Fiscal Dominance

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</thead>
<tbody>
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Fiscal Dominance

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Abstract

Who prevails when fiscal and monetary authorities disagree about the value of public expenditure and how much to discount the future? When the fiscal authority sets debt as its main policy instrument it achieves fiscal dominance, rendering the preferences of the central bank, and thus its independence, irrelevant. When the central bank sets the nominal interest rate it renders fiscal impatience (its debt bias) irrelevant, but still faces its expenditure bias. I find that the expenditure bias is about an order of magnitude more severe than the debt bias and has a major impact on welfare through higher public spending, while the effect on other policies is relatively minor. I also find that the central bank can do little to overcome the negative impact of the fiscal authority’s expenditure bias, though there are still gains from properly designing the central bank.

Keywords: discretion, time-consistency, government debt, deficit, inflation, institutional design, political frictions.

JEL classification: E52, E58, E61, E62.

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1 Introduction

“When you play the game of thrones, you win or you die.”
George R.R. Martin, A Game of Thrones

Who prevails when fiscal and monetary authorities disagree? Does the central bank accommodate expansionary fiscal policy or does it curb it by embarking, or credibly promising, undesirable outcomes? Can the fiscal authority prevail and impose its desired policies in the face of an independent central bank? These are classic policy concerns and our answers affect the way government institutions are designed.

Our thinking in addressing these questions has been greatly influenced by the work of Thomas Sargent and Neil Wallace. In this tradition, our answer to the questions posed above would likely rely on the concept of commitment or, at least, first-mover advantage: a central bank that will not budge can mitigate fiscal expansion by making it too costly. The mechanism through which the fiscal and monetary authorities interact is the consolidated government budget constraint. An unrelenting authority forces the other to conduct policy in a way that ensures the budget constraint is satisfied. A related concept is that of active and passive policies, as articulated by Leeper (1991): both authorities cannot set policy be actively, one must accommodate the other.

The commitment assumption, however, is itself unpleasant as it leads to the implementation of time-inconsistent policies. In the face of fiscal expansion, the central bank may find it ex post optimal to renege on its promise. And though modern central banks formulate their policy in terms of rules (say, a Taylor rule) it is not at all clear that they do follow one, even if used conceptual to articulate policy choices.

The purpose of this paper is to dispense with commitment or first-mover advantage and understand how government policy is determined in the presence of rival authorities. As in the classic work by Sargent and Wallace a key mechanism is the (consolidated) government budget constraint, which needs to be satisfied. In contrast to the classic approach, however, commitment or reputation are not operative, but rather a realization that not all policy instruments are free to choose. That is, given the policy choices made by the fiscal and monetary authorities, one instrument needs to adjust in order to satisfy the government budget constraint. This instrument choice affects how the preferences of competing government agencies are internalized.

The environment is a monetary economy populated by infinitely-lived agents, where a government uses distortionary taxes, fiat money and nominal bonds to finance the provision of a valued public good. There are two government authorities: a fiscal authority and a monetary authority (the central bank). Both authorities value the utility flow of private agents, but are subjected to an expenditure bias and a debt bias. The expenditure bias stems from preferring a higher public goods provision than private agents, while the debt bias arises from relative impatience.

When the preferences of the fiscal and monetary authorities coincide, they act as a single consolidated government. In this case, policy is determined by the interaction of three forces: a motive to smooth distortions, a time-consistency problem, and the expenditure and debt biases. The incentive to smooth distortions intertemporally follows the classic arguments in Barro (1979) and Lucas and Stokey (1983), and is further distorted by the relative impatience.

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1For example, see Sargent and Wallace (1981, 1987).
2The same argument also applies to the first-mover advantage. A more nuanced view would substitute reputation considerations for commitment.
of the government (i.e., its debt bias). Time-consistency problems arise from the interaction between debt and monetary policy, as analyzed in Martin (2009, 2011, 2013): how much debt the government inherits, affects its monetary policy since inflation reduces the real value of nominal liabilities; in turn, the anticipated response of future monetary policy affects the current demand for money and bonds, and thereby how the government today internalizes policy trade-offs. The preference for overspending (the expenditure bias) has also consequences for inflation and taxation, while leaving debt in terms of output largely unaffected.

What instruments do the authorities pick and what consequences do these choices have? I assume that the fiscal authority always sets public expenditure. The remaining instruments are: the tax rate, the interest rate, the money growth rate and end-of-period debt. In the model, there is a one-to-one mapping between the nominal interest rate and debt; hence, there are only three more available instruments, which span three possible scenarios. First, the central bank sets the interest rate and the fiscal authority sets taxes, with the money growth rate determined residually. Second, the fiscal authority sets debt and so, the central bank sets the money growth rate, with taxes determined residually. And third, the central bank sets the money growth rate and the fiscal authority sets taxes, with debt (and hence, the interest rate) determined residually.

I derive two main theoretical results. First, when the monetary authority sets the interest rate, it renders the debt bias of the fiscal authority irrelevant. This result generalizes that of Niemann et al. (2013), who derived for the case of a benevolent central bank and in the absence of taxation. However, the monetary authority’s debt bias and the fiscal authority’s expenditure and debt biases still affect policy outcomes. Second, when the fiscal authority sets the debt level, it renders the preferences of the central bank, and thus its independence, irrelevant. The equilibrium coincides with the case when there is a consolidated government with the preferences of the fiscal authority. In this scenario, we obtain fiscal dominance: the imposition of the fiscal authority’s preferences despite the disagreement from the central bank.

Next, I rely on numerical methods to obtain further results. First, I focus on the relative impact of the expenditure and debt biases, assuming the preferences of the two authorities are perfectly aligned. I find that the expenditure bias is about an order of magnitude more severe than the debt bias. Though the latter is a popular friction in the political economy and sovereign default literatures, its welfare costs are relatively minor even when implying a significant amount of debt issuance. In contrast, the expenditure bias has a major impact on welfare through higher public spending, while the effect on other policies is relatively minor. The reason for these contrasting results is that a spending bias has a first-order effect on welfare as it raises the distortions necessary to finance a higher expenditure, whereas a debt bias simply pushes distortions to the future. When combining both biases, we obtain the worst of both worlds: large welfare losses associated with high taxes and spending, high debt and deficit, and high inflation and nominal interest rates.

