

Political Disagreement, Lack of Commitment and the Level of Debt*

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Abstract

We analyze how public debt evolves when successive policymakers have different policy goals and cannot make credible commitments about their future policies. We consider several cases to be able to quantify the effects of imperfect commitment, political disagreement and political turnover. Imperfect commitment drives the long-run level of debt to zero. With political disagreement debt is a sizeable fraction of GDP. The frequency of political turnover does not produce quantitatively relevant effects. These results are consistent with and rationalize much of the existing empirical evidence. Finally, we find that political disagreement reduces the welfare gains of building commitment.

JEL classification: C61, E61, E62, P16

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1 Introduction

This paper analyzes the determinants of public debt in the long run. As shown in Barro (1979), Lucas and Stokey (1983) and Aiyagari, Marcet, Sargent, and Seppala (2002), one of the roles of debt is to smooth over time the deadweight losses associated with distortionary taxation.¹ These models can account for many aspects of the debt evolution in many countries. However, these theories do not explain why public debt is a sizable fraction of GDP.²

In a world where markets are complete and fiscal policy is chosen optimally by a benevolent government with full-commitment, as in Lucas and Stokey (1983), the long-run level of debt crucially depends on initial conditions.³ Countries starting with high debt will have high debt forever, and countries with low debt will have low debt forever. Since initial conditions are exogenous to the model and empirically difficult to determine, such a theory can not explain what induces countries to accumulate debt.

In this paper, we depart from the idealized environment described in Lucas and Stokey (1983) by incorporating the effects of imperfect commitment and political disagreement. There are important reasons to think that these two forces may induce countries to accumulate debt, thus reconciling the theory about optimal debt policies with the empirical evidence.

The role of commitment is related to the time-inconsistency problem in optimal policy choices, as illustrated in the seminal works of Kydland and Prescott (1977) and Barro and Gordon (1983). In the Lucas and Stokey (1983) framework, if a government with full-commitment were allowed to revise its plans, it would run a deficit and accumulate debt.⁴ A natural question is therefore if a positive long-run

¹When lump-sum taxes are available, Barro (1979) showed the debt policy to be irrelevant since the so-called Ricardian equivalence holds.

²In the appendix, we report the values of the debt/GDP ratio for OECD countries.

³Lucas and Stokey (1983), as we do here, analyzed an economy with complete financial markets. Removing this assumption, as shown by Aiyagari, Marcet, Sargent, and Seppala (2002) leads to asset accumulation.

⁴The increase in debt occurs unless the initial level of debt is sufficiently high. In that situation, the interest rate improvement is applied to a larger base and can be sufficient to finance the initial tax cut.

level of debt can be the outcome of the policymakers' inability to commit. In this model, we conclude that it is not. If a government cannot commit debt converges to zero in the long-run.⁵ As we will discuss later, reducing debt over time is the only way the planner with no-commitment can affect favorably the interest rate. Interestingly, debt converges to zero also in intermediate commitment settings, when a planner occasionally reneges on her past promises. This result suggests that the steady-state dependency on initial conditions found in Lucas and Stokey (1983) is not robust to small deviations from the full-commitment case.

Lack of commitment and political disagreement are intrinsically related. The latter constitutes a natural limitation to the governments' ability to commit. Alesina and Tabellini (1990) and Persson and Svensson (1989) showed that political disagreement provides an incentive to accumulate debt. On the contrary, as explained above, lack of commitment *per se* drives debt to zero. Despite these considerations, the political economy literature has typically assumed that commitment does not influence private agent's choices, thus not playing any relevant role.⁶ With respect to that literature, the novelty of this paper is to quantify and disentangle the effects of lack of commitment, political turnover and political disagreement in a joint framework. We find that political disagreement has significant effects leading to positive debt in the long-run. On the contrary, the degree of commitment and the frequency of political turnover have a small impact. Our predictions are consistent with most of the existing empirical evidence.

Finally, we analyze the welfare implications of building commitment in a world with political disagreement. To the best of our knowledge, we are the first addressing this question. We find that the gains from commitment are lower in the presence of political disagreement. Intuitively, in the absence of political disagreement governments with more commitment will maximize overall social welfare. However, with

⁵As in Lucas and Stokey (1983), we assume that there is still commitment to honor debt payments. In this paper, the absence of commitment is referred to future policy actions. Niepelt (2006) discusses this issue in more detail.

⁶The dynamic political economy literature has been limited to frameworks where private agents' current choices do not depend on future policy, see e.g. Azzimonti-Renzo (2004). Alesina and Tabellini (1990) set the initial level of debt to zero, thereby avoiding the time-inconsistency problem.

political disagreement a better commitment technology can be used by each party to maximize specific groups' welfare.

There are other factors affecting debt accumulation, not necessarily of a political nature. The presence of a wider array of tax instruments, the possibility to default on debt, and social redistribution are some examples. Abstracting from these factors, our purpose is to illustrate the interplay between political disagreement and lack of commitment in a simple model. The framework developed here integrates the analysis about the time-inconsistency of optimal policy choices, typical of the dynamic macroeconomic literature, into a political economy model. It can be applied to study the effects of commitment in richer infinite-horizon optimal policy problems, where policymakers with different preferences alternate in office.

This paper is related to many recent studies in the optimal fiscal policy and political economy literature. Krusell, Martin, and Rios-Rull (2006), analyze the no-commitment solution of the otherwise standard Lucas and Stokey (1983) model, where government expenditures are exogenous. They focus on non-differentiable policy functions and find a multiplicity of steady-states that are similar to those under full-commitment. In our model, government expenditure is endogenous. The presence of this additional instrument in the hands of the policymaker widens the set of feasible choices. We obtain differentiable policy functions and that without political disagreement debt converges to zero.⁷ Ortigueira and Pereira (2008) examine optimal fiscal policy with no-commitment in an economy with debt, capital, exogenous labor, and where the tax rate is equal for all sources of income. The authors find that one of the equilibria is associated with issuance of public debt. These papers are complementary as they identify different effects influencing the level of debt.

Several papers have analyzed the effects of lack of commitment on debt in monetary economies (e.g. Ellison and Rankin (2007), Diaz-Gimenez, Giovannetti, Marimon, and Teles (2008) and Martin (2009)). They find that, depending on the degree of substitutability of cash-goods, the steady-state level of debt can be positive, negative or zero. Since in most countries central banks are independent and committed

⁷In section 3, we extensively discuss the differences between the two cases.

to price stability, we believe that focusing on a real economy is a reasonable assumption. Our result that debt converges to zero is neither due to the real erosion of nominal bonds nor to the presence of a cash-in-advance constraint.⁸

As we do here, Azzimonti-Renzo (2004) extends the political economy framework of Alesina and Tabellini (1990) to an infinite horizon problem. The author considers a fiscal policy model with balanced budget, and public but no private capital. Song, Storesletten, and Zilibotti (2006) and Battaglini and Coate (2008) study the evolution of debt in a dynamic political economy framework, and provide an explanation for the presence of a long-run positive level of debt. More recently, Azzimonti-Renzo (2009) focuses on private investment and growth. Aguiar and Amador (2004), Cuadra and Sapriza (2008), and Aguiar and Amador (2009) incorporate political dimensions in open economy settings where the lack of commitment is due to the possibility to default on sovereign debt and to expropriate capital. In contrast to these works, in our closed economy model the interest rate is endogenously determined and constitutes the source of time-inconsistency. We contribute to this literature by considering several commitment settings in order to analyze the role of commitment in the strategic interactions between agents and policymakers. In addition, we disentangle the effects of political disagreement and turnover finding the former to be a stronger determinant of debt.

