AER: Insights 2024, 6(3): 377–394
https://doi.org/10.1257/aeri.20230263

Central Bank Credibility and Fiscal Responsibility†

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We consider a New Keynesian model with strategic monetary and fiscal interactions. The fiscal authority maximizes social welfare. Monetary policy is delegated to a central bank with an anti-inflation bias that suffers from a lack of commitment. The impact of central bank hawkishness on debt issuance is nonmonotonic because increased hawkishness reduces the benefit from fiscal stimulus while simultaneously increasing real debt capacity. Starting from high levels of hawkishness (*dovishness*), *a marginal increase in the central bank's anti-inflation bias decreases* (*increases*) *debt issuance.* (*JEL* E12, E31, E52, E58, E62, H63)

Conventional wisdom holds that a more hawkish central bank will promote fiscal responsibility. Policymakers will refrain from pursuing a debt-fueled government expansion if they expect the central bank to counteract it with high interest rates.[1] Indeed, the notion that a conservative central bank can serve to discipline fiscal policy is often used as a justification for moving central banks toward inflation targeting.

This mechanism is supported by a number of historical episodes where fiscal discipline has improved in countries pursuing monetary stabilization.[2] Moreover, it can also explain cases where a relaxation of monetary stance can lead to fiscal expansions. For instance, in August 2020, the US Federal Reserve changed its monetary framework toward average inflation targeting. Because this new policy framework allowed for inflation to temporarily overshoot the 2 percent target, this change was interpreted by many as a shift toward a more dovish monetary policy.[3] In the ensuing months, the US Congress took public debt to unprecedented levels by

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† Go to https://doi.org/10.1257/aeri.20230263 to visit the article page for additional materials and author disclosure statement(s).

[1] This idea goes back at least as far as Ricardo (1824). See Sims (2016) and Orphanides (2018) for more recent discussions.

[2] Fatás and Rose (2001), for example, find that belonging to a currency board results in an improvement in fiscal outcomes.

[3] See Board of Governors of the Federal Reserve System (2020) and Politi and Smith (2020).

passing two massive fiscal stimulus bills, and this was followed by the highest level of inflation since the early 1980s.[4]

Despite numerous examples consistent with the conventional wisdom, there are also cases of the reverse, where the introduction of monetary stabilization was followed by a deterioration of fiscal discipline.[5] For example, consider the adoption of the euro in 1999. Greece—which had experienced inflation levels averaging above 10 percent in the previous two decades—saw inflation drop precipitously. However, rather than responding with a more restrained fiscal policy, the Greek government facing historically low interest rates undertook a large debt buildup.[6]

Why would a more conservative central bank improve fiscal discipline in some cases but worsen it in others? In this paper, we explore this question using a simple two-period New Keynesian model with monetary and fiscal interactions. A key feature of our framework is that monetary policy is delegated to a central bank that does not have the same welfare as the fiscal authority and puts more weight on fighting inflation, as in Rogoff (1985). Our analysis considers how public debt issuance responds to changes in the central bank's hawkishness.

We show that there are two forces at play. On the one hand, a more hawkish central bank is more inclined to keep real interest rates high to offset fiscal stimulus to prevent the accompanying inflation. On the other hand, a more hawkish central bank is less likely to inflate away debt ex post, and this increases real debt capacity by inducing lower future debt devaluation in response to additional borrowing. In the face of a more hawkish central bank, the first force induces *more* fiscal discipline since a fiscal authority sees a lower benefit of stimulus. However, the second force induces *less* fiscal discipline since a fiscal authority sees a greater opportunity to borrow.

Our analysis evaluates the relative strength of these two forces, and our main result is that the impact of central bank hawkishness on debt issuance is nonmonotonic. Starting from high levels of hawkishness, a marginal increase in the central bank's anti-inflation bias decreases debt issuance, whereas the opposite happens starting from low levels of hawkishness. This nonmonotonicity emerges because the starting level of real debt capacity is higher for countries with more hawkish central banks. Thus, they do not respond on the margin to an increase in real debt capacity induced by an increase in central bank hawkishness. They instead become more fiscally disciplined in anticipation of more counteraction of stimulus by a more inflation-averse central bank. In contrast, countries with very dovish central banks are debt constrained, and they increase their debt in response to an increase in real debt capacity. In those cases, an increase in central bank hawkishness leads to less fiscal discipline.[7]

Our results provide us with a framework to interpret our motivating case studies. The increase in public debt in the United States following the adoption of the new

[4] Similar developments occurred in the euro area, where the European Central Bank also announced a change to its strategy in 2021. What ensued was a record increase in public debt across the euro area, even in countries with historically large surpluses like Germany.

[5] See, for example, the analysis in Frieden (2018) and Tornell and Velasco (1995, 1998).

[6] See, for example, the discussion in Jalles, Mulas-Granados, and Tavares (2021).

[7] Those governments issue more debt even though the degree of central bank accommodation conditional on the level of real debt issuance is lower.

monetary policy framework in 2020 can be interpreted as the optimal response of a fiscal authority that is not debt constrained and that is anticipating a more acommodative monetary policy. As such, our theoretical analysis complements the quantitative analysis of Bianchi, Faccini, and Melosi (2023), who argue that the postpandemic increase in inflation can be understood as the outcome of coordinated monetary and fiscal policy.[8] Moreover, the increase in public debt in Greece following entry into the euro in 1999 can in contrast be interpreted as the optimal response of a fiscal authority that is debt constrained and taking advantage of its enhanced debt capacity following monetary stabilization.[9]

Related Literature.—This paper contributes to the literature on monetary and fiscal interactions dating back to the important work of Sargent and Wallace (1981); Leeper (1991); and Woodford (1998).[10] Relative to this literature, we do not assume that policies are exogenous, but we consider policies chosen by a monetary and a fiscal authority that interact strategically with one another in the absence of commitment. As such, our discussion does not touch on questions of determinacy or monetary versus fiscal dominance (see, for example, the discussion in Cochrane 2023). In our framework, inflation is jointly determined by the sequential decisions of the monetary and fiscal authorities.

The work of Dixit and Lambertini (2003) and Adam and Billi (2008) also studies strategic monetary and fiscal interactions. In contrast to their analyses, our model explicitly considers the role of government debt and the possibility of debt devaluation via inflation, which they abstract from. In this regard, we build on Alvarez, Kehoe, and Neumeyer (2004); Chari and Kehoe (2007); and Aguiar et al. (2015), among others, who consider the monetary authority's commitment to preserving the value of public debt. In contrast to this work, we introduce sticky prices, which endow the central bank with an additional role in supporting a fiscal expansion with a monetary one. The combination of this feature with the possibility of a debt devaluation is what generates the nonmonotonic results in our model.

