Fiscal Strength within a Framework of Institutional Independence

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Abstract

This paper develops a theoretical framework in which fiscal and monetary authorities interact strategically to determine tax, inflation, and debt policy. A tax-minimizing debt-manager and inflation-minimizing central bank operate non-cooperatively constrained by government solvency, household optimization, and each other's choices. Greater fiscal strength, measured as debt-manager bargaining power, leads to higher inflation and lower taxes. I impute American post-war fiscal strength and compare it with data on presidential pressure on the Fed, finding the two generally move in tandem. When compared with first-best, U.S. fiscal policy was too strong in the 1970s and has been too weak since 2008, largely because surprise inflation is more effective at financing highly indebted governments.

Keywords: Fiscal policy, Monetary policy, Central bank independence, Nash bargaining, U.S. macroeconomic policy.

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1 Introduction

America's monetary and fiscal architecture has remained remarkably consistent since the 1951 Treasury-Fed Accord, yet the individuals directing these institutions are ever-changing. Presidents and high-ranking Federal Reserve (Fed) officials alike bring ideologies concerning how Congressional and Fed policies should jointly shape the country's economic backdrop. As part of his 2024 presidential campaign, Donald Trump released his vision for the future of this relationship, endorsing that, "Congress should limit [the Fed's] mandate to the sole objective of stable money" and stating, "I feel that the president should have at least [a] say in [making interest rate decisions]."[1]

Many theoretical models exist separating fiscal and monetary policy within a competitive, general equilibrium setting, beginning with work by Sargent and Wallace (1981). The Fiscal Theory of the Price Level (FTPL) initially developed by Leeper (1991), Sims (1994) and Woodford (1995) characterizes distinct regimes where fiscal and monetary policy commit to follow rules in an economy with nominal government debt. Models by Dixit and Lambertini (2003), Gnocchi (2013) and Gnocchi and Lambertini (2016) iterate on FTPL by assuming monetary and fiscal policies engage in non-cooperatively optimal policy unrestricted by a rules framework, pinning down unique subgame-perfect equilibria through discrepancies in institutions' abilities to commit. Work by Chen, Leeper, and Leith (2021) combines non-cooperation with FTPL by including Markov switching and policy non-cooperation within a policy rules framework. Yet, a common and persistent challenge exists throughout the literature: reconciling high U.S. inflation during periods of low and stable government indebtedness, as in the 1970s, and low U.S. inflation during periods of high and rising government indebtedness, as in the 2010s.

This paper develops a theory of fiscal and monetary non-cooperation where a unique equilibrium is determined by fiscal policy's strength relative to monetary policy. An inflation-targeting central bank and tax-minimizing debt-manager operate within an economy similar to that in Lucas and Stokey's (1983) model but with nominal debt. Policy authorities simultaneously commit to state contingent plans that maximize their own institution-specific payoffs resulting in a one-shot game. Equilibrium satisfies requirements for a competitive equilibrium outlined by Barro (1979) and Lucas and Stokey (1983) and a Nash equilibrium introduced by Nash (1951). I select a unique equilibrium

[1]See Chapter 24 of *Project 2025* by Winfree (2024) and the *Wall Street Journal*'s 4/26/2024 article by Restuccia, Timmons, and Leary (2024).

from the resulting continuum using Harsanyi and Selten's (1972) asymmetric Nash bargaining concept and interpret the bargaining parameter as a measure of fiscal strength.

Given inherited debt and a stochastic stream of current and future government spending, the debt-manager chooses a plan for labor-distorting taxes and fiscally-issued debt while the central bank chooses a plan for costly inflation and monetarily-demanded debt. Households hold the difference of fiscal and monetary debt portfolios once markets clear. Given one institution's plan and optimal household consumption, labor supply and savings behavior, the other institution must satisfy government solvency along an individually-optimal policy path.

The government must be financed somehow, introducing a fundamental trade-off. Surprise inflation devalues debt to keep taxes low while distortionary taxes raise real revenues to keep inflation low. The central bank selects the zero-inflation equilibrium when it has unilateral control of government policy. The debt-manager selects a tax-minimizing equilibrium with arbitrarily high inflation when it has unilateral control of government policy. If only one of these government branches exists in the economy, households improve welfare by institutionalizing the other.

A Ramsey planner selects the tax/inflation financing mix that maximizes household welfare. The planner calls for an interior solution: one with non-zero inflation and non-minimized tax rates. The Ramsey plan is achievable under a non-cooperative government when fiscal strength is low, echoing a chorus of work supporting strong, independent monetary policy like that by Alesina (1988), Grilli, Masciandaro, and Tabellini (1992), and Alesina and Summers (1993).

Recent work by Drechsel (2024) uncovers historical data on meetings between U.S. presidents and Fed officials and compares them to U.S. inflation outcomes, positing that presidents meet with Fed officials to pressure them into reducing rates. Drechsel supports this claim by finding a causal link between the meetings President Richard Nixon (1969–1974) held with Fed officials in 1971 during Fed Chair Arthur Burns's (1970–1978) tenure and a decrease in the Fed Funds rate, calling such an event a 'political pressure shock.'

It is not entirely clear what a political pressure shock looks like in a DSGE model as compared with a monetary or fiscal policy shock, for instance. If political pressure exists in the meeting rooms of high-ranking policymakers and affects macroeconomic variables like the Fed's policy rate, a theory that specifies this pressure may be useful. Additionally, such a theory may be the *only* way to identify political pressure going forward as presidential meeting agendas are no longer available to the public. I consider this paper's notion of fiscal strength the theoretical counterpart to Drechsel's empirical political pressure concept.

To show the relationship between the two, I solve this paper's model in every year from 1943–2023 given American data on privately-held debt and spending, and I impute the implicit amount of fiscal strength required for the model to match realized U.S. inflation rates each year. I compare the imputed fiscal strength time series with that of hours presidents spent with Fed officials in meetings each year from 1943–2008 (hours data end in 2008). The time series line up especially well from 1952, the year after the Treasury-Fed Accord, until 1975 and again from 1983 until 2008.[2] Both datasets exhibit two major upward spikes between 1971–1981. Imputed fiscal strength remains low until post-COVID inflation arrives in 2021.

For further comparison, I calculate average imputed fiscal strength and average annual meeting hours by presidential and Fed chair term over the same time frame, finding a positive relationship between the number of hours presidents and Fed chairs spent in meetings and the amount of imputed fiscal strength they experienced during their time in office.

Another question the paper answers is normative: when was American fiscal policy 'too strong' and when was it 'too weak?'[3] Given U.S. debt and spending data each year from 1943–2023, I calculate the amount of fiscal strength that implements the model's Ramsey plan each year and compare it with imputed fiscal strength. Imputed and first-best fiscal strengths line up well from the beginning of the sample until the late-1960s and again from the mid-1980s until the Great Financial Crisis (GFC) in 2008. I find that fiscal policy was too strong throughout the 1970s and has been too weak since the GFC. The key piece of intuition is that surprise inflation is a more powerful financing tool in high-debt economies than low-debt ones, while imposing similar welfare costs on households in both. Debt-to-GDP remained between 20%-30% in the 1970s while inflation soared: high inflation financed a large portion of a small debt stock. Government debt spiked in 2008 and rose to more than 80% by 2015 while inflation remained below the Fed's 2% target: low surprise inflation financed a small amount of a large debt stock. The COVID spike in fiscal strength and corresponding inflation better approximated the model planner's solution because such an inflation greatly reduced tax distortions the government would otherwise need to levy.

[2]Hours fall in the late 70s while fiscal strength remains high until 1982.
[3]Too strong and too weak compared to what the planner would choose if at America's helm that year.

Greenwood et al. (2015) argue the Treasury partially neutralized Fed QE after the GFC through longer newly-issued debt. Miran and Roubini (2024) claim the Treasury offset the Fed's post-COVID quantitative tightening efforts by issuing large amounts of short-term debt. The final set of exercises in the paper examines how a maturity structure of government debt interacts with fiscal and monetary non-cooperation.

I find that replacing one-period inherited debt with one- and two-period inherited debt matching the average privately-held U.S. debt structure from 1942–2022 results in a debt savings analogous to $247B (in 2024 dollars) along the Ramsey plan. When the market value of inherited debt can be devalued through commitments about future policy, the government can better smooth tax and inflation policy over time increasing welfare as in models by Lustig, Sleet, and Yeltekin (2008), Debortoli, Nunes, and Yared (2017), Faraglia et al. (2019) and Leeper and Zhou (2021), among others.

Finally, long-term government debt provides better insurance against monetary-fiscal non-cooperation. Given two welfare-equivalent economies along their respective Ramsey plans, one with a maturity structure and one without, deviations from the Ramsey plan (in both directions) are more welfare-reducing in the economy without a maturity structure. A debt structure allows for even a weak fiscal or monetary policymaker to better smooth its own financing tool.

This paper offers four main contributions. First, it develops a theory by which intra-governmental bargaining power determines a unique equilibrium under individually-optimizing fiscal and monetary policy, providing a measure of fiscal strength relative to monetary policy. Second, it reconciles theoretical underpinnings of new and exciting empirical data and offers a way to extend that data to present day. Third, it gives a glimpse into the history of fiscal and monetary interaction in post-war America and compares those interactions to a normative standard. Fourth, it explores how the maturity structure of government debt can be used as insurance against non-cooperative policy away from first-best, when either fiscal or monetary policy is too strong.

2 Model

2.1 Environment

I consider an infinitely-lived flexible-price economy with periods indexed by $t \in \{0, 1, 2, \cdots\}$. Three types of agents inhabit the model: households, a debt-manager and a central bank.

A measure-1 continuum of identical price-taking households consume c_t and produce an aggregated, non-storable good in every period equal to their labor supply n_t. Households own the economy's production technology, and their labor income is taxed at rate $\tau_t \in [0, 1)$.

Exogenous government purchases of the consumption good g_t evolve according to an S-state Markov process with transition matrix $\mathcal{P}$. The $S \times 1$ vector of spending states is $g \equiv \{g(s)\}_s$ where $s \in \{1, \cdots, S\}$, and the time t history of government spending realizations is $g^t \equiv \{g_0, g_1, \cdots, g_t\}$. The set of potential time t histories is given by G^t. Finally, let F^t denote the marginal distribution of histories implied by $\mathcal{P}$ and g_0, and let f^t denote the density for F^t. There is no other source of uncertainty in the model.

Total production is consumed by households and the government, so the economy's aggregate resource constraint (ARC) is

$$n_t = c_t + g_t \ \ \forall \ t \tag{1}$$

Define $P_t > 0$ as the aggregate price level, which represents the exchange rate between nominal objects (hereafter referred to as 'dollars') and the numeraire. Households lend (borrow) in dollars using a portfolio of nominal, one-period, state-contingent government debt $B_t = \left\{B_t^{(s)}\right\}_{s=1}^{S}$, where they receive $B_t^{(s')}$ dollars upon realizing state $s' \in \{1, \cdots, S\}$ when entering period $t+1$. This is a nominal version of the portfolio originally studied in Arrow (1964). Finally, call $\pi_t = \frac{P_t}{P_{t-1}}$ the economy's time t gross inflation rate.

Household welfare is defined as the sum of discounted expected utility over its lifetime according to the function

$$W_0 = \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{u(c_t) - v(n_t) - w(\pi_t)\right\} = \sum_{t=0}^{\infty} \beta^t \sum_{g_t \in G^t} \left\{u(c_t) - v(n_t) - w(\pi_t)\right\} f^t\left(g^t\right) \tag{2}$$

where $\beta \in (0, 1)$, where u, v and w are twice-differentiable, where $u' > 0$, $u'' < 0$, $v' > 0$, $v'' > 0$, and where w is minimized at 1.

The government is split into two branches: the debt-manager and central bank. Institutions have commitment power, and each institution aims to maximize the sum of discounted expected household utility under a reweighing of utility components.

The debt-manager chooses the issued supply of government debt across types $\boldsymbol{B}_t^{dm} = \left\{\boldsymbol{B}_t^{(s),dm}\right\}_{s=1}^{S}$ and the labor income tax rate τ_t each period to maximize its lifetime payout given by

$$\begin{aligned} W_0^{dm} &= \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{\left(1-\rho^{dm}\right)\left[u\left(c_t\right)-v\left(n_t\right)\right]-\rho^{dm} w\left(\pi_t\right)\right\} \\ &= \sum_{t=0}^{\infty} \beta^t \sum_{g_t \in G^t} \left\{\left(1-\rho^{dm}\right)\left[u\left(c_t\right)-v\left(n_t\right)\right]-\rho^{dm} w\left(\pi_t\right)\right\} f^t\left(g^t\right) \end{aligned} \tag{3}$$

where $\rho^{dm} \in [0,1]$, and where $\boldsymbol{B}_t^{dm} \in \mathbb{R}^S$ is otherwise unrestricted.

The central bank simultaneously chooses its debt demand $\boldsymbol{B}_t^{cb} = \left\{\boldsymbol{B}_t^{(s),cb}\right\}_{s=1}^{S}$ and the inflation rate π_t each period to maximize its lifetime payout given by

$$\begin{aligned} W_0^{cb} &= \mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left\{\left(1-\rho^{cb}\right)\left[u\left(c_t\right)-v\left(n_t\right)\right]-\rho^{cb} w\left(\pi_t\right)\right\} \\ &= \sum_{t=0}^{\infty} \beta^t \sum_{g_t \in G^t} \left\{\left(1-\rho^{cb}\right)\left[u\left(c_t\right)-v\left(n_t\right)\right]-\rho^{cb} w\left(\pi_t\right)\right\} f^t\left(g^t\right) \end{aligned} \tag{4}$$

where $\rho^{cb} \in [0,1]$, and where $\boldsymbol{B}_t^{cb} \in \mathbb{R}^S$ is otherwise unrestricted.

The structure of outstanding government debt at time t is $\boldsymbol{B}_t = \boldsymbol{B}_t^{dm} - \boldsymbol{B}_t^{cb}$. Debt markets clear when household lending equals consolidated government borrowing so that

$$\boldsymbol{B}_t = B_t \quad \forall\ t \tag{5}$$

where $B_t = \left\{B_t^{(s)}\right\}_{s=1}^{S}$.