Finally, Lucas and Stokey (1983) and Persson, Persson, and Svensson (2006) show that a carefully chosen maturity of nominal and indexed debt for each contingent state of nature and at each maturity can solve the time-consistency problem. As in many papers in the literature, we do not consider this possibility. This is for three reasons. First, the necessary structure of debt to implement such policy is not observed in reality. Second, as shown in Faraglia, Marcet, and Scott (2008) such strategies are intricate to implement and very sensitive to specific modeling assumptions. Finally and more importantly, this paper will consider a model with an endogenous public good. Rogers (1989) showed that in such case debt restructuring can not enforce the commitment solution.

⁸Ellison and Rankin (2007) and Diaz-Gimenez, Giovannetti, Marimon, and Teles (2008) also examine indexed debt building on Nicolini (1998).

The paper is organized as follows: in section 2 we introduce the model and, as a benchmark for our analysis, we recover the solution under full-commitment. In section 3, we describe the solution under no-commitment. In section 4, we illustrate the behavior of debt under the less extreme assumption of *loose commitment*. In section 5, we study the joint implications of political disagreement and imperfect commitment and we compare our findings with the existing empirical literature. Finally, we discuss welfare implications. Section 6 concludes.

2 The model

We consider an economy where labor is the only factor of production, technology is linear, and there is no uncertainty.⁹ Output can be used either for private consumption c_t or for public consumption g_t . The economy's aggregate budget constraint is

$$c_t + g_t = 1 - x_t \quad (1)$$

The public good is provided by a benevolent government and financed through a proportional tax τ_t on labor income and by issuing a one-period bond b_t^G with price p_t . At any point in time, the government budget constraint is

$$g_t + b_{t-1}^G = \tau_t(1 - x_t) + p_t b_t^G. \quad (2)$$

In a decentralized equilibrium, given taxes, prices and the quantities of public expenditure, the representative household chooses consumption, savings and leisure by solving the following problem

$$\max_{\{c_t, x_t, b_t^P\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t, x_t, g_t) \quad (3)$$

$$s.t. : c_t + p_t b_t^P = (1 - x_t)(1 - \tau_t) + b_{t-1}^P, \quad \forall t = 0, 1, 2, \dots \quad (4)$$

⁹In the presence of exogenous shocks, many of our considerations are still valid under the assumption of complete financial markets.

where b_t^P denotes private bond holdings. The household's first order conditions are

$$\frac{u_{x,t}}{u_{c,t}} = (1 - \tau_t) \quad (5)$$

$$p_t = \beta \frac{u_{c,t+1}}{u_{c,t}}, \quad (6)$$

together with the budget constraint (4). Equation (5) and (6) represent the equilibrium condition in the labor market and the bond market, respectively.

2.1 Full-commitment

As a benchmark for our analysis, we characterize the government solution under full-commitment. For a given initial level of debt (b_{-1}), the government solves the following problem

$$\max_{\{c_t, g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t, 1 - c_t - g_t, g_t) \quad (7)$$

$$s.t. : c_t u_{c,t} + \beta u_{c,t+1} b_t = (c_t + g_t) u_{x,t} + b_{t-1} u_{c,t}, \quad \forall t = 0, 1, 2, \dots \quad (8)$$

where we made use of the household's optimality conditions (4)-(6), the resource constraint (1) and the market clearing condition $b_t^P + b_t^G = 0$, to substitute for taxes, public expenditure, leisure and government debt. We rule out Ponzi schemes, by imposing the transversality condition

$$\lim_{T \rightarrow \infty} \beta^T u_{c,T} b_T = 0. \quad (9)$$

As in the full-commitment framework of Lucas and Stokey (1983), after an initial jump, all the allocations reach their steady-state level remaining constant from then on. Apart from $t = 0$, all the periods are identical and the government is willing to smooth private and public consumption over time. However, the steady-state allocations depend on the initial condition b_{-1} . Because of this dependency on initial conditions, which are exogenous to the model and empirically difficult to determine, this theory cannot explain why countries accumulate debt.

Current consumption influences both p_t and p_{t-1} in eq. (6) for a generic $t > 0$. As a consequence, if the government uses taxes and public expenditure to increase

the price of the bond p_t , other things equal, it also decreases p_{t-1} . At an optimum, it turns out that $p_{t-1} = p_t$. However, at $t = 0$ consumers' savings and previous prices (p_{-1}) are given. Therefore, if the government inherits a positive level of debt, it can benefit from an increase in the price of the bond without incurring any additional cost. By setting its policies such that current consumption is higher than in the future, the government is able to foster the demand for savings, thus selling bonds at a more convenient price.¹⁰ These incentives to increase initial consumption prevail whenever the government is allowed to make a new policy plan.

The left panel of Figure 1 plots the level of consumption at $t = 0$ (c_0) and the steady-state level of consumption (c_{ss}), for a given positive initial level of debt ($b_{-1} \geq 0$).¹¹ The higher is debt, the bigger is the difference between current and future consumption, and thus the lower is the interest rate at $t = 0$. The reason is that the higher is the inherited level of debt, the greater is the government's benefit from lowering the interest rate.

The behavior of debt is determined by equation (2). On the one hand, the tax cut necessary to foster initial consumption reduces the tax revenues of the government. On the other hand, the resulting lower interest rate allows the government to sell bonds at a higher price. The right panel of Figure 1 plots the level of debt chosen in the first period (the steady-state level of debt), as a function of b_{-1} . For low levels of b_{-1} , the government accumulates debt. Conversely, if the initial level of debt is large enough, the increase in bond prices applies to a larger base. As a consequence, the tax cut can be self-financed decreasing debt.

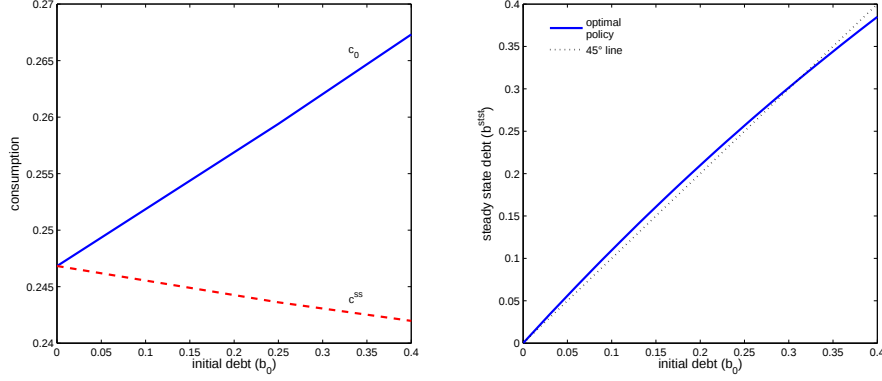
3 The time-consistent solution

In the no-commitment solution, we keep the assumption that the planner can credibly commit to repay her loans. Due to the reasons explained in the introduction, we are not considering the possibility of enforcing the time-inconsistent solution through the maturity of debt. We also assume that reputation mechanisms are

¹⁰The opposite happens when the initial level of debt $b_{-1} < 0$.

¹¹The picture is based on the calibration of the next sections. Lucas and Stokey (1983) provide analytical solutions of the model with a quadratic utility function.

