-election is ensured, the incumbent scraps substantial part of its own project.

Second, restrictions on public investment bring the current cost of funds more in line with the expected future cost of funds and thus diminish the strategic incentive to borrow too much. Investment restrictions therefore raise social welfare, especially if the probability of a change in government is high. Under such restrictions any additional resources left for the future are no longer channelled into investments that benefit only part of the population, but will be transformed into public consumption goods that are valued by everyone. For any given level of (future) investment, a restriction thus induces the incumbent to restrain debt accumulation, which in turn leads to lower scrap in equilibrium and a more balanced time profile of public consumption.

Third, the political economy outcome with restrictions on public debt dominates the unconstrained political economy outcome. The political distortions can thus also be curbed with a deficit rule such as the one prescribed by the Stability and Growth Pact of the European Union. The optimal restriction on public debt exceeds the planner's optimal debt level, because it needs to make a trade-off between over-investment in the two different public investment projects. Although restrictions on public debt are welfare improving, they are dominated by the optimal investment restrictions, which are more directly targeted at the origins of the distortions. In fact, if scrapping is forbidden, investment restrictions can ensure that the socially optimal outcome is attained.

Fourth, restrictions on public investment or debt are not needed if projects only have financial returns, since then the partisan and planner outcomes coincide.

Our results are obtained in a partial equilibrium framework with exogenous wages and interest rates, and a rudimentary private sector. In future work on the potential merits of golden rules, investment restrictions and debt restrictions it is important to model private behaviour (labour supply, saving, etc.) and extend our results to a general equilibrium setting. It would also be important to allow for the effects of government investment on productivity and the rate of economic growth along the lines of Barro (1990) and Barro and Sala-i-Martin (1995). Although we expect taxes to adversely affect private saving and labour supply and to

increase the marginal cost of public funds, we do not expect that the qualitative nature of our conclusions will be much affected.

It is interesting to investigate how the political economy of public investment projects impacts on the optimal budget window (cf., Auerbach, 2004). Governments tend to choose public investment projects with immediate benefits over projects with delayed benefits (Rogoff and Sibert, 1988; Rogoff, 1990). The budget window should therefore not be too short, since otherwise the benefits of public investment are not fully taken account of or the costs are shifted beyond the window. However, the budget window should not be too long either for otherwise it includes future years for which current legislation is meaningless. At the same time, budget windows should be designed in such a way to ensure solvency and long-term budget commitments.

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Table 1: Apolitical benchmark

