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 disentangle and quantify the respective effects of imperfect commitment and political disagreement. Absent political turnover, imperfect commitment drives the long-run level of debt to zero. With political disagreement, debt is a sizeable fraction of GDP and increasing in the degree of polarization among parties, no matter the degree of commitment. The frequency of political turnover does not produce quantitatively relevant effects. These results are consistent with much of the existing empirical evidence. Finally, we find that in the presence of political disagreement the welfare gains of building commitment are lower.

JEL *classification*: C61, E61, E62, P16

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1 Introduction

1.1 Motivation

In the fiscal policy literature, there is not a clear theoretical understanding of the forces driving the observed patterns of public debt. This paper explores how debt evolves when governments cannot make credible commitments about future policies and when policymakers with different policy goals alternate in office. We consider several cases to be able to disentangle and quantify the respective effects of imperfect commitment and political disagreement.

As it is well known, the evolution of debt matters in a world where the provision of public goods has to be financed by raising distortionary taxes.[1] In this context, as shown e.g. in the works of Barro (1979), Lucas and Stokey (1983) and Aiyagari et al. (2002), debt is used to smooth over time the deadweight losses associated with such distortions. These models do not provide a complete explanation of some basic and stylized facts, like why public debt is a sizeable fraction of GDP in many developed countries and why there is a substantial variation in the debt/GDP ratio both over time and across countries with similar economic conditions.[2]

In macroeconomic models, the optimal (second-best) allocations are usually characterized as the solution to a Ramsey problem. It is assumed that the same planner is always in charge and that he can commit to future policies, maximizing the welfare of a representative agent.[3] Under these assumptions and with complete financial markets, as shown by Lucas and Stokey (1983), the long-run level of debt crucially

[1] When lump-sum taxes are available, the debt policy is irrelevant, since the so-called Ricardian equivalence holds, see e.g. Barro (1979).

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

[3] For a study about policy choices made by self-interested policymakers see e.g. Persson and Tabellini (2000).

depends on the initial conditions.[4] 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.

Policymaking in practice departs from the idealized environment described in Lucas and Stokey (1983) in many dimensions. In this work, we investigate how imperfect commitment and disagreement among successive policymakers can provide an incentive to accumulate debt, and analyze their interactions. There are important reasons to think that these two forces may considerably affect the behavior of debt.

First, 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 our context, the solution under full-commitment is time inconsistent because a planner, at a given point in time, is willing to abandon his previous plans to manipulate the interest rate. For example, if the planner needs to issue debt, he has an incentive to reduce the interest rate. Hence, the planner is willing to lower current taxes, in order to foster current consumption. Indeed, because of a smoothing motive, this leads to an increase in the demand for savings and thus to a reduction in the interest rate. As a consequence, because of the lower tax revenues, in a one-time deviation from the full-commitment solution, the planner runs deficits and accumulates debt.[5] Therefore, it seems worth exploring how debt evolves when the planner cannot make credible commitments about his future policies.[6] We thus check whether a positive long-run level of debt

[4]Lucas and Stokey (1983), as we do here, analyzed an economy with complete financial markets. Removing this assumption, as shown by Aiyagari et al. (2002), it is optimal to accumulate assets.

[5]This happens unless the initial level of debt is sufficiently high. In the latter case, the improvement in the interest rate, since applied to a larger base, can be sufficient to finance the initial tax cut.

[6]As in Lucas and Stokey (1983), we assume that there is still commitment to honor the debt

may be the outcome of the optimal policy under the no-commitment assumption and other imperfect commitment settings.

Second, some studies in the political economy literature (see e.g. Alesina and Tabellini (1990) and Persson and Svensson (1989)), have emphasized how the presence of political disagreement provides incentives to accumulate an inefficiently high level of debt. Indeed in such cases, debt may be used strategically to influence the choices of the successors. In comparison with the no-disagreement case, more resources are used for current purposes and less resources, i.e higher debt, are left to the successors to pursue their objectives. In a world characterized by political disagreement, the assumption of full-commitment seems unrealistic. However, it would still be reasonable to assume that governments may have commitment during their tenures, but cannot commit on behalf of their successors, who have different objectives. In this paper, we consider a framework with political disagreement among successive policymakers, where commitment plays an important role in the strategic game between policymakers and private agents.[7] In this context, the incumbent policymaker makes different choices depending on his ability to commit while staying in office. This allows us to explicitly analyze the effects of commitment in a world with political disagreement among successive policymakers.

1.2 Main findings

We build on the simple Lucas and Stokey (1983) model, introducing endogenous government expenditure, which has to be financed by raising a proportional income

payments. On the contrary, the absence of commitment is referred to future policy actions. For a further discussion on this issue see Niepelt (2006).

[7]The 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). Also note that Alesina and Tabellini (1990) by setting the initial level of debt to zero, restrict their analysis to a case where the time inconsistency problem does not play any role.

tax and/or by issuing debt. We analyze optimal policy choices under different assumptions about commitment and disagreement among successive policymakers.

We develop a framework that allows us to disentangle and quantify the effects of imperfect commitment, frequency of turnover and political disagreement in a dynamic context. In this respect, our contribution is methodological. Our framework can indeed be used to analyze the effects of commitment in a wide set of infinite-horizon optimal policy problems, where policymakers with different objectives alternate in office. In other words, the methodology developed here allows us to integrate the analysis about the time-inconsistency of optimal policy choices, typical of the dynamic macroeconomic literature, into a political economy model. By doing so, we are able to measure the implications of building commitment in the presence of political disagreement.

From an economic point of view, the main contribution and findings of our analysis are the following. First, abstracting from political disagreement, we study the optimal fiscal policy under the no-commitment assumption. Under a wide set of initial conditions and parameterizations, we find that debt goes to zero in the long-run. Perhaps surprisingly, this means that there is a striking difference in the behavior of debt in a one-time deviation from commitment and in the no-commitment (time-consistent) solution. As we will discuss later, reducing debt over time is the only way the planner with no-commitment can favorably affect the interest rate.

Second, we study the behavior of debt in cases where the planner has access to a commitment technology, but under some circumstances, say because of political pressures, big shocks etc., he may renege on his past promises. This is what we call the *loose commitment* setting. Because of the striking difference in the behavior of debt between the full-commitment and the no-commitment cases, it seems worth

checking how debt evolves under *loose commitment*. We find that even in the latter case the level of debt converges to zero in the long-run. This 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. In addition, our results suggest that departing from the full-commitment assumption cannot help explaining why the level of debt is a sizeable fraction of GDP.

Third, we also find that debt is generally increased in periods when the planner reneges on his past promises and reduced over the periods of commitment. This result is interesting since it suggests that the simple expectation that the planner may surprise the economy at a future date induces him to commit to reduce debt over time.

Fourth, we investigate one case where the imperfect commitment assumption is natural, i.e. when successive planners have different policy goals. We find that in the presence of political disagreement, debt is a sizeable fraction of GDP, regardless of the assumptions made about commitment. In our numerical exercises, political disagreement seems to be the main driving force for accumulating deficits. On the contrary, the effects of imperfect commitment and political turnover have a small impact on the level of debt. Our predictions are consistent with most of the existing empirical evidence. Indeed, while there is a large consensus on the positive relationship between the degree of political polarization and debt accumulation, the empirical findings about the effects of the frequency of political turnover are less clear-cut. More importantly, our results suggest that when testing empirically the effects of political instability on the level of debt, it is important to control both for measures of polarization among parties and measures of political turnover, rather than using any of them as a generic indicator of political instability.

Finally, when analyzing welfare implications, we find that the gains from commitment are lower in the presence of political disagreement than in a no-disagreement case. From an intuitive point of view, this happens because in the absence of political disagreement governments with more commitment will maximize overall social welfare. On the contrary, with political disagreement a better commitment technology can be used by each party to maximize specific groups' welfare.

1.3 Related Literature

Krusell et al. (2006) analyze the time-consistent solution of the otherwise standard Lucas and Stokey (1983) model, where government expenditures are exogenous. The authors find as a solution a multiplicity of steady states and discontinuous policy functions, where debt adjusts for one or two periods and then remains constant. Their main finding is that under no-commitment the equilibrium is close to the solution under commitment. In our paper, we also build on the Lucas and Stokey (1983) model, but consider the case where government expenditure is endogenous. The presence of this additional instrument in the hands of the policymaker widens the set of his feasible choices. In Section 3, we extensively discuss how this make a difference. We obtain continuous policy functions and we find that in the absence of commitment debt goes to zero. This result is surprising because it is usually the case that in a one-time deviation from commitment debt increases.

In the literature, several papers have analyzed the effects of lack of commitment on debt in monetary economies. When nominal debt is present, the monetary authority usually has an incentive to raise the price level to reduce the real value of the outstanding debt. The first period of the full-commitment solution reveals such incentives, since debt is eroded in real terms. Diaz-Gimenez et al. (2006) confirm

that in a monetary economy under discretion the features of a one-time deviation from commitment are obtained in every period. The real value of debt is found to be eroded systematically.[8] Martin (2006) extends the work of Diaz-Gimenez et al. (2006) in important ways. The author finds that the steady-state level of debt can be positive, negative or zero depending on the parametrization of the utility function. If it is easy (difficult) for households to substitute cash goods then government holds assets (debt).[9] As in Krusell et al. (2006) we focus on a real economy. Since in most countries central banks are independent and committed to price stability, we believe that focusing on a real economy is a reasonable assumption. Our result that debt converges to zero is not due to the presence of nominal bonds nor is it achieved with surprise inflation.