Figure 1: Consumption and debt under full-commitment



Note: In the left-panel, the figure shows, for different level of initial debt, the level of consumption in the first period (solid line) and the steady-state level of consumption (dashed line). In the right panel the steady-state level of debt is reported. Values correspond to the calibration specified in table A-2.

not operative, focusing only on Markov-Perfect equilibria, as defined for instance in Klein, Krusell, and Ríos-Rull (2008).¹² The problem of the planner is accordingly defined as

$$V(b_{t-1}) = \max_{\{c_t, g_t, b_t\}} u(c_t, 1 - c_t - g_t, g_t) + \beta V(b_t) \quad (10)$$

$$s.t. : c_t u_{c,t} + \beta u_c(\Psi(b_t)) b_t = (c_t + g_t) u_{x,t} + b_{t-1} u_{c,t}. \quad (11)$$

The function $\Psi(b_t)$ in constraint (11) determines the quantity of consumption the consumer expects for period $t + 1$ as a function of the debt level outstanding at the beginning of next period (b_t). Since the current planner cannot make credible commitments about her future actions, the future stream of consumption is not under her direct control. By taking as given the policy $\Psi(b_t)$ of her successor (or herself in the next period), the current planner can only influence future consumption through her current debt policy. Being the function $\Psi(b_t)$ unknown, the solution of

¹²Dominguez (2007) and Reis (2008) provide an interesting analysis of debt policies with trigger strategies.

the problem relies on solving a fixed point problem in $\Psi(b_t)$.¹³

We assume the utility function to be separable in consumption of private and public goods and leisure. This assumption facilitates the comparison with the political economy model analyzed in section (5), where separability is needed for tractability reasons. Separable utility does not affect the possible classes of steady-states described below.¹⁴

The generalized Euler equation is a crucial element determining the steady-state:¹⁵

$$\gamma_t(u_{cc,t+1}\Psi_{b,t}b_t + u_{c,t+1}) = u_{c,t+1}\gamma_{t+1}, \quad (12)$$

where γ_t indicates the Lagrange multiplier attached to constraint (11).¹⁶ The term $u_{cc,t+1}\Psi_{b,t}b_t$ constitutes the only difference with respect to full-commitment. Without this term, equation (12) simplifies to $\gamma_t u_{c,t+1} = \gamma_{t+1} u_{c,t+1}$ and is always satisfied in steady-state regardless of the level of debt, which remains indeterminated. Instead, for eq. (12) to be satisfied in a steady-state with no-commitment, it must be that

$$\gamma u_{cc}\Psi_b b = 0. \quad (13)$$

As illustrated in Figure 2, such relationship can hold in three different situations. The figure provides a qualitative representation of the transition dynamics obtained in our numerical experiments. First, a steady-state is obtained with $\gamma = 0$. In such equilibrium, constraint (11) is not binding and the economy is at the unconstrained optimum corresponding to the first-best solution. The planner can avoid to raise distortionary taxes and can finance public expenditure through the interest payments received on outstanding assets.¹⁷

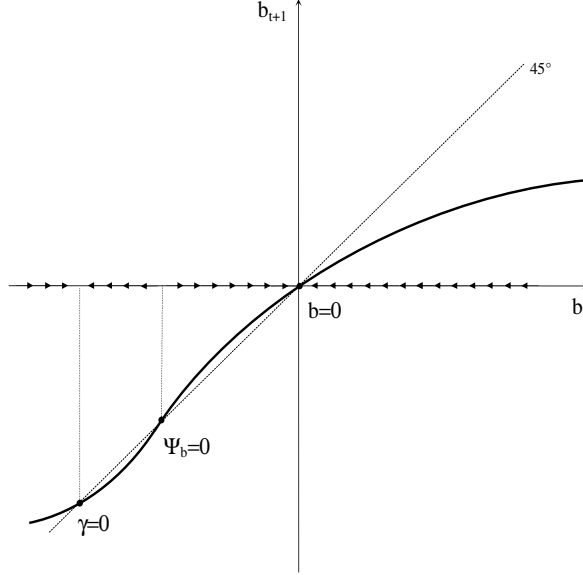
¹³A detailed discussion of this topic is available in Klein, Krusell, and Ríos-Rull (2008) and Judd (2004). Ortigueira (2006) analyzes different assumptions on the extent of government's intra-period commitment.

¹⁴The detailed derivations are shown in the Appendix.

¹⁵In the present framework, the generalized Euler equation is the derivative of the Lagrangian associated with the problem (10) w.r.t. b_t . The other optimality conditions can be found in the appendix.

¹⁶By doing so, we are implicitly assuming differentiability of the function $\Psi(b_t)$. We do not have a formal proof about the existence and/or uniqueness of this solution. However, in our numerical

Figure 2: Debt dynamics in the time-consistent case



Note: The figure is a qualitative representation of debt equilibrium dynamics resulting from our numerical experiments.

The second steady-state corresponds to $\Psi_b = 0$, where a marginal change in the debt level does not induce any change in the equilibrium level of private consumption.¹⁸ When the planner inherits a higher level of debt, she has to raise more distortionary taxes reducing hours worked due to a substitution effect. An increase in debt also create a positive wealth effect, which furtherly decreases hours worked. Altogether, leisure (x) increases as debt increases ($\partial x / \partial b > 0$).

The composite effect on private consumption can be understood by examining the aggregate resource constraint. Differentiating equation (1) with respect to debt

exercises we do find a continuous and differentiable solution.

¹⁷In this case, the level of government debt should be $b = -g^* / (1 - \beta)$, where g^* is the first-best level of public consumption.

¹⁸Given the presence of distortionary taxation, this is not due to Ricardian equivalence.

(b) yields

$$\frac{\partial c}{\partial b} + \frac{\partial g}{\partial b} = -\frac{\partial x}{\partial b}. \quad (14)$$

It is possible that a marginal change in the level of debt does not produce any effect on the level of equilibrium consumption (i.e. $\Psi_b = 0$) as long as the effects on leisure (x) and public expenditure (g) exactly offset each other. On the contrary, in a model where public expenditure is exogenous as in Krusell, Martin, and Rios-Rull (2006), the effects on consumption must be equal to the ones on hours worked. In their model, Ψ_b cannot be zero.

Finally, we have a steady-state associated with a level of debt equal to zero. When debt is zero, the government does not have any incentive to manipulate the interest rate. At this point, policymakers' commitment is irrelevant and debt remains constant at a zero level.

3.1 Transition dynamics

As illustrated in Figure 2, in the (more relevant) circumstance in which the government initially holds a positive amount of debt or relatively small amount of assets, the economy will converge to the steady-state with zero debt. In the full-commitment case, whenever a government inherits a positive amount of debt, it has the incentive to use the instruments at its disposal to reduce the interest rate payments. To do so, the demand for savings should increase, which will happen if current consumption increases more than future consumption. A government with full-commitment could promise the desired level of future consumption regardless of the debt level, as long as the allocation is feasible.