This paper more broadly builds on the literature that studies the time consistency of monetary policy (e.g., Kydland and Prescott 1977; Calvo 1978; Barro and Gordon 1983). As in the seminal contribution of Rogoff (1985), we consider an environment in which monetary policy is delegated to a central bank with an anti-inflation bias. Using this framework, we show that a higher anti-inflation bias not only increases a central bank's incentives to counteract an inflationary fiscal stimulus but also increases a government's debt capacity.

Finally, this paper also relates to the literature on fiscal responsibility and fiscal rules.[11] Relative to this literature, we consider the extent to which delegation of

[8] More specifically, these authors show that inflation accelerated once the Fed announced its new policy strategy after the first stimulus had occurred.

[9] This theoretical analysis also complements the work of Bianchi and Ilut (2017), who argue that the switch from a high-inflation and low–public debt regime in the 1960s and 1970s in the United States to a regime of low inflation and high public debt from the 1980s onward can be understood as the consequence of a shift to a more active hawkish monetary policy that expanded fiscal space.

[10] See Leeper and Leith (2016) for a survey.

[11] This literature includes, among others, Halac and Yared (2014, 2018, 2022); Azzimonti, Battaglini, and Coate (2016); Dovis and Kirpalani (2020); and Bouton, Lizzeri, and Persico (2020).

monetary policy serves as an indirect fiscal rule, which changes a government's debt capacity.

I. Model

We consider a simple two-period New Keynesian model with $t = 0,1$. At each date, households choose consumption across varieties, labor, and savings. Monopolistically competitive firms sell consumption varieties. Prices are sticky at date 0 and flexible at date 1. At each date, the government chooses proportional consumption taxes, lump sum taxes, government spending, government debt, and the price level.[12] The government also chooses the nominal interest rate at date 0.

A. *Households*

There is a continuum of mass 1 of households that have the following preferences over a consumption bundle $C_t \geq 0$, labor $N_t \geq 0$, and government spending $G_t \geq 0$:

$$\sum_{t=0,1} \left[(1 - \mu) \left(\log C_t - \frac{N_t^{1+\varphi}}{1 + \varphi} \right) + \mu \log G_t \right], \tag{1}$$

where $\mu \in (0,1)$ and $\varphi \geq 0$.[13] Moreover, C_t satisfies $C_t = \left(\int_0^1 C_{j,t}^{1-\sigma^{-1}} \right)^{1/(1-\sigma^{-1})} dj$, where $C_{j,t} \geq 0$ is the household consumption of variety j at date t and $\sigma > 1$. We define G_t analogously as composed of government consumption of varieties $G_{j,t} \geq 0$, where $G_t = \left(\int_0^1 G_{j,t}^{1-\sigma^{-1}} \right)^{1/(1-\sigma^{-1})} dj$.

The household budget constraint at date 0 is

$$(1 + \tau_0) \int_0^1 P_{j,0} C_{j,0} \, dj + P_0 T_0 + \frac{1}{1+i} B = W_0 N_0 + \phi_0,$$

and at date 1 is

$$(1 + \tau_1) \int_0^1 P_{j,1} C_{j,1} \, dj + P_1 T_1 = W_1 N_1 + \phi_1 + B.$$

$P_{j,t}$ is the price of consumption variety j at date t, and $P_t = \left(\int_0^1 P_{j,t}^{1-\sigma} \right)^{1/(1-\sigma)} dj$ is the price index. The variable i is the nominal interest rate at date 0, B are nominal government bonds purchased by households at date 0, W_t is the nominal wage at date t, τ_t is a proportional consumption tax at date t, T_t is a lump sum tax at date t, and ϕ_t is the profit from firms owned by the households at date t. These profits are measured before price adjustment costs for reasons explained in the next section.

[12] We assume that the government can coordinate firm behavior by setting the price level via monetary policy. This is necessary since the model has a finite horizon with limited commitment and the price level needs to be pinned down in the final period.

[13] We consider balanced growth path preferences, as they imply a globally concave policy problem under flexible prices (i.e., a globally concave implementability condition). Our results extend to other preferences for which this is the case. The analog of Assumption 1 in Debortoli, Nunes, and Yared (2017) would be required in that case.

B. *Firms*

There is a continuum of mass 1 of firms, each indexed by j, corresponding to the variety produced by the firm. The production function is

$$N_{j,t} = C_{j,t} + G_{j,t}, \tag{2}$$

where $N_{j,t}$ represents the labor employed by firm j at date t. Firm profits before price adjustment costs at t equal

$$P_{j,t}\left(C_{j,t} + G_{j,t}\right) - W_t N_{j,t}. \tag{3}$$

At date 0, firms face quadratic price adjustment costs (as in Rotemberg (1982)) equal to

$$\frac{\alpha}{2}\left(P_{j,0} - 1\right)^2 P_0\left(C_0 + G_0\right), \tag{4}$$

so that deviations from a normalized price of 1 are costly for firms. This cost is proportional to aggregate nominal output $P_0\left(C_0 + G_0\right)$ and indexed by $\alpha > 0$, which parameterizes the degree of price stickiness. To faciliate exposition and with no bearing on our results, we assume that this cost corresponds to a transfer payment to workers. As such, the term ϕ_t in the household budget constraint corresponds to (3).

There are no price adjustment costs at date 1. Observe that the resource constraint of the economy requires that $\int_0^1 N_{j,t}\,dj = N_t$.

C. *Government*

The government budget constraint at date 0 is

$$\int_0^1 P_{j,0} G_{j,0}\,dj = \tau_0 \int_0^1 P_{j,0} C_{j,0}\,dj + P_0 T_0 + \frac{B}{1+i} \tag{5}$$

and at date 1 is

$$\int_0^1 P_{j,1} G_{j,1}\,dj = \tau_1 \int_0^1 P_{j,1} C_{j,1}\,dj + P_1 T_1 - B. \tag{6}$$

Government policy corresponds to the set $\left\{\left\{\left\{G_{j,t}\right\}_{j\in[0,1]}, \tau_t, T_t\right\}_{t=0,1}, B, i, P_0, P_1\right\}$. The government chooses varieties $G_{j,t}$ that are optimal conditional on G_t and prices $P_{j,t}$:

$$G_{j,t} = G_t\left(\frac{P_{j,t}}{P_t}\right)^{-\sigma}. \tag{7}$$

The value $B \in \left[0, \bar{B}\right]$ for some finite but arbitrarily large $\bar{B} > 0$. This upper bound on nominal debt can be thought of as being associated with the real natural debt limit in an extended environment where P_1 is stochastic, under the lowest potential value of P_1. Our environment thus corresponds to the special case where the noise around P_1 goes to zero.