2.2 Market Structure

S asset markets exist in every period: one for each circulating debt instrument. Debt is exchanged at nominal prices $Q_t \equiv \left\{Q_t^{(s)}\right\}_{s=1}^{S}$ where $Q_t^{(s)}$ is the time t price of a bond that matures in state s at time $t+1$.

Upon entering state $s' \in \{1, \cdots, S\}$, each household chooses $\{c_t, n_t, B_t\}_{t=0}^{\infty}$ to maximize (2) subject to its household budget constraint (HHBC), given as

$$P_t c_t + \sum_{s=1}^{S} Q_t^{(s)} B_t^{(s)} \leq P_t (1 - \tau_t) n_t + B_{t-1}^{(s')} \tag{6}$$

Household debt holdings are subject to limits that eliminate Ponzi schemes:

$$B_t^{(s)} \in \left[\underline{B}, \overline{B}\right] \quad \forall\, t, s \tag{7}$$

where debt limits $\underline{B}$ and $\overline{B}$ are set to be sufficiently large so that (7) does not bind in equilibrium.

The debt-manager chooses fiscal policy $\left\{\tau_t, \boldsymbol{B}_t^{dm}\right\}_{t=0}^{\infty}$ to maximize (3). The central bank chooses monetary policy $\left\{\pi_t, \boldsymbol{B}_t^{cb}\right\}_{t=0}^{\infty}$ to maximize (4). Institutions are constrained by the ARC (1), HHBC (6), household optimization, and the other institution's simultaneous policy choice, which is taken as given at time t. The ARC (1) and HHBC (6), combine to produce the consolidated government's budget constraint (GBC), written as

$$B_{t-1}^{(s')} + P_t g_t \geq \sum_{s=1}^{S} Q_t^{(s)} B_t^{(s)} + P_t \tau_t n_t \tag{8}$$

upon entering state $s' \in \{1, \cdots, S\}$ at time t.

3 Competitive Nash Equilibrium

3.1 Equilibrium Definition

Equilibrium is similar to that in the anonymous, commitment game found in Chari and Kehoe (1990) except for the addition of a second committing policymaker. Time 0 institutions select infinite sequences of policies, contingent on future realizations of uncertainty. Due to initial institutions' commitment technologies, future institutions are constrained to follow such time 0 plans. Households move after institutions at time 0.

I define the economy's time t state as $x_t \equiv \{g^t, B_{t-1}\}$. The debt-manager's time t action is a selection of fiscal policy $\eta_t^{dm} = \eta^{dm}(x_t) = \left\{\tau_t, \boldsymbol{B}_t^{dm}\right\}$, the central bank's time t action is a selection of monetary policy $\eta_t^{cb} = \eta^{cb}(x_t) = \left\{\pi_t, \boldsymbol{B}_t^{cb}\right\}$ and households' time t action is a selection of consumption, labor supply and debt holdings $\eta_t^{hh} = \eta^{hh}(x_t) = \{c_t, n_t, B_t\}$.

I index government institutions by $i \in \{dm, cb\}$ and denote i's opponent by $-i$. A time 0 strategy for institution i is a set of current and future committed action profiles $\gamma_0^i\left(x_0, \gamma^i(\cdot), \gamma^{-i}(\cdot)\right) \equiv \left\{\left\{\eta\left(x_t, \gamma^i(\cdot), \gamma^{-i}(\cdot)\right)\right\}_{g^t \in G^t}\right\}_{t=0}^{\infty}$ and its time $t > 0$ strategy is simply its previously-committed, state-contingent action $\gamma_t^i\left(x_t, \gamma^i(\cdot), \gamma^{-i}(\cdot)\right) \equiv \eta^i\left(x_t, \gamma^i(\cdot), \gamma^{-i}(\cdot)\right)$.[4] Combine these strategies into i's unified strategy profile $\gamma^i(\cdot) \equiv \{\gamma_0^i(\cdot), \gamma_t^i(\cdot)\}$.

A pure strategy competitive Nash equilibrium (CNE) consists of a debt-manager strategy $\gamma^{dm}(\cdot)$, a central bank strategy $\gamma^{cb}(\cdot)$, a household strategy $\gamma^{hh}\left(x_t, \gamma^{dm}(\cdot), \gamma^{cb}(\cdot)\right) = \eta^{hh}\left(x_t, \gamma^{dm}(\cdot), \gamma^{cb}(\cdot)\right)$, a pricing function for the aggregate price level $P_t = \gamma^P\left(x_t, \gamma^{dm}(\cdot), \gamma^{cb}(\cdot)\right)$ and a pricing function for the vector of bond prices $Q_t = \gamma^Q\left(x_t, \gamma^{dm}(\cdot), \gamma^{cb}(\cdot)\right)$ such that in every period:

1. The household strategy $\gamma^{hh}(\cdot)$ maximizes (2) given $\gamma^{dm}(\cdot)$, $\gamma^{cb}(\cdot)$, $\gamma^P(\cdot)$ and $\gamma^Q(\cdot)$ while satisfying (6) and (7),

2. The debt-manager's strategy $\gamma^{dm}(\cdot)$ maximizes (3) given $\gamma^{hh}(\cdot)$, $\gamma^{cb}(\cdot)$, $\gamma^P(\cdot)$ and $\gamma^Q(\cdot)$ while satisfying (8),

3. The central bank's strategy $\gamma^{cb}(\cdot)$ maximizes (4) given $\gamma^{hh}(\cdot)$, $\gamma^{dm}(\cdot)$, $\gamma^P(\cdot)$ and $\gamma^Q(\cdot)$ while satisfying (8),

4. The set of pricing equations $\gamma^P(\cdot)$ and $\gamma^Q(\cdot)$ clear all markets, satisfying (1) and (5).

Households, the debt-manger and the central bank are fully rational, have complete information about each others' problems and understand the underlying government spending process $\{g, \mathcal{P}\}$.

3.2 Household Optimization

Household optimization ensures the HHBC (6) and GBC (8) hold as strict equalities and that

$$1 - \tau_t = \frac{v'(n_t)}{u'(c_t)} \quad \text{and} \quad Q_t^{(s')} = \beta \mathbb{E}_t \left[\frac{u'(c_{t+1}) P_t}{u'(c_t) P_{t+1}}\right] \mathcal{P}_{s,s'} \quad \forall\ s, s' \in \{1, \cdots, S\} \tag{9}$$

when all debt is traded, where $\mathcal{P}_{s,s'}$ is the $s \times s'$ element of $\mathcal{P}$: the probability of entering state s' at time $t+1$, conditional on being in state s at time t.

[4]Where action profiles are now more appropriately written as functions of the economy's state and government strategy.

Well-known properties of such a Markovian process allow for a reduction in the economy's state space, as, at time t, the time $t-1$ history of spending states g^{t-1} is not informative to households or government branches, given B_{t-1}. The economy's relevant state space can be therefore be rewritten as $\tilde{x}_t = \{g_t, B_{t-1}\}$.

Equation (9) and properties of $u(\cdot)$, $v(\cdot)$ and β imply a transversality condition (TVC) on the real value of maturing government debt so that

$$\lim_{i\to\infty}\left(\frac{\beta^i B^{(s)}_{t-1+i}}{P_{t+i}}\right) = 0 \quad , \quad \forall\, s \in \{1, \cdots, S\} \tag{10}$$

3.3 Price Level Determination

I combine the ARC (1), HHBC (6) and household optimization (9), forward-iterate on the probability-weighted sum of maturing government debt and apply the TVC (10) to write

$$\underbrace{\frac{B^{(s)}_{t-1}}{P_t}}_{(\text{Maturing debt})/P_t} = \underbrace{\frac{1}{u'(c_t)}\mathbb{E}_t \sum_{i=0}^{\infty} \beta^i \left[u'(c_{t+i})\, c_{t+i} - v'(n_{t+i})\, n_{t+i}\right]}_{\mathbb{E}_t[\text{PV(primary surpluses)}]} \tag{11}$$

which I call the economy's pricing equation.

As is the case in the New Keynesian, FTPL, and other conventional, macroeconomic DSGE models, the price level P_t adjusts in every period to ensure that the real value of outstanding nominal debt equals the expected present value of government primary surpluses.[5]

3.4 A Quasi-Primal Approach

Households and government branches derive utility in part from inflation. The analysis thus far has focused on the relationships between nominal debt, fiscal financing and the price level. To better align the model with agents' preferences, it is useful to convert the pricing equation (11) from being in terms of nominal debt and the price level to instead being in terms of real debt and inflation.

Define a household's real (indexed) debt holdings as $b^{(s)}_t \equiv \frac{B^{(s)}_t}{P_t}$ and the government's real debt supplied as $\boldsymbol{b}^{(s)}_t \equiv \frac{\boldsymbol{B}^{(s)}_t}{P_t}$, and define the vector of real debt allocations held by households as $b_t \equiv \left\{b^{(s)}_t\right\}_{s=1}^{S}$ and jointly-supplied by the government as $\boldsymbol{b}_t \equiv \left\{\boldsymbol{b}^{(s)}_t\right\}_{s=1}^{S}$. The economy's pricing

[5]Notice that $u'(c_{t+i})\, c_{t+i} - v'(n_{t+i})\, n_{t+i} = u'(c_{t+i})\,(\tau_{t+i} n_{t+i} - g_{t+i})$ from the ARC (1) and the HH FOC on τ_t (9).

equation (11) can now be expressed as

$$\underbrace{\frac{b_{t-1}^{(s)}}{\pi_t}}_{(\text{Maturing debt})/P_t} = \underbrace{\frac{1}{u'(c_t)}\mathbb{E}_t \sum_{i=0}^{\infty} \beta^i \left[u'(c_{t+i})\, c_{t+i} - v'(n_{t+i})\, n_{t+i}\right]}_{\mathbb{E}_t[\text{PV(primary surpluses)}]} \tag{12}$$

where I call (12) the economy's implementability constraint (IC).

Any CNE must be a competitive equilibrium. Lucas and Stokey (1983) employ the primal approach to characterize a competitive equilibrium, which consists of substituting out all prices from the economy and writing the system in terms only of allocations. I employ a quasi-primal approach that follows Lucas and Stokey (1983), except I allow π_t to remain in the system. Equations (1) and (12) are necessary and sufficient conditions for a competitive equilibrium.

Proposition 1 ***(competitive equilibrium)*** *A stochastic sequence* $\left\{\left\{c_t(x_t), n_t(x_t), g_t, \pi_t(x_t)\right\}_{g^t \in G^t}\right\}_{t=0}^{\infty}$ *is a competitive equilibrium if and only if it satisfies* (1) $\forall g^t \in G^t, \forall t$ *and* $\exists \left\{\left\{\left\{\boldsymbol{b}_t^{(s)}(x_t)\right\}_{s=1}^{S}\right\}_{g^t \in G^t}\right\}_{t=0}^{\infty}$ *which satisfies* (12) $\forall g^t \in G^t, \forall t$.

Proof: The proof can be found in appendix A.

The requirements for a competitive equilibrium are met so long as there exists allocations that satisfy the ARC and the IC every period for every possible draw of exogenous government spending. Nominal Arrow securities complete financial markets, so they can be issued to implement any feasible, pre-committed joint tax/inflation path.[6] Solving government institutions' problems subject only to (1) and (12) dramatically simplifies the analysis.

The IC (12) is the key to the game played between institutions. Because inflation doesn't enter the ARC (1), $\{c_t, n_t\}$ depends entirely on fiscal policy while $\{\pi_t\}$ depends entirely on monetary policy.[7] The IC (12) connects the two: institutions' state-contingent plans must be jointly consistent with (12). A debt-manager that chooses current and future tax policy constrains the central bank through (12). Symmetrically, a central bank that chooses current and future inflation policy constrains the debt-manager through (12). The IC becomes the frontier along which the institutional

[6]Implementing these plans requires that $b_{t-1}^{(s)} = \frac{B_{t-1}^{(s)}}{P_{t-1}}$ satisfies the IC (12) for every potential time t realized state.

[7]Notice that the ARC (1) and the HH FOC on τ_t (9) form a system of two equations with two unknowns in c_t and n_t, given τ_t and g_t.

game is played.

4 Equilibrium Analysis

4.1 Ramsey Plan: An Efficient Benchmark

I begin by considering welfare-maximizing joint fiscal-monetary policy conducted by a Ramsey planner with commitment power. Such a Ramsey plan serves as an efficient benchmark by which to compare outcomes from equilibrium government policy.

The Ramsey planner commits to state-contingent plans for $\{\tau_t\}$, $\{\pi_t\}$, and $\{\boldsymbol{b}_t\}$ to maximize true household welfare (2), given its constraint set (1), (5)–(7), (9)–(10). Applying the quasi-primal approach described in section 3.4 transforms the problem so the Ramsey planner equivalently commits to state-contingent plans for $\{c_t\}$, $\{n_t\}$, $\{\pi_t\}$, and $\{\boldsymbol{b}_t\}$ subject to the ARC (1) and IC (12).

The Ramsey planner's FOCs on $\{c_t\}$ and $\{n_t\}$ combine to yield

$$u'(c_0)[1+\lambda_0] + \lambda_0\left[u''(c_0)\left(c_0 - \frac{b_{-1}^{(s)}}{\pi_0}\right)\right] = v'(n_0)[1+\lambda_0] + \lambda_0 v''(n_0)\, n_0 \qquad \text{and} \tag{13}$$

$$u'(c_t)[1+\lambda_0] + \lambda_0 u''(c_t)\, c_t = v'(n_t)[1+\lambda_0] + \lambda_0 v''(n_t)\, n_t \qquad \forall\ t > 0 \tag{14}$$

where λ_0 is the planner's Lagrange multiplier on the time 0 IC (12).[8]

The Ramsey planner's FOCs on $\{\pi_t\}$ are

$$w'(\pi_0)\,\pi_0^2 = \lambda_0 u'(c_0)\, b_{-1}^{(s)} \qquad \text{and} \tag{15}$$

$$\pi_t = 1 \qquad \forall\ t > 0 \tag{16}$$

The Ramsey planner sets $\{\tau_t\}$ and $\{\pi_t\}$ to simultaneously achieve three directives. The first is an intratemporal goal to align marginal welfare losses between using τ_t and π_t each period. The second is a goal to smooth welfare losses from its costly tools intertemporally. Both goals take the amount of financing needed to satisfy the IC (12) as given. The third goal is embedded in the planner's FOC on τ_0's (13) and π_0's (15) terms which include inherited, maturing debt $b_{-1}^{(s)}$: the

[8]Specifying linearly-separable CRRA utility in c_t and n_t would imply a perfectly-smooth stationary tax rate. When $u''(c_t)\, c_t = \bar{u}u'(c_t)$ and $v''(n_t)\, n_t = \bar{v}v'(n_t)$, where $\bar{u}$ and $\bar{v}$ are constants, the Ramsey FOC on τ_t (14) becomes $\frac{v'(n_t)}{u'(c_t)} = \frac{1+\lambda_0(1+\bar{u})}{1+\lambda_0(1+\bar{v})}$. The tax rate is then $\tau_t = \tau = 1 - \frac{1+\lambda_0(1+\bar{u})}{1+\lambda_0(1+\bar{v})}$ by the household's FOC on τ_t (9).

planner sets τ_t and π_t to lessen its own financing burden by devaluing (appreciating) inherited debt (assets).