In the no-commitment case, the government can only influence future allocations through the level of debt. The higher the inherited debt, the higher will be the incentive in the next period to increase consumption again. Therefore, to face favorable bond prices, the current government needs to leave a lower debt to its successor. If it does not do so, the successor will raise consumption even more, and the anticipated positive consumption growth would harm the current bond price. It follows that debt is reduced until a level of zero debt is reached. At this point, the

incentive to manipulate the interest rate vanishes.¹⁹

3.1.1 Transition dynamics: special cases

The mechanism explained above relies on the temptation of every government to manipulate the bond price. If a government reduces debt, then tomorrow's government will face a smaller temptation to manipulate the bond price. Yet, there is a second effect. As we mentioned before, when debt is lowered, the government can afford to lower taxes. As a consequence, leisure decreases, output increases and the economy can increase both private and public consumption. According to this effect, if tomorrow's government has lower debt then it will increase private consumption. Notice that the second effect goes in an opposite direction of the first one. At the point $\Psi_b = 0$ the two effects exactly cancel out. To the left of $\Psi_b = 0$ the second effect dominates, i.e. when assets are accumulated (debt is reduced) consumption increases. The amount of debt at which $\Psi_b = 0$ depends on the marginal rate of substitution between private and public consumption and between consumption and leisure.²⁰ As shown in Figure 2, under our baseline calibration the point where $\Psi_b = 0$ is associated with government asset holdings ($b < 0$). The steady-state with $\Psi_b = 0$ is unstable, whereas the steady-state with $b = 0$ is stable.²¹

From a theoretical point of view, the equality $\Psi_b = 0$ can also hold when debt is positive. Such steady-state would become stable, while the steady-state with $b = 0$ would turn unstable. In our numerical exercises, we found that for calibrations implying a plausible level of public expenditure the case depicted in Figure 2 is the relevant one. In particular, one can obtain that the steady-state with zero debt is

¹⁹With a symmetric argument, if the government starts with assets, but to the right of the point where $\Psi_b = 0$, asset holdings will be reduced until the zero debt level is reached.

²⁰Unlike Diaz-Gimenez, Giovannetti, Marimon, and Teles (2008), our model does not have a cash-in-advance constraint, and the steady-state level of debt is not only determined by the utility specification on private consumption.

²¹If the initial condition is to the left of the point where $\Psi_b = 0$, an increasing path of consumption is instead obtained by accumulating assets over time, until the point where a level of zero taxation is reached and public expenditure can be financed only through the interest payments on the asset holdings. In the subsequent analysis, as it seems more reasonable, we will ignore that case.

unstable only when the steady-state public expenditures are unreasonably low.²² In the remainder of the paper, we focus on the case where the steady-state with $b = 0$ is stable.

3.1.2 Transition dynamics: numerical simulations

To provide a more concrete description of the behavior of our economy, we solve the model numerically by assuming the following functional form for the utility function:²³

$$u(c, x, g) = (1 - \phi_g) \left[\phi_c \frac{c^{1-\sigma_c} - 1}{1 - \sigma_c} + (1 - \phi_c) \frac{x^{1-\sigma_x} - 1}{1 - \sigma_x} \right] + \phi_g \frac{g^{1-\sigma_g} - 1}{1 - \sigma_g}, \quad (15)$$

where ϕ_c and ϕ_g denote the preference weights on private and public consumption. We use a standard calibration for an annualized model of the US economy in order to match long-run ratios of our variables. Table A-2 summarizes the parameter values.²⁴

The evolution of the allocations is illustrated in Figure 3. For a given level of initial debt, we observe a decreasing pattern of private consumption and an increasing interest rate.²⁵ This pattern is achieved by lowering taxation and increasing public consumption over time. Such policies allow not only to foster private consumption in the desired way, but also to decrease debt over time. As the level of debt and interest payments are reduced, public consumption is raised and taxes are reduced. The increase in public expenditure increases hours worked and reduces consumption over time.

As discussed above, it is feasible to have lower taxes and lower levels of private consumption only if the level of public consumption is increased. In a model where

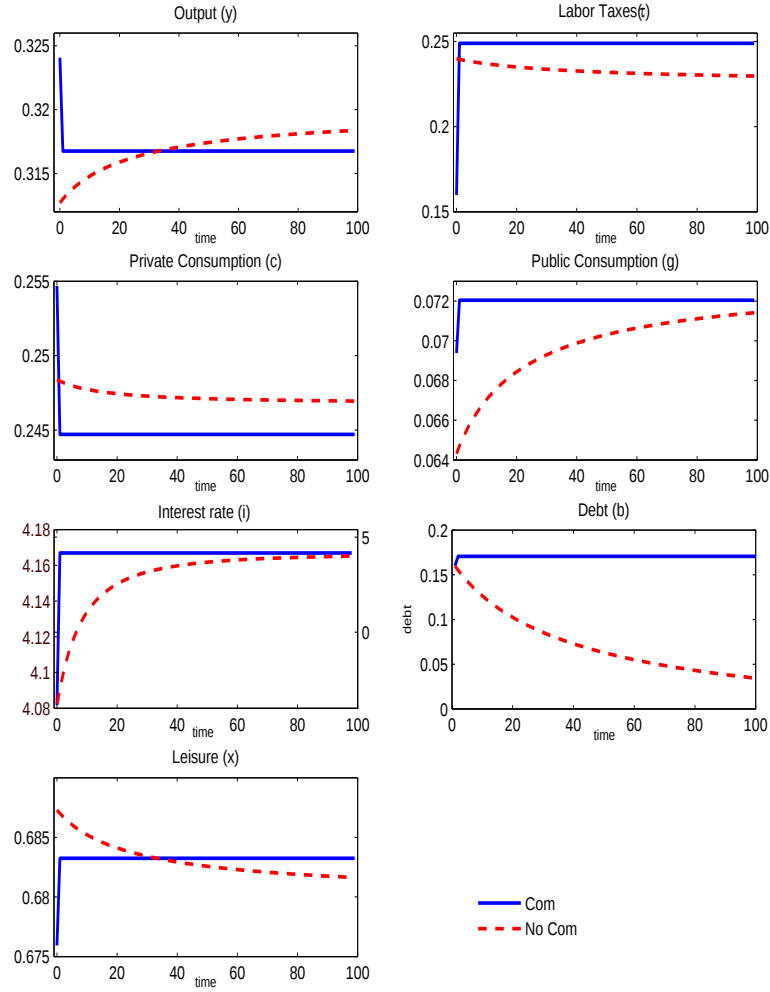
²²If the first-best level of g is relatively low, an increase in production (due to a reduction in debt) will mainly imply a higher consumption instead of a higher g .

²³We assume separability as it is convenient for our analysis in section 5.

²⁴The implied long-run values are $g/c = .3$, $c/y = .77$, income taxes ($\tau = .25$), the fraction of time devoted to leisure ($x = .68$) and an annual real interest rate of about 4%. These values change only minimally under the different commitment/political scenarios considered below. Also, we have tried many parameter specifications to check that results do not change qualitatively.

²⁵Here we initialize debt at approximately 50% of steady-state GDP under commitment. Even though the steady-state under commitment depends on initial conditions, long-run GDP is almost insensitive to variations of debt.

Figure 3: Commitment vs. no-commitment: time pattern of allocations



Note: The figure plots the equilibrium allocations over time, giving an initial condition of $b = .16$ which is roughly 50% of GDP under our parametrization. The interest rate (lower-left panel) for the full-commitment case (continuous line) has to be referred to the right-hand scale.

public expenditure is exogenously determined, it will not be possible to have lower taxes and lower consumption at the same time. Lower taxes would imply a higher amount of hours worked and, by the resource constraint, higher consumption. This effect would prevent having a decreasing pattern of consumption and reducing debt at the same time.²⁶

We find that with no-commitment the exposure of the government in terms of debt/assets will be lower than with full-commitment. This result may seem counter-intuitive when compared with our discussion about the temptation to deviate from full-commitment in section 2.1. In general, there is no reason why the policy with no-commitment should mimic the policy implemented in a one-time deviation from full-commitment. A planner with commitment can benefit from the interest rate manipulation simply by taxing less today, and promising that future consumption will be lower, regardless of the level of debt. If the government lacks commitment, then it realizes that it has to leave a lower debt to its successor in order to conveniently manipulate the interest rate.

Figure 3 shows that the movements in the interest rate are quite small, being only 8 basis points. Even though the interest rate does not display large movements, one should not conclude that the government does not face a severe time-inconsistency problem related specifically to the interest rate. In fact, lack of commitment is present in the model and has dramatic effects on the debt level.