We assume from hereon that taxes are exogenously set with

$$\tau_t = -\frac{1}{\sigma} \tag{8}$$

and

$$T_t = T + \frac{1}{\sigma} C_t \quad \text{for} \quad T < \mu(1-\mu)^{-\frac{1}{1+\varphi}}. \tag{9}$$

The assumption in (8) is standard in New Keynesian models as it is sufficient to guarantee the absence of monopoly distortions in equilibrium. Note that the upper bound on T in (9) is satisfied under high enough μ. We discuss the implications of these assumptions on fiscal policy in Section IID.

In our framework, the fiscal authority chooses government spending G_t and borrowing B and the monetary authority chooses the nominal interest rate i and the price levels P_0 and P_1. We discuss the strategic interaction between the two authorities in Section III.

II. Competitive Equilibrium

In this section, we define the necessary and sufficient conditions for a competitive equililibrium in which households and firms maximize their payoffs subject to their budget constraint given government policy. Using this characterization, we explain the implications of the assumptions on fiscal policy in (8) and (9).

A. *Household Optimality*

Optimal consumption across varieties implies that

$$C_{j,t} = C_t \left(\frac{P_{j,t}}{P_t}\right)^{-\sigma}. \tag{10}$$

Moreover, the household's intratemporal condition taking into account (8) is

$$C_t N_t^{\varphi} = \frac{\sigma}{\sigma - 1} \frac{W_t}{P_t}, \tag{11}$$

and the household's intertemporal condition is

$$1 = (1+i) \frac{P_0}{P_1} \frac{C_0}{C_1}. \tag{12}$$

B. *Firm Optimality*

At date 0, firms maximize profits given the production function (2), price adjustment cost (4), and demand (10). The date 0 firm problem can be written as

$$\max_{P_{j,0}} \left[(P_{j,0} - W_0) \left(\frac{P_{j,0}}{P_0}\right)^{-\sigma} - \frac{\alpha}{2} (P_{j,0} - 1)^2 P_0 \right] (C_0 + G_0).^{14}$$

[14] At date 0, dynamic considerations do not have to be made since all firms can change their prices flexibly at date 1.

The first-order conditions yield

$$\frac{W_0}{P_0} = \frac{\sigma - 1}{\sigma}\frac{P_{j,0}}{P_0} + \frac{\alpha}{\sigma}\left(\frac{P_{j,0}}{P_0}\right)^{\sigma+1}\big(P_{j,0} - 1\big)P_0. \tag{13}$$

Since all firms are identical, $P_{j,0} = P_0$, and this condition becomes

$$\frac{W_0}{P_0} = \frac{\sigma - 1}{\sigma} + \frac{\alpha}{\sigma}\big(P_0 - 1\big)P_0. \tag{14}$$

By analogous reasoning, first-order conditions at date 1, taking into account the absence of price adjustment costs, yield

$$\frac{W_1}{P_1} = \frac{\sigma - 1}{\sigma}. \tag{15}$$

C. *Aggregation*

We now characterize the allocations at date 0 and 1 as a function of policy. Since $C_{j,t} = C_t$, $G_{j,t} = G_t$, and $N_{j,t} = N_t$ for all j and t, equation (2) implies an aggregate resource constraint at $t = 0, 1$:

$$N_t = C_t + G_t. \tag{16}$$

Combining (14) and (15) with the intratemporal condition (11), taking into account (8), we achieve

$$C_0 N_0^{\varphi} = 1 + \frac{\alpha}{\sigma - 1}\big(P_0 - 1\big)P_0 \tag{17}$$

and

$$C_1 N_1^{\varphi} = 1. \tag{18}$$

By analogous reasoning, government budget constraints (5) and (6), taking into account (7), (8), and (9), can be rewritten as

$$G_0 = T + \frac{C_0}{C_1}\frac{B}{P_1} \tag{19}$$

and

$$G_1 = T - \frac{B}{P_1}. \tag{20}$$

We can use this aggregation to characterize necessary and sufficient conditions for a competitive equilibrium.

LEMMA 1: *Given* (8) *and* (9), *the set* $\big\{\{P_t, C_t, G_t, N_t\}_{t=0,1}, B, i\big\}$ *is a competitive equilibrium if and only if it satisfies* (12) *and* (16)–(20).

D. *Discussion of Assumptions*

The assumptions on taxes in (8) and (9) allow us to focus on monetary and fiscal interactions. To see why, it is useful to consider the first-best benchmark in the absence of price adjustment costs. Maximization of welfare (1) subject to the resource constraint (16) yields the first-best allocation, which admits $C_{j,t} = (1-\mu)^{\varphi/(1+\varphi)}$, $G_{j,t} = \mu(1-\mu)^{-1/(1+\varphi)}$, and $N_{j,t} = (1-\mu)^{-1/(1+\varphi)}$ for all j and t.

Observe that the first-best allocation can be implemented as a competitive equilibrium with $\tau_t = -1/\sigma$, $P_t = 1$, and $T_t = \mu(1-\mu)^{-1/(1+\varphi)} + (1/\sigma)(1-\mu)^{\varphi/(1+\varphi)}$ for $t = 0, 1$, with $B = 0$. Intuitively, the monopolistic power of firms results in a labor wedge, which can be undone with a consumption subsidy of $1/\sigma$. Moreover, lump sum taxes can be chosen so that total tax revenue net of the consumption subsidy equals the first-best level of government spending.[15]

Thus, the assumption on the value of τ_t in (8) implies that there is no role for monetary policy to undo monopoly distortions since tax rates have already been set to do so. Importantly though, the assumption on T_t in (9) implies that tax revenue is not large enough to support the first-best value of government spending, and this provides a role for monetary policy in supporting the fiscal policy goal of increasing spending.

More specifically, consider the following observations. First, note from (20) that if $B > 0$, then an increase in P_1 increases G_1. By devaluing the debt via inflation, the government can increase public spending. Observe further that because of the assumption in (9), this will increase G_1 toward the first-best level from below.

Second, observe that if $B = 0$, then $G_0 = G_1 = T$, where this follows from (19) and (20). This means that a spending increase at date 0 is infeasible without debt issuance. Note further that the solution that maximizes social welfare subject to the additional constraint that $G_0 = G_1 = T$ can be implemented with $P_0 = 1$. This means that in the absence of any public debt issuance, there is no social benefit from a monetary expansion that increases P_0 above 1. This follows from the assumption in (8) since absent this assumption, distortions due to monopoly power could be reduced with an increase in P_0.