The planner chooses $\boldsymbol{b}_t$ so that, given its own Ramsey plan defined by FOCs on τ_t (14) and π_t (16), the state of the economy $\{g_t, b_{t-1}\}$, and the government's exogenous spending process embedded in $\{g, \mathcal{P}\}$, $b_t^{(s')}$ satisfies the time $t+1$ IC (12) in every potential time $t+1$ state $s' \in \{1, \cdots, S\}$.

4.2 Non-Cooperative Equilibrium

Sargent (1986) credits Neil Wallace for characterizing monetary-fiscal coordination during the Reagan (1981–1989) and Volcker (1979–1987) years as a precarious 'game of chicken,' where fiscal policymakers promised tax reductions and expenditure plans while Fed officials pledged unwavering commitment to tight money. They pursued conflicting plans with the expectation that the other would 'chicken out' as the U.S.'s GBC tightened. These incompatible strategies created an unsustainable impasse: either the Fed would capitulate by monetizing government debt or Congress would yield by reducing expenditures to balance budgets.

Wallace's metaphor illuminates how institutional commitments transform policy coordination into strategic gamesmanship, with macroeconomic consequences hanging in the balance.

The debt-manager commits to state-contingent plans for $\{\tau_t\}$ and $\left\{\boldsymbol{b}_t^{dm}\right\}$ to maximize its payout (3), and the central bank commits to state-contingent plans for $\{\pi_t\}$ and $\left\{\boldsymbol{b}_t^{cb}\right\}$ to maximize its payout (4), given each branch's opponent's plan and given the consolidated government's constraint set (1), (5)–(7), (9)–(10). Applying the quasi-primal approach described in section 3.4 transforms the problem so that the debt-manager equivalently commits to state-contingent plans for $\{c_t\}$, $\{n_t\}$ and $\left\{\boldsymbol{b}_t^{dm}\right\}$ to maximize its payout (3), and the central bank commits to state-contingent plans for $\{\pi_t\}$ and $\left\{\boldsymbol{b}_t^{cb}\right\}$ to maximize its payout (4), given each branch's opponent's plan and given the ARC (1) and IC (12). For the rest of the analysis, assume inherited, maturing debt $b_{-1}^{(s)}$ is such that the debt-manager could feasibly, individually satisfy the ARC (1) and IC (12) under $\pi_t = 1$ every period.

I specify the model by setting $\rho^{dm} = 0$ and $\rho^{cb} = 1$ so that the debt-manager minimizes welfare loss from tax distortions while central bank minimizes welfare loss from inflation.

The debt-manger's FOCs on $\{c_t\}$ and $\{n_t\}$ imply

$$u'(c_0)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}\left[u''(c_0)\left(c_0-\frac{b_{-1}^{(s)}}{\pi_0}\right)\right]=v'(n_0)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}v''(n_0)\,n_0 \quad \text{and} \tag{17}$$

$$u'(c_t)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}u''(c_t)\,c_t=v'(n_t)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}v''(n_t)\,n_t \quad \forall\ t>0 \tag{18}$$

where λ_0^{dm} is the debt-manager's Lagrange multiplier on the time 0 IC (12).

The central bank's FOCs on $\{\pi_t\}$ are

$$w'(\pi_0)\,\pi_0^2=\lambda_0^{cb}u'(c_0)\,b_{-1}^{(s)} \qquad \text{and} \tag{19}$$

$$\pi_t=1 \qquad \forall\ t>0 \tag{20}$$

where λ_0^{dm} is the central bank's Lagrange multiplier on the time 0 IC (12).

FOCs (17)–(20) are identical to the planner's FOCs (13)–(16), except for the replacement of λ_0 with λ_0^{dm} in (17)–(18) and with λ_0^{cb} in (19)–(20).

The non-cooperative government shares only two of the Ramsey planner's three policy directives. While institutions individually smooth welfare losses intertemporally and devalue inherited debt, no longer does government policy ensure that *intratemporal* marginal welfare losses from τ_t and π_t equate.

Splitting the government into two non-cooperative institutions results in a second Lagrange multiplier, and, with no additional restrictions on the model, multiple state-contingent policy paths consistent with the definition of CNE.

4.2.1 A Continuum of Equilibria

For the remainder of the analysis, assume the time 0 government inherits a strictly positive amount of maturing debt $b_{-1}^{(s)}>0$.[9] So long as the debt-manager's and central bank's plans follow (17)–(20) while satisfying the ARC (1) and IC (12), no institution finds it desirable to deviate from its own plan. Any deviation from such a plan along the ARC (1) violates either the IC (12) or optimal smoothing of individual payout losses.

For instance, in the case where the debt-manager sets taxes lower than what is required to

[9]This assumption is not required for future results, but it aids in clarifying exposition.

finance inherited debt and current and expected future spending along a zero (net) inflation plan ($\pi_t = \pi = 1 \ \forall t$), the central bank optimally inflates away a portion of the inherited debt stock's real value so as to ensure the ARC (1) and IC (12) hold while it follows its payout-maximizing plan according to (19)–(20).

Conversely in the case where the central bank sets inflation lower than what is required to entirely erode away inherited debt's value ($\pi_0 < \infty$), for instance, the debt-manager optimally taxes households to pay off un-eroded inherited debt and current and expected future spending so as to ensure the ARC (1) and IC (12) hold while it follows its payout-maximizing plan given by (17)–(18).

Either instituion can act in an unconstrained manner but only so long as the other institution picks up the slack to satisfy the consolidated government's constraints. An unconstrained debt-manager sets taxes only to finance new government spending without financing any inherited debt, relying on the central bank to hyperinflate all debt away at time 0 $\left(\lambda_0^{cb} \to \infty\right)$. An unconstrained central bank sets inflation to $\pi_t = \pi = 1$ every period, leaving the debt-manager to finance the entire stock of inherited debt as well as current and future spending with explicit taxes $\left(\lambda_0^{cb} = 0\right)$. The continuum between these extremes all satisfy CNE and can be indexed by the central bank's Lagrange multiplier $\lambda_0^{cb} \in [0, \infty)$.

There exists another continuum of CNE – one associated with time 0 deflation $\left(\lambda_0^{cb} < 0\right)$. I define a boundary set of inherited debt structures $\hat{b}_{-1}$ as

$$\hat{b}_{-1} \equiv \left\{ b_{-1} \in \mathbb{R}^S_{++} : \forall b'_{-1} > b_{-1}, \pi_0 > 1 \text{ is required for CNE} \right\}$$

to characterize this continuum in Lemma 1.

Lemma 1 ***(payoff dominated CNE)*** $\forall b_{-1} \in \left(\mathbf{0}, \hat{b}_{-1}\right)$, $\exists \lambda_0^{dm} > 0$, $\lambda_0^{cb} < 0$ *which satisfies a CNE.*

Proof: The proof can be found in appendix A.

As long as solvency is feasible under time 0 deflation ($\pi_0 < 1$), there exists CNE beyond the continuum observed between unconstrained institutions $\lambda_0^{cb} \in [0, \infty)$. Given maturing inherited debt, this continuum of 'payoff dominated' CNE can be indexed by $\lambda_0^{cb} \in [-N, 0)$ where $N \geq 0$ is a constant. Deflated inherited debt needs to be financed by higher taxes than those required for a zero inflation economy. Conversely, any path of sufficiently elevated tax rates needs to be accommodated by deflation so that the ARC (1) and IC (12) hold.

I call this set of equilibria payoff dominated due to the fact that institutions could individually be made better off moving the economy toward a zero inflation ($\lambda_0^{cb} = 0$) equilibrium. Tax distortions fall and costly deflation wanes as a negative λ_0^{cb} approaches 0.

4.2.2 Payoff Dominance: A Refinement

Payoff dominance, as proposed by Harsanyi and Selten (1988), is a refinement criterion for selecting among multiple Nash equilibria. It asserts that, when faced with multiple equilibria, rational, non-cooperative players will coordinate to eliminate equilibria where players can be individually made better off.

I apply Harsanyi and Selten (1988)'s payoff dominance refinement to section 3.1's CNE definition, eliminating all CNE indexed from $\lambda_0^{cb} \in [-N, 0)$ and leaving the set of payoff dominant CNE as those indexed from $\lambda_0^{cb} \in [0, \infty)$.

4.2.3 Fiscal Strength and a Unique Equilibrium

Beginning with the Fed's inception in 1913, and continuing through the Treasury-Fed Accord in 1951 until today, U.S. fiscal policymakers have placed varying degrees of (implicit and explicit) pressure on Fed officials. Arguments in support of reduced Fed operational independence resurfaced during the U.S.'s 2024 presidential election. Common rhetoric included calls for a fiscal seat on the FOMC, for the president to be personally consulted on rate decisions, and for stronger Fed oversight by the Treasury.

The model's multiplicity serves as an opportunity to determine a unique equilibrium while simultaneously introducing a measure of institutional strength. One that can be used to measure the degree to which fiscal policy pressures monetary policy using macroeconomic data alone.

To close the model, I introduce the asymmetric Nash bargaining solution proposed by Harsanyi and Selten (1972). Institutions agree to maximize a product of individual surpluses, weighted by the amount of bargaining power the debt-manager possesses relative to the central bank. The weighted product is

$$\left(W_0^{dm} - d_0^{dm}\right)^{\alpha} \left(W_0^{cb} - d_0^{cb}\right)^{1-\alpha} \tag{21}$$

where d_0^i is institution i's payout under its worst-case feasible CNE and where $\alpha \in [0,1)$ is a measure of fiscal strength. Maximize (21) taking α as given to arrive at the model's unique solution.

Conventional bargaining models include non-cooperative games where a set of feasible equilibria lie inside the Pareto frontier. With some justification, one such equilibrium from that set is designated the game's 'disagreement equilibrium,' which players realize should negotiations break down. Players' 'disagreement payouts' are typically used for $\{d_0^i\}$.

This paper's model differs from a standard bargaining set-up due to the full set of feasible CNE lying on the Pareto frontier – the IC (12). Imagine a single, feasible equilibrium is labeled the model's disagreement point. In such a scenario, equilibrium collapses to that disagreement point for all $\alpha \in [0,1)$ as the bargaining solution (21) maximizes a weighted product of utility gains relative to the disagreement point, and, by definition, any movement along the IC (12) results in a negative weighted product (21).

I use the endpoints of the Pareto frontier as player-specific reference points for $\{d_0^i\}$, rather than those from a single disagreement outcome. The approach shares conceptual similarities with economic analyses of claims problems in O'Neill's (1982) work and spatial voting models by Downs (1957) and Black (1958), while maintaining a structure consistent with asymmetric bargaining.

The debt-manager enjoys its best-case scenario when fiscal strength approaches $\alpha \to 1$ so that inherited nominal debt is fully financed by time 0 hyperinflation and taxes only need to finance current and expected future spending. Symmetrically, the central bank achieves its best-case scenario when fiscal strength is set to $\alpha = 0$ so that debt and spending are entirely tax-financed. The continuum indexed by $\lambda_0^{cb} \in [0,\infty)$ is also indexed by $\alpha \in [0,1)$.

Finally, denote the welfare-maximizing level of fiscal strength α^* as the amount of fiscal bargaining power for which equilibrium allocations are consistent with those defined by the Ramsey plan in section 4.1. Institutions are equally constrained when $\alpha = \alpha^*$ so that $\lambda_0^{dm} = \lambda_0^{cb} = \lambda_0$.

5 Model Calibration

I consider a two-sate (low and high government spending) economy where households derive per-period payoffs in the form

$$u(c_t) - v(n_t) - w(\pi_t) = \frac{c_t^{1-\sigma}}{1-\sigma} - \frac{n_t^{1+\varphi}}{1+\varphi} - \frac{1}{2}\theta\left(\frac{1}{\pi_t} - 1\right) \tag{22}$$

for the remainder of the paper, where $\sigma = \varphi = 2$. Time periods are years, so I set $\beta = 0.9875^4$ to match the annualized time discount factor from Chari, Christiano, and Kehoe (1995) and Buera and Nicolini (2004). I set government spending $\{g_\ell, g_h\} = \{0.1764, 0.3568\}$ and transition matrix probabilities $\{p_{\ell\ell}, p_{hh}\} = \left\{\frac{75}{76}, \frac{2}{3}\right\}$ to match U.S. (spending+transfer) moments from 1942–2024.[10]

Inherited debt $b_{-1} = 0.5210$ matches the U.S.'s average debt-to-GDP ratio from 1942-2022. The functional form for $w(\pi_t)$ comes from Sims's (2013) work. I set $\theta = 1.22$ so that the planner chooses $\pi_0 = 1.0340$, the U.S.'s average inflation rate from 1943–2023, given the rest of the calibration.

5.1 Fiscal Strength and Tax, Inflation Determination

An optimizing debt-manager perfectly smooths time $t > 0$ tax rates $\tau_t = \bar{\tau}$ according to its FOC (18).[11] An optimizing central bank perfectly smooths time $t > 0$ inflation $\pi_t = 1$ according to its FOC (20). The IC (12) relates surprise inflation π_0 and the path of taxes $\{\tau_0, \bar{\tau}\}$.

Figure 1 shows the relationship between the stationary tax rate $\bar{\tau}$ and time 0 inflation π_0, visualizing the economy's Pareto frontier discussed in section 4.2.3 along which institutions determine economic outcomes. Government policy to the left of the frontier violates the household budget constraint while policy to the right is inconsistent with household, debt-manager and/or central bank optimization.