4 Loose commitment

Because the evolution of debt is dramatically different with full-commitment and no-commitment, we analyze an intermediate *loose commitment* setting. We consider that governments have the ability to commit but, under some circumstances (like wars, political pressures, etc.), policy plans are reneged on. We assume that successive governments share the same objectives (i.e. there is no political disagreement).

²⁶We are assuming the economy to be in the upward-sloping part of the Laffer curve. This reasoning provides an explanation for why Krusell, Martin, and Rios-Rull (2006) optimal policy does not involve reducing debt to zero. If the government would do so in their model, it can not influence bond prices in the desired way.

In this context, it is equivalent to consider that the same government reneges on its past promises or a new one is appointed.

Loose commitment is introduced into the basic model following the methodology developed in Debortoli and Nunes (2009).²⁷ For simplicity, we consider an institutional setting where the ability to commit is driven by an exogenous shock $s_t \in \{0, 1\}$. At any point in time t , with probability π the previously announced plans are fulfilled ($s_{t+1} = 1$), while with probability $1 - \pi$ plans are revised ($s_{t+1} = 0$).²⁸ The policymaker's problem becomes

$$V(b_{-1}) = \max_{\{c_t, g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} (\beta\pi)^t \{u(c_t, 1 - c_t - g_t, g_t) + \beta(1 - \pi)V(b_t)\}, \quad (16)$$

$$s.t. : c_t u_{c,t} + \beta\pi u_{c,t+1} b_t + \beta(1 - \pi) u_c(\Psi(b_t)) b_t = (c_t + g_t) u_{x,t} + b_{t-1} u_{c,t}. \quad (17)$$

The objective function (16) contains two parts. The first term in the summation refers to the plan currently made by the planner. The possibility of future reoptimizations decreases the discount rate to $\beta\pi$. Second, at any point in time a new plan will be made with probability $1 - \pi$ yielding the value $V(b_t)$. The planner can influence the choices made when a reoptimization occurs through the state variable b only.

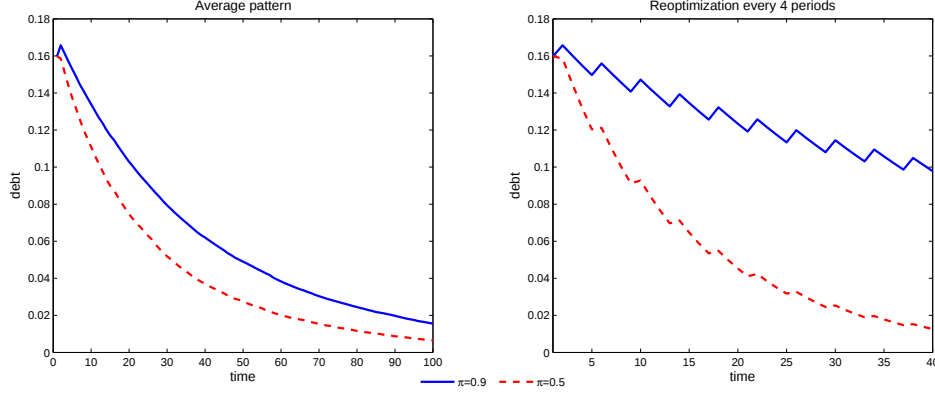
The constraint in equation (17) is obtained by expanding the term $\beta u_{c,t+1}$ in the Euler equation (8). With probability π , the plans announced by the planner will be fulfilled. With probability $1 - \pi$, a new plan will be made, previous promises will be disregarded and the new policies $\Psi(b_t)$ will be implemented. In Debortoli and Nunes (2009) we prove that such kind of problems can be written recursively and solved using dynamic programming. We solve the problem numerically with a collocation method on the first-order conditions.

The left panel of Figure 4 shows the average value of debt for several degrees of commitment (measured by the parameter π). Even a relatively small departure

²⁷Schaumburg and Tambalotti (2007) developed a similar methodology than can be applied only to linear-quadratic problems. Our problem is not linear-quadratic and the non-linearity of the policy functions is crucial to determine the level of debt.

²⁸Since the average duration of the announced plans is $1/(1 - \pi)$, a higher π can be interpreted as a longer horizon over which the government is expected to commit.

Figure 4: Loose commitment: time pattern of debt



Note: The figure plots the evolution of debt over time, for values of parameter $\pi = .9$ (solid line) and $\pi = .5$ (dashed line). In the left-panel average across simulations of the histories of the shock $\{s_t\}_{t=0}^{\infty}$ are reported. The right-panel shows a particular history with reoptimizations every 4 periods. The initial condition is $b = .16$ (roughly 50% of GDP).

from the full-commitment assumption makes the economy to behave very similarly to the no-commitment case.²⁹ If at period $t = 0$ the government holds debt (assets), it accumulates surpluses (deficits), until the level of zero debt is reached. Hence, the property that the steady-state level of debt is determined by the initial conditions is not robust to small deviations from full-commitment.

The right-panel of Figure 4 plots a particular realization of the shocks $\{s_t\}_{t=0}^{\infty}$ where a reoptimization occurs every 4 periods. Debt is increased when a reoptimization occurs, and decreased when promises are fulfilled. This pattern is in contrast with the no-commitment solution, where debt is always reduced. In the no-commitment solution, the planner knows that she can conveniently affect the interest rate if and only if debt is reduced. In the *loose commitment* setting this is no longer true. With probability π promises will be fulfilled and determine the interest

²⁹Differently from what Debortoli and Nunes (2009) found in an economy with capital and labor taxation without debt, here the long-run allocations under *loose commitment* coincide with those prevailing under no-commitment.

rate independently of the debt level. The planner can afford to increase debt when reoptimizing, and conveniently manipulate the interest rate, as long as she promises to reduce debt if she stays in office in the following period.

5 Political disagreement

In this section, we extend the analysis to incorporate political disagreement among successive planners alternating in office. There are two main reasons to do so. First, the assumption of imperfect commitment is natural in this setting. In the presence of political turnover, the party currently in office cannot make credible commitments about the choices of a successor, who in general has different objectives. Second and as discussed in Alesina and Tabellini (1990), political disagreement and political uncertainty provide incentives to accumulate an excessive level of debt with respect to the standard (Ramsey) framework.

There are other factors not present in our model potentially affecting debt accumulation such as: overlapping generations (Erosa and Gervais (2002)), differences in discount rates (Kumhof and Yakadina (2006)), heterogeneous agents with undiversifiable risk (Aiyagari and McGrattan (1998), Shin (2006)), sovereign default risk (Aguiar and Amador (2004), Cuadra and Sapriza (2008), Aguiar and Amador (2009)), private capital accumulation (Ortigueira and Pereira (2008)) and other forms of political conflicts and voting mechanisms (Song, Storesletten, and Zilibotti (2006), Battaglini and Coate (2008)). It is not our goal to model all those features and to match empirically observed debt levels. Nevertheless, in our simple model the interplay between commitment and disagreement generates some novel empirical implications, which can be compared with the existing evidence.

Consider two political parties (A and B) with equal preferences regarding private consumption and leisure but disagreeing on the allocation of public expenditure. More formally, we assume that when a given party is in power its period utility (u) is given by equation (15). Nonetheless, when not in power the period utility ($\tilde{u}$) is

given by

$$\tilde{u}(c_t, l_t, g_t) = (1 - \phi_g) \left[\phi_c \frac{(c_t)^{1-\sigma_c} - 1}{1 - \sigma_c} + (1 - \phi_c) \frac{(x_t)^{1-\sigma_x} - 1}{1 - \sigma_x} \right] + \phi_g \alpha \frac{(g_t)^{1-\sigma_g} - 1}{1 - \sigma_g} \quad (18)$$

where the parameter $\alpha \leq 1$ measures the degree of disagreement between the two parties. Several reasons may induce disagreement. Political parties may attach more weight to different constituents or regions. Parties may also disagree on the composition of public expenditure, or which specific private contractors should provide them. The appendix provides specific examples where disagreement gives rise to the preferences specified in (15) and (18).