Some studies in the political economy literature have analyzed how policy decisions are formulated when policymakers with different political views alternate in office. The work of Alesina and Tabellini (1990) shows how political uncertainty and turnover lead to an inefficiently high steady state level of debt and public expenditure and how these political factors can account for the differences in debt management across countries and over time. Azzimonti-Renzo (2004), as we do here, extends the previous works to an infinite horizon problem, but in a context where commitment about future policy does not affect private agents' choices. The author considers a fiscal policy model with balanced budget, and public but no private capital. Instead, we focus on the effects of political disagreement on the level of government debt. Our main contribution with respect to this literature is to study optimal policy where commitment plays a role in the strategic interactions between

[8] If debt is real, their model does not have a time-inconsistency problem and real debt remains constant. The authors show that this result is also obtained for a monetary economy with inflation and consumption taxes.

[9] Ellison and Rankin (2007) examine the case of indexed debt building on Nicolini (1998)

agents and the policymakers. Moreover, we solve the problem under different commitment settings. We indeed consider the case where parties cannot commit at all, but we also assume that parties can credibly commit for the future, in case they are reappointed in office. This allows to disentangle and quantify the effects of imperfect commitment, political disagreement and frequency of political turnover on the level of debt. Finally, it allows to measure the welfare gains from commitment in the presence of political disagreement.

In recent work, Song et al. (2006) study the evolution of debt in a dynamic political economy framework. They consider an overlapping generation model with intergenerational political conflicts over public goods and incomplete financial markets. In their work, however, the interest rate is exogenous, and the time-inconsistency problem arises because agents vote repeatedly at different stages of their life. In our work, instead, we study an infinite horizon problem, the disagreement is about the composition of a public good, the time-inconsistency problem arises because of the policymaker's incentive to manipulate the interest rate and voting outcomes are left as an exogenous process.

The paper is organized as follows: in Section 2 we introduce the model and, as benchmark for our analysis, we recover the solution under full-commitment. In Section 3, we describe the solution under no-commitment, i.e. the time-consistent solution. 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 build our analysis on a simple model, as in Lucas and Stokey (1983), where time-inconsistency issues arise, and analyze the solution under the assumptions of full-commitment, full discretion and *loose commitment*. For the time being, we abstract from uncertainty and political disagreement between successive governments.[10] The latter feature is introduced in Section 5.

We consider an economy where labor is the only factor of production, and technology is linear,

$$c_t + g_t = 1 - x_t \tag{1}$$

for $t = 0, 1, 2, ...$, where c_t, g_t and x_t denote private consumption, public consumption and leisure, respectively.

The representative household derives utility from leisure and the consumption of private and public goods. The latter are provided by a benevolent government and financed through a proportional tax (τ) on labor income and/or by issuing a one-period bond b_t^G with price p_t. At any point in time, the government budget constraint is

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

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:

$$\begin{aligned} &\max_{\{c_t, x_t, b_t^P\}} \sum_{t=0}^{\infty} \beta^t u(c_t, x_t, g_t) \\ &s.t. \qquad c_t + p_t b_t^P = (1 - x_t)(1 - \tau_t) + b_{t-1}^P \qquad t = 0, 1, 2, ... \end{aligned} \tag{3}$$

[10] The absence of uncertainty is for notational convenience. In the presence of exogenous shocks, many of our considerations are still valid under the assumption of complete financial markets.

where p_t is the price at time t of private bond holdings (b_t^P), paying one unit of consumption at time t+1.

The household's first order conditions are

$$\frac{u_{x,t}}{u_{c,t}} = (1 - \tau_t) \tag{4}$$

$$p_t = \beta \frac{u_{c,t+1}}{u_{c,t}} \tag{5}$$

together with the budget constraint (3). Equation (4) and (5) represent the equilibrium condition in the labor market and the bond market, respectively.

In what follows, we analyze the problem of the government and characterize its solution under the assumption of full-commitment. This will serve as a benchmark for our discussion in subsequent sections.

2.1 The case of full-commitment

If the government has full-commitment, for a given initial level of debt (b_{-1}), it solves the following problem

$$\begin{aligned} &\max_{\{c_t, g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} \beta^t u(c_t, 1 - c_t - g_t, g_t) \\ s.t. \qquad & c_t u_{c,t} + \beta u_{c,t+1} b_t = (c_t + g_t) u_{x,t} + b_{t-1} u_{c,t} \qquad t = 0, 1, 2, ... \end{aligned} \tag{6}$$

where we made use of the household's optimality conditions (3) and (5), 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 also rule out Ponzi schemes, by imposing the transversality condition

$$\lim_{T \to \infty} \beta^T u_{c,T} b_T = 0. \tag{7}$$

For our purposes it is worth recalling some features of the resulting equilibrium. As discussed in Lucas and Stokey (1983), in the full-commitment case after an initial

jump, all the allocations, including the amount of debt, reach their (deterministic) steady-state level, and remain constant from then on.[11] This is because, apart from $t = 0$, all the periods look 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}. In other words, countries starting with high debt will have high debt forever, and countries with low debt will have low debt forever. 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 to start with. Moreover, it cannot explain why the level of debt is so different across countries with similar economic conditions.

As anticipated, allocations in the first-period are different. This is related to the time-inconsistency problem typical of this setting. The government, when making its plans at period $t = 0$, would like to use taxes and public expenditure to manipulate the bond price. This is because of the following. For a generic $t > 0$, current consumption influences both p_t and p_{t-1}. 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 the costs of such a procedure offset the benefits. However, at $t = 0$ things are different. Since previous prices (p_{-1}) are given, if the initial level of debt is positive, the government can benefit from an increase in the price of the bond, without incurring any additional cost. For example, 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.[12] These incentives to increase initial consumption prevail whenever the government is allowed to make a new plan. This is why the solution

[11] See the optimality conditions in the appendix.

[12] The opposite happens when $b_{-1} < 0$.

to this problem is in general time-inconsistent.

To explain better the mechanism described above, in Figure 1 we plot 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 ($b_{-1} \geq 0$), under the full-commitment assumption.[13] We can see that the higher is debt, the bigger is the difference between current and future consumption, and thus the higher is the drop in the interest rate. This happens because the higher is debt the larger is the base on which the improved interest rate is applied. As a consequence, the higher is the inherited level of debt, the greater is the willingness to manipulate the interest rate.

Now we can look at the behavior of debt in the first period, by looking at the government budget constraint in 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. Whether $b_0 > b_{-1}$ depends on the composite effect of these two forces. In Figure 2, we plot the level of debt chosen in the first period (and thus the steady state level of debt), as a function of b_{-1}. For low levels of b_{-1}, the reduction of tax revenues is bigger than the benefits derived from higher bond prices. The government thus runs a deficit in the first period and accumulates debt. However, 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 and the level of debt can also decrease. This can be seen in Figure 2, at a level at which the continuous line intersects the 45-degrees line.

To summarize, the long-run level of debt under the full-commitment assumption depends on initial conditions. In the first-period and, consequently, in a one-time

[13]The picture is based on the calibration of the next sections. See Lucas and Stokey (1983) for the analytical solution of the model in the case of a quadratic utility function.

deviation from commitment there is a tendency to run deficits and increase debt. In order to understand if the absence of commitment can lead to public debt accumulation, we now relax the full-commitment assumption.

3 The time-consistent solution

In this section, we analyze the problem of a benevolent planner which, as opposed to the case of the previous section, does not have access to a commitment technology. More precisely, we consider the case in which the current planner cannot make credible promises about his future actions. We keep the assumption that the planner can credibly commit to repay his loans.[14] In what follows, we also assume that reputation mechanisms are not operative, focusing only on Markov-Perfect equilibria, as defined for instance in Klein et al. (2004).

In this case the problem of the planner is

$$V(b_{t-1}) = \max_{\{c_t, g_t, b_t\}} u(c_t, 1 - c_t - g_t, g_t) + \beta V(b_t) \tag{8}$$

$$s.t. \qquad c_t u_{c,t} + \beta u_c(\Psi(b_t)) b_t = (c_t + g_t) u_{x,t} - b_{t-1} u_{c,t}. \tag{9}$$

It is important to highlight the presence of the function $\Psi(b_t)$ in the constraint (9). This determines the quantity of consumption the consumer expects for period $t+1$ as a function of the outstanding level of debt b at the beginning of next period. This represents the main difference with respect to the full-commitment case. Since the current planner cannot make credible commitments about his future actions, the future stream of consumption is not under his direct control. By taking as given the policy $\Psi(b_t)$ of his successor (or himself in the next period), the current planner

[14] This may be justified by thinking that if the planner would be allowed to default on his outstanding debt at no cost, then consumers would anticipate it, and there would be no trading.

can only influence future consumption through his current debt policy. Being the function $\Psi(b_t)$ unknown, the solution of this problem relies on solving a fixed point problem in $\Psi(b_t)$.[15]

We can now look at the first order conditions of the associated Lagrangian, and in particular at the so called generalized Euler equation (GEE)

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

where γ_t indicates the Lagrange multiplier attached to constraint (9).[16,17] The inspection of the previous equation allows us to describe the behavior of the economy in a (deterministic) steady state. In particular, for the GEE to be satisfied in steady state, it must be that

$$\gamma u_{cc}\Psi_b b = 0 \tag{10}$$

We can identify three different cases in which such relationship holds, as illustrated in Figure 3. This picture, together with the steady states implied by eq. (10), gives a qualitative representation of the transition dynamics obtained in our numerical experiments.[18]

First, we have the case in which $\gamma = 0$. This means that constraint (9) is not binding, and we are at an unconstrained optimum. From an economic point of view, this is saying that the planner can avoid to raise distortionary taxes and can finance his public expenditure through the interest payments received on his outstanding

[15]See Klein et al. (2004) and Judd (2004) for a detailed discussion on this topic.