Preferences	
$U = u(G_1) + \phi [u(G_2) + \lambda \psi K(I) + (1-\lambda)\psi \phi L(J, I-\zeta S)]$	
where $u', K', L_J, L_I, L_{II} > 0$, $u'', K'', L_{JJ}, L_{II} < 0$ and $K(0) = L(0, I-\zeta S) = 0$	
Budget constraint	
First period:	$B_1 = G_1 + I - R_1$
Second period:	$B_2 = (1+r) B_1 + G_2 + J - R_2 - \beta \zeta S - \rho_K K(I)$, $0 < \beta \leq 1$
Final period:	$(1+r) B_2 = \rho_L L(J, I-\zeta S)$
Present value:	$G_1 + I + \phi(G_2 + J) = R_1 + \phi[R_2 + \rho_K K(I) + \beta \zeta S] + \phi^2 \rho_L L(J, I-\zeta S)$
Smoothing of public consumption	
$u'(G_{1U}) = u'(G_{2U}) = \eta_U \Rightarrow G_{1U} = G_{2U} = G(\eta_U)$	
Demand for investment in second period (project L) – No scrap:	
$[(1-\lambda) \phi \psi + \phi \rho_L \eta_U] L_J(J_U, I_U) = \eta_U$	$\Rightarrow J_U = J(\eta_U, I_U, r, \rho_L, \psi, \lambda)$
Scrapping and demand for investment in second period (project L) – With scrap:	
$[(1-\lambda) \phi \psi + \phi \rho_L \eta_U] L_I(J_U, I_U - S_U) = \eta_U \beta$	$\Rightarrow S_U = S(I_U, \eta_U, r, \beta, \rho_L, \psi, \lambda) = I_U + S^{US}(\eta_U, r, \beta, \rho_L, \psi, \lambda)$
$[(1-\lambda) \phi \psi + \phi \rho_L \eta_U] L_J(J_U, I_U - S_U) = \eta_U$	$\Rightarrow J_U = J^{US}(\eta_U, r, \beta, \rho_L, \psi, \lambda)$
Demand for investment in first period (project K) – No scrap:	
$\phi \{(\lambda \psi + \rho_K \eta_U) K'(I_U) + \phi [(1-\lambda) \psi + \rho_L \eta_U] L_I(J_U, I_U)\} = \eta_U$	$\Rightarrow I_U = I(\eta_U, J_U, r, \rho_K, \rho_L, \psi, \lambda)$
Demand for investment in first period (project K) – With scrap:	
$\phi \{(\lambda \psi + \rho_K \eta_U) K'(I_U) + \phi [(1-\lambda) \psi + \rho_L \eta_U] L_I(J_U, I_U - S_U)\} = \eta_U$	$\Rightarrow I_U = I^{US}(\eta_U, r, \rho_K, \rho_L, \psi, \lambda)$
Notation	
$\zeta = 0$: no scrap, $\zeta = 1$: scrap,	
λ = fraction of population in favour of project K, $1-\lambda$ = fraction in favour of project L,	
ρ = financial return on public investment, ψ = ideological return on public investment,	
r = interest rate, $\phi = 1/(1+r)$ = discount factor, U = utility, u = felicity function,	
B = public debt, G = government consumption, I = investment in project K,	
J = investment in project L, S = investment in K that is scrapped, η = cost of public funds,	
β = scrap value of investment done in project K, R = exogenous government revenue.	
Subscript U denotes the apolitical, utilitarian outcome.	