The government can jointly set taxes lower than 20.2% should it inflate away inherited debt. Hyperinflation of such debt allows for a 3.5% tax reduction to 16.7%. Setting fiscal strength $\alpha \in [0, 1)$ determines where on Figure 1's frontier the economy falls.

Figure 2 displays the relationship between tax and inflation rates along a portion of the fiscal-monetary regime continuum, marking the amount of fiscal strength required to implement the

[10] Data sources are listed in Appendix D.
[11] The debt-manger's FOC (18) and isoelastic household utility in c_t and n_t imply this result.

Ramsey plan. I compare the CNE consistent with first-best to corner CNE in Table 1.

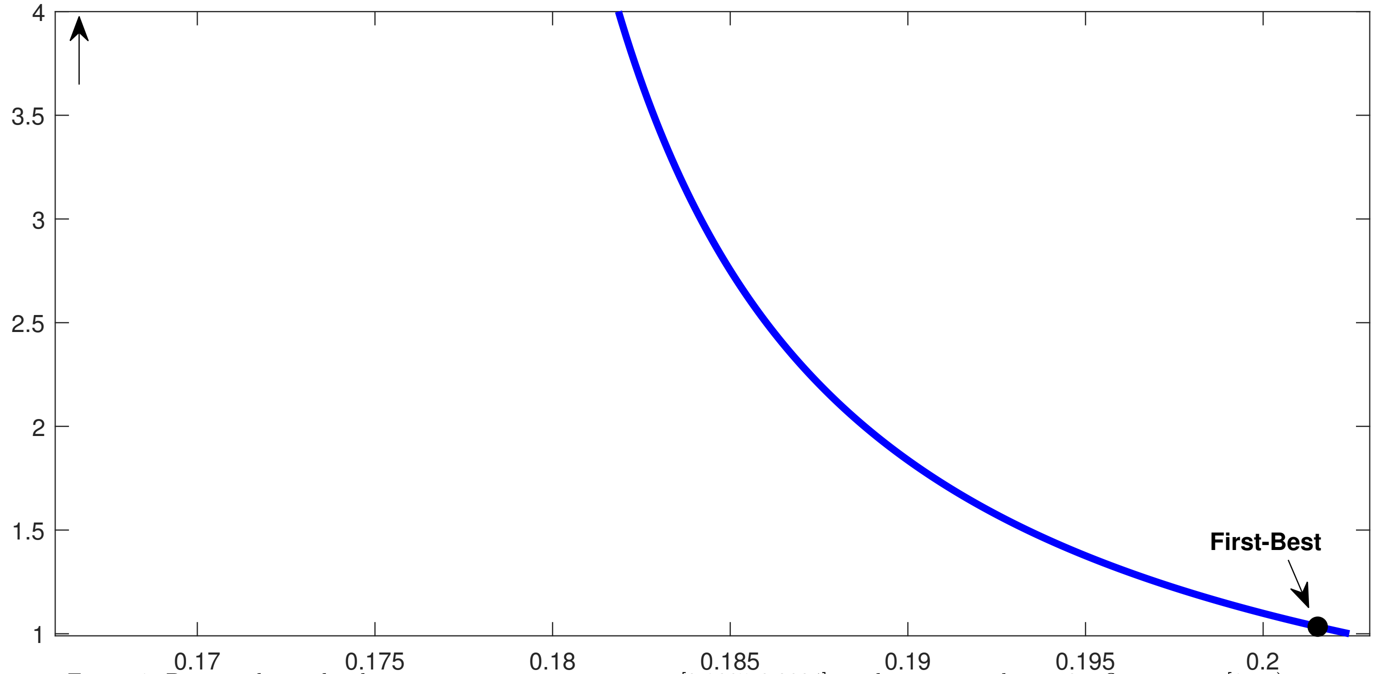

Figure 1: Pareto relationship between stationary tax rate $\bar{\tau} \in [0.1665, 0.2024]$ on the x-axis and time 0 inflation $\pi_0 \in [1, \infty)$ on the y-axis. All feasible equilibria lie along the frontier: points to the left violate the household budget constraint (6) and points to the right violate household, government optimization (9), (17)–(20).

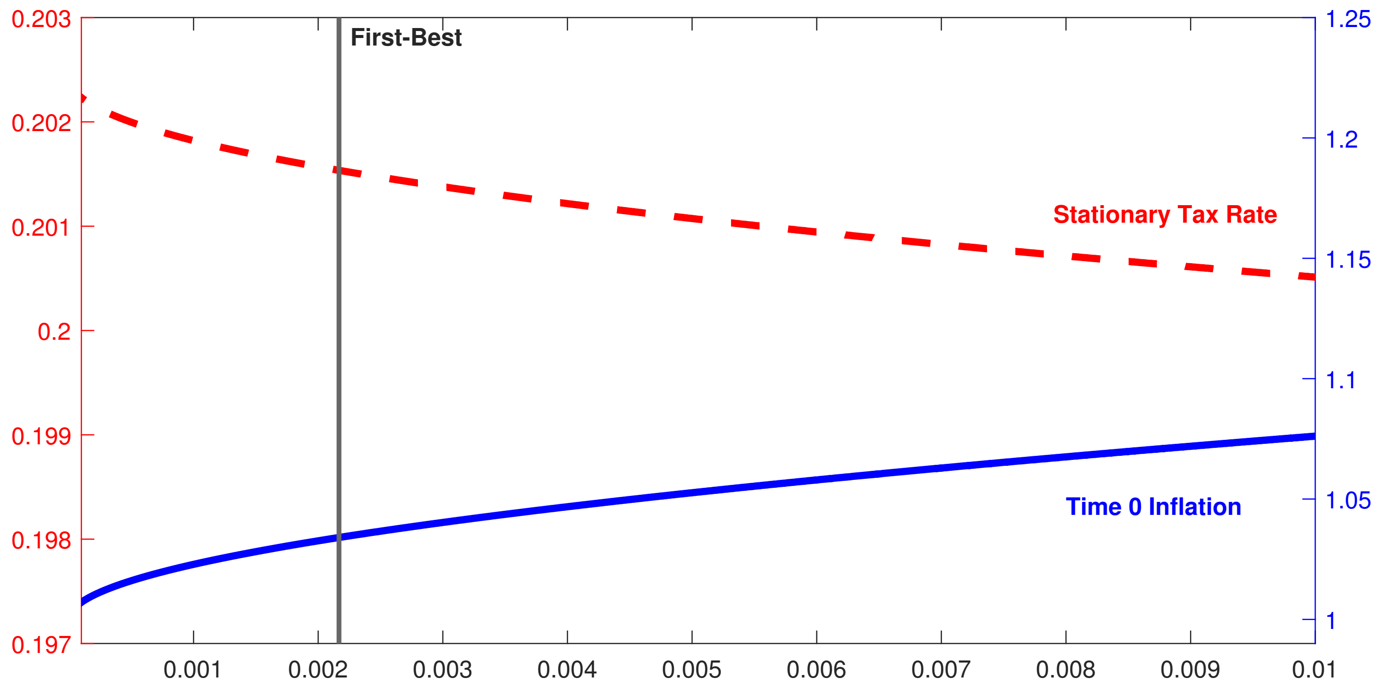

Figure 2: Stationary tax rate $\bar{\tau}$ (left y-axis) and time 0 inflation π_0 (right y-axis) across fiscal strengths, $\alpha \in [0, 0.01]$ (x-axis).

The economy matches the Ramsey Planner's solution only under an extremely powerful central bank, one with more than 99% of the government's relative bargaining power. This result arises

CNE	α	$\bar{\tau}$	π_0
All-powerful central bank	0	0.2024	1
Ramsey plan	0.0022	0.2015	1.0340
All-powerful debt-manager	1	0.1665	∞

Table 1: Fiscal strengths, stationary tax rates and time 0 inflation rates across corner and first-best CNE

because, while the debt-manager feasibly sets taxes somewhere between 16.65%-20.24%, a relatively narrow range, feasible central bank outcomes span from zero (net) inflation to hyperinflation. This large fiscal-monetary asymmetry in payout possibilities, paired with the fact that welfare is maximized when $\pi_0 = 1.0340$, results in a government that requires a strong central bank to match the planner's solution.

Figure 3 displays welfare outcomes across the same fiscal strength range. Consumption-equivalent welfare loss moving left from the Ramsey plan $\alpha = \alpha^*$ to an all-powerful central bank $\alpha = 0$ is about half of that moving right from the Ramsey plan $\alpha = \alpha^*$ to a government where fiscal policy has just one percent of relative bargaining power $\alpha = 0.01$. Welfare maximization is approximated by an all-powerful central bank – a theoretical result joining a well-established chorus of support for strong, independent monetary policy.

An omnipotent central bank comes closer to maximizing welfare with higher welfare costs from inflation $\theta \to \infty$ and with lower levels of inherited debt $b_{-1}^{(s)} \to 0$, relative to baseline. When households greatly dislike inflation, a more powerful inflation-minimizing central bank is required to match the Ramsey plan. When the government is saddled with high levels of maturing debt, though, a less powerful central bank is required to match the Ramsey plan, as surprise inflation devalues more debt while imposing identical welfare losses. Appendix B explains these relationships in more detail.

5.2 A Time Series of American Fiscal Strength

I use this paper's framework to rationalize American inflation outcomes. Figure 4 displays imputed U.S. government fiscal strength relative to the Fed from 1943–2023.

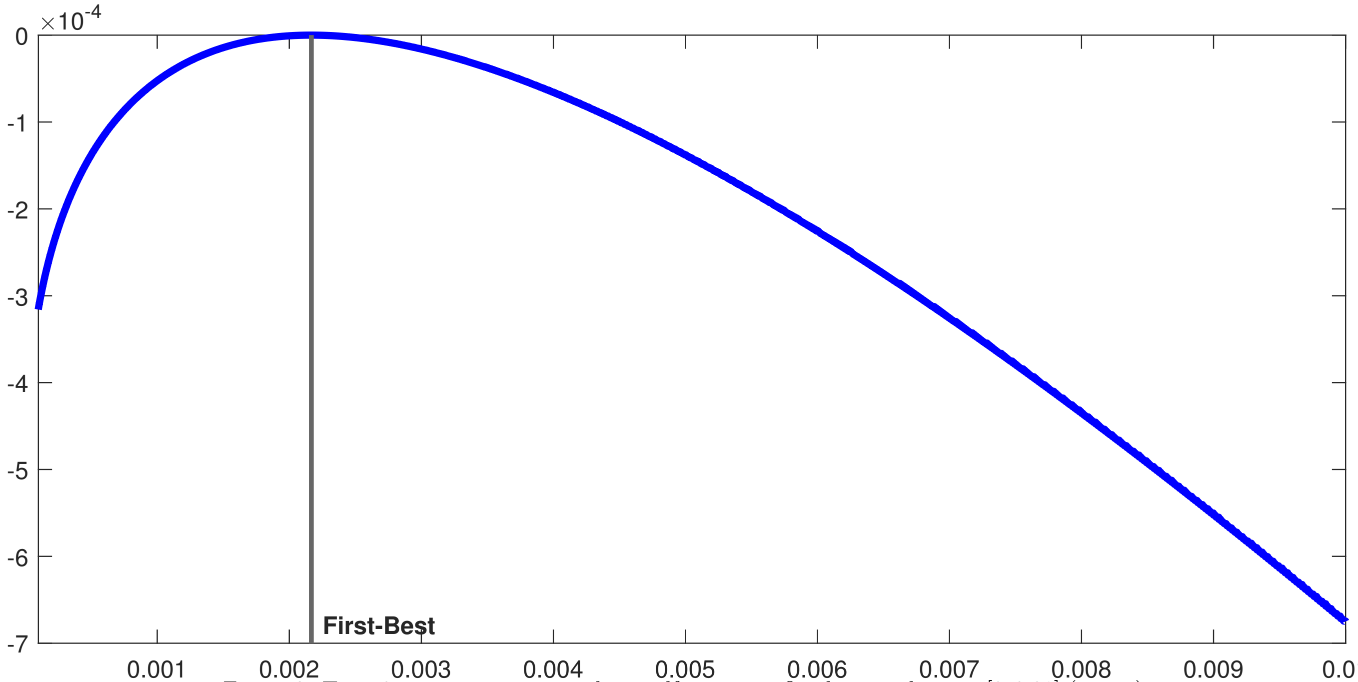

Figure 3: Time 0 consumption-equivalent welfare across fiscal strengths, $\alpha \in [0, 0.01]$ (x-axis).

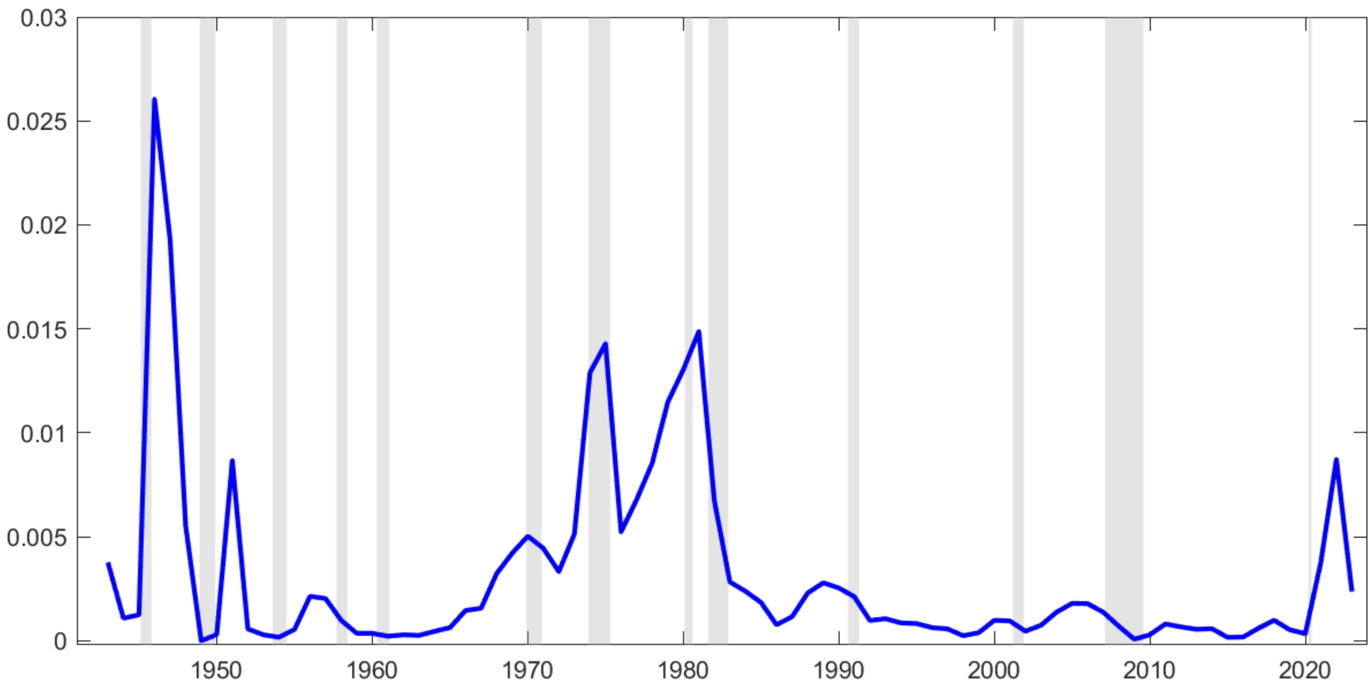

Figure 4: U.S. fiscal strength from 1943-2023. I re-solve the model every year, given that year's observed inherited debt and spending $\{b_{-1,t}, g_{0,t}\}_{t=1943}^{2023}$, and selecting fiscal strength $\{\alpha_t\}_{t=1943}^{2023}$ (y-axis) which sets time 0 inflation π_0 equal to observed inflation $\pi_{0,t}$ every year. Debt and spending data are measured as percentages of GDP.