[16]By 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 exercises we do find a continuous and differentiable solution.

[17]In the present framework, the generalized Euler equation is the derivative of the Lagrangian associated with the problem (8) w.r.t. b_t.

[18]Results do not change qualitatively for any of the parametrization we used.

assets. This represents the first-best solution.[19] As discussed later, this steady state can only be reached if the planner initially holds a sufficiently high level of assets (roughly 5 times GDP under our calibration).

Second, we have the case in which $\Psi_b = 0$. This can happen when a marginal change in the level of debt does not induce any change in the equilibrium level of private consumption. This case cannot be ruled out. However, given the presence of distortionary taxation, this is not due to Ricardian equivalence. On the contrary, when a planner inherits a higher level of debt, he has to raise more distortionary taxes. Because of the bigger distortions created, by a substitution effect, this will reduce hours worked and private consumption. An increase in debt also creates a wealth effect that decreases hours worked and increases private consumption.

Both the wealth and substitution effects lead to a reduction in hours worked as debt increases. The composite effect on private consumption can be understood by examining the aggregate resource constraint. By differentiating equation (1) with respect to debt (b) we can see that in equilibrium we must have

$$\frac{\partial c}{\partial b} + \frac{\partial g}{\partial b} = -\frac{\partial x}{\partial b}. \tag{11}$$

In a model where public expenditure is exogenous, the effects on consumption must be equal to the ones on hours worked. As a consequence, in such case, Ψ_b cannot be zero. But in our framework, there is another way for the planner to cope with the higher burden created by the higher debt. That is, by reducing the amount of public good provision. As a result 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

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

each other. In our calibration, we find that this second type of steady state is at a point where the level of assets is roughly two times GDP. Moreover, for the reasons explained below, this steady state is found to be unstable.[20]

Finally, we have a steady state, associated with a level of debt equal to zero. As illustrated in Figure 3, this is the steady state to which the economy will converge in the (more relevant) cases in which the government initially holds a positive amount of debt or relatively small amount of assets. The intuition for such a result goes as follows. As explained for 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 or, equivalently, to increase the selling price of bonds, as given by (5). 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. In the no-commitment case this is no longer true. The government can only influence future actions through the states variables, which in our case is debt. The higher the inherited debt, the higher will be the incentive in the next period to increase consumption again, in order to manipulate bond prices. 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.

[20]The position of this point depends on the marginal rate of substitution between private and public consumption and between consumption and leisure. Moreover, a priori, there may be more than one level of debt for which this can happen. For all the utility specifications and the calibrations used in our numerical exercises, we found a unique steady state with $\Psi_b = 0$, characterized by asset holdings.

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:[21]

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

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 3 summarizes the parameter values.[22]

The evolution of the allocations over time is illustrated in Figures 4 and 5 where, for comparison, we also display the solution under full-commitment. For a given level of initial debt, we can observe a decreasing pattern of private consumption and an increasing interest rate.[23] This is achieved by lowering taxation and increasing public consumption over time.

It is important to highlight that in the initial period, in the no-commitment case taxes are higher and public consumption is lower than in the full-commitment case. Such policies allow not only to foster private consumption in the desired way, but also to run a surplus. As a result debt decreases over time. As the level of debt and interest payments are reduced, public consumption is raised and taxes are reduced. This will make consumers work more and consume less over time.

As discussed above, it is feasible to have lower taxes and lower levels of private

[21] We assume separability as it is convenient for our analysis in Section 5.

[22] The ratios that we match are c/g, c/y, income taxes (τ), the fraction of time devoted to leisure (x) and the interest rate. We have tried many parameter specifications to check that results do not change qualitatively.

[23] Here 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.

consumption only if the level of public consumption is increased. In a model where public expenditure is exogenously determined, for example, it will not be possible to have lower taxes and lower consumption at the same time. In that context, for an exogenously given amount of public expenditure, lower taxes will imply a higher amount of hours worked and thus, by the resource constraint, higher consumption.[24] This prevents having a decreasing pattern of consumption and reducing debt at the same time.

Our results suggests that with no-commitment the exposure of the government in terms of debt/assets will be lower than in the case of full-commitment. This result may seem counterintuitive when compared with our discussion about the temptation to deviate from full-commitment (see Section 2.1). In general, however, there is no reason why behavior with no-commitment should mimic the policy implemented in a one-time deviation from full-commitment. In the commitment case, the planner 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. In the case of no-commitment, the government realizes that in order to conveniently manipulate the interest rate, it has to leave a lower debt to its successor. Thus debt decreases over time.

So far, we have explained why with a positive initial level of debt the planner will run surpluses until the zero level is reached. By a symmetric argument, we have that if the planner starts with assets, he is willing to induce an increasing pattern of consumption, in order to increase the interest payments he is receiving. Unless the initial level of assets is so high (i.e. in Figure 3 as long as the initial condition is to the right of the point where $\Psi_b = 0$), the planner achieves this goal by increasing

[24] In this reasoning, we are considering that we are in the upward-sloping part of the Laffer curve.

taxes over time, reducing public expenditure and accumulating deficits until the level of outstanding assets is zero.

In case the planner initially holds a sufficiently high amount of assets (i.e. in Figure 3 the initial condition is to the left of the point where $\Psi_b = 0$) an increasing path of consumption is instead obtained by reducing taxes and increasing public expenditure. Indeed, in such circumstances, public expenditure is already so high that moving taxes will have a bigger effect on private consumption. To induce an increasing path of consumption it is therefore convenient to lower taxation, slightly increase public expenditure and accumulate assets over time. This process will continue 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.

To summarize, we find that debt dynamics are very different depending on the specific assumptions about commitment. In the absence of commitment, debt converges to zero in the long-run, unless the planner initially holds a substantially high amount of assets. In the subsequent analysis, as it seems more reasonable, we will ignore that case. From a positive point of view, both the full commitment and the full discretion case are unappealing. In the former case, the level of debt crucially depends on initial conditions, while in the latter case the implication of the model of zero long-run debt is clearly at odds with the empirical evidence.

4 Loose Commitment

As shown in the previous sections, the evolution of debt changes dramatically depending on whether we assume full-commitment or no-commitment. Both cases are clearly extreme depictions of reality. As it seems more realistic, in this section we analyze the case where a benevolent policymaker has the ability to commit but,

under some circumstances (like wars, political pressures, etc.), it may renege on its past promises. We refer to this case as *loose commitment*. This allows us to check whether in such circumstances it is possible to have a steady-state with a positive level of debt, independently of the initial condition. In what follows, we show that this is not the case. Unless there is full-commitment, debt converges to zero in the long-run.

We introduce *loose commitment* into the basic model of the previous sections, following the methodology developed in Debortoli and Nunes (2006).[25] We consider an institutional setting where the ability to commit is driven by an exogenous shock $s_t \in \{0, 1\}$.[26] In particular, we assume that at any point in time t, each government faces a probability π of being reappointed ($s_{t+1} = 1$) in the following period, while with probability $1-\pi$ another government will come into power ($s_{t+1} = 0$). There is an alternative interpretation for parameter π. Since the average duration of a tenure is $1/(1-\pi)$, a higher π implies a larger horizon over which the current government is expected to commit.

In this section, we assume that successive governments share the same objectives (i.e. there is no political disagreement).[27] A government can credibly commit to its own future policies. However, when a new government is appointed, a reoptimization occurs and previous promises are then discarded.

Taking into account that next period either the current government will be in

[25] Schaumburg and Tambalotti (2005) developed a similar methodology than can be applied only to linear-quadratic problems. Our problem is not linear-quadratic and, more importantly, the non-linearity of the policy functions is crucial to determine the level of debt.

[26] For simplicity, we will abstract from other shocks hitting the economy.

[27] In this context, it is equivalent to say that a new government is appointed or that the same government defaults on its past promises. This assumption is relaxed in the next section

charge or a new one is elected, the implementability condition (6) can be written as

$$c_t u_{c,t} + \beta\pi u_{c,t+1} b_t + \beta(1-\pi) u_c(\Psi(b_t)) b_t = (c_t + g_t) u_{x,t} + b_{t-1} u_{c,t}. \qquad (12)$$

This is obtained by expanding the term $\beta u_{c,t+1}$ in the Euler equation (6). With probability π, the current government will stay in power for another period. In that case, we are assuming that a commitment technology is operational and future variables can be directly controlled by the government. With probability $1-\pi$, a new government is elected. In that case, it is anticipated that the new government will disregard previous promises and implement new policies, which are a function of next period's state variable, b_t. It is thus anticipated that a level of consumption $c_{t+1} = \Psi(b_t)$ will prevail under a newly elected government. The functions $\Psi(\cdot)$ will be specified later.