Finally, observe that conditional on $B/P_1 > 0$, an increase in P_0 starting from $P_0 = 1$, holding C_1 and G_1 constant, increases G_0, which is beneficial if it is approaching the first-best level from below. More specifically, for a given $B/P_1 > 0$ and C_1, an increase in C_0 increases G_0 by increasing the right-hand side of (19). In other words, a stimulus to consumption C_0 reduces the gross real interest rate (which equals C_1/C_0), thus allowing for more government spending for a given value of real debt issuance. Moreover, note that an increase in the price level P_0 is an indirect consumption subsidy, which increases the right-hand side of (17), thus increasing C_0 and G_0. This is a useful observation for establishing our later results.

[15] By Ricardian equivalence, multiple combinations of T_t and B could potentially satisfy the government budget constraints in this case.

III. Strategic Monetary and Fiscal Interactions

We consider the following game between a fiscal authority and a monetary authority. The fiscal authority shares the same preferences as society ((1)). The monetary authority's welfare is

$$\sum_{t=0,1}\left\{(1-\lambda)\left[(1-\mu)\left(\log C_t - \frac{N_t^{1+\varphi}}{1+\varphi}\right) + \mu \log G_t\right] - \lambda H(P_t)\right\} \tag{21}$$

for $\lambda \in (0,1)$ and $H(\cdot) \geq 0$, which is strictly convex and satisfies $H(1) = H'(1) = 0$. The value of λ captures how committed the monetary authority is to price stability versus maximizing social welfare. If $\lambda = 0$, the monetary and fiscal authorities share the same preferences, and if $\lambda = 1$, the monetary authority only cares about minimizing inflation.[16]

Observe that given the values of B, P_0, and P_1, conditions (16)–(20) determine the allocations $\{C_t, G_t, N_t\}_{t=0,1}$. This means that the fiscal authority's and monetary authority's welfare ((1) and (21)) are determined by B, P_0, and P_1.

Taking this into account, we consider a game with the following sequence of events:

(i) The fiscal authority chooses B.

(ii) The monetary authority chooses P_0.

(iii) The date 0 market opens and clears.

(iv) The monetary authority chooses P_1.

(v) The date 1 market opens and clears.

An important feature of this environment is that the monetary authority lacks commitment. It is unable to precommit to monetary policy before fiscal policy is chosen at date 0. Moreover, it is unable to precommit to the price level at date 1 until after date 0 policies are chosen and the date 0 market has opened and cleared.[17] This is an important feature for generating the main insights of this model.[18,19]

[16] Without loss of generality, we can replace the monetary authority's inflation cost with $H(P_t - P_{t-1})$, so that its disutility is a function of price changes versus price levels. This is equivalent to our formulation at date 0 since $P_0 - P_{-1} = P_0 - 1$. But it may not be equivalent at date 1 since $P_1 - 1$ may not equal $P_1 - P_0$. However, because prices are flexible at date 1, this normalization has no bearing on our results.

[17] Observe that we have ignored the fiscal authority's decision at date 1 since it is implied by the government budget constraint at date 1.

[18] If, instead, the monetary authority chooses the price level before the fiscal authority chooses debt, the equilibrium policies change, but our main results regarding comparative statics on λ around the extremes do not change. If, instead, the monetary and fiscal authorities move simultaneously, then multiple equilibria emerge.

[19] We let the central bank choose the price level at date 0 in order to have a symmetric set of tools across dates. An equivalent formulation has the central bank choose the nominal interest rate i at date 0.

IV. Main Results

We use backward induction to characterize optimal policies chosen by the monetary and fiscal authorities. We then use this analysis to describe the equilibrium under extreme monetary bias. Finally, we describe policies under intermediate monetary bias for an analytical example.

A. *Characterization by Backward Induction*

Monetary Policy at Date 1.—At date 1, the monetary authority takes B as given as it solves the following program:

$$\max_{C_1, G_1, N_1, P_1} \left\{ (1-\lambda)\left[(1-\mu)\left(\log C_1 - \frac{N_1^{1+\varphi}}{1+\varphi}\right) + \mu \log G_1\right] - \lambda H(P_1)\right\} \tag{22}$$

subject to (16), (18), and (20).

The solution to the relaxed problem that ignores (18) achieves the first-order condition with respect to G_1,

$$-(1-\mu)N_1^{\varphi} + \mu \frac{1}{G_1} = \frac{\lambda}{1-\lambda} H'\left(\frac{B}{T-G_1}\right)\frac{B}{(T-G_1)^2}, \tag{23}$$

and also satisfies (18).[20] Therefore, policy at date 1 is characterized by (16), (18), (20), and (23).

LEMMA 2: *The solution to* (22) *has the following properties:*

(*i*) *An increase in B increases P_1 and decreases G_1.*

(*ii*) *An increase in λ decreases P_1 and decreases G_1.*

If the inherited debt is higher, this tightens the government budget constraint and results in lower levels of government spending for a given price level. As such, the central bank is more motivated to devalue the debt via inflation if the debt is higher.

Since B is bounded from above by $\bar{B} > 0$, G_1 is bounded from below by $\underline{G}_1(\lambda)$, which is the value of G_1 that solves (22) for $B = \bar{B}$. Note that $\lim_{\lambda \to 1} \underline{G}_1(\lambda) = 0$ and $\lim_{\lambda \to 0} \underline{G}_1(\lambda) = T$. Intuitively, if $\lambda = 1$, the central bank is very hawkish and does not tolerate any inflation. It will choose $P_1 = 1$ for any value of B, and the level of spending therefore is bounded from below by the nonnegativity limit.[21] In contrast, if $\lambda = 0$, then the central bank is very dovish and will choose $P_1 = \infty$ if $B > 0$, and debt therefore is fully inflated away and the budget is always balanced.

[20] This is because it is optimal to have zero intratemporal distortions conditional on the level of government spending (which is determined by the price level).

[21] Note in that case that if $\bar{B} > T$, then the choice of $B = \bar{B}$ at date 0 is equivalent to $B = T$, so that the date 0 government does not need to consider values of B that exceed T.