The series exhibits three periods of elevated fiscal strength: from 1947–1951, throughout the 1970s and from 2021–2023.

The U.S. Treasury explicitly pressured the Fed from WWII until the 1951 Treasury-Fed Accord. Prior to the Accord, the Fed had an obligation to repress interest rates to support new debt issuance, which constrained its ability to independently manage monetary policy to fight inflation. Pre-1951 monetary policy was thus torn between fighting inflation and propping up bond prices. This, coupled with Congress's repeated reluctance to raise post-war surpluses until the second half of 1948, resulted in increased levels of fiscal strength until the 1949 recession.[12] Fiscal strength again spiked upward in 1951 but immediately fell and remained low until the late 1960s.

In 1964, President Lyndon B. Johnson pushed Fed Chair William McChesney Martin against a wall and exclaimed, "Martin, my boys are dying in Vietnam and you won't print the money I need." In 1971, Fed Chair Arthur Burns wrote "I am convinced that the President [Nixon] will do anything to be reelected." Indeed, Figure 4 shows fiscal strength beginning to rise during the U.S.'s mid-1960s deployments to Vietnam. American inflation followed suit, continuing to rise and peaking at above 13% in 1979 before falling to less than 4% in 1982, midway through Paul Volcker's (1979-1987) term: a Fed Chair who stood up to Congress in 1980, declaring, "Monetary policy cannot – without peril – be relied on alone to halt inflation. The other major tools of public policy must also be brought to bear on the problem, with fiscal policy playing a central role."

America endured a global health crisis from 2020-2022, committing to six trillion dollars in additional spending and transfer programs over that time.[13] Despite the U.S.'s large fiscal response and resulting ballooning debt position, there was little discussion from policymakers about how COVID policies would ultimately be financed. Eventually, in 2022, White House Press Secretary Jen Psaki said "It's important to note that we believe [federal transfers] should be provided on an emergency basis, not something where it would require offsets." Congress heavily borrowed and chose to keep taxes low despite potential inflationary consequences, which were then realized from 2022-2023. These events perfectly illustrate growing fiscal strength's economic impacts.

[12] Caplan (1956) documents federal policy shifts leading up to the 1949 recession.
[13] Anderson and Leeper (2023) break down the U.S.'s fiscal response to COVID.

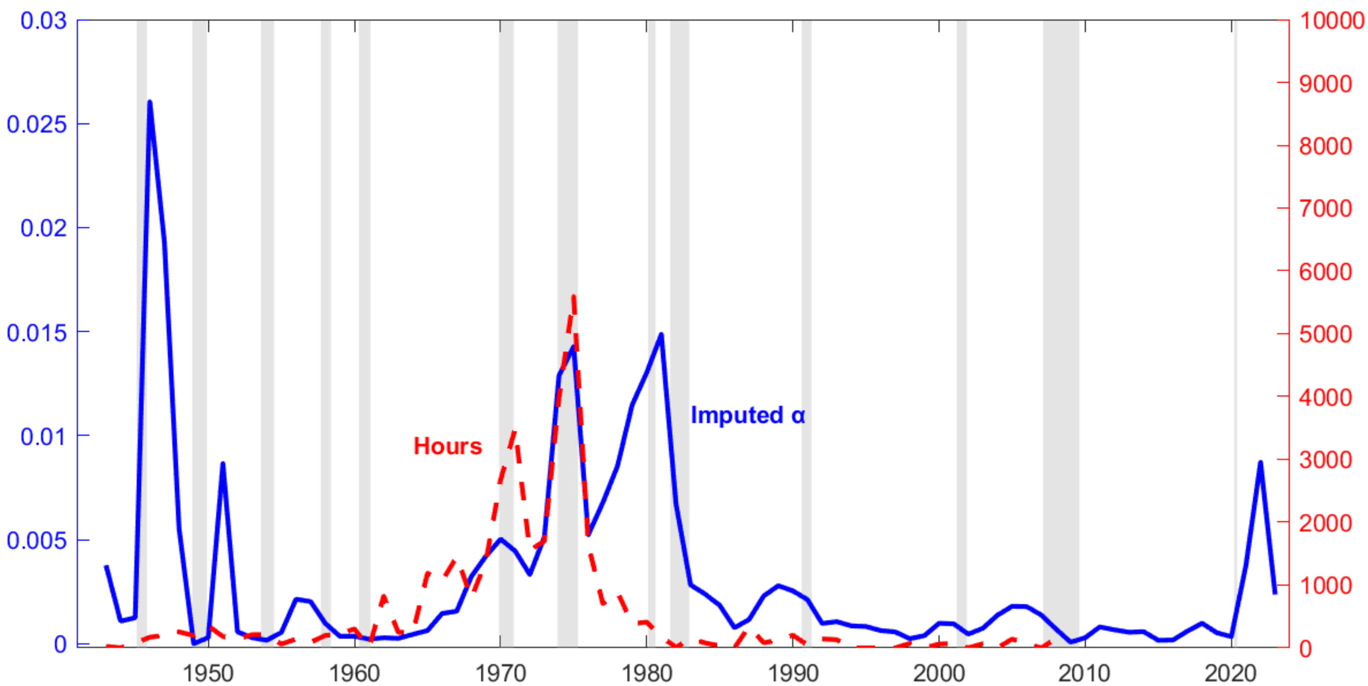

Figure 5: Imputed U.S. fiscal strength (left y-axis) and Drechsel (2024)'s president-Fed official hours in meetings (right y-axis) from 1943-2023.

5.2.1 Comparing to President-Fed Meeting Data

Drechsel (2024) extracts presidential meeting data from archival records and measures inflationary effects of presidential pressure on the Fed. One of the paper's major contributions is a novel dataset including the number of meetings between American presidents and Fed officials from 1933-2016 and the hours presidents spent with Fed officials from 1933-2008.

I see fiscal strength as the theoretical counterpart to Drechsel (2024)'s political pressure, so I plot imputed fiscal strength against the number of hours the president met with Fed officials per year in Figure 5.

Prior to the Treasury-Fed Accord of 1951, the Fed lacked meaningful monetary policy independence despite limited direct presidential engagement, operating primarily in support of Treasury issuance. The 1951 Accord formally established the Fed's policy autonomy, and post-Accord fiscal strength declined as president-Fed hours remained low. Fiscal strength started to pick up in the mid-1960s when meeting hours began to increase, marking a new era of political influence on monetary policy through direct presidential pressure.[14]

From 1960–1970, the steady increase in imputed fiscal strength matches that in president-Fed

[14] Drechsel (2024) explores strains on early-1970s fiscal and monetary relationships in more detail.

hours. Imputed fiscal strength and president-Fed hours each spike upwards twice between 1971–1981, with hours declining in the late 70s before fiscal strength declines in the early 80s. The two remain low from the mid-80s until the end of hours data in 2008.

A major advantage of imputing fiscal strength through a model like the one described above is the availability of data. Records of presidential meeting duration ended in 2008 during W. Bush's final term. Those of presidential meetings ceased altogether in 2016 during Obama's final term. Fortunately, interpreting fiscal strength as political pressure allows one to implicitly derive political pressure for any year when aggregate economic data are available.

I follow Drechsel (2024) by classifying presidents and Fed chairs according to the average annual imputed fiscal strength during their terms from 1943–2023. I compare this to the average annual number of hours the president spent meeting with Fed officials over the same date range. Table 2 lists presidents in the left panel and Fed chairs in the right panel.

President	**Fiscal Strength**	**Hours**
Carter (D)	1.19	455.43
Ford (R)	0.75	1897.4
Nixon (R)	0.71	3021.1
Truman (D)	0.69	213.83
Biden (D)	0.55	
Roosevelt (D)	0.44	47
Reagan (D)	0.26	102.03
Johnson (D)	0.22	1169.3
Bush HW (R)	0.17	127.35
Trump (R)	0.16	
Bush W (R)	0.10	
Eisenhower (R)	0.08	158.77
Clinton (D)	0.07	24.742
Obama (D)	0.05	
Kennedy (D)	0.03	443.51

Fed Chair	**Fiscal Strength**	**Hours**
Miller	1.22	395.56
Eccles	0.92	122.84
Burns	0.77	2368.5
Volcker	0.46	124.76
Powell	0.32	
McCabe	0.28	232.44
Martin	0.13	632.95
Greenspan	0.12	61.731
Bernanke	0.06	
Yellen	0.05	

Table 2: President and Fed chair average annual imputed fiscal strength (in hundredths) and annual president-Fed official meeting hours from 1943–2023. Hours data are from Drechsel (2024). Blank entries represent periods for which data are unavailable.

Jimmy Carter's (1977–1981) average annual imputed fiscal strength is substantially higher than any other eligible president at 1.19 despite spending relatively few hours with Fed officials. Carter's presidency succeeded Gerald Ford's (1974–1977) and Richard Nixon's (1969–1974) terms – the presidents with the next highest fiscal strengths and who spent the most hours meeting with the Fed. G. William Miller (1978–1979) tops eligible Fed chairs with 1.22 average annual fiscal strength, and, while his tenure at the Fed was brief, monetary policy had a reputation for being loose under his watch. Marriner S. Eccles (1934–1948) and Arthur Burns (1970–1978) are next on the list.

The two presidential terms featuring the least amount of fiscal strength are those of Barack Obama (2009–2017) and John F. Kennedy (1961–1963). Inflation remained historically low during Obama's presidency after he announced "...I'm pledging to cut the deficit we inherited in half by the end of my first term in office" in 2009 during the Great Recession. Ben Bernanke's (2006–2014) and Janet Yellen's (2014–2018) terms feature the lowest amount of fiscal strength among in-sample Fed chairs as their time heading the Fed featured low inflation in spite of high government debt.

Figure 6 plots the relationship between imputed fiscal strength and hours data from Table 2. The relationship between the two among presidential and Fed chair terms are positive, with R^2s of 0.15 and 0.04, respectively.

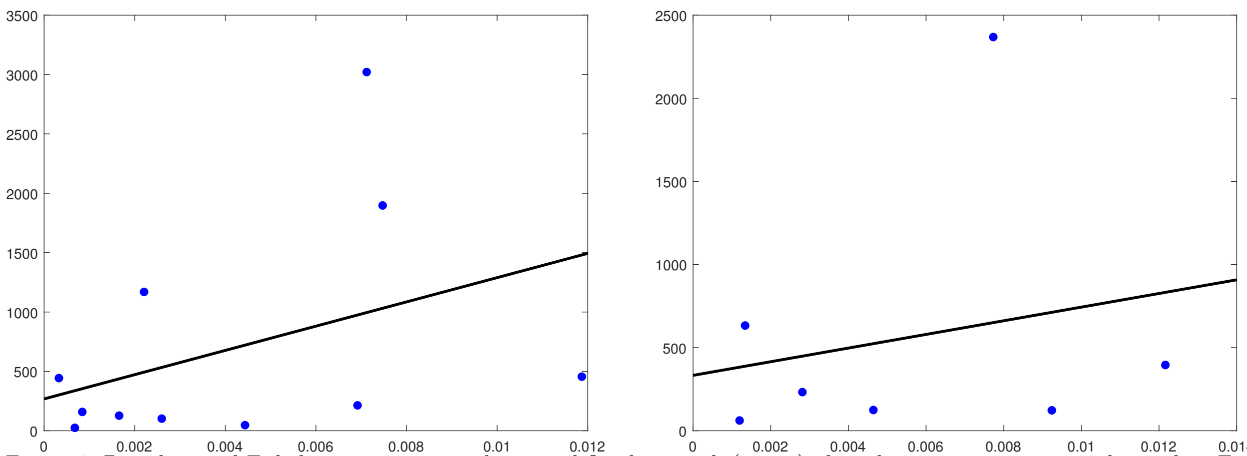

Figure 6: President and Fed chair average annual imputed fiscal strength (x-axis) plotted against average annual president-Fed official meeting hours (y-axis) from 1943–2023. Presidents plotted in the left panel and Fed chairs plotted in the right panel. Each term in office is one entry. Hours data are from Drechsel (2024).

5.2.2 Comparing to First-Best

This section's final exercise is a normative one. For each year from 1943–2023, how does imputed fiscal strength compare to that which would maximize welfare? Figure 7 plots imputed fiscal strength against first-best fiscal strength.