Second, I find that the central bank can do very little to overcome the negative impact of the fiscal authority’s expenditure bias. Still, welfare gains can be derived from endowing the central bank with appropriate preferences. In particular, a dislike of public expenditure and relative patience can lead to better outcomes better aligned with the preferences of private agents.

There are a few closely related papers. Martin (2015a) and Martin (2020) study the effects of the expenditure bias. The former considers the effects of making the central bank independent (with its own preferences for public expenditure) but does not explore the effects of different instrument choices. The latter studies how fiscal rules can counteract the negative welfare effects of an expenditure bias. Niemann et al. (2013) show how instrument choice can affect equilibrium policies when an impatient fiscal authority faces a benevolent central bank. Relative to this paper, I add an expenditure bias and a theoretical analysis that includes taxation; in the
quantitative section I also allow for a non-benevolent central bank. Finally, Barthélemy et al. (2020) formalizes Neil Wallace’s game of chicken between the fiscal and monetary authorities. They also identify circumstances where there is fiscal dominance.

The paper is organized as follows. Section 2 presents the environment. Section 3 characterizes government policy when there is a single government authority or, equivalently, when the fiscal and monetary authority share the same preferences. Section 4 characterizes government policy when the fiscal and monetary authority disagree in their expenditure and debt biases. It develops the main theoretical results of the paper. Section 5 conducts the quantitative analysis: seizing the expenditure and debt biases; understanding the welfare and policy effects of instrument choice; and exploring the impact of central bank design. Section 6 concludes.

2 Model

2.1 Environment

Consider an economy populated by a continuum of infinitely-lived agents, which discount the future by factor $\beta \in (0, 1)$. Each period, two competitive markets open in sequence, for expository convenience labeled day and night. All goods produced in the economy are perishable and cannot be stored from one subperiod to the next.

At the beginning of each period, agents receive an idiosyncratic shock that determines their role in the day market. With probability $\eta \in (0, 1)$ an agent wants to consume but cannot produce the day-good $x$, while with probability $1 - \eta$ an agent can produce but does not want consume. A consumer derives utility $u(x)$, where $u$ is twice continuously differentiable, satisfies Inada conditions and $u_{xx} < 0 < u_x$. A producer incurs in utility cost $\phi > 0$ per unit produced.

Agents are anonymous and lack commitment. Thus, credit arrangements are not feasible and some medium of exchange is necessary for day trade to occur. Exchange media in this economy takes the form of government-issued liabilities: cash and one-period nominal bonds. Cash is universally recognized and can be used in all transactions. Following Kiyotaki and Moore (2002), assume that agents may pledge a fraction $\theta \in [0, 1)$ of their government bond holdings to finance day market expenditures.

At night, all agents can produce and consume the night-good, $c$. The production technology is assumed to be linear in labor, such that $n$ hours worked produce $n$ units of output. Assuming perfect competition in factor markets, the real wage rate is equal to 1. Utility at night is given by $U(c) - \alpha n$, where $U$ is twice continuously differentiable, $U_{cc} < 0 < U_c$ and $\alpha > 0$. Though a medium of exchange is not essential in this market, agents also trade money and bonds at night.

There is a government that supplies a valued public good $g$ at night. Agents derive utility from the public good according to $v(g)$, where $v$ is twice continuously differentiable, satisfies Inada conditions and $v_{gg} < 0 < v_g$. To finance its expenditure, the government may use proportional labor taxes $\tau$, print fiat money at rate $\mu$ and issue one-period nominal bonds, which are redeemable in fiat money. Government policy choices for the period are announced at the beginning of each day, before agents’ idiosyncratic shocks are realized. The government only actively participates in the night market, i.e., taxes are levied on hours worked at night and open-market operations are conducted in the night market. The public good is transformed one-to-one from the night-good.

All nominal variables—except for bond prices—are normalized by the aggregate money

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stock. Thus, today’s aggregate money supply is equal to 1 and tomorrow’s is $1 + \mu$. The government budget constraint can be written as

$$p_c(\tau n - g) + (1 + \mu)[1 + B'(1 + R)^{-1}] - (1 + B) \geq 0,$$

where $B$ is the current aggregate bond-money ratio, $p_c$ is the—normalized—market price of the night-good $c$, and $R$ is the nominal interest rate; note that $1 + R$ is the inverse of the price of a bond that earns one unit of fiat money in the following night market. “Primes” denote variables evaluated in the following period. Thus, $B'$ is tomorrow’s aggregate bond-money ratio.

In equilibrium, prices and policy variables depend on the aggregate state, $B$; this dependence is omitted from the notation to simplify exposition.

2.2 Problem of the agent

Let $V(m, b, B)$ be the value of entering the day market with (normalized) money balances $m$ and bond balances $b$, when the aggregate state of the economy is the aggregate bond-to-money ratio, $B$. Upon entering the night market, the composition of an agent’s nominal portfolio (money and bonds) is irrelevant, since bonds are redeemed in fiat money at par. Thus, let $W(z, B)$ be the value of entering the night market with total (normalized) nominal balances $z$.

In the day market, consumers and producers exchange money and bonds for goods at (normalized) price $p_x$. Let $x$ be the individual quantity consumed and $\kappa$ the individual quantity produced; these quantities are generally different in equilibrium, unless there is an equal measure of consumers and producers. A consumer with starting balances $(m, b)$ has total liquidity $m + \theta b$ to purchase day output. The problem of a consumer is

$$V^c(m, b, B) = \max_x u(x) + W(m + b - p_xx, B)$$

subject to: $p_xx \leq m + \theta b$. The problem of a producer is

$$V^p(m, b, B) = \max_\kappa - \phi \kappa + W(m + b + p_x \kappa, B).$$

Hence, the ex ante value of an agent with portfolio $(m, b)$ at the start of the period satisfies $V(m, b, B) \equiv \eta V^c(m, b, B) + (1 - \eta)V^p(m, b, B)$.