It can be shown that the problem of a government, in the first period of its tenure, can be written as

$$V(b_{-1}) = \max_{\{c_t, g_t, b_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} (\beta\pi)^t \{u(c_t, 1-c_t-g_t, g_t) + \beta(1-\pi)\xi(b_t)\} \qquad (13)$$

subject to the sequence of constraint (12) for $t = 0, 1, 2, ...$[28]

The objective function contains two parts. First, the current government can make its own plans for the cases in which it will be in charge. This is represented by the first term in the summation. Uncertainty about being in office in the future makes the government to discount next periods' utilities at the rate $\beta\pi$. Second, with probability $1-\pi$ a new government is elected. The current government can only influence the decisions of its successors through the state variable b. This effect

[28]Such formulation encompasses all the possible histories of commitment/no-commitment, as shown in Debortoli and Nunes (2006) in a more general framework.

is captured through the function $\xi(b_t)$. This represents the value that the current government obtains if a reoptimization occurs at $t+1$.

Our formulation (13) is quite general in the sense that it nests as special cases the full-commitment ($\pi = 1$) and no-commitment solution ($\pi = 0$), and the continuum between such extremes ($0 < \pi < 1$). Debortoli and Nunes (2006) prove that such kind of problems can be cast into the framework of Marcet and Marimon (1998). By doing so, one can prove that the problem is recursive and that the policy functions are time-invariant and only depend on a finite set of state variables.[29] For current purposes, it is worth mentioning that constraint (12) is associated, in a Lagrangian formulation, with a Lagrange multiplier, which we denote as γ. Marcet and Marimon (1998) show that such a Lagrange multiplier measures the values of past commitments. In our formulation, when a new government is appointed, the Lagrange multiplier(γ) is set to zero since past commitments do not need to be fulfilled.

It must also be emphasized that the policy function $\Psi(b)$ and the value function $\xi(b)$ are unknown functions, taken as given by the current government. As a consequence, such functions need to be found as a solution of a fixed point problem. However, when successive planners share the same objective function $\xi(b)$=$V(b)$. This allows the use of an envelope result to get rid of the value function $\xi(b)$. We solve the problem numerically, by a collocation method on the first-order conditions of problem (13).[30]

In Figure 6 we show the average value of debt for several degrees of commitment, as measured by the parameter π.[31] We find that even a relatively small departure

[29] As before, we are only focusing on Markov Perfect equilibria.

[30] The policy functions are approximated either by splines or by Chebyshev polynomials.

[31] Averages are taken with respect to the realizations of the history of the shock $\{s_t\}_{t=0}^{\infty}$.

from the full-commitment assumption makes the economy behave very similarly to the no-commitment case. 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 the full-commitment case.

In Table 1, we show long-run average allocations with a degree of commitment of $\pi = .75$, together with the full-commitment and no-commitment cases.[32] Unless there is full-commitment, the debt/GDP ratio is zero, due to the reasons explained above. All the other ratios are substantially unchanged, apart from a small reduction in taxes. In this type of models, the steady state interest rate is only minimally affected by the outstanding level of debt.[33] As a consequence, a higher level of debt only affects the base to which the interest rate is applied. This explains why lower debt implies lower taxation, and only slightly affects the other allocations.

Table 1: Average Long-Run Allocations under Loose Commitment

	COM	$\pi = .75$	No COM
b/y	0.52	0.0	0.0
g/y	0.26	0.26	0.26
c/y	0.74	0.74	0.74
τ	0.28	0.26	0.26

To gain a deeper understanding of the transition dynamics, it is useful to look at Figure 7. Here we consider a particular realization of the shocks $\{s_t\}_{t=0}^{\infty}$, where

[32] As before, we set as the initial condition for the simulation a level of b_0 equal to 50% of GDP. Such initial condition only matters for the values of the full-commitment case

[33] The steady state interest rate in the full-commitment and no-commitment cases, is β^{-1}, thus totally independent of debt. In the *loose commitment* settings, the interest rate slightly oscillates even in the long-run, due to the presence of the shock s_t. In contrast, the level of debt would affect the long-run interest rate, for example, in a model where there is a concern about the default on outstanding debt. However analyzing such case is out of the scope of this study.

a reoptimization occurs every 4 periods, independently of the probability π.

It is interesting to observe that in the *loose commitment* framework, debt is increased when a reoptimization occurs and past promises are not kept. On the other hand, debt is decreased when promises are fulfilled. This is in contrast with the no-commitment solution, where debt is always reduced. This occurs because in the no-commitment solution the planner knows that he can conveniently affect the interest rate only if debt is reduced. In the *loose commitment* setting this is no longer true. With probability $1 - \pi$ the planner will be replaced, and promises will not be kept. In that case, the level of debt is key to determine the policy of the successor and thus the interest rate. But with probability π, promises will be fulfilled, and such promises will determine the interest rate independently of the level of debt. In a *loose commitment* setting, the planner can thus afford to increase debt when reoptimizing, and conveniently manipulate the interest rate, as long as he promises to reduce debt if he stays in office in the following periods. Finally, we note that if π is near zero debt is always reduced, no matter whether promises are kept or not. In that case, debt is reduced at a higher pace when promises are kept.

To summarize, in our *loose commitment* setting, we find that unless the government has full-commitment, debt goes to zero in the long-run and that debt is reduced mainly in the periods over which the government has commitment. This is saying that the behavior of the economy resembles the one that would prevail under no-commitment. Moreover, our considerations about the transition dynamics suggests that the simple possibility that in a future period a reoptimization will occur is enough to make it optimal to reach the zero level of debt.

5 Political Disagreement

In this section, we extend our analysis to take into account political disagreement among successive planners alternating in office. There are two reasons why we believe this case is interesting.

First, this is a case where the assumption of imperfect commitment is natural. 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. Therefore, there is also the issue of imperfect commitment. As explained in the previous section, this feature, *per se*, drives debt to zero.

Second, as discussed in Alesina and Tabellini (1990), the presence of political disagreement and political uncertainty provides an incentive to accumulate an excessive level of debt with respect to the standard (Ramsey) case. In particular, they show that disagreement on the composition of the public good and more frequent political turnovers lead to a higher steady state level of debt. These two channels may explain the different debt levels across countries and over time.

In the dynamic political economy literature, it has been typically assumed that in the presence of political turnover, the assumption about commitment of policymakers is irrelevant to determine private agents' choices. For example, this happens whenever the current choices of the agents (e.g. their savings/consumptions) do not depend on the expectations about future policy choices (e.g., future taxes, public expenditure, etc.).

Our contributions with respect to this literature are the following. First, we consider a framework where the time-inconsistency of policy choices do play a role in the strategic interactions between private agents and policymakers. In our case, as discussed above, the time-inconsistency problem arises because of the governments'

incentives to manipulate the interest rate once the amount of private savings is given. Second, we combine imperfect commitment with political disagreement into a unique framework. We first solve the problem assuming that governments cannot make credible commitments about their future actions, no matter whether they are reappointed in office or not. In such circumstances, the probability of re-election is totally unrelated to the probability of being committed in the future. Moreover, we also consider the case that governments can commit for the case they are reappointed, but cannot commit on behalf of their successors. By doing so, we are able to distinguish and quantify the effects of imperfect commitment and political disagreement, which in principle would seem to drive debt in opposite directions. Finally, it allows to measure the welfare gains from commitment in the presence of political disagreement.

We introduce political disagreement in a relatively stylized way. Let's consider an economy where there are two types of public goods g^1 and g^2. As a consequence the aggregate resource constraint (1) takes now the form

$$c_t + g_t^1 + g_t^2 = 1 - x_t. \tag{14}$$

Two political parties, A and B, with different preferences about the composition of a public good alternate in office. Parties derive utility from leisure (x) and consumption of a pr ivate good (c) and the two types of public goods, g^1 and g^2. However, party A has a preference for public goods of type 1, while party B prefers the public good g^2. More formally, we assume that period utility, for party $i = A, B$, is given by

$$u(c_t, l_t, g_t^i) = (1 - \phi_g) \left[\phi_c \frac{c_t^{1-\sigma_c} - 1}{1 - \sigma_c} + (1 - \phi_c) \frac{x_t^{1-\sigma_x} - 1}{1 - \sigma_x} \right] + \phi_g \frac{(g_t^i)^{1-\sigma_g} - 1}{1 - \sigma_g} \tag{15}$$

where ϕ_c and ϕ_g denote the preference weights on private and public consumption.