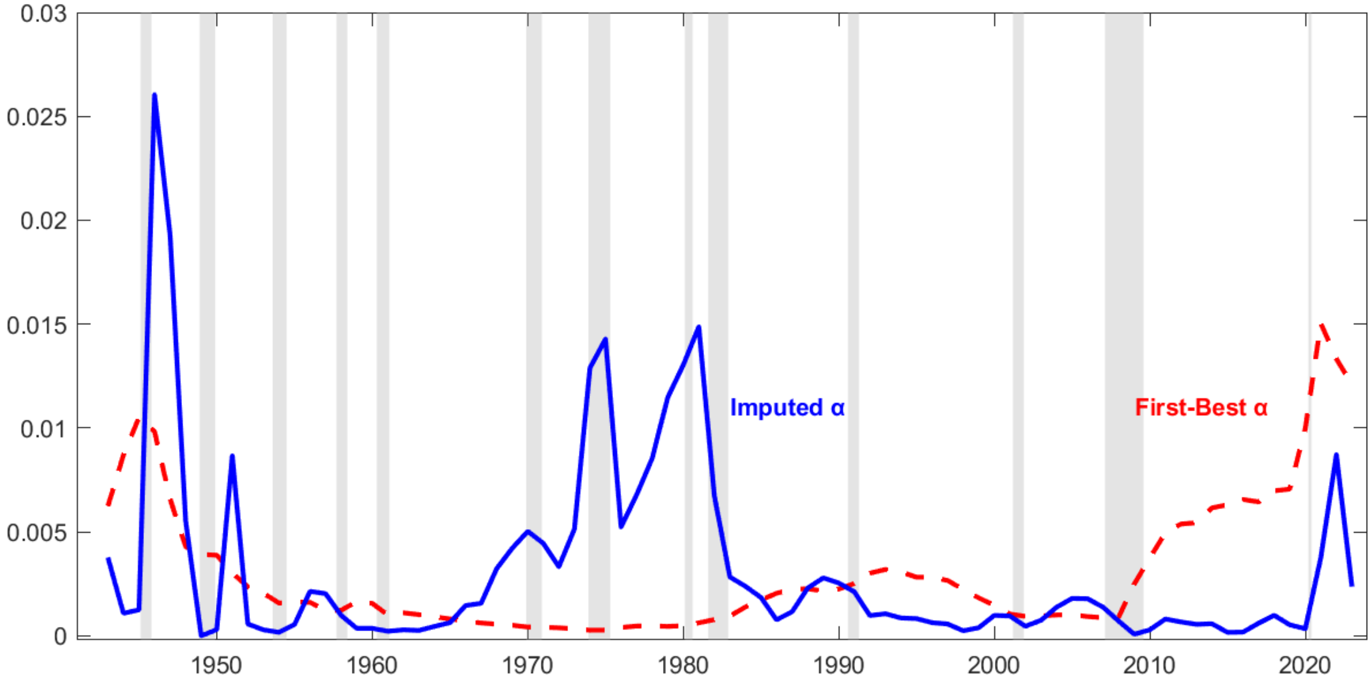

Figure 7: Comparing U.S. fiscal strength to that which implements the Ramsey plan from 1943–2023. I re-solve the model every year, given that year's observed inherited debt and spending $\{b_{-1,t}, g_{0,t}\}_{t=1943}^{2023}$, and select fiscal strengths $\{\alpha_t\}_{t=1943}^{2023}$ (y-axis) which result in allocations matching the model's Ramsey plan. Debt and spending data are measured as percentages of GDP.

Wartime and post-war imputed strength, albeit with high variability, decline with first-best strength. Imputed strength in the 1970s is an order of magnitude larger than that which matches the Ramsey plan. Starting with the Great Recession in 2008 and moving forward until 2023, first-best fiscal strength is *larger* than imputed fiscal strength.

If taxes are too high (fiscal strength is too low) relative to the Ramsey plan, welfare losses from labor distortions dominate those from inflation. If inflation is too high (fiscal strength is too high) relative to the Ramsey plan, inflation-derived welfare losses dominate those from labor market distortions. Financing the government requires facing a trade-off between using the two tools, and the Ramsey planner equates their marginal welfare losses.

The discrepancies in Figure 7 largely relate to the link between inherited debt and welfare maximizing inflation. Surprise inflation is more powerful at financing high-debt governments than low-debt ones, but 1% of inflation reduces household welfare identically across the two. First-best fiscal strength rises in years where the U.S. inherits large levels of debt. Figure 8 visualizes this relationship.

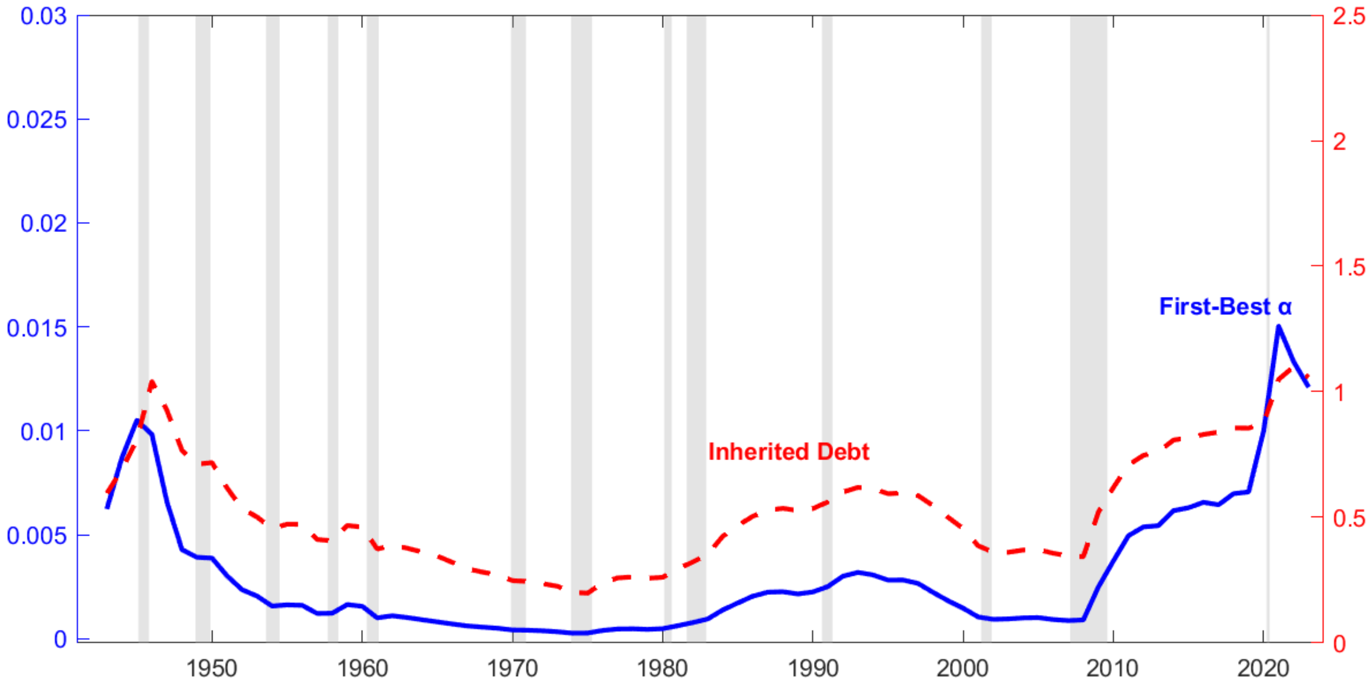

Figure 8: Comparing U.S. fiscal strength which implements the Ramsey plan (left y-axis) to the U.S.'s inherited debt/GDP ratio (right y-axis) from 1943–2023.

The 1970s featured less than 27% outstanding debt/GDP, yet U.S. annual inflation topped out at around 10% over the period – high inflation financed a large portion of a small debt stock. From 2008–2018, inflation peaked at around 2% while government debt spiked in 2008 and gradually increased through 2018 where it reached around 86% of GDP – low inflation did little to finance a large debt stock. According to the model, if the rise in COVID fiscal strength (and resulting inflation) was surprising, such a surprise *improved* welfare relative to an alternative at the Fed's 2% target because it relieved the economy from tax-financing the increase in indebtedness.

6 Under a Maturity Structure of Non-Contingent Debt

This section answers two main questions. First, "What is the value of borrowing in long-term debt along the Ramsey plan?" Second, "How well does the maturity structure of government debt mitigate welfare loss when the government settles on policy away from first-best?"

I answer these questions in three steps. First, I re-specify the baseline model's debt portfolio so that the government issues an effectively-complete markets maturity structure of debt, re-calibrating inherited debt to target the average U.S. maturity structure from 1943–2023.[15] Second, I specify two analogous Arrow security economies by varying the baseline model's inherited debt stock: a welfare-equivalent economy and a debt-equivalent economy. In the welfare-equivalent Arrow security economy, I set inherited debt such that households are indifferent between living in the maturity structure economy and the welfare-equivalent economy when both economies operate along their own Ramsey plans. In the debt-equivalent Arrow security economy, I set inherited debt such that the real (deflated) market value of inherited debt is identical to that of the inherited maturity structure, holding policy constant across the two. Third, I compare the three economies' welfare outcomes, both at first-best and along the fiscal strength continuum $\alpha \in [0, 1)$.

To be concrete, assume an identical model to that described in section 2 and specified in section 4.2, except that households now lend (borrow) in dollars using a portfolio of nominal, non-contingent government debt $B_t = \left\{B_t^{(t+j)}\right\}_{j=1}^{J}$, where j represents a bond's term to maturity. Additionally, the number of debt maturities J is equal to the number of Markov states $S = 2$ so that, according to arguments similar to those made in Angeletos (2002) and Buera and Nicolini (2004), the government may implement almost any complete-markets allocation by replicating state-contingent debt using unique linear combinations of debt maturities.[16] As a result, Proposition 1 to continues to hold: the ARC, IC and opponent's choices remain each institution's relevant constraints.

The debt-manager now chooses (issues) a maturity structure $\boldsymbol{B}_t^{dm} = \left\{\boldsymbol{B}^{(t+j),dm}\right\}_{j=1}^{2}$ and the central bank simultaneously chooses (demands) debt holdings $\boldsymbol{B}_t^{cb} = \left\{\boldsymbol{B}^{(t+j),cb}\right\}_{j=1}^{2}$ to maximize their respective objectives (3)–(4). Debt markets continue to clear according to (5). The full model is described in appendix C.

The economy's IC now reads

$$\underbrace{\frac{1}{\pi_t}\left\{b_{t-1}^{(t)} + \beta \mathbb{E}_t\left[\frac{1}{\pi_{t+1}}\frac{u'(c_{t+1})}{u'(c_t)}\right] b_{t-1}^{(t+1)}\right\}}_{\text{MV(debt)}/P_t} = \underbrace{\frac{1}{u'(c_t)}\mathbb{E}_t \sum_{i=0}^{\infty} \beta^i \left[u'(c_{t+i})\, c_{t+i} - v'(n_{t+i})\, n_{t+i}\right]}_{\mathbb{E}_t[\text{PV(primary surpluses)}]} \tag{23}$$

[15] Lucas and Stokey (1983), Angeletos (2002), Buera and Nicolini (2004) and Faraglia, Marcet, and Scott (2010), among others, explore how a Ramsey planner completes markets using a maturity structure of public debt. Such an assumption is tractable yet counter-factual (see Faraglia, Marcet, and Scott (2010) for a critique). I assume effectively complete markets here in an effort to fairly compare such an economy to baseline.

[16] There is a question of whether state-contingent inflation may be chosen such that the government cannot insure itself with ex-post prices of un-matured, deflated debt. This is not an issue in the following numerical exercises.

where a household's real (indexed) debt holdings are $b_t^{(t+j)} \equiv \frac{B_t^{(t+j)}}{P_t}$, the government's real debt supply is $\boldsymbol{b}_t^{(t+j)} \equiv \frac{\boldsymbol{B}_t^{(t+j)}}{P_t}$.

The left hand side of the economy's IC (23) includes the market value of un-matured debt, which depends on future policy. Because τ_{t+1} and π_{t+1} now affect the level of initial government indebtedness, institutions may choose to smooth welfare losses from surprise debt devaluation over time by using time t and time $t+1$ policy.[17]

6.1 Two Welfare Comparisons

I continue to use section 5's utility specification and numerical calibration except for the model's initial maturity structure is now $\left\{b_{-1}^{(0)}, b_{-1}^{(1)}\right\} = \{0.2261, 0.2949\}$, matching U.S. average debt-to-GDP ratios from 1943–2023 of debt maturing within 1 year and in greater than 1 year, respectively.

To responsibly measure welfare improvements when introducing a maturity structure to an economy, I compare three economies: the recently-described 'maturity structure economy,' a 'welfare-equivalent economy,' and a 'debt-equivalent economy.' The latter two are Arrow security economies with structures like the baseline economy discussed in sections 2–5.

The welfare-equivalent economy is defined by simply setting this paper's baseline economy's inherited debt stock $b_{-1}^{(s)}$ so that welfare along the maturity structure economy's Ramsey plan is equivalent to that along the welfare-equivalent economy's Ramsey plan.

The debt-equivalent economy is defined by setting this paper's baseline economy's inherited debt stock $b_{-1}^{(s)}$ so that its market value of inherited debt is equivalent to that of the maturity structure economy's inherited debt, holding policy constant at the debt-equivalent economy's Ramsey plan, so that

$$\underbrace{b_{-1}^{(s)}}_{\text{Debt-Equivalent}} = \underbrace{b_{-1}^{(0)} + \beta \mathbb{E}_0 \left[\frac{1}{\pi_1} \frac{u'(c_1)}{u'(c_0)} \right] b_{-1}^{(1)}}_{\text{Maturity Structure}} \tag{24}$$

I define the debt-equivalent economy this way to ensure that any additional debt devaluation by the maturity structure's planner is not bestowed upon the debt-equivalent economy in par value terms in its definition.

[17] More generally, smoothing occurs from period 0 to period $J-1$.

6.1.1 Value of Long-Term Debt

What is the value of borrowing in long-term debt along the Ramsey plan? Table 3 compares welfare improvements from moving from the debt-equivalent economy to the welfare-equivalent economy.

Economy (Ramsey Plan)	b_{-1}	W_0 (CE)
Welfare-Equivalent	$\{0.5093, 0\}$	0
Debt-Equivalent	$\{0.5182, 0\}$	-0.0005

Table 3: Inherited debt and consumption-equivalent welfare in the welfare-equivalent and debt-equivalent economies.