At night, the problem of an agent arriving with total nominal balances $z$ is

$$W(z, B) = \max_{c,n,m',b'} U(c) - \alpha n + v(g) + \beta V(m', b', B')$$

subject to: $p_c c + (1 + \mu)[m' + b'(1 + R)^{-1}] = p_c(1 - \tau)n + z$.

2.3 Derivations

Here, we derive the conditions which characterize a monetary equilibrium. Let us start with the problem of an agent at night. Solving the budget constraint for $n$ and replacing in the objective function, the first-order conditions imply:

$$U_c - \frac{\alpha}{1 - \tau} = 0$$

$$- \frac{\alpha(1 + \mu)}{p_c(1 - \tau)} + \beta V'_m = 0$$

$$- \frac{\alpha(1 + \mu)}{p_c(1 - \tau)(1 + R)} + \beta V'_b = 0$$
The night-value function \( W \) is linear in \( z \), \( W_z = \frac{\alpha}{p_c(1-\tau)} \). Hence, \( W(z, B) = W(0, B) + \frac{\alpha z}{p_c(1-\tau)} \), which we will use to rewrite the problem of the agent in the day. Accordingly, the problem of a consumer in the day can be rewritten as

\[
V_c(m, b, B) = \max_x u(x) + W(0, B) + \frac{\alpha (m + b - px)}{p_c(1-\tau)}
\]

subject to the liquidity constraint \( px \leq m + \theta b \), with associated Lagrange multiplier \( \xi \). The first-order condition is

\[
u_x - \frac{\alpha p_x}{p_c(1-\tau)} - \xi p_x = 0
\]

Similarly, the problem of a producer can be rewritten as

\[
V_p(m, b, B) = \max_x \kappa - \phi \kappa + W(0, B) + \frac{\alpha (m + b + px \kappa)}{p_c(1-\tau)}
\]

The first-order condition implies

\[
\phi + \frac{\alpha p_x}{p_c(1-\tau)} = 0
\]

Given \( V(m, b, B) \equiv \eta V_c(m, b, B) + (1-\eta)V_p(m, b, B) \) and using (6) we obtain \( V_m = \phi/p_x + \eta \xi \) and \( V_b = \phi/p_x + \eta \theta \xi \). Using these expressions, together with (6), we can rewrite (3) and (4) as

\[
1 + \mu = \frac{\beta p_x(\phi/p'_x + \eta \xi')}{\phi}
\]

\[
1 + R = \frac{\phi/p'_x + \eta \theta \xi'}{\phi/p'_x + \eta \theta \xi'}
\]

### 2.4 Monetary equilibrium

The resource constraints in the day and night equate total consumption to total production in each subperiod. The resource constraint in the day is \( \eta x = (1-\eta) \kappa \). Given the assumptions on preferences, individual consumption at night is the same for all agents, whereas individual labor depends on whether an agent was a consumer or a producer in the day. Hence, the resource constraint at night is given by \( c + g = \eta n^c + (1-\eta)n^p \), where \( n^c \) and \( n^p \) denote night-labor by agents that were consumers or producers in the day, respectively. As shown in Lagos and Wright (2005), the preference specification also implies that all agents make the same portfolio choice. Market clearing at night implies \( m' = 1 \) and \( b' = B' \).

The liquidity constraint of consumers in the day holds with equality (wlog if it does not bind). Thus,

\[
p_x = \frac{1 + \theta B}{x}
\]

which is a standard condition in monetary economies: the price of the day-good \( p_x \) equals the total means of payment \( 1 + \theta B \) (money plus a fraction \( \theta \) of bonds) divided by the total quantity traded. Note that variations in \( \theta B \) imply variations in the (measured) velocity of circulation of money.

Plugging (2) and (9) into (6) yields:

\[
p_c = \frac{U_c(1 + \theta B)}{\phi x}
\]

The price of the night-good \( p_c \) depends on the equilibrium quantities traded in the day and night. The relative price between day and night goods, \( p_x/p_c \) is pinned down by the first-order
condition to the producer’s problem: a producer sells goods in the day to save on effort at night and this decision is distorted by labor taxes $\tau$, which as shown next can be expressed a function of the night-good allocation $c$. Condition (2) can be rearranged to yield:

$$\tau = 1 - \frac{\alpha}{U_c} \quad (11)$$

which states the trade-off between the marginal utility of night-good consumption and the marginal disutility of night-labor. This trade-off is distorted by the labor tax: a higher tax rate $\tau$ implies lower night-good consumption $c$. As with monetary policy, we can interchangeably refer to variations in the night-good allocation, $c$ and variations in the tax rate, $\tau$.

Given (9)–(10) we can solve for the Lagrange multiplier of the liquidity constraint:

$$\xi = \frac{(u_x - \phi)x}{1 + \theta B}$$

which by (7) implies

$$\mu = \left(\frac{1 + \theta B}{1 + \theta B'}\right) \frac{\beta x '[\eta u_x' + (1 - \eta)\phi]}{\phi x} - 1 \quad (12)$$

For a given expected future day-good allocation, which in equilibrium is a function of debt choice, $B'$, a higher money growth rate $\mu$ implies lower day-good consumption $x$. In other words, given current debt policy and future monetary policy, the allocation of the day-good is a function of current monetary policy. Thus, we can interchangeably refer to variations in the day-good allocation, $x$ and variations in current monetary policy, $\mu$.

Finally, from (8) we obtain

$$R = \frac{\eta u_x' + (1 - \eta)\phi}{\eta \theta u_x' + (1 - \eta \theta)\phi} - 1 \quad (13)$$

The equilibrium nominal interest rate is a function of next-period’s day-good allocation $x'$ and total means payment $1 + \theta B'$. In essence, the bond return reflects its liquidity premium: agents need to be compensated for the fact that bonds are not as liquid as money for purchasing day goods.\footnote{Note that, despite the linearity in the disutility of labor, the real interest rate is not exogenous, and fluctuates with variations in the tax rate. The yield on an illiquid real bond would be $\frac{U_c}{\alpha x} - 1$; by (11) we can see how this yield depends on taxes today and tomorrow.}

Using (9)–(13), we can write the government budget constraint (1) in a monetary equilibrium as a function of allocations and debt,

$$\varepsilon(B, B', x, x', c, g) \equiv (U_c - \alpha) c - \alpha g - \frac{\phi x (1 + B)}{1 + \theta B} + \frac{\beta \phi x' (1 + B')}{1 + \theta B'} + \beta \eta x' (u_x' - \phi) = 0. \quad (14)$$

This condition is also known as an implementability constraint, as it restricts the set of allocations that a government can implement in a monetary equilibrium.