The problem of a government of type $i = A, B$, at the beginning of its tenure, can be written as

$$V(b_{-1}) = \max_{\{c_t, g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} (\beta\pi)^t \{u(c_t, 1 - c_t - g_t, g_t) + \beta(1 - \pi)\xi(b_t)\} \quad (19)$$

subject to (17). The main difference with respect to (16) is that when a reoptimization occurs, choices are taken by another party allocating the public expenditure differently. Hence, in the objective function of party i , the function $\xi(b_t)$ denotes the lifetime utility obtained if the other party is elected at $t + 1$.

The symmetry of the problem faced by the two political parties implies equal choices for the debt level, private consumption, leisure, taxes, and public expenditure.³⁰ The value $\xi(\cdot)$ is defined as

$$\xi(b_{-1}) = \sum_{t=0}^{\infty} (\beta\pi)^t [\tilde{u}(c_t^*, 1 - c_t^* - g_t^*, g_t^*) + \beta(1 - \pi)V(b_{t+1}^*)] \quad (20)$$

where stars denote variables evaluated with the policy functions solving the problem with political disagreement. Because the other party is in charge, allocations are evaluated according to $\tilde{u}$ instead of u . The value function $V(\cdot)$ is present because party i may regain power.

³⁰This symmetry is a direct consequence of assuming separability in the utility function, and is convenient because the policy functions of both parties become equal. Since in the solution technique we need to employ global methods and the model has two state variables and several decision variables, relaxing this symmetry significantly complicates our analysis. In a simpler framework, Azzimonti-Renzo (2004) considers asymmetric cases.

Definition 1 specifies our concept of equilibrium, which we restrict to be within the class of Markov equilibria.

Definition 1 *A Markov Perfect Equilibrium with Imperfect Commitment and Political Disagreement is an allocation $\{c_t, g_t, b_t\}_{t=0}^{\infty}$ satisfying the following conditions:*

1. Given $\Psi(b)$ and $\xi(b)$, the allocation $\{c_t, g_t, b_t\}_{t=0}^{\infty}$ solves (19) subject to (17);
2. The value function $\xi(b)$ is described by (20) and $V(b)$ is the maximum of problem (19);
3. The policy function of consumption $\psi(b, \gamma)$ solving problem (19) is such that $\Psi(b) = \psi(b, 0)$.

The first part of the definition is a simple optimality requirement. The second part requires consistency between the functions ξ and V . The third part requires policies implemented by future governments to be optimal. As in the loose commitment framework, when a new government is elected the Lagrange multiplier (γ) is set to zero. The policy functions $\Psi(b)$ and the value function $\xi(b)$ are unknown and need to be found as a solution of a fixed point problem. Envelope results are not available because $\xi(b)$ and $V(b)$ do not coincide.

The formulation in this section includes several combinations of the commitment degree and political disagreement. The standard Ramsey formulation of section 2.1 with full-commitment and no disagreement corresponds to $\pi = 1$ and $\alpha = 1$. On the other extreme, when $\pi = 0$ and $\alpha < 1$ the model displays political disagreement with no-commitment. By changing the values of the parameters π and α , we are able to disentangle the effects of these two sources of inefficiency.

5.1 Political disagreement and commitment

We distinguish between two different commitment assumptions. In the first environment, as in Alesina and Tabellini (1990) and Azzimonti-Renzo (2009), we keep the extreme assumption that governments can never commit. In the second environment, as a novelty of this paper, governments are able to credibly commit

as long as they last in power, but cannot commit on behalf of their successors. In other words, governments can commit along their tenures, but if a new party takes over, policy is reoptimized and previous promises are discarded. We denote these two cases as “*no-commitment-over-the-tenure*” and “*commitment-over-the-tenure*”, respectively.

This distinction is relevant for our model because there is a time-inconsistency problem even without political turnover. In the *no-commitment-over-the-tenure* case, the parameter π is unrelated to the degree of commitment and only measures the probability of being reelected. With *commitment-over-the-tenure*, π also reflects the degree of commitment.

For the *no-commitment-over-the-tenure* case, the left panel of Table 1 shows the long-run level of debt for different values of α and π . First, once there is political disagreement between successive planners, debt converges to a positive level in the long-run. Second, a higher degree of disagreement and more frequent turnover imply a higher level of debt. While the effects of different degrees of disagreement are relevant, those of the frequency of turnover seem quantitatively less important. For all the values of α reported, the difference on the level of debt between having $\pi = .9$ and $\pi = 0$ is less than 10% of GDP.

The *commitment-over-the-tenure* case is displayed in the right panel of table 1. As in the previous case, the level of debt is considerably increasing in the degree of disagreement. The effects of π on debt are less clear as debt changes non-monotonically. The reason is the following. A higher π implies a longer tenure on average. On the one hand, the commitment horizon is longer, and therefore debt can be increased by more when a reoptimization occurs. On the other hand, it is less likely that the other party comes into power, so the incentives to accumulate debt are smaller. The composite effect of changing π depends on the relative strength of these two forces, which are difficult to disentangle. Finally, the effects of a marginal change in the frequency of political turnover depend on the degree of disagreement. This result suggests that in empirical work one should consider the interaction between the frequency of turnover and the degree of polarization.

Table 1: Long-run debt (% of GDP)

α	No-commitment-over-the-tenure						Commitment-over-the-tenure					
	π						π					
	1	0.9	0.75	0.5	0.25	0	1	0.9	0.75	0.5	0.25	0
1	–	0.0	0.0	0.0	0.0	0.0	–	0.0	0.0	0.0	0.0	0.0
0.99	–	10.9	13.0	13.9	14.2	14.4	–	3.6	3.6	4.6	6.9	14.4
0.98	–	17.8	20.9	22.3	22.8	23.0	–	7.0	7.0	8.9	12.7	23.0
0.97	–	23.1	27.0	28.6	29.2	29.6	–	10.4	10.3	12.9	17.6	29.6
0.96	–	27.4	31.9	33.9	34.6	34.9	–	13.8	13.5	16.6	21.8	34.9
0.95	–	31.2	36.2	38.3	39.1	39.5	–	17.1	16.7	20.1	25.5	39.5

Note: The table reports the long-run level of debt, for different degree of disagreement (α) and frequency of turnover (π). In the left part of the table, governments do not have commitment, regardless of the probability (π). In the right part of the table, governments can commit over their tenures. Averages are taken across realizations of the shock s_T , where $T = 1000$.

5.2 Relationship with the empirical evidence

A large body of empirical studies examine the effects of political polarization and frequency of turnover on deficits and debt accumulation. Nonetheless, in most of these studies, polarization and turnover are not analyzed together, since they are usually considered as alternative proxies of political instability.

Different works have measured polarization in different ways, but it is generally found that a larger degree of polarization increases debt. Roubini and Sachs (1989) find coalition governments (interpreted as polarization) to be more likely to run deficits.³¹ Volkerink and de Haan (2001) and Huber, Kocher, and Sutter (2003) conclude that the fragmentation of governments (in terms of size or political ideology) is a source for relatively higher deficits. Alt and Lassen (2006) find fiscal transparency and less polarization to reduce debt. Woo (2003) concludes that countries with high polarization (measured as income inequality) have bigger fiscal deficits.