Households in the first-best debt-equivalent economy are indifferent between consuming 0.0005, or 0.054%, more in period 0 and moving to the first-best welfare-equivalent economy. A more salient measure of improvement across economies may be that households in the debt-equivalent economy are indifferent between their Ramsey planner inheriting 0.89% less debt and moving to the first-best welfare-equivalent economy. This 0.89% times 2023 U.S. GDP ($27.72T) is about $247B.

Adding a maturity structure allows the Ramsey planner to improve welfare by smoothing surprise debt devaluation across time. Such a result is not unique to effectively complete markets. Work by Lustig, Sleet, and Yeltekin (2008), Debortoli, Nunes, and Yared (2017), Faraglia et al. (2019) and Leeper and Zhou (2021) in incomplete market settings discuss un-matured long-term debt's role in absorbing unforeseen monetary and fiscal shocks through movements in its ex-post market price. The added flexibility of debt revaluation without the exclusive use of contemporaneous taxes and inflation results in a planner that can push financing costs further into the future.

6.1.2 Maturity Structure and Non-Cooperation

How well does the maturity structure of government debt mitigate welfare loss when the government chooses policy away from first-best? Figure 10 compares time 0 consumption-equivalent welfare from the maturity structure economy and welfare-equivalent economy along $\alpha \in [0, 0.01]$.

While the two economies are welfare-equivalent at each of their Ramsey plans, the Ramsey plan with a maturity structure includes more fiscal strength than that with only maturing one period debt. Households prefer the welfare-equivalent economy when FP is weak and prefer the maturity structure economy when FP is strong. To better compare the two welfare relations to *deviations* in

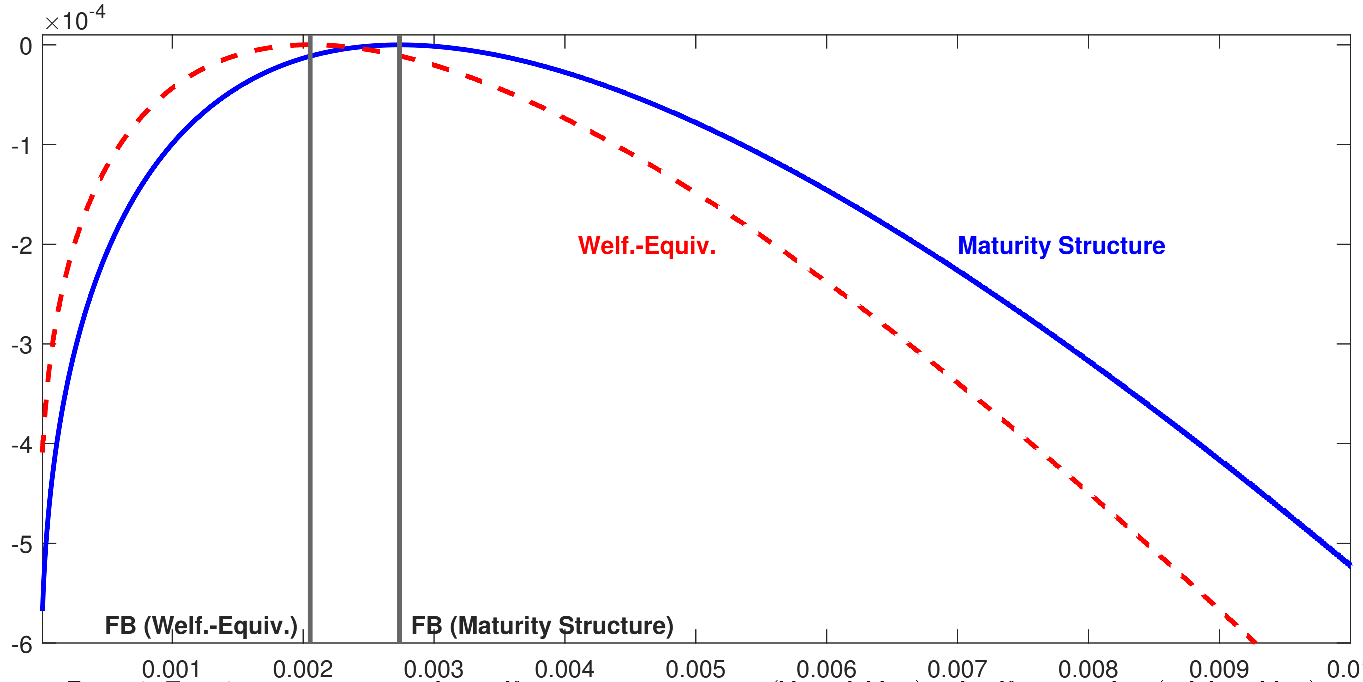

Figure 9: Time 0 consumption-equivalent welfare in maturity structure (blue solid line) and welfare-equivalent (red dotted line) economies across fiscal strengths $\alpha \in [0, 0.01]$ (x-axis).

fiscal strength from first-best, Figure 10 overlays these curves so that the x-axis is now the difference in realized and first-best fiscal strength in each economy.

Households living in the maturity structure economy enjoy better welfare insurance against jointly-implemented government policy away from the Ramsey plan than those living in the economy without a maturity structure. Even at relative deviations of only $\alpha - \alpha^* = -0.002$, the maturity structure economy has lost less than half of the welfare compared with the welfare-equivalent economy. Similar to an envelope theorem result, when monetary and fiscal policies have additional ways to smooth their costly policy over time, deviations from welfare-maximization hurt them less than they would otherwise.

Even when federal institutions act non-cooperatively with respect to how they manage the maturity structure of government, as suggested by Greenwood et al. (2015) and Miran and Roubini (2024), the existence of a maturity structure softens the blow better than a comparable, alternative economy without a maturity structure.

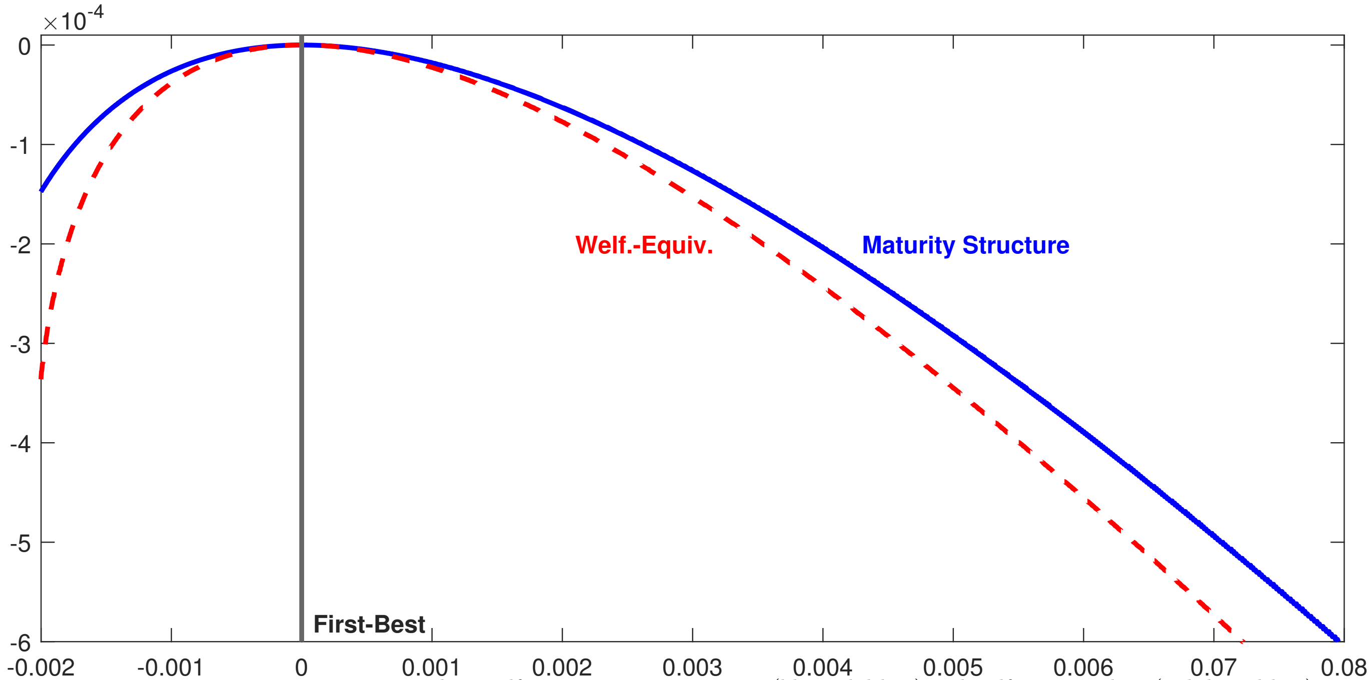

Figure 10: Time 0 consumption-equivalent welfare in maturity structure (blue solid line) and welfare-equivalent (red dotted line) economies by deviations in fiscal strength from first-best (x-axis).

7 Conclusion

This paper develops a framework for understanding fiscal and monetary policy non-cooperation through the lens of relative institutional strength. By modeling the strategic interaction between an inflation-targeting central bank and a tax-minimizing debt-manager as a non-cooperative game with asymmetric Nash bargaining, the model connects tax/inflation trade-offs in government financing to intra-governmental relations.

The paper makes four main contributions to the literature. First, it develops a theory by which intra-governmental bargaining power both determines a unique equilibrium under individually-optimizing fiscal and monetary policy and provides a measure of fiscal strength relative to monetary policy. Second, it provides theoretical underpinnings for the president-Fed meeting data in Drechsel (2024) and offers a way to extend them to present day. Third, it documents the history of fiscal and monetary interactions in post-war America and compares those interactions to a first-best measure of fiscal strength. Fourth, it investigates a maturity structure's role in monetary-fiscal non-cooperation, finding that such a structure is useful in insuring households against policy with too much or too little fiscal strength.

As the U.S. government continues to accumulate debt at an impressive rate, it is useful to consider how Americans' tax rates need to adjust in order to finance this debt without the need for inflation. If those distortions are too much to stomach, it may be worthwhile to re-frame how we think about surprise inflation: a costly tax on bondholders that provides more financing the more bonds are held. These discussions may be able to guide Fed and Treasury leadership to arrive at amicable agreements in policy despite their obvious differences in objectives.

As policymakers debate potential reforms to the U.S.'s fiscal-monetary architecture, including proposals to alter the Fed's mandate, increase presidential influence or otherwise erode the Fed's independence, it is important to emphasize that *institutional cooperation is not necessarily a good thing.* A fiscal authority and a central bank with no independence work cooperatively. A central bank that can use interest rates and remittance/recapitalization policy to unilaterally adjust taxes and keep inflation at zero is cooperative with fiscal policy. Both miss welfare gains from using available tools to finance the consolidated government. Non-cooperative policy can work just as well, if not better, than cooperative policy. Especially when factoring in real-world financial frictions, incomplete markets, political motives and asymmetric information, dividing government objectives among operationally independent institutions creates and enforces checks and balances needed to maintain credible policy, high employment, stable prices and financial stability.

Future research can extend this work in many directions. First may be to incorporate a bargaining equation with time-varying fiscal strength in a linearized model that includes a full suite of economic shocks, estimating the effect movements in fiscal strength have on model variables. It would be interesting to see what a fiscal strength IRF looks like in such a model. A second direction would be to think of fiscal strength as an endogenous variable, asking what economic and societal factors play into its movements throughout history.

References

Alesina, Alberto. 1988. "Macroeconomics and Politics." In *NBER Macroeconomics Annual 1988, Volume 3*. MIT Press, 13–62.

Alesina, Alberto and Lawrence H. Summers. 1993. "Central Bank Independence and Macroeconomic Performance: Some Comparative Evidence." *Journal of Money, Credit and Banking* 25 (2):151–162.

Anderson, Joe and Eric M. Leeper. 2023. "A Fiscal Accounting of COVID Inflation." *Mercatus Special Study* .

Angeletos, George-Marios. 2002. "Fiscal Policy with Non-Contingent Debt and the Optimal Maturity Structure." *Quarterly Journal of Economics* 117 (3):1105–1131.

Arrow, K.J. 1964. "The Role of Securities in the Optimal Allocation of Risk-bearing." *The Review of Economic Studies* 31 (2):91–96.

Barro, Robert J. 1979. "On the Determination of the Public Debt." *Journal of Political Economy* 87 (5):940–971.

Black, Duncan. 1958. *The Theory of Committees and Elections.*

Buera, Francisco and Juan Pablo Nicolini. 2004. "Optimal Maturity Structure of Government Debt without State Contingent Bonds." *Journal of Monetary Economics* 51 (3):531–554.

Caplan, Benjamin. 1956. "A Case Study: The 1948-1949 Recession." In *Policies to Combat Depression.* NBER, 27–58.

Chari, V. V., Lawrence J. Christiano, and Patrick J. Kehoe. 1995. "Policy Analysis in Business Cycle Models." In *Frontiers in Business Cycle Research*, edited by Thomas F. Cooley. Princeton, NJ: Princeton University Press, 357–391.

Chari, V. V. and Patrick J. Kehoe. 1990. "Sustainable Plans." *Journal of Political Economy* 98 (4):783–802.

Chen, Xiaoshan, Eric M. Leeper, and Campbell Leith. 2021. "U.S. Monetary and Fiscal Policy: Conflict or Cooperation?" Forthcoming in *Quantitative Economics.*

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

Dixit, Avinash and Luisa Lambertini. 2003. "Interactions of Commitment and Discretion in Monetary and Fiscal Policies." *The American Economic Review* 93 (5):1522–1542.

Downs, Anthony. 1957. *An Economic Theory of Democracy.* Harper and Brothers.

Drechsel, Thomas. 2024. "Estimating the Effects of Political Pressure on the Fed: A Narrative Approach with New Data." *Review of Economic Studies* Forthcoming.

Faraglia, Alisa, Albert Marcet, and Andrew Scott. 2010. "In Search of a Theory of Debt Management." *Journal of Monetary Economics* 57:821–836.

Faraglia, Elisa, Albert Marcet, Rigas Oikonomou, and Andrew Scott. 2019. "Government Debt Management: the Long and the Short of It." *Review of Economic Studies* 86:2554–2604.

Gnocchi, Stefano. 2013. "Monetary Commitment and Fiscal Discretion: The Optimal Policy Mix." *American Economic Journal: Macroeconomics* 5 (2):187–216.