Preferences for the composite public good g_t^i are given by

$$g_t^A = g_t^1 + \alpha g_t^2 \tag{16}$$

$$g_t^B = g_t^2 + \alpha g_t^1 \tag{17}$$

where differences between public goods can be interpreted as differences in their nature (e.g. education vs. military expenses), or in specific characteristics of the same good (e.g. location, producers, type of production, etc.). The latter can better rationalize our assumption of perfect substitution between the two types of goods. The parameter $\alpha \leq 1$ measures the degree of disagreement between the two parties. In the limiting cases, a value of $\alpha = 1$ means no disagreement, while $\alpha = 0$ indicates complete disagreement.[34]

Another feature regarding our specification of political disagreement is also worth noting. The intuition that political disagreement provides incentives to excessively accumulate debt works as long as, for any given level of g, the current government perceives to spend better than its successor an additional unit of public expenditure. Otherwise, it would be convenient for the current government to spend less in the current period and leave more resources for its successor, even if it has different preferences. Given our preferences specification, as in equations (15), (16) and (17), this is guaranteed as long as we assume that the parameter $\sigma_g < 1$.[35]

It can be shown that the problem of a government of type $i = A, B$, at the

[34]We do not consider the possibility that utility is decreasing in the public good preferred by the other party, thus setting $\alpha \geq 0$

[35]This assumption will not be necessary under different specifications of the utility function, e.g. removing the perfect substitutability between the two types of public good. However, this will complicate our analysis, since in this case both types of public goods will be provided by each type of government.

beginning of its tenure, can be written as

$$V(b_{-1}) = \max_{\left\{c_t, b_t, g_t^1, g_t^2\right\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} (\beta\pi)^t \{u(c_t, 1 - c_t - g_t^1 - g_t^2, g_t^i) + \beta(1-\pi)\xi(b_t)\} \quad (18)$$

subject to the sequence of constraint (12) for $t = 0, 1, 2, ...$, and the specification of g^i as in (16) and (17).

The previous formulation is similar to the one of problem (13). The main difference is that, when a reoptimization occurs, choices are taken by a government with different preferences. As a consequence, in the objective function of party i, the function $\xi(b_t)$ is the lifetime utility that party i obtains if the other party is elected at $t+1$.

Since the problem faced by the two government types is fully symmetric, in a given state of the world they will always choose the same level of debt, private and public consumption. Only the composition of the public good will be different. Moreover, perfect substitutability between the two public goods implies that, at an optimum, party A only chooses public good of type 1, while party B only chooses the type 2 good. Since one and only one of the public goods is produced in each period, we can make the simplification that g_t denotes g_t^1 or g_t^2. This symmetry allows us to define the lifetime utility derived by a party i when the other party is in charge $\xi(\cdot)$ as

$$\xi(b_{-1}) = \sum_{t=0}^{\infty} (\beta\pi)^t \left[u(c_t^*, 1 - c_t^* - g_t^*, \alpha g_t^*) + \beta(1-\pi) V(b_{t+1}^*)\right] \quad (19)$$

where stars denote variables evaluated with the policy functions solving problem (18). In the case there is no disagreement ($\alpha = 1$), we have that $\xi(\cdot) = V(\cdot)$.

Our formulation (18) allows to study all the combinations of degree of commitment and political disagreement. For example, if $\pi = 1$ and $\alpha = 1$ we have full

commitment and no disagreement among planners, as in the standard Ramsey formulation of Section 2.1. On the other extreme, when $\pi = 0$ and $\alpha < 1$ we have political disagreement with no-commitment. By changing the values of the parameters π and α, we are therefore able to disentangle the effects of these two sources of inefficiency.

We will next define 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 problem (18);

2. The value function $\xi(b)$ is described by Eq.(19) and $V(b)$ is the maximum of problem (18);

3. The policy function of consumption $\psi(b, \gamma)$ solving problem (18) is such that $\Psi(b) = \psi(b, 0)$.

The first part of the definition is a simple optimality requirement. The second part states that the functions ξ and V need to be consistent between themselves. The third part of the definition, states that the functions that the future government is expected to implement are optimal. Since the current and future governments face the same problem, the functions that the current government and future governments implement are equal. In particular, it is worth recalling that the public good provided only changes in nature, but not in level. Nevertheless, as stated previously, when a new government is elected the Lagrange multiplier (γ) is set to zero. Marcet and Marimon (1998) show that such Lagrange multiplier measures the values of

past commitments. In our formulation, when a new government is appointed, the Lagrange multiplier (γ) is set to zero, since past commitments do not need to be fulfilled.[36]

As explained in Section 4, $\Psi(b)$ and the value function $\xi(b)$ are unknown and need to be found as a solution of a fixed point problem. In the current case, however, the fact that $\xi(b)$ and $V(b)$ are not equal does not allow us to apply envelope results as can be done in absence of disagreement.

In order to understand the role played by the degree of commitment and political disagreement in shaping debt dynamics, we solve the optimal policy problem under different regimes. As explained above, the effects of commitment and political disagreement can be analyzed and disentangled by solving our model under different values of the parameters π and α.

5.1 The effects of Political Disagreement without Commitment over the Tenure

We start by considering the effect of political disagreement, abstracting from commitment issues. In other words, as in Alesina and Tabellini (1990), we keep the extreme assumption that governments can never commit, no matter if they are re-elected or not, and act with full discretion. It is worth emphasizing that in this case the parameter π is unrelated to the degree of commitment and only measures the probability of being reelected.

Figure 8 shows the long-run level of debt for different values of α and π. First, we can see that once we add a bit of political disagreement between successive planners, debt converges to a positive level in the long-run. Second, we can observe that a

[36] See Debortoli and Nunes (2006) for a discussion about this issue.

higher degree of disagreement (i.e. lower α) and more frequent turnover (lower value of π), imply a higher level of debt. However, while the effects of different degrees of disagreement are relevant, those of the frequency of turnover seems quantitatively less important. For example, when $\alpha = .9$ the effect on the level of debt between having $\pi = .75$ and $\pi = 0$ is less than 5% of GDP.

In Figure 9 we plot the transition dynamics for the case of $\alpha = .9$ and $\pi = .5$ for two different initial conditions.[37] In the upper panel we set the initial level of debt to zero. Note that while in the full-commitment/no-disagreement case debt does not change, under political disagreement debt is accumulated over time. This result is consistent with the intuition that under political disagreement an inefficiently high level of debt is accumulated. However, the picture changes if we set the level of debt above the steady state under political disagreement. As we can see in the upper panel of Figure 9, in that case debt under disagreement is inefficiently low.

From our analysis we can conclude that no-commitment, political disagreement and political turnover can explain why debt is (and remains) a sizable fraction of GDP in most countries. Moreover, countries with more polarized political forces should experience a higher level of debt than more homogenous countries. If governments dislike the public services provided by their potential successors, they are willing to spend more in the current period and leave less resources (i.e. more debt) as inheritance. The predictions of the model suggest that it is the different degree of polarization among the political forces, rather than the frequency of political turnover and the degree of commitment, what really matters in explaining the differences in the debt level across countries and over time.

[37] The qualitative message does not change for other values of these parameters

5.2 The Effects of Political Disagreement with Commitment over the Tenure

We now investigate the case where a government does commit over its tenure, but cannot commit on behalf of its successors. Besides being a more realistic depiction of reality, there are three main reasons to investigate this case. First, from a static point of view, to see the implications of political disagreement without removing completely the commitment assumption. Second, from a dynamic perspective, allowing for commitment over the tenure in the presence of political disagreement generates volatility in the variables as a consequence of political cycles, even in a fully symmetric model as ours. Indeed, because of the possibility to commit, choices differ depending on whether the government is new in office or not. Third, we can investigate the gains from commitment in a world characterized by political disagreement.

We should first note that, in this context, a higher political turnover also necessarily implies a lower degree of commitment. The lower is the probability of being re-elected, the shorter is the horizon over which the government is expected to commit. In other words, there are now two effects related to the parameter π. A higher π first implies less frequent turnover which leads, *ceteris paribus* to slightly lower debt, according to our analysis in Section 5.1. But it also means a higher degree of commitment, as shown in Section 4. Exploring the composite effects of these two forces seems therefore worthwhile.

In Figure 10, we show the average long-run level of debt in the case of political disagreement and commitment over the tenure.[38] As in the previous case, the level of debt is considerably increasing in the degree of disagreement and the effects of

[38] Averages are taken with respect to the realizations of the shock driving the election process.

changes in parameter π are quite small. However, as parameter π changes, debt now changes non-monotonically. A higher (lower) π means a longer (shorter) tenure, on average. On the one hand, the commitment horizon is longer (shorter). This means that debt can be increased by more (less) when a reoptimization occurs. On the other hand, it is less (more) likely that the other party comes into power, so the incentives to accumulate debt are smaller (bigger). The composite effect of changing π depends on the relative strength of these two forces, which are difficult to disentangle. Finally, it is worth emphasizing that the effects of a marginal change in the frequency of political turnover depends on the degree of disagreement. This suggests that, from an empirical point of view, it is important to consider the interactions among the two forces when testing the relationship between debt policies and political instability.

By comparing Figure 8 and Figure 10, we can also see that the long-run level of debt is lower when there is commitment within the tenure than if governments cannot commit. This result can be explained as follows. As emphasized in Section 4, in the *loose commitment* setting debt is reduced during the commitment periods and increased whenever past plans are abandoned. In the present context, when governments can commit over their tenure, debt is lower on average because of the longer commitment horizon of alternating governments.

To summarize, according to our model, differences in the frequency of political turnover cannot account for the differences in the level of debt across countries and over time. There are mainly two reasons for this result. First, from a qualitative point of view, the relationship between frequency of turnover and the level of debt seems unclear. This crucially depends on the relative importance of the opposite effects of having a longer (shorter) tenure versus those of having a longer (shorter) commitment horizon. Second, from a quantitative point of view, such effects seems

of minor importance.