Table 2: Political economy of public investment

Preferences:	
Party P – before election:	$U = u(G_I) + \phi [\pi u(G_{2P}) + (1-\pi) u(G_{2Q}) + \psi K(I)]$
Parties P and Q, respectively – after election:	$u(G_2) + \psi K(I)$ and $u(G_2) + \phi \psi L(J, I-\zeta S)$
Budget constraints:	
First period:	$B_I = G_I + I - R_I$
Second period party $i=P, Q$:	$B_2 = (1+r) B_I + G_{2i} + J_i - R_2 - \beta \zeta S_i - \rho_K K(I), \quad 0 < \beta \leq 1$
Final period party $i=P, Q$:	$(1+r) B_2 = \rho_L L(J_i, I-\zeta S_i)$
Present value $i=P, Q$:	$G_I + I + \phi (G_{2i} + J_i) = R_I + \phi [R_2 + \rho_K K(I) + \beta \zeta S_i] + \phi^2 \rho_L L(J_i, I-\zeta S_i)$
AFTER ELECTION	
Demand for public consumption, $i=P, Q$: $u'(G_{2i}) = \eta_i \Rightarrow G_{2i} = G(\eta_i), \quad G' = 1/u'' < 0$	
Demand for public investment by parties P and Q – No scrap:	
$\rho_L L_J(J_P, I) = 1 + r \Rightarrow J_P = J^P(I, r, \rho_L)$ and $(\psi + \rho_L \eta_Q) L_J(J_Q, I) = (1+r) \eta_Q \Rightarrow J_Q = J^Q(I, \eta_Q, r, \rho_L, \psi)$	
Scraping and demand for public investment by parties P and Q – With scrap:	
$\rho_L L_I(J_P, I-S_P) = (1+r) \beta$ and $\rho_L L_J(J_P, I-S_P) = 1+r \Rightarrow S_P = I + S^{PS}(r, \beta, \rho_L)$ and $J_P = J^{PS}(r, \beta, \rho_L)$	
$(\psi + \rho_L \eta_Q) L_I(J_Q, I-S_Q) = \eta_Q (1+r) \beta$ and $(\psi + \rho_L \eta_Q) L_J(J_Q, I-S_Q) = \eta_Q (1+r) \Rightarrow$	
$S_Q = I + S^{QS}(\eta_Q, r, \beta, \rho_L, \psi)$ and $J_Q = J^{QS}(\eta_Q, r, \beta, \rho_L, \psi)$	
Cost of public funds under parties P and Q – No scrap:	
$\eta_P = \eta_P(I, R_2 - (1+r)B_I, r, \rho_K, \rho_L)$ and $\eta_Q = \eta_Q(I, R_2 - (1+r)B_I, r, \rho_K, \rho_L, \psi)$	
Cost of public funds under parties P and Q – With scrap:	
$\eta_P = \eta_P^S(I, R_2 - (1+r)B_I, r, \beta, \rho_K, \rho_L)$ and $\eta_Q = \eta_Q^S(I, R_2 - (1+r)B_I, r, \beta, \rho_K, \rho_L, \psi)$	
BEFORE ELECTION	
No scrap: $U_P = u(G_I) + \phi [\pi u(G(\eta_P(I, R_2 - (1+r)B_I, r, \rho_K, \rho_L))) + (1-\pi)u(G(\eta_Q(I, R_2 - (1+r)B_I, r, \rho_K, \rho_L, \psi)))] + \psi K(I)$	
Scrap: $U_P = u(G_I) + \phi [\pi u(G(\eta_P^S(I, R_2 - (1+r)B_I, r, \beta, \rho_K, \rho_L))) + (1-\pi)u(G(\eta_Q^S(I, R_2 - (1+r)B_I, r, \beta, \rho_K, \rho_L, \psi)))] + \psi K(I)$	
Demand for public consumption: $u'(G_I) = \eta_I \Rightarrow G_I = G(\eta_I), \quad u'' < 0, \quad G' < 0$	
Investment by P – No scrap: $(\pi \eta_P \rho_K + \psi)K' + \phi \pi \eta_P \rho_L L_I^P + (1-\pi) \eta_Q [\rho_K K' + (\phi \rho_L L_J^Q - 1) J_I^Q + \phi \rho_L L_I^Q] \xi = (1+r) \eta_I$	
Investment by party P – With scrap: $(\rho_K + \psi / \eta_I)K' + \beta = 1+r$	
Dynamic efficiency debt – No scrap: $\pi \eta_P + (1-\pi) \eta_Q \xi = \eta_I, \quad 0 < \xi \equiv G'(\eta_Q) / [G'(\eta_Q) + (\phi \psi / \eta_Q) L_J^Q J_I^Q] \leq 1$	
Dynamic efficiency debt – With scrap: $\pi \eta_P + (1-\pi) \eta_Q \xi^S = \eta_I, \quad 0 < \xi^S \equiv G'(\eta_Q) / [G'(\eta_Q) + (\phi \psi / \eta_Q) (L_J^Q J_I^{QS} - L_I^Q S_I^{QS})] \leq 1$	
Notation: π = probability that P wins election. Other notation as in Table 1.	

Table 3: Results for planner and bipartisan outcomes

Utility of government consumption and cost of funds $u(G_t) = \delta G_t^{1-\varepsilon} / (1-\varepsilon)$, $\varepsilon \neq 1$, $u(G_t) = \delta \ln(G_t)$, $\varepsilon = 1$ and $\eta_t = \delta G_t^{-\varepsilon}$ Capital production in projects K and L $K(I) = I^\sigma \gamma^{1-\sigma}$ and $L(J, D) = J^\sigma I^\theta$, $0 < \sigma + \theta < 1$	Base parameters $\psi = 1$, $r = \delta = 0.2$, $\lambda = \pi = \sigma = \gamma = 0.5$ $\beta = \theta = 0.4$, $\varepsilon = 1.5$, $R_1 = R_2 = 2$, $\rho_K = \rho_L = 0.25$
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(a) Without scrap:

	Planner							Partisan						
	G_1	G_2	I	J	B_I	Ω	G_1	G_{2P}	G_{2Q}	I	J_P	J_Q	B_I	Ω
Baseline	0.836	0.836	1.574	1.164	0.410	0.017	1.002	0.903	0.398	2.145	0.0200	0.725	1.147	-0.174
$\pi=1$	0.836	0.836	1.574	1.164	0.410	0.017	0.958	0.958	0.410*	2.143	0.0200	0.778*	1.101	-0.251
$\delta=0.25$	0.954	0.954	1.436	1.035	0.390	-0.177	1.126	1.013	0.484	1.916	0.0183	0.744	1.042	-0.345
$\varepsilon=1.25$	0.809	0.809	1.605	1.193	0.414	-0.715	1.007	0.868	0.337	2.170	0.0202	0.758	1.177	-0.908
$r=0.15$	0.806	0.806	1.642	1.194	0.449	0.065	0.986	0.889	0.383	2.230	0.0224	0.741	1.215	-0.146
$\rho_K = 0.5$	0.827	0.827	1.752	1.235	0.579	0.067	1.003	0.904	0.390	2.383	0.0217	0.748	1.386	-0.138
$\rho_L = 0.5$	0.800	0.800	1.731	1.411	0.531	0.082	0.998	0.900	0.395	2.206	0.0817	0.992	1.204	-0.0982
$R_1=3$	0.881	0.881	2.145	1.717	0.026	0.268	1.119	1.013	0.391	2.980	0.0260	0.902	1.099	-0.00322
$R_2=3$	0.874	0.874	2.050	1.623	0.924	0.227	1.101	0.996	0.392	2.839	0.0250	0.874	1.939	-0.0300
$\psi=0.1$	1.962	1.962	0.108	0.026	0.070	-0.512	1.951	1.918	1.848	0.182	0.00277	0.101	0.133	-0.513

(b) With scrap:

	Planner								Partisan								
	G_1	G_2	I	J	S	B_I	Ω	G_1	G_{2P}	G_{2Q}	I	J_P	J_Q	S_P	S_Q	B_I	Ω
Baseline	0.836	0.836	1.574	1.164	0.000	0.410	0.017	0.717	0.532	0.385	4.214	0.000	0.101	4.214	4.012	2.930	-0.336
$\pi=1$	0.836	0.836	1.574	1.164	0.000	0.410	0.017	0.704	0.704	0.407*	4.007	0.000	0.201*	4.007	3.605	2.711	-0.284
$\beta=0.35$	0.836	0.836	1.574	1.164	0.000	0.410	0.017	0.730	0.537	0.373	3.926	0.000	0.114	3.926	3.664	2.656	-0.350
$\psi=0.1$	1.970	1.970	0.173	0.014	0.170	0.143	-0.510	1.827	1.682	1.635	0.861	0.000	0.0335	0.861	0.794	0.688	-0.526

* These values never materialise as party Q never comes to power if party P is sure to be re-elected. They are the values Q would choose as the probability of Q coming to power approaches zero.

Table 4: Results under fiscal restrictions**(a) Investment restrictions: No scrap**

	G_I	G_{2P}	G_{2Q}	I^R	J^R	B_I	Ω
Optimal restrictions: planner levels	0.836	0.836	0.836	1.574	1.164	0.410	0.017

(b) Investment restrictions: Scrap

	G_I	G_{2P}	G_{2Q}	I^R	J^R	S_P	S_Q	B_I	Ω
Investments at planner levels	0.904	1.163	0.753	1.574	1.164	1.491	0.000	0.478	-0.104
Optimal investment restrictions(I^{R*}, J^{R*})	0.968	1.247	0.806	1.617	0.966	1.546	0.000	0.585	-0.101

(c) Debt restrictions: No scrap

	G_I	G_{2P}	G_{2Q}	I	J_P	J_Q	B_I	Ω
Debt level at planner levels	0.913	1.739	0.579	1.497	0.0150	1.439	0.410	-0.134
Optimal debt restriction $B_I = B_I^{R*}$	0.940	1.530	0.535	1.655	0.0162	1.265	0.595	-0.130

(d) Debt restrictions: Scrap

	G_I	G_{2P}	G_{2Q}	I	J_P	J_Q	S_P	S_Q	B_I^R	Ω
Debt level at planner level	0.895	2.332	0.577	1.514	0.000	1.444	1.514	0.000	0.410	-0.142
Optimal debt restriction $B_I = B_I^{R*}$	0.931	2.112	0.512	1.757	0.000	1.180	1.757	0.000	0.688	-0.135

Note: All calculations at baseline parameter values.