### 3 Government policy without an independent central bank

The government can commit to policy announcements for the current period, but cannot commit to policies implemented in future periods. That is, at the beginning of the period, the current government chooses $\{B', \mu, \tau, g\}$—equivalently, as shown above, implements $\{B', x, c, g\}$—taking as given expected future policy. Policies implemented by the government in the future affect its current budget constraint, since future monetary policy affects the current demand for money.
and bonds. This is reflected by the presence of the future allocation \( x' \) in the government budget (implementability) constraint (14). Due to limited commitment, the current government cannot directly control future policy, even though it can affect future policy through its choice of debt, \( B' \). Future allocations depend on the policy expected to be implemented by the government, which in turn, depends on the level of debt it inherits and the exogenous aggregate state of the economy. Let \( \mathcal{X}(B) \) be the policy that the current government anticipates will be implemented by future governments; this function implies a future day-good allocation, \( X \) and bonds. This is reflected by the presence of the future allocation \( x' \) for any given future state, \( B' \). The function \( \mathcal{X} \) is an equilibrium object, but the current government takes it as given.

From the day resource constraint, we can write production in equilibrium as a function of consumption: \( \kappa = \eta x/(1 - \eta) \). Thus, an agent’s expected flow utility in the day is equal to \( u(x) = \kappa \eta x - \kappa \eta x \). Night output is equal to the consumption of private and public goods and so, we can use the night resource constraint to write expected night labor as \( c + g \). The ex ante period utility of an agent can be thus written in terms of the bundle \((x, c, g)\). Let \( U(x, c, g) \equiv \eta u(x) - \phi x + U(c) - \alpha(c + g) + v(g) \).

The government values the utility of its subjects, but is in general not benevolent. There are two dimensions of non-benevolence. First, following Martin (2015a), the government may value public expenditure differently: its flow utility is given by \( U(x, c, g) + \omega_F g \), where \( \omega_F \geq 0 \). The focus here is on situations when the government prefers larger public expenditure than private agents.\(^5\) This expenditure bias may arise from a variety of sources: a desire for empire-building, the spoils of patronage and clientelism, the existence of a self-serving public bureaucracy or the support of the sovereign’s lifestyle. Second, the government is more impatient than private agents, a popular assumption in the political economy and sovereign debt literatures. Specifically, it discounts the future by \( \beta (1 - \delta_F) \), where \( \delta_F \in [0, 1) \).

Let \( B \equiv [B, \overline{B}] \) be the set of possible debt levels, where \(-1 < B < \overline{B} \). Taking as given future government policy \( B, \mathcal{X}, C, G \) the problem of the current government can be written as

\[
\max_{B', x, c, g} U(x, c, g, s) + \omega_F g + \beta(1 - \delta_F)\mathcal{V}(B')
\]

subject to (14) and given a continuation value consistent with expected future policy:

\[
\mathcal{V}(B') \equiv U(\mathcal{X}(B'), C(B'), G(B')) + \omega_F G(B') + \beta(1 - \delta_F)\mathcal{V}(B(B')).
\]

We now have the necessary elements to define an equilibrium in this economy.

**Definition 1 (Consolidated government policy)** A Markov-Perfect Monetary Equilibrium (MPME) is a set of functions \( \{B, \mathcal{X}, C, G, \mathcal{V}\} : \Gamma \rightarrow \Gamma \times \mathbb{R}^3_+ \), such that for all \( B \in \Gamma \):

\[
\{B(B), \mathcal{X}(B), C(B), G(B)\} = \arg\max_{B', x, c, g} U(x, c, g, s) + \omega_F g + \beta(1 - \delta_F)\mathcal{V}(B')
\]

subject to \( \varepsilon(B, B', x, \mathcal{X}(B'), c, g) = 0 \) and where

\[
\mathcal{V}(B) \equiv U(\mathcal{X}(B), C(B), G(B)) + \omega_F G(B) + \beta(1 - \delta_F)\mathcal{V}(B(B)).
\]

A Markov-perfect equilibrium is a fixed-point in government policy functions, so that the best response of the current government is follow the same policies it expects to follow in the future, in all states of the economy.

\(^5\)One could also assume a more general function \( R(g) \), as in Martin (2015a). A linear function of \( g \) simplifies exposition and is sufficient for the purposes of this paper.
With Lagrange multiplier $\lambda_F$ associated with the government budget constraint, the first-order conditions of the government’s problem imply:

$$
\varepsilon_B' \{ \lambda_F - (1 - \delta_F) \lambda_F' \} + \lambda_F \varepsilon_{x'} X_B' = 0 \quad (15)
$$

$$
U_x' + \lambda_F \varepsilon_x = 0 \quad (16)
$$

$$
U_c' + \lambda_F \varepsilon_c = 0 \quad (17)
$$

$$
U_g' + \lambda_F \varepsilon_g = -\omega_F \quad (18)
$$

for all $B \in \Gamma$ and where $\varepsilon_i$ denotes the derivative of (14) with respect to variable $i = \{B, B', x, x', c, g\}$. Note that $\varepsilon_B' = -\beta \varepsilon_B''$, which is used to simplify (15).

A differentiable MPME is a set of differentiable (a.e.) functions $\{B, X, C, G, \Lambda_F\}$ that solve (14)–(18) for all $B$. Martin (2011) provides an extended analysis of these conditions and a characterization of the equilibrium, for the case of $\theta = 0$. Below, I describe the policy trade-offs implied by these conditions.

Conditions (16)–(18) describe the static trade-offs faced by the government when choosing the money growth rate, taxes and public expenditure. Each one of these policy instruments can be used to relax the government budget constraint at the cost of introducing a wedge, which lowers utility for the government (and private agents as well). Importantly, the incentives to inflate are increasing in debt and non-benevolence affects the amount of distortions the government is willing to impose.