³¹The authors do not present a regression with the average tenure and the evidence regarding this variable is only suggestive. The finding that coalition governments tend to accumulate more deficits has been challenged for instance by de Haan and Sturm (1997). Alesina, Roubini, and Cohen (1997) provide further evidence supporting Roubini and Sachs.

There is also a large empirical literature examining the effects of the average tenure or the re-election probability. These studies present less clear results. Alt and Lassen (2006), in contradiction with the theory, find that shorter tenures reduce debt. Skilling and Zeckhauser (2002) also find that political competition decreases debt. Lambertini (2004) and Franzese (2001) find that the incumbent's probability of being voted out of office can not explain budget deficits. Grilli, Masciandaro, and Tabellini (1991) find mixed results regarding the effects of the average tenure. de Haan and Sturm (1994) find that the frequency of government changes is positively correlated to budget deficits.

The overview of the empirical literature shows a consensus that polarization is translated into more debt or deficits. In contrast, the findings on the re-election probability are quite mixed. The implications of our model, which is clearly a very stylized depiction of reality, are consistent with these empirical findings. We find that both polarization and the probability of election matters. But the effect of the second variable is small and with ambiguous sign when commitment issues are taken into account.

5.3 Welfare implications

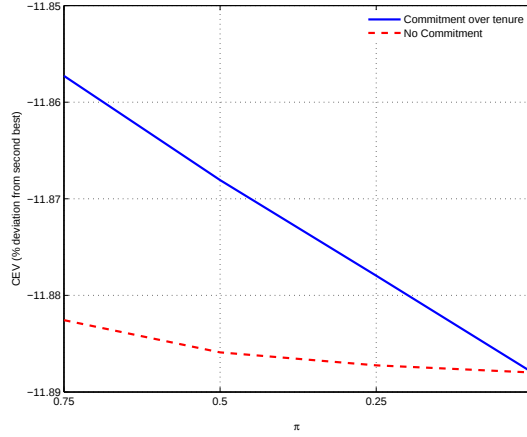
Building commitment with political disagreement is not necessarily welfare improving. Commitment is used to pursue partisan objectives, and can be detrimental for the parties disagreeing with the incumbent government. This also raises the question of how the desirability of building commitment depends on the degree of political polarization. To the best of our knowledge, we are the first analyzing this question. Needless to say, the purpose of this exercise is not to draw conclusions about the absolute magnitudes of welfare, but to show how welfare changes in these scenarios.

To address these questions, we compute social welfare as the average of the two types of agents lifetime utility. Figure 5 plots welfare as a function of π for a given degree of polarization α .³² The figure shows welfare to be increasing in π

³²In Figure 5 we set $\alpha = .95$. Results are robust for different values. For comparability purposes, throughout our analysis welfare is always measured in consumption equivalent variation from the

for both cases of commitment (continuous line) and *no-commitment-over-the-tenure* (dashed line). The difference between the two provides a measure of the welfare effects of building commitment. Being that difference positive and increasing in π , our analysis suggests that building commitment is welfare improving even in the presence of political disagreement. Another observation is that, since the dashed line is almost flat, the welfare effects of changing the frequency of turnover *per se* seem to be irrelevant.

Figure 5: Welfare with political disagreement



Note: The figure plots welfare as a function of π given a degree of polarization $\alpha = .95$. Both the cases where the government has *commitment-over-the-tenure* (solid line) and *no-commitment-over-the-tenure* (dashed line) are reported. Values are expressed in percentage consumption-equivalent variation (CEV) from the benchmark case of full-commitment and no-disagreement.

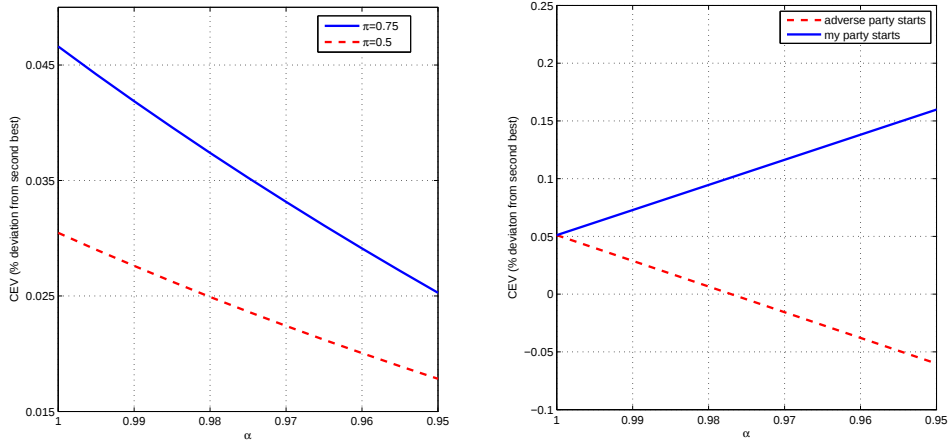
In the left panel of Figure 6, we analyze the welfare effects of building commitment as the degree of political polarization (α) changes.³³ The figure shows that the higher is polarization (i.e. lower α), the lower are the welfare gains of increasing

full-commitment and no-disagreement case.

³³The welfare effects of building commitment are computed as the welfare difference of the commitment and *no-commitment-over-the-tenure* cases.

commitment. The rationale for this result is provided in the right panel of Figure 6, where we compare the welfare implications of commitment for the two types of agents.³⁴ We find that building commitment is welfare improving if the preferred party starts in office (continuous line). However, it is detrimental if the adverse party starts in office (dashed line). Moreover, the higher is polarization, the higher are the welfare costs of building commitment for agents with different preferences from the incumbent government.

Figure 6: Welfare implications of building commitment with political disagreement



Note: The left panel of the figure plots the difference in welfare between the cases with *commitment-over-the-tenure* and *no-commitment-over-the-tenure* as a function of disagreement (measured by α). The dashed and solid lines consider the frequency of turnover to be $\pi = 0.5$ and $\pi = 0.75$, respectively. The right panel computes the same measure focusing on $\pi = 0.75$. The continuous line refers to the case where the preferred party starts in office, while the dashed line indicates the case where the adverse party starts. In both panels, welfare values (before differencing) are expressed in percentage consumption-equivalent variation (CEV) from the benchmark case of full-commitment and no-disagreement.

We also find that unless the degree of polarization is very small, the costs associated with having the adverse party in power outweigh the benefits of having more

³⁴Since the problem is fully symmetric, the difference in the utilities of the two types of agents is only due to the type of party starting in office.

credible authorities. From a political point of view, this rules out the possibility that agents would vote for the adverse party in order to benefit from the gains of having authorities with longer commitment horizons.³⁵

6 Concluding Remarks

Imperfect commitment, political disagreement and political uncertainty may be important sources of inefficient fiscal policies. Our work provides an analysis to distinguish and quantify the effects of each of these forces on the level of debt. In our model, imperfect commitment drives the long-run level of debt to zero. Debt is instead positive in the presence of political disagreement.

From a positive point of view, we show that the degree of polarization has a significant effect, while the frequency of turnover only plays a minor role. These results are consistent with most of the existing empirical literature. They also show that in empirical work one should distinguish between the degree of polarization and the frequency of political turnover, since they may drive debt and deficits in opposite directions once commitment issues are taken into account. From a normative point of view, we show that according to our model, the higher is the degree of polarization among political parties, the lower are the benefits of building commitment. In the presence of political disagreement, a better commitment technology will not be used to maximize overall welfare but to pursue partisan goals. This result is likely to be present in other institutional settings. Whenever a reform allows an institution to achieve a larger set of outcomes, then the welfare gains of such reform are likely to be larger if the institution cares about overall welfare instead of specific interests. These insights can be useful for understanding the effectiveness and the desirability of measures to enhance fiscal discipline, like limits on deficits and debt holdings, currently imposed by supranational authorities.