There are two important observations. First, note that for the fiscal authority, choosing B at date 0 is equivalent to choosing G_1 directly, subject to the constraint that $G_1 \geq \underline{G}_1(\lambda)$, and taking into account that C_1 and N_1 will be determined according to (16) and (18) given G_1.[22] For the remainder of our analysis, it will be useful for us to consider the fiscal authority as choosing G_1 directly, recognizing that higher values of G_1 are associated with lower choices of B. With that in mind, let us define $C_1^*(G_1)$ and $N_1^*(G_1)$ as the values of C_1 and N_1 that satisfy (16) and (18) given G_1.

Second, note that the monetary authority's policy at date 0 will have no effect on the monetary authority's policy at date 1 since the latter will be fully determined by the level of debt B chosen by the fiscal authority at date 0. Thus, the monetary authority at date 0 focuses on maximizing date 0 welfare.

Monetary Policy at Date 0.—At date 0, the monetary authority takes the choice of B and therefore G_1 and the implied P_1 from (23) as given. To facilitate the analysis, note that (19) and (20) can be combined to yield

$$\frac{T - G_0}{C_0} + \frac{T - G_1}{C_1} = 0. \tag{24}$$

The monetary authority thus solves the following problem:

$$\max_{C_0, G_0, N_0, P_0} \left\{ (1-\lambda)\left[(1-\mu)\left(\log C_0 - \frac{N_0^{1+\varphi}}{1+\varphi}\right) + \mu \log G_0\right] - \lambda H(P_0) \right\} \tag{25}$$

$$\text{subject to (16), (17), (24), } C_1 = C_1^*(G_1), \text{ and } N_1 = N_1^*(G_1).$$

Observe that the value of G_1 that constrains this program maps directly into the value of real debt B/P_1, which the central bank at date 0 takes as given. We now characterize the optimal monetary policy at date 0.

LEMMA 3: *The solution to* (25) *has the following properties:*

(*i*) *If* $B/P_1 = 0$, *then* $P_0 = 1$.

(*ii*) *There exists* $\upsilon > 0$ *such that* $P_0 > 1, \forall B/P_1 \in (0, \upsilon)$.

(*iii*) P_0 *is locally decreasing in* $\lambda, \forall B/P_1 \in (0, \upsilon)$.

If $B/P_1 = 0$, there is no value from monetary stimulus for the central bank since this would increase labor and consumption with no impact on government spending given that the budget is balanced. In contrast, starting from $B/P_1 > 0$, the monetary authority may wish to expand monetary policy because increasing P_0 is an indirect labor subsidy. It results in higher aggregate demand for goods, which stimulates firm demand for workers and which boosts wages, resulting in

[22] The implied value of P_1 determined by (23) is payoff irrelevant for the date 0 fiscal authority, which places no weight on date 1 inflation.

higher consumption and labor. Since households now face higher consumption at date 0 versus date 1, real interest rates faced by the fiscal authority decline, allowing for an increase in government spending toward the efficient level. Observe that the extent to which the central bank will accommodate the fiscal stimulus depends on its level of hawkishness, with more hawkish central banks accommodating the stimulus by less. Define by $\{C_0^*(G_1), G_0^*(G_1), N_0^*(G_1), P_0^*(G_1)\}$ the central bank's strategy at date 0.

Fiscal Policy at Date 0.—The fiscal authority at date 0 takes as given the strategy of the date 0 monetary authority $\{C_0^*(G_1), G_0^*(G_1), N_0^*(G_1), P_0^*(G_1)\}$ and the strategy of the date 1 monetary authority $\{C_1^*(G_1), G_1^*(G_1)\}$, and it solves the following program:

$$\max_{G_1}\left\{(1-\mu)\left[\log\left(C_0^*(G_1)\right) - \frac{N_0^*(G_1)^{1+\varphi}}{1+\varphi}\right] + \mu\log\left(G_0^*(G_1)\right) + (1-\mu)\left[\log C_1^*(G_1) - \frac{N_1^*(G_1)^{1+\varphi}}{1+\varphi}\right] + \mu\log G_1\right\} \tag{26}$$

subject to

$$G_1 \in \left[\underline{G}_1(\lambda), T\right]. \tag{27}$$

Given the reaction functions of the date 0 and date 1 central banks, the fiscal authority decides on how to allocate government spending between dates 0 and 1.

B. *Extreme Bias*

We now present the main result of the paper.

PROPOSITION 1: *There exists $\bar{\lambda}, \underline{\lambda} \in (0,1)$ with $\bar{\lambda} > \underline{\lambda}$ such that, in equilibrium,*

(*i*) *if $\lambda > \bar{\lambda}$, then B/P_1 is weakly decreasing in λ, and $B/P_1 \to 0$ as $\lambda \to 1$, and*

(*ii*) *if $\lambda < \underline{\lambda}$, then B/P_1 is weakly increasing in λ, and $B/P_1 \to 0$ as $\lambda \to 0$.*

To understand this result, suppose that $\lambda = 1$, so that the central bank is extremely hawkish and $P_0 = P_1 = 1$. Then there is no value for the fiscal authority from debt issuance since issuing debt would tilt government spending toward date 0 while taking away from government spending at date 1 on a one-for-one basis, where this follows from the fact that the economy is identical in the two periods and households value consumption identically across periods. Given that government spending enters symmetrically across dates in the fiscal authority's welfare, it is optimal to not borrow and to smooth government spending across periods.

In contrast, suppose that $\lambda = 0$. In the face of an extremely dovish central bank at date 0, the fiscal authority values fiscal stimulus because it knows that a dovish central bank will accommodate the stimulus and maximize social welfare. However, the central bank is also dovish at date 1 and suffers from lack of commitment, and the private sector anticipates that the central bank will devalue the debt at date 1. Therefore, nominal interest rates for any debt issues are infinity, making it impossible for the central bank to issue any debt and engage in fiscal stimulus. Therefore, even though it would be optimal for the fiscal authority to borrow, it is unable to.

To see what this means for comparative statics, consider a situation in which λ is close to 1 and the government is borrowing with $B/P_1 > 0$. Then a marginal increase in λ reduces B/P_1. A higher anti-inflation bias makes the benefit to the fiscal authority from stimulus lower since the stimulus is less accommodated by the central bank. This reduces the incentive to issue debt, which results in lower stimulus and lower inflation through P_0. Intuitively, the value of $\underline{G}_1(\lambda)$ in the fiscal authority's program in (26)–(27) is not binding, which means that the main consideration for the fiscal authority is the extent to which the monetary authority will accommodate the stimulus at date 0.