5.3 Relationship with the empirical evidence

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

There are many studies analyzing the effects of political polarization on public debt and deficits. 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 that coalition governments (interpreted as polarization) are more likely to run deficits.[39] Volkerink and de Haan (2001) and Huber et al. (2003) find that the fragmentation of governments (in terms of size or political ideology) is a source for relatively higher deficits. Alt and Lassen (2006) find that fiscal transparency and less polarization reduce debt. Woo (2003) finds that countries with high polarization, measured as income inequality, have bigger fiscal deficits.

There is also a large empirical literature examining the effects of the average tenure or the re-election probability. In this case, however, results are controversial. 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 et al. (1991) find mixed results regarding the effects of the average tenure. de Haan and

[39]The 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 Haan and Sturm (1997). See also Alesina et al. (1997) for some evidence supporting Roubini and Sachs.

Sturm (1994) find that the frequency of government changes is positively correlated to budget deficits.

The overview of the empirical literature shows that there is some consensus that polarization is translated into more debt or deficits. On the contrary, the findings on the re-election probability are quite mixed. Our paper can help understand these results. We find that both polarization and the probability of election matters, but the effect of the second variable is small. Different degrees of commitment and small changes in the economic structure among countries may blur the effects of the re-election probability. On the other hand, our model suggests that the effects of polarization are quite strong and easy to detect, as the data confirms. Overall, from an empirical point of view, the more important implication of our analysis is that when testing the relationship between debt and political instability rather than a generical indicator of the latter feature, it is important to consider both the degree of polarization and the frequency of political turnover.

5.4 Welfare Implications

We now turn our attention to the welfare implications of imperfect commitment and political disagreement. For all the settings analyzed in the previous sections, we computed the consumption equivalent variation from the second-best full-commitment and no-disagreement case.

In Figure 11, we show the welfare costs of imperfect commitment. Moving from full-commitment ($\pi = 1$) to no-commitment ($\pi = 0$), the implied loss is equivalent to a per-period reduction in consumption of 0.07%. This means that while the degree of commitment has a big impact on the level of debt, it has less striking welfare implications. However, it should be remarked that in our model the level of

debt affects welfare relevant allocations because of the interest rate payments. Since the long-run interest rate is only minimally affected by the level of debt, the latter can only have limited effects on consumers' welfare. This will not be the case in a world where there are other links between the level of debt and the interest rate, like introducing the possibility that the government defaults on its outstanding debt. Analyzing such cases is certainly interesting, but is out of the scope of the present analysis. Our work should serve as a reference for countries with small risk of default and which can easily refinance their debt.

We now consider the welfare implications in a world with political disagreement. In this context, building commitment is not necessarily welfare improving. Indeed, in this context commitment is used to pursue partisan objectives, and it can thus be detrimental for agents having different preferences from the government in office. In what follows, we use as measure of social welfare the average of the lifetime utility of our two types of agents, and then compute the consumption equivalent variation from the second-best solution.[40]

First, we analyze the welfare implications of less frequent political turnover (i.e. higher π). For this purpose, as shown in Figure 12, we compute the consumption equivalent variation for different values of parameter π, for a given degree of disagreement ($\alpha = .9$). The dashed line refers to the case where governments cannot commit, while the continous line indicates the case where governments commit over their tenures. When governments do not have commitment over the tenure, welfare is almost constant in π, which says that the frequency of turnover, *per se*, is quantitatively irrelevant in terms of welfare. On the contrary, when governments have commitment over their tenure, the lower is the frequency of turnover the higher is

[40]Since 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.

welfare. In this case, a higher π means not only less frequent turnover but also a longer commitment horizon. This last component seems therefore the one with more important welfare implications. In Figure 13, we analyze the welfare consequences of increasing π in a world where governments have commitment over the tenure and there is political disagreement. The figure plots the welfare gains achieved by increasing π from zero to another value. As before, we find that the higher is disagreement (i.e. the lower is α) the lower are the welfare gains for an increase in π. This result is interesting since it suggests that, according to our analysis, building commitment is less important in a country with more polarization among political parties.

Second, in a world characterized by political disagreement, we compute the welfare implications of having commitment over the tenure. For this purpose, in Figure 14, we show the difference in welfare (in consumption equivalent variation from second-best) between having commitment over the tenure and not having commitment (regardless of π). We plot such differences for several values of α and for values of $\pi = 0.75$ and $\pi = 0.5$.[41] We observe that the difference in welfare is positive. Interestingly this is saying that having governments committing over their tenures is welfare improving also in a world with political disagreement. We also notice that such gains from commitment are decreasing in α. This suggests once more that building commitment is less important the higher is the degree of polarization (i.e. the lower is α).

In a world with political disagreement, the fact that a government has commitment may also be detrimental for agents having different preferences from the policymaker. This is shown in Figure 15, where we compare the welfare implications

[41] A value of $\pi = .75$ implies that a government is replaced on average every four periods (i.e. four years under our calibration). This is why we take it is as benchmark.

of commitment depending on which of the two parties starts in office. Interestingly, we can see that building commitment is welfare improving if the favorite party starts in office (continous line). On the contrary, it is detrimental if the adverse party, i.e. the party providing a public good that the agent value less, starts (dashed line) in office. Overall, our analysis therefore suggests that building commitment is welfare improving even in a world with political disagreement and that building commitment is less important the higher is the polarization among political forces.

We finally check if there is any circumstance under which an agent prefers that the adverse party always stays in power. This may indeed happen when the gain from having political stability outweighs the cost associated with a provision of a less favorable public good. For this purpose, we compute the welfare that the agent would obtain under political turnover (measured by π) against the welfare he will obtain if the opposite party will always be in charge. As shown in Table 4, welfare is higher in the latter case only for a very small level of disagreement. Indeed, when $\alpha = .95$ having political turnover (as implied by $\pi = .75$) still gives a welfare level that is higher by approximately 1% of per-period second-best consumption. This is because in our model, the gains from commitment are much smaller than the gains from having less political disagreement.

6 Conclusions

As it has been documented in the literature, 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 a dynamic context.

On the methodological side, our contribution is to develop a framework to analyze

the interactions between commitment and political disagreement that can be applied to a wide set of optimal policy problems. In other words, this allows us to integrate the analysis about the time-inconsistency of optimal policy choices, typical of the dynamic macroeconomic literature, into a political economy model.

On the economic side, we show that imperfect commitment drives the long-run level of debt to zero. Thus, the dependency of debt on initial conditions found in Lucas and Stokey (1983) is shown not to be robust to small departures from the full-commitment assumption. Interestingly, for debt to be driven to zero, it is enough that both the agents and the government anticipate the possibility of the temptation to surprise the economy and to manipulate the interest rate, even if this ultimately never occurs. We find that debt is increased when the government reneges on past promises and is driven to zero when past promises are fulfilled.

Our framework allows the incorporation of political disagreement and imperfect commitment into dynamic macro models. We find that debt is increasing in the level of disagreement among political parties. On the other hand, the frequency of turnover and the degree of commitment do not seem to produce quantitatively important effects. These results are consistent with most of the existing empirical literature. Altogether, our analysis suggests the importance of distinguishing between the degree of polarization among parties and the frequency of political turnover when analyzing the effects of political instability on debt policies.

From a normative point of view, we show that according to our model, the welfare gains from commitment are lower when successive planners disagree about their goals than in the no-disagreement case. With political disagreement, a better commitment technology will not be used to maximize overall welfare but to pursue partisan goals. We plan to pursue this line of research further both from a theoretical

and an empirical point of view.

There are many interesting aspects which deserve further explorations. Among them, we have abstracted from the possibility of default on outstanding debt. This feature is important since it will generate an additional link between the level of debt and the interest rate. This may have an important impact on the interest rate manipulation mechanism, which is crucial in our analysis. Moreover, there will be bigger welfare implications of having different levels of debt.

More generally, our framework would allow us to address several interesting questions. For example, it would be interesting to address some normative implications of this line of research, especially in relationship with fiscal discipline, like limits on deficits and debt holdings, currently imposed on many developed countries by supranational authorities. In this context, considering other forms of political conflicts, voting mechanisms and shocks affecting the economy is an interesting line for future research.

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Appendix

The Full-Commitment case - Optimality Conditions

Following Lucas and Stokey (1983), under the assumption of complete financial markets, the problem of a planner with full-commitment can be written as

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

$$s.t. \qquad \sum_{t=0}^{\infty} \beta^t [c_t u_{c,t} - (c_t+g_t)u_{x,t}] = b_{-1}u_{c,0}. \tag{20}$$

The planner is thus facing a unique intertemporal constraint (20). Taking derivatives with respect to $\{c_t, g_t\}_{t=0}^{\infty}$ we have

$$\begin{aligned}
c_0 : \qquad & (u_{c,0}-u_{x,0})(1-\Lambda) = \Lambda[c_0(u_{cc,0}-u_{xx,0}) - u_{cc,0}b_{-1}] \\
c_t : \qquad & (u_{c,t}-u_{x,t})(1-\Lambda) = \Lambda c_t(u_{cc,t}-u_{xx,t}) \qquad t=1,2,... \\
g_t : \qquad & u_{g,t} - u_{x,t}(1-\Lambda) = -\Lambda u_{xx,t} \qquad t=0,1,2,...
\end{aligned}$$

where Λ denotes the Lagrange multiplier associated with constraint (20). For notational convenience only, we assumed separability in the utility function, thus implying $u_{cg} = u_{xc} = u_{xg} = 0$.