³⁵We have formally investigated this option comparing the welfare with political turnover and the one an agent would obtain with the adverse party always in power. Results are available upon request.

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Appendix

The no-commitment case - optimality conditions

The first-order necessary conditions of the planner problem under no-commitment are given by equations (11), (12) and

$$\begin{aligned} c_t : \quad & u_{c,t} - u_{x,t} = \gamma_t [u_{c,t} + u_{cc,t}(c_t - b_{t-1}) + (c_t + g_t)u_{xx,t} - u_{x,t}] \\ g_t : \quad & u_{g,t} - u_{x,t} = \gamma_t [(c_t + g_t)u_{xx,t} - u_{x,t}] \end{aligned}$$

where it was assumed separability in the utility function, implying $u_{cg} = u_{xc} = u_{xg} = 0$.

The no-commitment case with non-separable utility

This section shows that a steady-state with zero debt exists even when the utility function is non-separable. The first-order condition with respect to debt becomes

$$\gamma_t [(u_{cc,t+1}\Psi_{b,t}^c + u_{cg,t+1}\Psi_{b,t}^g + u_{cx,t+1}\Psi_{b,t}^x)b_t + u_{c,t+1}] = u_{c,t+1}\gamma_{t+1},$$

where $\Psi_{b,t}^c$, $\Psi_{b,t}^g$, and $\Psi_{b,t}^x$ denote respectively the derivatives of the policy functions of private consumption, public consumption, and leisure with respect to debt. The previous equation implies that in a steady-state

$$\gamma(u_{cc}\Psi_b^c + u_{cg}\Psi_b^g + u_{cx}\Psi_b^x)b = 0.$$

There are then three possible steady-states. First, the undistorted equilibrium ($\gamma = 0$). Second, the level of debt is zero ($b = 0$). Third, the steady-state where the equality $u_{cc}\Psi_b^c + u_{cg}\Psi_b^g + u_{cx}\Psi_b^x = 0$ holds. Therefore, a steady-state with $b = 0$ exists even with a more generic utility function. As discussed in section 3, the stability properties of the three classes of steady-states depend on the relative weight of public and private consumption and leisure in the utility function and on its curvature.

The loose commitment case - optimality conditions

The first-order conditions of the planner problem under *loose commitment* are given by (17) and

$$\begin{aligned} b_t : \gamma_t[(1 - \pi)u_{cc,t+1}^D \Psi_{b,t} b_t + (1 - \pi)u_{c,t+1}^D + \pi u_{c,t+1}] &= \pi u_{c,t+1} \gamma_{t+1} + (1 - \pi)u_{c,t+1}^D \gamma_{t+1}^D \\ c_t : u_{c,t} - u_{x,t} &= \gamma_t[u_{c,t} + c_t u_{cc,t} - u_{x,t} + (c_t + g_t)u_{xx,t}] - (\gamma_t - \gamma_{t-1})u_{cc,t} b_{t-1} \\ g_t : u_{g,t} - u_{x,t} &= \gamma_t[(c_t + g_t)u_{xx,t} - u_{x,t}] \end{aligned}$$

In the FOC w.r.t debt, the subscript D denotes next period variables when previous plans are abandoned.

Alternative formulations of the problem with political disagreement

In this appendix, we explain specific cases that give rise to the disagreement specification considered in the main part of the text.

First case: Consider that there are two composite public expenditure goods. Each of these public good differs in location, contractors, type and so on. Consider that for both parties each of these goods is a perfect substitute. More formally:

$$g_t^A = g_t^1 + \alpha_s g_t^2 \quad \text{and} \quad g_t^B = g_t^2 + \alpha_s g_t^1 \quad (\text{A-1})$$

where $\alpha^s < 1$. Under this specification, party A will only provide good of type 1 and, viceversa, party B only provides good of type 2. Consider in addition that the utility function in g is homogenous of degree $p > 0$, which is satisfied for instance by any power function. In this case, the utility that each party receives while in power is simply $(u(c) + v(x) + h(g))$, while if the other party is in power, it receives the utility $(u(c) + v(x) + \alpha_s^p h(g))$. By denoting $\alpha_s^p = \alpha$ we obtain the specification in the main part of the text.

Second Case: Consider that there is a continuum of households indexed from 0 to 1. The function f_h^i represents the weight that each party $i = A, B$ assigns to each household $h \in (0, 1)$. The functions satisfy the following property $\int_0^1 f_h^A dh = \int_0^1 f_h^B dh = 1$. Each party believes that a set M of households will benefit from the

public expenditure regardless of which party is in power. However, the remaining households (set N) will not receive any utility from the public good if the other party is in power. Denote I_h^M and I_h^N by the indicator functions with value 1 if the household is in group M, N and 0 otherwise. The functions satisfy the following two properties: i) $I_h^N I_h^M = 0$, and ii) $I_h^N + I_h^M = 1$.

Even if a party assigns different weights to individuals, the private consumption and leisure of all individuals will be the same. This is because we are assuming separable utility and that all individuals face the same tax schedule. When party i is in power the public expenditure is denoted by g^i , while if it is not in power it is denoted g^{-i} . Under these conditions, if a given party is in power it receives the utility:

$$\int_0^1 f_h^i(u(c) + v(x) + (I_h^M + I_h^N)h(g^i))dh = u(c) + v(x) + h(g)$$

While if the other party is in power, it receives the utility:

$$\int_0^1 f_h^i(u(c) + v(x) + I_h^M h(g^{-i}))dh = u(c) + v(x) + \alpha h(g)$$

where $\int_0^1 f_h^A I_h^M dh = \alpha \in (0, 1)$, and for the problem to be symmetric we also assume $\int_0^1 f_h^B I_h^M dh = \alpha$.

Data and calibration

Table A-1: Debt in the OECD countries in 2006

	gross	net		gross	net
Australia	15.0	-2.8	Korea	27.9	-30.2
Austria	69.1	41.8	Luxembourg	6.6	.
Belgium	91.2	76.8	Netherlands	59.4	33.7
Canada	68.0	27.6	New Zealand	29.8	-3.5
Czech Republic	39.3	2.8	Norway	48.1	-149.3
Denmark	39.7	6.9	Poland	51.7	16.6
Finland	48.2	-60.6	Portugal	74.3	46.6
France	75.3	43.0	Slovak Republic	38.4	-11.7
Germany	71.3	51.9	Spain	46.8	26.7
Greece	120.6	86.9	Sweden	56.0	-15.0
Hungary	68.8	43.9	Switzerland	54.2	21.0
Iceland	24.5	8.5	United Kingdom	47.9	41.7
Ireland	32.5	4.9	United States	60.9	42.8
Italy	120.8	95.4	Euro Area	76.8	51.3
Japan	176.2	89.5	Total OECD	76.9	44.4

Note: The table displays the general government financial liabilities as percent of nominal GDP. The source is the OECD Economic Outlook.

Table A-2: Parameter values

Parameter	Value	Description
β	.96	discount factor
ϕ_c	.2	weight of consumption (priv. + publ.) vs. leisure
ϕ_g	.2	weight of public vs. private consumption
σ_x	3	Elasticity of leisure
σ_c	2	Elasticity of private consumption
σ_g	.95	Elasticity of public consumption