Equation (15), known as a Generalized Euler Equation (GEE), describes the intertemporal trade-offs faced by the government when choosing debt. The first term depends on the difference between current and future implementation costs, as reflected by the multiplier on (14), capturing the distortion-smoothing role of debt. From an ex ante perspective, this gap would ideally be eliminated in expectation, but this is prevented by the limited commitment friction.

The second term in (15) reflects the time-consistency problem, which consists of how current changes in debt trigger future changes in policy, which in turn, affect the current budget constraint of the government. Choosing a higher debt implies higher inflation tomorrow, which affects the demand for money and bonds today. The impact on the latter is always negative: higher inflation implies higher nominal interest rates; the former depends on how the income and substitution effects determine how the current demand for money is affected by future higher inflation. When income effects dominate, the overall effect of higher debt is to relax the government budget constraint at low level of debt and to tighten it for high levels of debt.

An important point relates to time-consistency in the long run. In steady state, (15) becomes $\varepsilon_B' \delta_F + \varepsilon_{x'} X_B = 0$. The presence of the derivative of the function $X$ implies that a time-consistency problem is still active in steady state. However, when $\delta_F = 0$, we get $\varepsilon_{x'} X_B = 0$, which given $X_B < 0$ implies $\varepsilon_{x'} = 0$—see Martin (2015a) for a formal proof. In other words, when there is no debt bias, the steady state has no time-consistency problem and is thus, constrained efficient.

### 4 Government policy with an independent central bank

Now suppose that the monetary authority (or central bank) is an independent institution within the government. As such, it has its own preferences which arise from its design, charter or the political process by which its authorities are appointed. For the purpose of this paper, consider the situation in which the central bank is endowed with its own expenditure and debt biases, $\omega_M$ and $\delta_M$. That is, the central bank’s flow utility is given by $U(x, c, g) + \omega_M g$ and it discounts the future by factor $\beta(1 - \delta_M)$. As we shall see below, it might be desirable to have negative
values for $\omega_M$ and/or $\delta_M$, so this is allowed. The rest of the government, which I will label the fiscal authority, retains biases $\omega_F$ and $\delta_F$.

With separate fiscal and monetary authorities, the question now is how policy is chosen and determined. I will assume that neither authority has a first-mover advantage relative to the other. Hence, both will move simultaneously, albeit before private agents. Since both authorities move at the same time and the government budget constraint needs to be satisfied, this means that one policy variable cannot be chosen by either: i.e., one policy variable needs to satisfy the government budget constraint, given the policy choices made by the two authorities.

Since the fiscal authority represents all the government except the central bank, it will be in charge of choosing expenditure $g$. The remaining instruments are debt $B'$, the nominal interest rate $R$, the tax rate $\tau$ and the money growth rate $\mu$. Variables $B'$ and $\tau$ are within the purview of the fiscal authority, while $R$ and $\mu$ are instruments of the central bank. Recall that $B'$ and $R$ are in fact the same instrument by (13). So, for example, if the central banks sets the interest rate, the fiscal authority cannot choose the debt level.

There are three possible combinations. First, the central bank sets the interest rate $R$ and the fiscal authority sets taxes $\tau$, with $\mu$ determined residually. Second, the fiscal authority sets debt $B'$ (and thus, $R$) and so, the central bank sets the money growth rate $\mu$, with taxes $\tau$ determined residually. And third, the central bank sets the money growth rate $\mu$ and the fiscal authority sets taxes $\tau$, with $B'$ (and $R$) determined residually.

### 4.1 Interest rate policy

Suppose the central bank chooses the nominal interest rate every period. By (13) there is a one-to-one mapping between $R$ and $B'$; hence we can equivalently think of the central bank as picking debt $B'$. In this case, the fiscal authority is left with choosing $\tau$ and $g$. By (11) there is a one-to-one mapping between $\tau$ and $c$, so we can also think of the fiscal authority as implementing $(c,g)$. Given the state $B$ and policy choices $B', c, g$, the day-good allocation $x$ (equivalently, the money growth rate $\mu$) satisfies the government budget constraint (14).

Each authority decides on policy anticipating the choices of the other authority today and those of future authorities from tomorrow onwards. In other words, the central bank takes as given policies $\mathcal{C}(B)$ and $\mathcal{G}(B)$ followed by the fiscal authority today and in the future, monetary policy $B(B)$ followed by future central banks, as well as the function $\mathcal{X}(B)$ consistent with these future choices. Analogously, the fiscal authority takes as given current and future monetary policy $B(B)$, as well as future fiscal policy $\mathcal{C}(B)$ and $\mathcal{G}(B)$, as well as the function $\mathcal{X}(B)$ consistent with these future choices. These policies span continuation values for the fiscal and monetary authority, $\mathcal{F}(B)$ and $\mathcal{M}(B)$, respectively.

When formulating the problem of each authority, we need to take into account that its policy choices will affect the instrument/allocation determined residually, $x$ (or $\mu$) in this case. For example, for the central bank each choice of $B'$ implies a specific allocation $x$ that solves the government budget constraint, given the policies followed by the fiscal authority. That is, from the perspective of the central bank the day-good allocation $x$ is such that, $\varepsilon(B, B', x, \mathcal{X}(B'), \mathcal{C}(B), \mathcal{G}(B)) = 0$. Hence, $x$ is a function of $(B, B')$ given $\mathcal{X}, \mathcal{C}, \mathcal{G}$. Equivalently, the problem of the central bank if to choose $(B', x)$ given $\mathcal{X}, \mathcal{C}, \mathcal{G}$ and subject to $\varepsilon(B, B', x, \mathcal{X}(B'), \mathcal{C}(B), \mathcal{G}(B)) = 0$.

What is critical is that the fiscal authority understands that the central bank is setting $B'$ and not $x$; that is, its own policy choices will affect $x$ but not $B'$. For the fiscal authority, the

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6There are some interesting issues that arise when government authorities move at the same time as private agents. See Ortigueira (2006) and Martin (2015b).
relevant constraint that determines the day-good allocation \( x \) given its own choices for \((c, g)\) is 
\[ \varepsilon(B, B(B), x, \mathcal{X}(B(B)), c, g) = 0. \]

We are now ready to formulate the problems of the fiscal and monetary authorities, and define an equilibrium in this setting.