In contrast, consider a situation in which λ is close to 0 with $B/P_1 > 0$. A marginal increase in λ increases B/P_1. This is because a higher anti-inflation bias increases debt capacity since the central bank is more committed to not devaluing the debt in the future. This facilitates the issuance of debt for the fiscal authority, which results in greater stimulus. This comparative static stems from the lack of commitment of the central bank. The marginally more hawkish central bank would like to commit to either accommodating the stimulus by less at date 0 or to devaluing the debt by more at date 1 in order to dissuade fiscal stimulus. However, it is unable to do so.

C. *Analytical Example*

To facilitate analysis away from the extremes, we can consider a special case, where

$$(28) \quad \mu \to 1, \quad \varphi = 0, \quad \text{and} \quad H(P) = \frac{\kappa}{2}\big[P(P-1)\big]^2 \quad \text{for some} \quad \kappa > 0.^{23}$$

Under this formulation, a desire to increase government spending dominates social welfare considerations in (1) since $\mu \to 1$.[24] Moreover, labor is perfectly elastic, which means that (17) and (18) become

$$(29) \qquad C_0 = 1 + \frac{\alpha}{\sigma - 1}(P_0 - 1)P_0 \quad \text{and} \quad C_1 = 1.$$

Date 0 consumption C_0 is proportional to monetary policy expansion P_0, whereas C_1 is constant. As such, the gross real interest rate equals C_0^{-1} and is decreasing in C_0 and P_0. Observe further that (24) taking into account (29) yields

$$G_0 = T + C_0(T - G_1).$$

[23] This example can be solved analytically. We have computed the model under different parameterizations and achieved similar nonmonotonic effects of anti-inflation bias on debt issuance. Details available upon request.

[24] This assumption means that the fiscal authority under $\mu = 1$ prefers maximal inflation at date 0 if $G_1 < T$, which is not the case in our benchmark model where $\mu < 1$ since inflation has direct costs on social welfare through subsidization of labor.

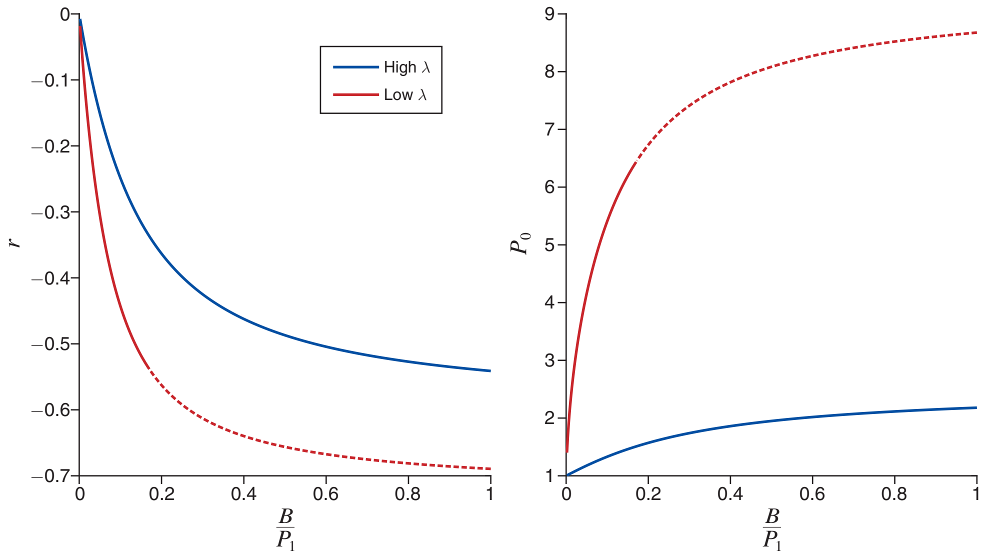

Figure 1. Impact of Debt Issuance on Real Interest Rates and Inflation

Notes: This figure represents the date 0 central bank's reaction function conditional on the fiscal authority's real debt issuance B/P_1 in the analytical example. The left panel represents the real interest rate r. The right panel represents the price level P_0. These are drawn for high and low levels of central bank hawkishness λ. The dotted line corresponds to debt levels that exceed the economy's endogenous debt capacity conditional on λ.

Finally, observe that $H(P_0)$ is equal to $\kappa\left[(\sigma-1)/\alpha\right]^2(C_0-1)^2/2$. These observations imply that the central bank's problem at date 0 in (25) can be represented as

$$(30) \qquad \max_{C_0}\left\{(1-\lambda)\log\left(T+C_0(T-G_1)\right)-\lambda\kappa\left(\frac{\sigma-1}{\alpha}\right)^2(C_0-1)^2/2\right\}.$$

Figure 1 displays the central bank's reaction function in the solution to (30) and what it implies for how the real interest rate $r = C_0^{-1}$ and inflation P_0 depend on a hypothetical value of issued real debt B/P_1 (which is inversely related with the level of spending G_1). Observe that as the level of real debt increases, so does the degree of central bank accommodation, with lower real interest rates C_0^{-1} and higher levels of inflation P_0.[25] Importantly, the extent of accommodation depends on the anti-inflation bias λ. For a given level of real debt issuance, real interest rates are higher and the price level is lower the more hawkish the central bank. Moreover, a more hawkish central bank is less acommodative on the margin as debt increases relative to a less hawkish one. However, note that a more acommodative central bank also makes a higher level of real debt issuance infeasible by limiting debt capacity. These observations lead to the following proposition.

[25] The negative response of real interest rates to debt issuance is driven by the quasi linearity in this setting. Without this assumption, real interest rates can increase in response to debt issuance, with a smaller increase under a more dovish central bank.

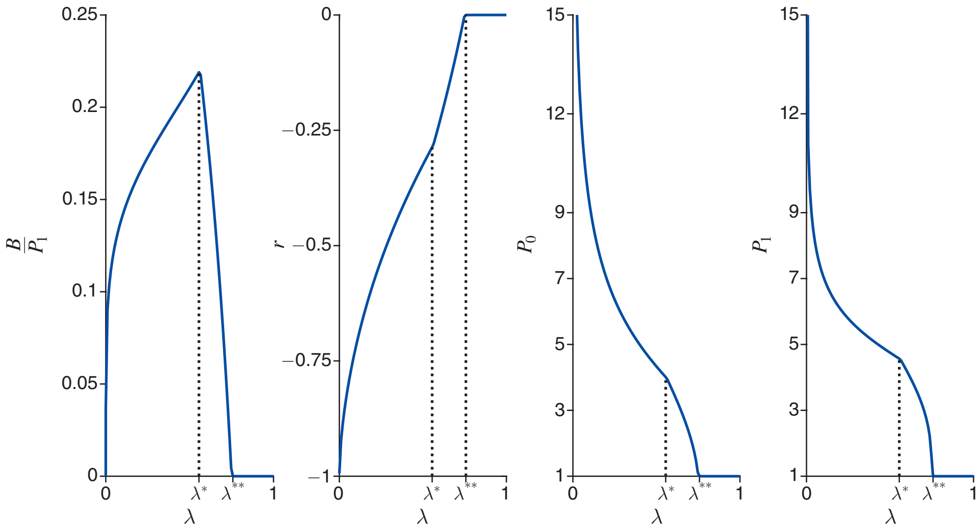

Figure 2. Equilibrium Debt Issuance and Inflation

Note: This figure represents the equilibrium as a function of central bank hawkishness λ in the analytical example. The first panel represents real debt issuance B/P_1. The second panel represents the real interest rate r. The third panel represents the date 0 price level P_0. The fourth panel represents the date 1 price level P_1.