It is worth noting that, for $t = 1, 2, ...$, such conditions are static and identical, thus implying that from period $t = 1$ onward all the allocations are constant. In $t = 0$, unless $b_{-1} = 0$, the first-order condition with respect to consumption is different, as can be seen by the presence of the last term on the right-hand side. This reflects the incentive to manipulate the interest rate at $t = 0$, which is the source of the time-inconsistency problem in the present framework.

Tables and Figures

Table 2: Debt in the OECD countries

	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

General government financial liabilities (percent of nominal GDP) in 2006. Source: OECD Economic Outlook

Table 3: Parameter values

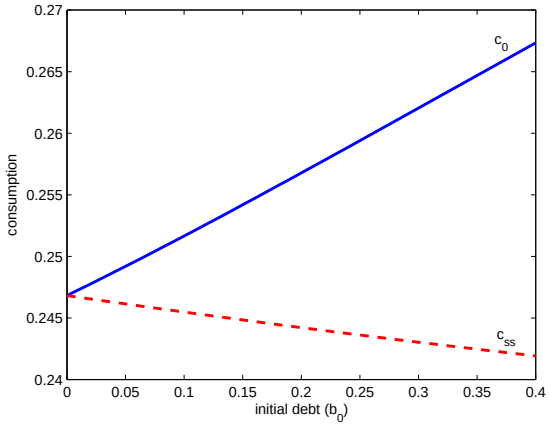
Parameter	Value	Description
β	.96	discount factor
ϕ_c	.2	weight of consumption (priv. + publ.) vs. leisure
ϕ_g	.2	weight of public vs. private consumption
σ_x	3	Elasticity of leisure
σ_c	2	Elasticity of private consumption
σ_g	.95	Elasticity of public consumption

Table 4: Welfare Implications of Political Stability (as CEV (%) from second-best)

α	With Turnover		With Adverse Party
	$\pi = .75$	$\pi = .5$	
1	-0.02	-0.04	0.00
0.95	-0.70	-0.72	-1.36
0.9	-1.41	-1.43	-2.74
0.8	-2.91	-2.93	-5.62
0.6	-6.36	-6.38	-11.93
0.4	-10.75	-10.77	-19.39
0.1	-22.61	-22.62	-36.88

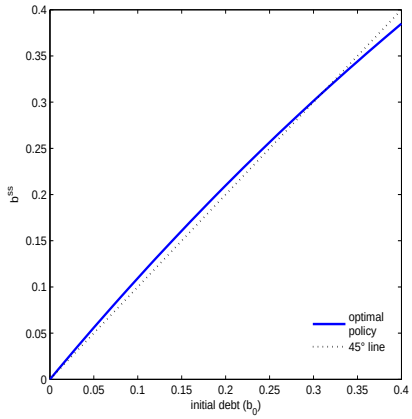
Note: In the first column, we report the welfare implications of having political turnover ($\pi = .75$ and $\pi = .5$) between parties with different objectives (disagreement measured by α). In the second column we report the welfare that an agent would get if the party providing the less preferred good would always stay in office.

Figure 1: Consumption under Full-Commitment



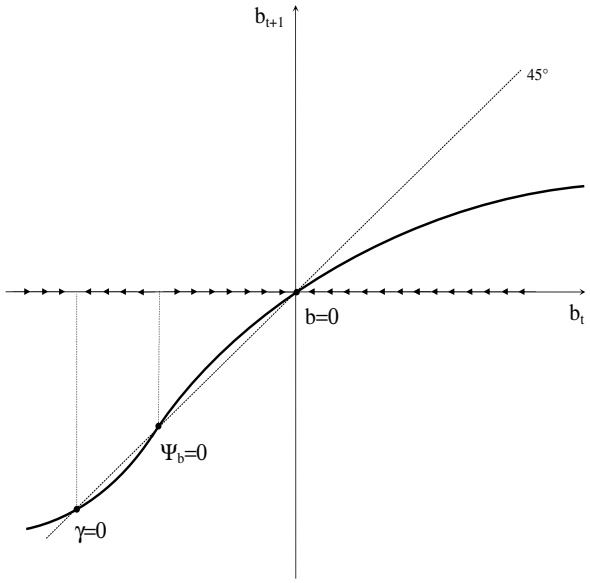
Note: The figure plots, for different level of initial debt, the level of consumption in the first period (solid line) and the steady state level of consumption (dashed line). The reported values correspond to the calibration specified in Table 3.

Figure 2: Debt dynamics under Full-Commitment



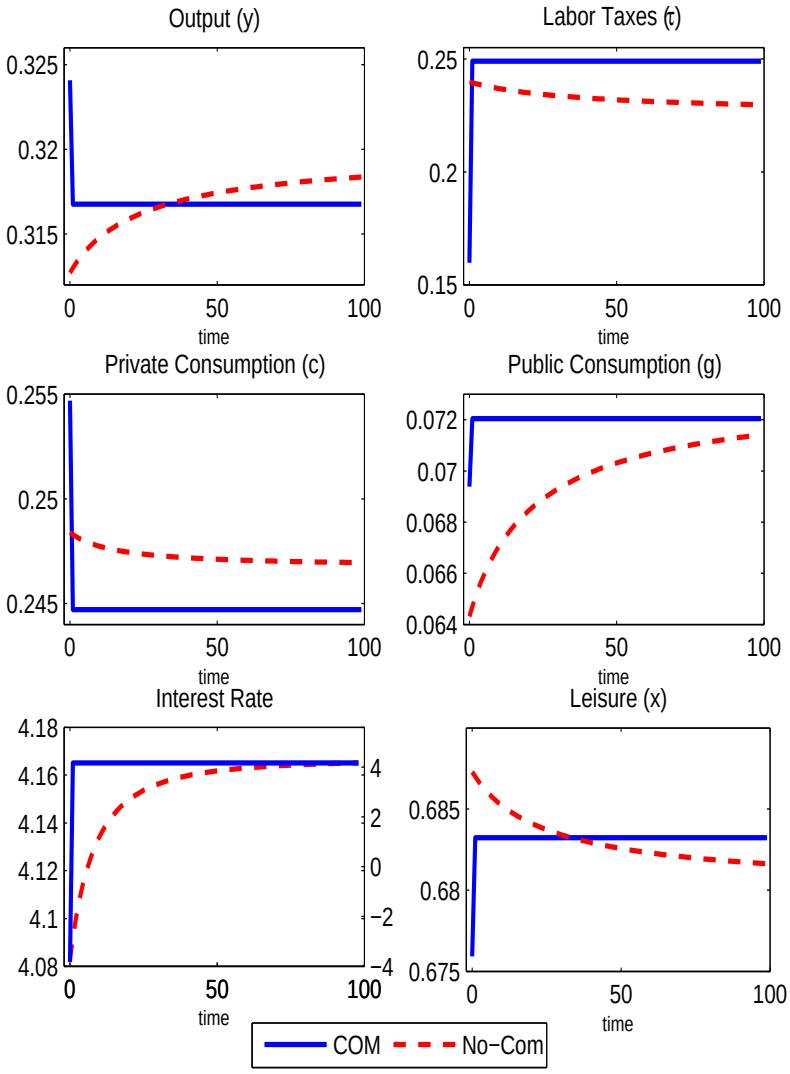
Note: The figure plots the steady state level of debt (b^{ss}), that is the level of debt prevailing from the first period on, as a function of the initial debt (b_0). The reported values correspond to the parametrization specified in Table 3.

Figure 3: Debt dynamics in the Time-Consistent Case



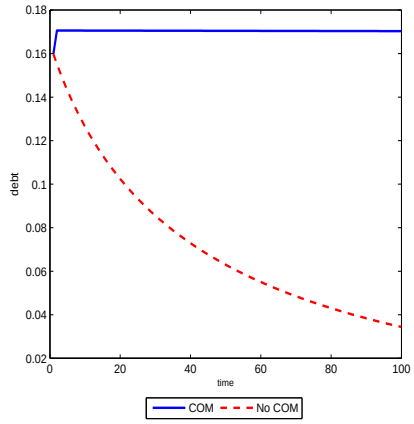
Note: The figure is a qualitative representation of debt equilibrium dynamics resulting from our numerical experiments.

Figure 4: Commitment vs. No-Commitment: Time-Path of Allocations



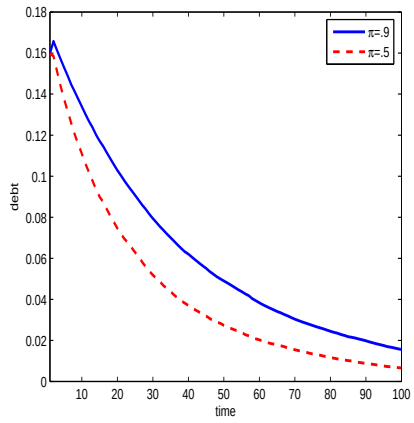
Note: The figure plots the equilibrium allocations over time, giving an initial condition of $b = .16$ which is roughly 50% of GDP under our parametrization. The interest rate (lower-left panel) for the full-commitment case (continous line) has to be referred to the right-hand scale.