**Definition 2 (Interest rate regime)** A Markov-Perfect Monetary Equilibrium (MPME) when the central bank follows an interest rate policy is a set of functions \( \{B, \mathcal{X}, C, G, F, M\} : \Gamma \to \Gamma \times \mathbb{R}_+^4 \), such that for all \( B \in \Gamma \):

\[
\{\mathcal{X}(B), C(B), G(B)\} = \arg\max_{x, c, g} U(x, c, g) + \omega_F g + \beta(1 - \delta_F)F(B(B))
\]

subject to \( \varepsilon(B, B(B), x, \mathcal{X}(B(B)), c, g) = 0, \)

\[
\{B(B), \mathcal{X}(B)\} = \arg\max_{B', x} U(x, C(B), G(B)) + \omega_M G(B) + \beta(1 - \delta_M)M(B')
\]

subject to \( \varepsilon(B, B', x, \mathcal{X}(B'), C(B), G(B)) = 0, \) and where

\[
F(B) \equiv U(\mathcal{X}(B), C(B), G(B)) + \omega_F G(B) + \beta(1 - \delta_F)F(B(B))
\]

\[
M(B) \equiv U(\mathcal{X}(B), C(B), G(B)) + \omega_M G(B) + \beta(1 - \delta_M)M(B(B)).
\]

We can further characterize government policy by taking the first-order conditions of the problems of the fiscal and monetary authorities. With Lagrange multipliers \( \lambda_F \) and \( \lambda_M \) on their respective constraints, the first-order conditions imply

\[
\varepsilon_B'\lambda_F - (1 - \delta_M)\lambda_F^F + \lambda_F \varepsilon_x \mathcal{X}_B' = \beta(1 - \delta_M)(\omega_F - \omega_M)G_B^B \tag{19}
\]

\[
U_x + \lambda_F \varepsilon_x = 0 \tag{20}
\]

\[
U_c + \lambda_F \varepsilon_c = 0 \tag{21}
\]

\[
U_g + \lambda_F \varepsilon_g = -\omega_F \tag{22}
\]

\[
\lambda_M = \lambda_F \tag{23}
\]

It is instructive to compare this conditions with those of the consolidated government, (15)–(18). The GEE (19) differs from (15) in two ways: first, \( \delta_M \) substitutes for \( \delta_F \); and second, the right-hand side is generally not equal to zero. Conditions (20)–(22) are identical to (16)–(18).

The extra equation, \( \lambda_F = \lambda_M \), comes from the fact that the first-order condition with respect to \( x \) for each authority imply: \( U_x + \lambda_F \varepsilon_x = U_x + \lambda_M \varepsilon_x = 0 \). Given \( \varepsilon_x = -\phi(1 + B)/(1 + \theta B) \), this implies that both authorities are internalizing in the same way how inherited debt affects the day-good allocation. Specifically, how higher debt increases the incentive to print money at a faster rate (as explained above), which is the residual instrument in this case.

What do we make of all this? First, the impatience of the fiscal authority is irrelevant; \( \delta_F \) does not appear in the equations characterizing equilibrium policy. This is the case since the central bank is choosing the interest rate (equivalently, \( B' \)), which renders the problem of the fiscal authority static. That is, the future path of the economy is determined by the central bank’s choice for the interest rate, regardless of what the fiscal authority does today. This result generalizes the findings of Niemann et al. (2013), which derived it for the case without taxes.

Second, though the fiscal debt bias does not matter, its expenditure bias does. In particular, the difference between how much the fiscal and monetary authorities value public expenditure introduces a wedge in the GEE (19). Note that preference agreement along this dimension still does not imply a benevolent policy; if \( \omega_M = \omega_F < 1 \), the resulting policy is not benevolent since \( \omega_F \) distorts the choice of government spending in condition (23).
Third, endowing the central bank with appropriate values for $\omega_M$ and $\delta_M$ can be welfare improving as it could counter the fiscal authority’s expenditure bias, $\omega_F$. This possibility will be explored further in the quantitative section.

Fourth, having both agreement in expenditure bias and a central bank without a debt bias eliminates the time-consistency problem in the long run. To see this, impose $\omega_M = \omega_F \leq 1$ and $\delta_M = 0$. Then, (19) simplifies to $\varepsilon B'(\lambda_F - X_F) + \lambda_F \varepsilon x'X_B' = 0$ and in steady state, $\varepsilon x' = 0$. As explained in the previous section, this implies there is no time-consistency problem in steady state.

**Proposition 1 (Interest rate regime)** When the monetary authority sets the interest rate, it renders the debt bias of the fiscal authority irrelevant. However, the monetary authority’s debt bias and the fiscal authority’s expenditure and debt biases affect the MPME. There is no time-consistency problem in steady state if the monetary authority has no debt bias, $\delta_M = 0$ and the monetary and fiscal authorities share the same expenditure bias, $\omega_M = \omega_F$.

### 4.2 Fiscal dominance

Consider now the case when the fiscal authority sets debt policy, which is equivalent to setting the nominal interest rate. Now, the central bank cannot simultaneously set the interest rate, so it has to pick the money growth rate. Taxes are determined residually to satisfy the government budget constraint. This is critical: the fiscal authority is willing to let taxes adjust to meet its goal of end-of-period debt.

From (12), given a choice for $B'$ and future policy $X(B)$, setting $\mu$ is equivalent to choosing the day-good allocation $x$. Thus, in this case, we have the fiscal authority picking $(B', g)$ and the central bank choosing $x$, while the night-good allocation $c$ adjusts to satisfy the government budget constraint (14).

The fiscal authority takes as given current and future monetary policy $X(B)$, as well as future fiscal policy $B(B)$ and $G(B)$, as well as the function $C(B)$ consistent with these future choices. The central bank takes as given policies $B(B)$ and $G(B)$ followed by the fiscal authority today and in the future, monetary policy $X(B)$ followed by future central banks, as well as the function $C(B)$ consistent with these future choices. These policies span continuation values for the fiscal and monetary authority, $F(B)$ and $M(B)$, respectively.