PROPOSITION 2: *Consider an economy under condition* (28)*. In equilibrium,* $\exists \lambda^*, \lambda^{**} \in (0,1)$ *with* $\lambda^{**} > \lambda^*$ *such that*

(*i*) *if* $\lambda < \lambda^*$, *then* B/P_1 *is strictly increasing in* λ,

(*ii*) *if* $\lambda \in (\lambda^*, \lambda^{**})$, *then* B/P_1 *is strictly decreasing in* λ, *and*

(*iii*) *if* $\lambda > \lambda^{**}$, *then* $B/P_1 = 0$.

Figure 2 displays the result of Proposition 2 graphically. If $\lambda > \lambda^*$, the constraint that $G_1 \geq \underline{G}_1(\lambda)$ is not binding for the fiscal authority, so it is unconstrained in its borrowing. An increase in the anti-inflation bias of the central bank reduces the benefit from debt issuance since the central bank accommodates stimulus by less with a higher real interest rate. Once the bias becomes high enough with $\lambda > \lambda^{**}$, there is no further benefit from debt issuance. By contrast, if $\lambda < \lambda^*$, the constraint that $G_1 \geq \underline{G}_1(\lambda)$ is binding, and a marginal increase in the anti-inflation bias increases real debt capacity and relaxes the borrowing limit of the fiscal authority, resulting in more real debt issuance. Figure 2 also displays the effect of central bank hawkishness on inflation through P_0 and P_1. Higher values of λ cause both P_0 and P_1 to decline; a more hawkish central bank results in more price stability.[26]

[26] We can also show that an increase in price flexibility (reduction in α) or increase in competition (increase in σ) both increase λ^*. Both of these factors increase the central bank's incentives to increase inflation P_0 conditional on the level of hawkishness λ, as they imply a larger decline in real interest rates C_0^{-1} for any given level of inflation P_0. Thus, the central bank has more scope for stimulating the economy at little cost to inflation. Because a fiscal authority expecting a more expansionary central bank is more likely to be debt constrained, the value of λ^* increases.

This example helps to highlight the role of the key frictions in the model. First, the fiscal authority, which shares the preferences of society, has preferences that are misaligned with those of the central bank.[27] Second, the central bank lacks commitment. Clearly, in the presence of only one friction, social welfare would be enhanced by removal of that friction. But it is also true that social welfare can be enhanced by the introduction of the second friction. For example, a hawkish central bank would like to commit at date 0 to inflating away the debt at date 1 in order to prevent the fiscal authority from borrowing at date 0. However, it is unable to do so due to lack of commitment, and this lack of commitment results in higher date 0 borrowing capacity, which raises social welfare. Analogously, in the face of a central bank without commitment, the fiscal authority prefers a central bank that is misaligned since central bank hawkishness reduces date 1 inflation and enhances date 0 borrowing capacity.[28]

V. Concluding Remarks

We have presented a model of monetary and fiscal interactions in which the effect of central bank hawkishness on fiscal outcomes is nonlinear. The model allows for an interpretation of different historical episodes, and a natural next step for future research is a systematic empirical analysis combined with a quantification of the model in a dynamic environment. Such an analysis is challenging, as it would require solving a dynamic game—with monetary and fiscal state variables—between the monetary and fiscal authority.

Our model has three important implications for the implementation of monetary reform, where monetary reform can be interpreted as an increase in the central bank's inflation aversion. First, if the government is constrained in its ability to borrow by the market's expectation of debt devaluation, monetary reform should not be pursued in a vacuum if greater fiscal responsibility is socially desirable. Monetary reform should be paired with fiscal reform such as the adoption of credible fiscal rules in order to prevent the deterioration of fiscal discipline. Such reforms would lead to a simultaneous improvements in monetary credibility and fiscal discipline, which reinforce each other.

A second implication of our model is that the degree of political support for monetary reform will depend both on the government's current monetary framework and its fiscal goals.[29] Support for monetary reform by the fiscal authority can be viewed as support for the ensuing expanded debt capacity. In contrast, backlash against monetary reform can be viewed as disapproval of the anticipated undoing of fiscal stimulus by the central bank.

A final consequence of our model is a conundrum that results from the first and second implications: support from policymakers for monetary reform is greatest

[27] A large body of work considers fiscal authorities with preferences that are not the same as society's. See Yared (2019) for a survey.

[28] This preference for misalignment would not be present if inflation-indexed debt were available since, in that case, the central bank's lack of commitment at date 1 would not be pertinent anymore, given that devaluing the debt with inflation is no longer feasible. As such, the fiscal authority is never debt constrained in such a framework, and higher central bank hawkishness always leads to lower debt issuance.

[29] For interior values of μ, the fiscal authority in our model prefers a central bank with an intermediate degree of hawkishness because such a central bank allows for some government borrowing and some accommodation of fiscal stimulus.

in environments where it is least effective. The government, in particular the fiscal authority, is inclined toward appointing a more conservative central banker when the direct effect on inflation reduction is partly offset by the indirect effect due to a loosening of the government's borrowing constraint, which in turn raises the central bank's incentive to generate inflation.

REFERENCES

Adam, Klaus, and Roberto M. Billi. 2008. "Monetary Conservatism and Fiscal Policy." *Journal of Monetary Economics* 55 (8): 1376–88.

Aguiar, Mark, Manuel Amador, Emmanuel Farhi, and Gita Gopinath. 2015. "Coordination and Crisis in Monetary Unions." *Quarterly Journal of Economics* 130 (4): 1727–79.

Alvarez, Fernando, Patrick J. Kehoe, and Pablo Andrés Neumeyer. 2004. "The Time Consistency of Optimal Monetary and Fiscal Policies." *Econometrica* 72 (2): 541–67.