Figure 5: Commitment vs. No-Commitment: Time Pattern of Debt



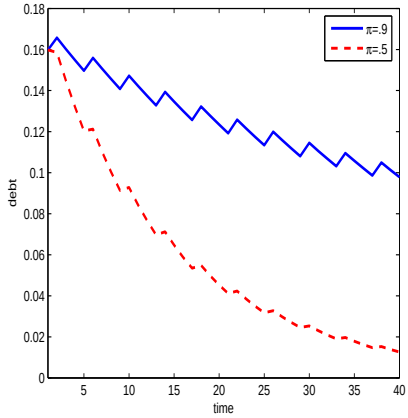
Note: The figure plots the evolution of debt over time, giving an initial condition of $b = .16$ which is roughly 50% of GDP under our parametrization. The solid line corresponds to the full-commitment case, while the dashed line corresponds to the no-commitment case.

Figure 6: Loose Commitment: Time Pattern of Debt



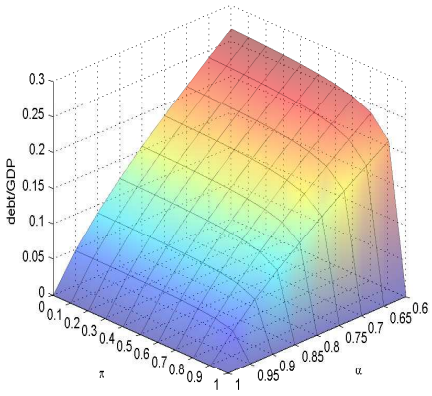
Note: The figure plots the evolution of debt over time, under different values of parameter π. The solid line corresponds to the case of $\pi = .9$, while the dashed line corresponds to the case of $\pi = .5$. We take average across simulations of the histories of the shock $\{s_t\}_{t=0}^{\infty}$. The initial condition is $b = .16$ (roughly 50% of GDP).

Figure 7: Loose Commitment: Reoptimization every 4 periods



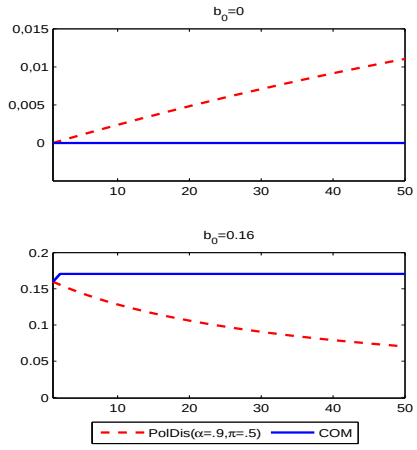
Note: The figure plots the evolution of debt over time, in the particular history of the shock $\{s_t\}_{t=0}^{\infty}$ such that a reoptimization occurs every four periods. The solid line corresponds to the case of $\pi = .9$, while the dashed line corresponds to the case of $\pi = .5$. The initial condition is $b = .16$ (roughly 50% of GDP).

Figure 8: Long-Run Debt with Political Disagreement without Commitment



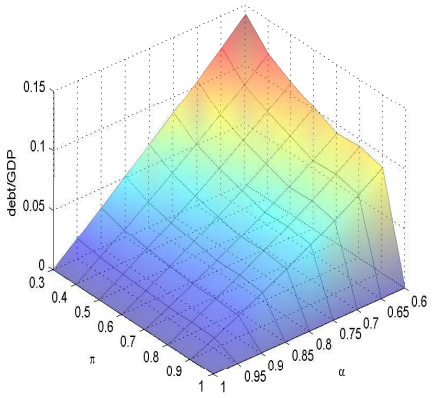
Note: The figure plots the long-run level of debt, for different degree of disagreement (α) and frequency of turnover (π). Governments do not have commitment, regardless of the probability (π).

Figure 9: Evolution of Debt under Political Disagreement without Commitment



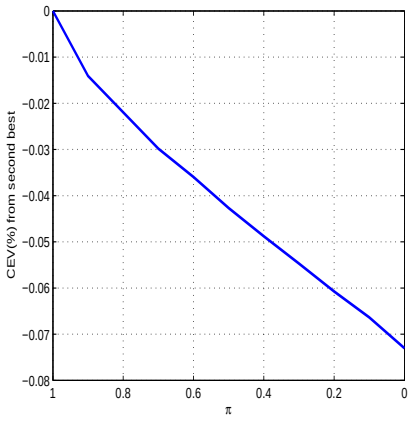
Note: The figure plot the evolution of debt under full-commitment and no-disagreement, as indicated by the solid line, and a case with political disagreement ($\alpha = .9$) and political turnover ($\pi = .75$), as indicated by the dashed line. In the upper panel the initial condition is $b = .16$, while in the lower panel the initial condition is $b = .16$.

Figure 10: Long-Run Debt with Political Disagreement and Commitment over the Tenure



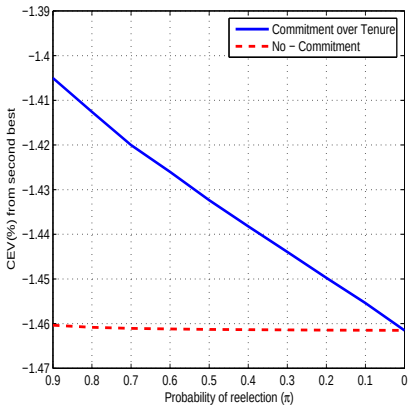
Note: The figure plots the average long-run level of debt for different degree of disagreement (α) and frequency of turnover(π). Averages are taken across realizations of the shock s_T, where $T = 1000$.

Figure 11: The Welfare Costs of Losing Commitment



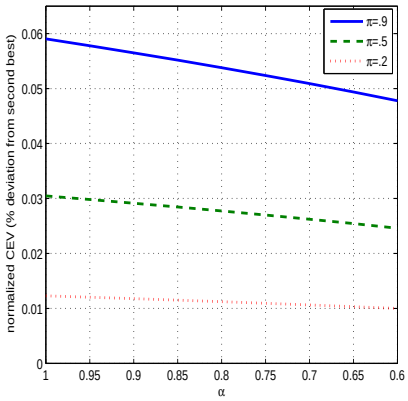
Note: The figure plots the welfare losses from reducing commitment (as measured by π) in a world without political disagreement, expressed in percentage consumption-equivalent variation (CEV) from the benchmark case of full-commitment.

Figure 12: The Welfare Costs of Political Turnover ($\alpha = .9$)



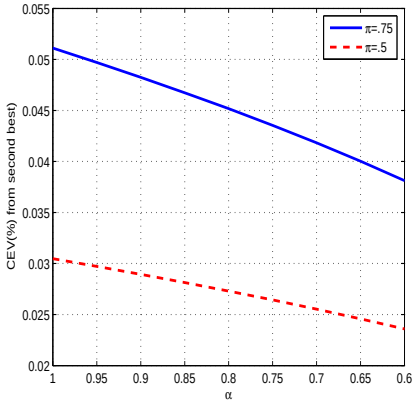
Note: The figure plots the welfare gains from less frequent turnover (as measured by π) in a world with political disagreement ($\alpha = .9$). The continous line refers to the case where governments can commit over their tenure, while the dashed line refers to the case where there is not commitment over the tenure (regardless of π). Values are expressed in percentage consumption-equivalent variation (CEV) from the benchmark case of full-commitment and no-disagreement.

Figure 13: The Welfare Gains of Less Frequent Political Turnover



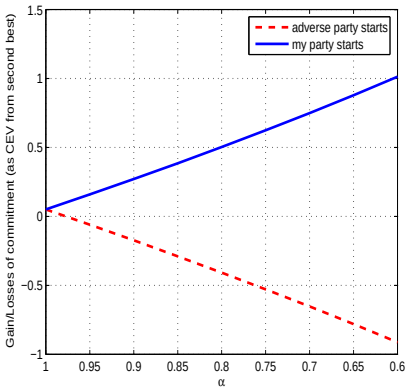
Note: The figure plots the consequences of political disagreement (measured by α) to the welfare gains of increasing π. We first computed welfare for each π measured as percentage consumption-equivalent variation (CEV) from the benchmark case of full-commitment and no-disagreement. In the figure, each line plots the welfare differences from $\pi = 0$ to another level of π.

Figure 14: The Welfare Gains of Commitment in the presence of Political Disagreement



Note: The figure plots, for several degrees of disagreement (measured by α) the difference in welfare (in percentage consumption-equivalent variation (CEV) from second-best), between the case where governments have commitment over their tenure and the case where there is not commitment over the tenure (regardless of π).

Figure 15: Welfare Implications of Commitment in the presence of Political Disagreement



Note: The figure plots, for several degrees of disagreement (measured by α) the difference in welfare (in percentage consumption-equivalent variation (CEV) from second-best), between the case where governments have commitment over their tenure and the case where there is not commitment over the tenure (regardless of π). The continuous line refers to the case where the favorite party starts in office, while the dashed line indicates the case where the adverse party starts. The frequency of turnover is $\pi = .75$.