As before, we now formulate the problems of the fiscal and monetary authorities, and define an equilibrium in this setting.

**Definition 3 (Debt regime)** A Markov-Perfect Monetary Equilibrium (MPME) when the fiscal authority sets the debt level is a set of functions $\{B, X, C, G, F, M\} : \Gamma \rightarrow \Gamma \times \mathbb{R}_+^4$, such that for all $B \in \Gamma$:

$$\{B(B), C(B), G(B)\} = \operatorname{argmax}_{B,c,g} U(X(B), c, g) + R_F(g) + \beta(1 - \delta_F)F(B')$$

subject to $\varepsilon(B, B', X(B), X(B'), c, g) = 0$,

$$\{X(B), C(B)\} = \operatorname{argmax}_{x,c} U(x, c, G(B)) + R_M(G(B)) + \beta(1 - \delta_M)M(B(B))$$

subject to $\varepsilon(B, B(B), x, X(B(B)), c, G(B)) = 0$, and where

$$F(B) \equiv U(X(B), C(B), G(B)) + \omega_F G(B) + \beta(1 - \delta_F)F(B(B))$$

$$M(B) \equiv U(X(B), C(B), G(B)) + \omega_M G(B) + \beta(1 - \delta_M)M(B(B)).$$
We can further characterize government policy by taking the first-order conditions of the problems of the fiscal and monetary authorities. With Lagrange multipliers $\lambda_F$ and $\lambda_M$ on their respective constraints, the first-order conditions imply

$$\varepsilon_B' [\lambda_F - (1 - \delta_F) \lambda_F'] + \lambda_F \varepsilon_x' X_B' = 0 \quad (24)$$

$$U_c + \lambda_F \varepsilon_x = 0 \quad (25)$$

$$U_c + \lambda_F \varepsilon_c = 0 \quad (26)$$

$$U_g + \lambda_F \varepsilon_g = -\omega_F \quad (27)$$

$$\lambda_M = \lambda_F \quad (28)$$

Conditions (24)–(27) are identical to (15)–(18). Thus, the equilibrium in this case coincides with the equilibrium with a single consolidated government unit with preferences $\omega_F$ and $\delta_F$. By picking the debt level, the fiscal authority effectively makes the problem of the central bank static. The monetary authority cannot now affect the future through its policy choices. As such, its own preferences are irrelevant. In effect, the fiscal authority imposes its preferences on the central bank. Notably, this is achieved without manipulating the timing of policy choices (both decide simultaneously) but rather by picking the appropriate instrument, end-of-period debt. As for time-consistency in the long run, all that’s needed is $\delta_F = 0$, as in the consolidated case, regardless of the preferences of the central bank. These results are summarized in the following proposition.

**Proposition 2 (Fiscal dominance)** When the fiscal authority sets the debt level, it renders the preferences of the central bank irrelevant. The MPME coincides with the case when there is a consolidated government with the preferences of the fiscal authority. There is no time-consistency problem in steady state if the fiscal authority has no debt bias, $\delta_F = 0$.

5 Quantitative Evaluation

5.1 Calibration

Consider the following functional forms: $u(x) = \frac{x^{1-\sigma} - 1}{1-\sigma}; \quad U(c) = \frac{c^{1-\sigma} - 1}{1-\sigma}; \quad$ and $v(g) = \ln g$. The calibration is borrowed from Martin (2020) which targets the postwar U.S. economy when $\omega_F = \omega_M = 0.75$ and $\delta_F = \delta_M = 0$. Table 1 presents the benchmark parameters.

|  |  |  |  |  |  |  |
|---|---|---|---|---|---|
| $\alpha$ | $\beta$ | $\sigma$ | $\eta$ | $\phi$ | $\theta$ |
| 8.9790 | 0.9452 | 3.7009 | 0.3776 | 3.7617 | 0.3747 |

5.2 The impact of policy biases

Table 2 presents steady state statistics for the case without an independent central bank, i.e., with $\omega_M = \omega_F$ and $\delta_M = \delta_F$. The first column is the benevolent case, $\omega_F = \delta_F = 0$; the second column corresponds to the case with an expenditure bias $\omega_F > \delta_F = 0$; the third column presents the case with a debt bias $\delta_F > \omega_F = 0$; and the last column includes both biases.

Welfare is expressed in terms of equivalent compensation, measured in units of night-good consumption. Formally, welfare is measured at each level of debt as the proportion $\Delta(B)$ that
Table 2: Steady state statistics without an independent central bank

<table>
<thead>
<tr>
<th></th>
<th>Benevolent</th>
<th>Expenditure bias</th>
<th>Debt bias</th>
<th>Both biases</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\omega_F$</td>
<td>0.00</td>
<td>0.75</td>
<td>0.00</td>
<td>0.75</td>
</tr>
<tr>
<td>$\omega_M$</td>
<td>0.00</td>
<td>0.75</td>
<td>0.00</td>
<td>0.75</td>
</tr>
<tr>
<td>$\delta_F$</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>$\delta_M$</td>
<td>0.00</td>
<td>0.00</td>
<td>0.03</td>
<td>0.03</td>
</tr>
<tr>
<td>Debt over GDP</td>
<td>0.319</td>
<td>0.325</td>
<td>0.759</td>
<td>0.728</td>
</tr>
<tr>
<td>Expenditure over GDP</td>
<td>0.148</td>
<td>0.180</td>
<td>0.148</td>
<td>0.180</td>
</tr>
<tr>
<td>Revenue over GDP</td>
<td>0.152</td>
<td>0.180</td>
<td>0.154</td>
<td>0.180</td>
</tr>
<tr>
<td>Primary deficit over GDP</td>
<td>-0.004</td>
<td>0.000</td>
<td>-0.006</td>
<td>0.000</td>
</tr>
<tr>
<td>Deficit over GDP</td>
<td>0.010</td>
<td>0.018</td>
<td>0.045</td>
<td>0.056</td>
</tr>
<tr>
<td>Nominal interest rate</td>
<td>0.048</td>
<td>0.058</td>
<td>0.072</td>
<td>0.084</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.020</td>
<td>0.036</td>
<td>0.059</td>
<td>0.079</td>
</tr>
<tr>
<td>Real interest rate</td>
<td>0.028</td>
<td>0.021</td>
<td>0.012</td>
<td>0.005</td>
</tr>
<tr>
<td><strong>Welfare gain vs BNV</strong></td>
<td>-</td>
<td>-7.52%</td>
<td>-0.22%</td>
<td>-7.91%</td>
</tr>
</tbody>
</table>