Azzimonti, Marina, Marco Battaglini, and Stephen Coate. 2016. "The Costs and Benefits of Balanced Budget Rules: Lessons from a Political Economy Model of Fiscal Policy." *Journal of Public Economics* 136: 45–61.

Barro, Robert J., and David B. Gordon. 1983. "Rules, Discretion and Reputation in a Model of Monetary Policy." *Journal of Monetary Economics* 12 (1): 101–21.

Bianchi, Francesco, Renato Faccini, and Leonardo Melosi. 2023. "A Fiscal Theory of Persistent Inflation." *Quarterly Journal of Economics* 138 (4): 2127–79.

Bianchi, Francesco, and Cosmin Ilut. 2017. "Monetary/Fiscal Policy Mix and Agents' Beliefs." *Review of Economic Dynamics* 26: 113–39.

Board of Governors of the Federal Reserve System. 2020. *Review of Monetary Policy Strategy, Tools, and Communications*. Washington, DC: Board of Governors of the Federal Reserve System.

Bouton, Laurent, Alessandro Lizzeri, and Nicola Persico. 2020. "The Political Economy of Debt and Entitlements." *Review of Economic Studies* 87 (6): 2568–99.

Calvo, Guillermo A. 1978. "On the Time Consistency of Optimal Policy in a Monetary Economy." *Econometrica* 46 (6): 1411–28.

Chari, Varadarajan V., and Patrick J. Kehoe. 2007. "On the Need for Fiscal Constraints in a Monetary Union." *Journal of Monetary Economics* 54 (8): 2399–408.

Cochrane, John H. 2023. *The Fiscal Theory of the Price Level*. Princeton, NJ: Princeton University Press.

Debortoli, Davide, Ricardo Nunes, and Pierre Yared. 2017. "Optimal Time-Consistent Government Debt Maturity." *Quarterly Journal of Economics* 132 (1): 55–102.

Dixit, Avinash, and Luisa Lambertini. 2003. "Interactions of Commitment and Discretion in Monetary and Fiscal Policies." *American Economic Review* 93 (5): 1522–42.

Dovis, Alessandro, and Rishabh Kirpalani. 2020. "Fiscal Rules, Bailouts, and Reputation in Federal Governments." *American Economic Review* 110 (3): 860–88.

Fatás, Antonio, and Andrew K. Rose. 2001. "Do Monetary Handcuffs Restrain Leviathan? Fiscal Policy in Extreme Exchange Rate Regimes." *IMF Staff Papers* 47 (005): 40–61.

Frieden, Jeffry A. 2018. "Making Commitments: France and Italy in the European Monetary System, 1979–1985." In *The Political Economy of European Monetary Unification*, edited by Barry Eichengreen and Jeffry A. Frieden, 23–47. Boulder, CO: Westview Press.

Halac, Marina, and Pierre Yared. 2014. "Fiscal Rules and Discretion under Persistent Shocks." *Econometrica* 82 (5): 1557–614.

Halac, Marina, and Pierre Yared. 2018. "Fiscal Rules and Discretion in a World Economy." *American Economic Review* 108 (8): 2305–34.

Halac, Marina, and Pierre Yared. 2022. "Fiscal Rules and Discretion under Limited Enforcement." *Econometrica* 90 (5): 2093–127.

Jalles, Joao Tovar, Carlos Mulas-Granados, and José Tavares. 2021. "Fiscal Discipline and Exchange Rates: Does Politics Matter?" *Scottish Journal of Political Economy* 68 (2): 155–78.

Kydland, Finn E., and Edward C. Prescott. 1977. "Rules Rather than Discretion: The Inconsistency of Optimal Plans." *Journal of Political Economy* 85 (3): 473–92.

Leeper, Eric M. 1991. "Equilibria under 'Active' and 'Passive' Monetary and Fiscal Policies." *Journal of Monetary Economics* 27 (1): 129–47.

Leeper, Eric M., and Campbell Leith. 2016. "Understanding Inflation as a Joint Monetary-Fiscal Phenomenon." In *Handbook of Macroeconomics*, Vol. 2, edited by John B. Taylor and Harald Uhlig, 2305–415. Amsterdam: Elsevier.

Orphanides, Athanasios. 2018. "Independent Central Banks and the Interplay between Monetary and Fiscal Policy." *International Journal of Central Banking* 14 (3): 447–70.

Politi, James, and Colby Smith. 2020. "Fed Urged to Back Up New Dovish Policy with Action." *Financial Times*, September 14, 2020. https://www.ft.com/content/d2fd2c05-80ac-4a91-b1f5-e77abfc17318.

Ricardo, David. 1824. *Plan for the Establishment of a National Bank*. London: John Murray.

Rogoff, Kenneth. 1985. "The Optimal Degree of Commitment to an Intermediate Monetary Target." *Quarterly Journal of Economics* 100 (4): 1169–89.

Rotemberg, Julio J. 1982. "Monopolistic Price Adjustment and Aggregate Output." *Review of Economic Studies* 49 (4): 517–31.

Sargent, Thomas J., and Neil Wallace. 1981. "Some Unpleasant Monetarist Arithmetic." *Federal Reserve Bank of Minneapolis Quarterly Review* 5 (3): 1–17.

Schreger, Jesse, Pierre Yared, and Emilio Zaratiegui. 2024. *Data and Code for: "Central Bank Credibility and Fiscal Responsibility."* Nashville, TN: American Economic Association; distributed by Inter-university Consortium for Political and Social Research, Ann Arbor, MI. https://doi.org/10.3886/E196521V1.

Sims, Christopher A. 2016. "Fiscal Policy, Monetary Policy and Central Bank Independence." In *Designing Resilient Monetary Policy Frameworks for the Future*, edited by Esther L. George, 313–25. Jackson Hole, WY: Federal Reserve Bank of Kansas City.

Tornell, Aarón, and Andrés Velasco. 1995. "Fiscal Discipline and the Choice of Exchange Rate Regime." *European Economic Review* 39 (3–4): 759–70.

Tornell, Aarón, and Andrés Velasco. 1998. "Fiscal Discipline and the Choice of a Nominal Anchor in Stabilization." *Journal of International Economics* 46 (1): 1–30.

Woodford, Michael. 1998. "Control of the Public Debt: A Requirement for Price Stability?" In *The Debt Burden and Its Consequences for Monetary Policy*, edited by Guillermo Calvo and Mervyn King, 117–58. London: Springer Macmillan.

Yared, Pierre. 2019. "Rising Government Debt: Causes and Solutions for a Decades-Old Trend." *Journal of Economic Perspectives* 33 (2): 115–40.