solves

$$\eta[u(X(B)) - \phi X(B)] + U(C(B)(1 + \Delta(B))) + v(G(B)) - \alpha(C(B) + G(B)) + \beta V(B(B)) = \bar{V}(B)$$

where $\{B, X, C, G\}$ is the corresponding Markov-perfect equilibrium, with associated agent’s value function $V(B)$, and $\bar{V}(B)$ corresponds to the agent’s value function in a Markov-perfect equilibrium with an alternative regime (e.g., one with expenditure bias). Given the assumptions on functional forms, the equivalent compensation has a closed-form solution:

$$\Delta(B) = \left\{ \frac{(1 - \sigma)[\bar{V}(B) - V(B)]}{C(B)^{1-\sigma}} + 1 \right\}^{1/(1-\sigma)} - 1$$

if $\sigma \neq 1$ and $\Delta(B) = \exp\{\bar{V}(B) - V(B)\} - 1$ if $\sigma = 1$. Welfare in Table 2 is measured at the steady state of the benevolent equilibrium and thus measures the associated loss of switching to the various regimes.

Two results in Table 2 strike immediately. First, the expenditure bias has a major impact on welfare through higher public spending, while the effect on other policies is relatively minor. Second, the debt bias has a minor welfare impact, despite implying a significant growth in debt. The reason for these contrasting results is that a spending bias has a first-order effect on welfare as it raises the distortions necessary to finance a higher expenditure, whereas a debt bias simply pushes distortions to the future. When combining both biases, we obtain the worst of both worlds: large welfare losses associated with high taxes and spending, high debt and deficit, and high inflation and nominal interest rates.

Figure 1 measures the welfare costs of expenditure and debt biases. For the range of parameters considered, we verify that the expenditure bias is an order of magnitude more costly than the debt bias.
Figure 1: Consolidated government—welfare gain relative to benevolent government

5.3 Preference disagreement and instrument choice

Table 3 presents steady state statistics and associated welfare under the assumption that the fiscal authority is subject to an expenditure or debt bias, while the central bank is benevolent. For each case it displays the cases with preference agreement as a reference and then the two analyzed policy regimes: $\tau$ and $R$ (interest rate policy) and $B'$ and $\mu$ (fiscal dominance). As we can see, steady state policies depend on the instrument choice, but welfare does not appear to be affected significantly. When the central bank is benevolent, it does not appear that it can do much to counteract the expenditure bias. In contrast, as we saw in the previous section, by following an interest rate policy the central bank can effectively eliminate the debt bias; however, the associated welfare loss of the debt bias is small.

The third column for each bias demonstrates how to effect fiscal dominance. When the fiscal authority chooses the debt level, it imposes the same equilibrium as would obtain without an independent central bank (“agreement”).

5.4 Who wants a patient central banker?

The best prescription for overturning fiscal dominance is to have a central bank that sets an interest rate policy. But there is still the question of what preferences we wish to endow the central banker. Consider the case with only an expenditure bias, $\omega_F = 1.94$, which carries the higher welfare cost of the two biases. Figure 2 shows the welfare gains that would obtain if we endowed the central bank with different degrees of patience and different preferences for government expenditure.

For a given $\omega_M$, welfare is hump-shaped in $\delta_M$. In particular, private agents would prefer a patient central banker, $\delta_M < 0$, but not excessively so. The bigger gains, however, come from having both a patient central banker and one that prefers lower government expenditure. Note, however, that the gains are modest relative to the welfare losses due to the fiscal authority’s profligacy. At the end of the day, the best reform is to make the fiscal authority less prone to excess spending.
Table 3: Fiscal biases vs benevolent central bank and instrument choice

<table>
<thead>
<tr>
<th></th>
<th>Fiscal expenditure bias</th>
<th>Fiscal debt bias</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Agreement</td>
<td>$\tau$ &amp; $R$</td>
</tr>
<tr>
<td>$\omega_F$</td>
<td>1.94</td>
<td>1.94</td>
</tr>
<tr>
<td>$\omega_M$</td>
<td>1.94</td>
<td>0.00</td>
</tr>
<tr>
<td>$\delta_F$</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>$\delta_M$</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Debt over GDP</td>
<td>0.325</td>
<td>0.687</td>
</tr>
<tr>
<td>Expenditure over GDP</td>
<td>0.180</td>
<td>0.180</td>
</tr>
<tr>
<td>Revenue over GDP</td>
<td>0.180</td>
<td>0.180</td>
</tr>
<tr>
<td>Primary deficit over GDP</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>Deficit over GDP</td>
<td>0.018</td>
<td>0.052</td>
</tr>
<tr>
<td>Nominal interest rate</td>
<td>0.058</td>
<td>0.082</td>
</tr>
<tr>
<td>Inflation rate</td>
<td>0.036</td>
<td>0.075</td>
</tr>
<tr>
<td>Real interest rate</td>
<td>0.021</td>
<td>0.006</td>
</tr>
<tr>
<td>Welfare gain vs BNV</td>
<td>−7.52%</td>
<td>−7.86%</td>
</tr>
</tbody>
</table>

Figure 2: Interest rate regime—welfare as a function of $\delta_M$
6 Concluding remarks

Biases, disagreement and instrument choice all have meaningful impact on policy outcomes. As we have shown, instrument choice by a government authority can nullify some or all biases of the other agency. Specifically, by choosing debt, the fiscal authority renders the preferences of the central bank irrelevant; by choosing an interest rate, the central bank nullifies the fiscal authority’s debt bias.

Quantitatively, I find that the expenditure bias is about an order of magnitude more severe than the debt bias and has a major impact on welfare through higher public spending, while the effect on other policies is relatively minor. I also find that the central bank can do little to overcome the negative impact of the fiscal authority’s expenditure bias, though there are still gains from properly designing the central bank.
References