Gnocchi, Stefano and Luisa Lambertini. 2016. "Monetary Commitment and the Level of Public Debt." Bank of Canada Staff Working Paper No. 2016-3.

Greenwood, Robin, Samuel G. Hanson, Joshua S. Rudolph, and Lawrence H. Summers. 2015. "Debt Management Conflicts Between the U.S. Treasury and the Federal Reserve." In *The $13 Trillion Question*, edited by David Wessel. Washington, D.C.: Brookings Institution Press, 43–75.

Grilli, Vittorio, Donato Masciandaro, and Guido Tabellini. 1992. "Political and Monetary Institutions and Public Financial Policies in the Industrial Countries." *Economic Policy* 7 (14).

Hall, George J. and Thomas J. Sargent. 2022. "Three World Wars: Fiscal-Monetary Consequences." *Proceedings of the National Academy of Sciences* 119(18).

Harsanyi, John C. and Reinhard Selten. 1972. "A Generalized Nash Solution for Two-Person Bargaining Games with Incomplete Information." *Management Science* 18 (5):80–106.

———. 1988. *A General Theory of Equilibrium Selection in Games*. MIT Press.

Leeper, Eric M. 1991. "Equilibria Under 'Active' and 'Passive' Monetary and Fiscal Policies." *Journal of Monetary Economics* 27 (1):129–147.

Leeper, Eric M. and Xuan Zhou. 2021. "Inflation's role in optimal monetary-fiscal policy." *Journal of Monetary Economics* 124:1–18.

Lucas, Robert E., Jr. and Nancy L. Stokey. 1983. "Optimal Fiscal and Monetary Policy in an Economy without Capital." *Journal of Monetary Economics* 12 (1):55–93.

Lustig, Hanno, Christopher Sleet, and Sevin Yeltekin. 2008. "Fiscal Hedging with Nominal Assets." *Journal of Monetary Economics* 55 (4):710–727.

Miran, Stephen and Nouriel Roubini. 2024. "Activist Treasury Issuance and the Tug-Of-War Over Monetary Policy." Hudson Bay Capital Report.

Nash, John. 1951. "Non-Cooperative Games." *Annals of Mathematics* 54 (2):286–295.

O'Neill, Barry. 1982. "A problem of rights arbitration from the Talmud." *Mathematical Social Sciences* 2 (4):345–371.

Restuccia, Andrew, Nick Timmons, and Alex Leary. 2024. "Trump Allies Draw Up Plans to Blunt Fed's Independence." URL `https://www.wsj.com/economy/central-banking/trump-allies-federal-reserve-independence-54423c2f`. The Wall Street Journal.

Sargent, Thomas J. 1986. "Reaganomics and Credibility." In *Rational Expectations and Inflation*, chap. 2. New York: Harper & Row.

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

Sims, Christopher A. 1994. "A Simple Model for Study of the Determination of the Price Level and the Interaction of Monetary and Fiscal Policy." *Economic Theory* 4 (3):381–399.

———. 2013. "Paper Money." *American Economic Review* 103 (2):563–584.

Winfree, Paul. 2024. "Federal Reserve." In *Project 2025*. The Heritage Foundation, 731–743.

Woodford, Michael. 1995. "Price-Level Determinacy Without Control of a Monetary Aggregate." *Carnegie-Rochester Conference Series on Public Policy* 43:1–46.

A Appendix: Proofs

Proof for Proposition 1

Let $\left\{\{c_t(x_t), n_t(x_t), g_t, \pi_t(x_t)\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$ represent a stochastic sequence. Substituting (1), (9), and the definitions $b_t^{(s)} = \frac{B_t^{(s)}}{P_t}$ and $\pi_t = \frac{P_t}{P_{t-1}} > 0$ into (6), while considering (7), forward-iterating, and applying (10), results in (12). If a stochastic sequence $\left\{\{c_t(x_t), n_t(x_t), g_t\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$ is generated by a competitive equilibrium, then it necessarily satisfies (1) and (12).

Let government institutions jointly choose the associated level of debt $\left\{\left\{\left\{\boldsymbol{b}_t^{(s)}(x_t)\right\}_{s=1}^{S}\right\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$, let the debt-manager choose a tax sequence $\left\{\{\tau_t(x_t)\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$ and the central bank choose a sequence of inflation rates $\left\{\{\pi_t(x_t)\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$ such that (9) is satisfied. (12) and (1) imply (6) and (8) as well as (5) are satisfied, given definitions $\boldsymbol{b}_t^{(s)} = \frac{\boldsymbol{B}_t^{(s)}}{P_t}$ and $\pi_t = \frac{P_t}{P_{t-1}} > 0$. All optimality conditions, dynamic budget constraints, and market clearing criteria are satisfied, so the equilibrium is competitive.

Proof for Lemma 1

By definition, if $\pi_0 > 1$ is not required for a CNE, then the debt-manager can feasibly individually satisfy (1) and (12) under $\pi_t = 1\ \forall t$.

$0 < b_{t-1} < \hat{b}_{t-1} \implies \exists \varepsilon \in \mathbb{R}_{++}^S$ for which $b'_{t-1} = b_{t-1} + \varepsilon < \hat{b}_{t-1}$. Due to the properties of u, v and w and the definition of $\hat{b}_{t-1}$, $\exists \left\{\{\tau_t(x_t)\}_{g^t\in G^t}\right\}_{t=0}^{\infty}$ for which an economy inheriting b'_{t-1} requires $\pi_0 < 1$ for (1) and (12) to hold. Finally, by (19)–(20), $\pi_0 < 1 \implies \lambda_0^{cb} < 0$.

B Appendix: CNE Sensitivity

B.1 Inherited Debt

This section finds to what degree an increased inherited debt position affects the baseline model's CNE. I begin by calibrating the model's inherited debt position to match the average par value/GDP ratio of privately-held U.S. debt during the post-COVID era from 2020–2022 so that $b_{-1}^{(s)'} = 1.07$, keeping the rest of the model calibration fixed. Figure 11 plots the the two economies' Pareto frontiers.

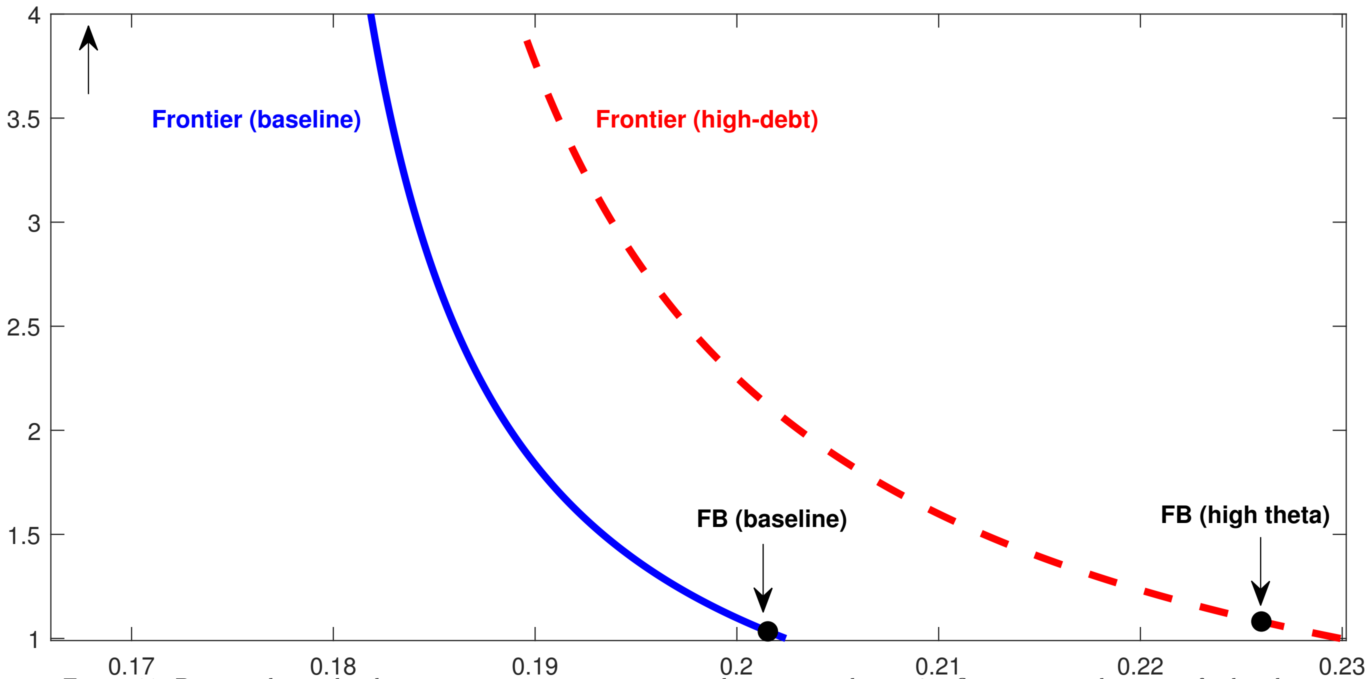

Figure 11: Pareto relationship between stationary tax rate $\bar{\tau}$ on the x-axis and time 0 inflation π_0 on the y-axis for baseline (blue solid line) and high-debt (red dotted line) economies. Feasible equilibria lie along the frontier: points to the left violate the household budget constraint (6) and points to the right violate household, government optimization (9), (17)–(20).

Increasing $b_{-1}^{(s)}$ tightens the government budget constraint, shifting its Pareto frontier to the right. The Ramsey plan in the high-debt economy thus includes higher taxes and greater inflation. Also apparent from the curvature of the two frontiers is that surprise inflation, as opposed to explicit taxation, does a better job of financing high-debt economies.

How does institutional non-cooperation factor into equilibrium determination? Figure 15 visualizes the two frontiers as functions of fiscal strength and Table 4 displays tax and inflation at the economies' corners and and Ramsey plans where $\alpha \in [0, .02]$.

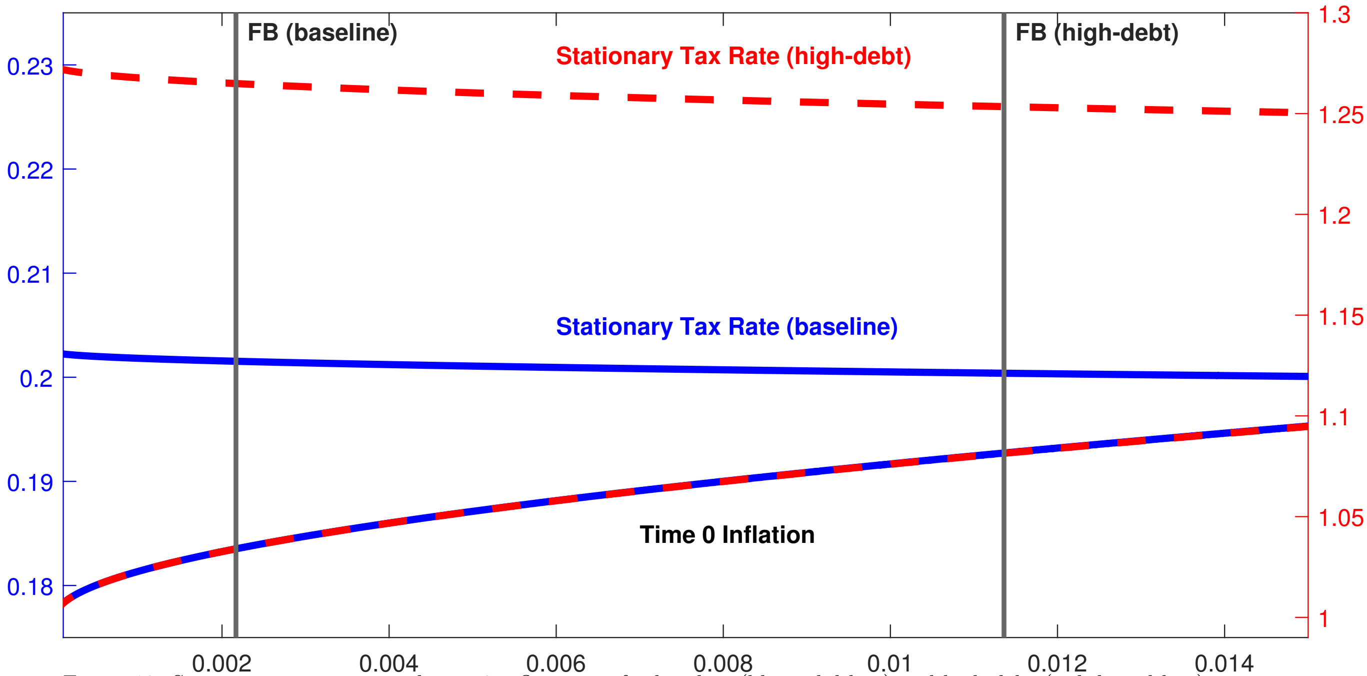

Figure 12: Stationary tax rate $\bar{\tau}$ and time 0 inflation π_0 for baseline (blue solid line) and high-debt (red dotted line) economies across fiscal strengths, $\alpha \in [0, 0.015]$.

CNE	α	$\bar{\tau}$	π_0
All-powerful central bank (baseline)	0	0.2024	1
Ramsey plan (baseline)	0.0022	0.2015	1.0340
All-powerful debt-manager (baseline)	1	0.1665	∞
All-powerful central bank (high-debt)	0	0.2299	1
Ramsey plan (high-debt)	0.0114	0.2260	1.0814
All-powerful debt-manager (high-debt)	1	0.1665	∞

Table 4: Fiscal strengths, stationary tax rates and time 0 inflation rates in corner and first-best CNE for baseline and high-debt economies.

Feasible stationary tax rates $\bar{\tau}$ are more than 2.5% higher between the baseline and high-debt economy, yet inflation is identical. This is because the figure is displaying policy close to $\alpha = 0$, where time 0 inflation π_0 equals 1 regardless of the government's outstanding debt position.

Households with more indebted governments prefer stronger fiscal policy. The intuition is an extension of that discussed above: surprise inflation is more effective at financing high-debt economies *and* imposes no more welfare costs than inflation in a low-debt economy.

Figure 13 compares the baseline and high-debt economies' relative time 0 consumption-equivalent welfares as functions of fiscal strength. Households in the high-debt economy not only prefer more fiscal strength, deviations from first-best are less impactful than those in the low-debt economy.

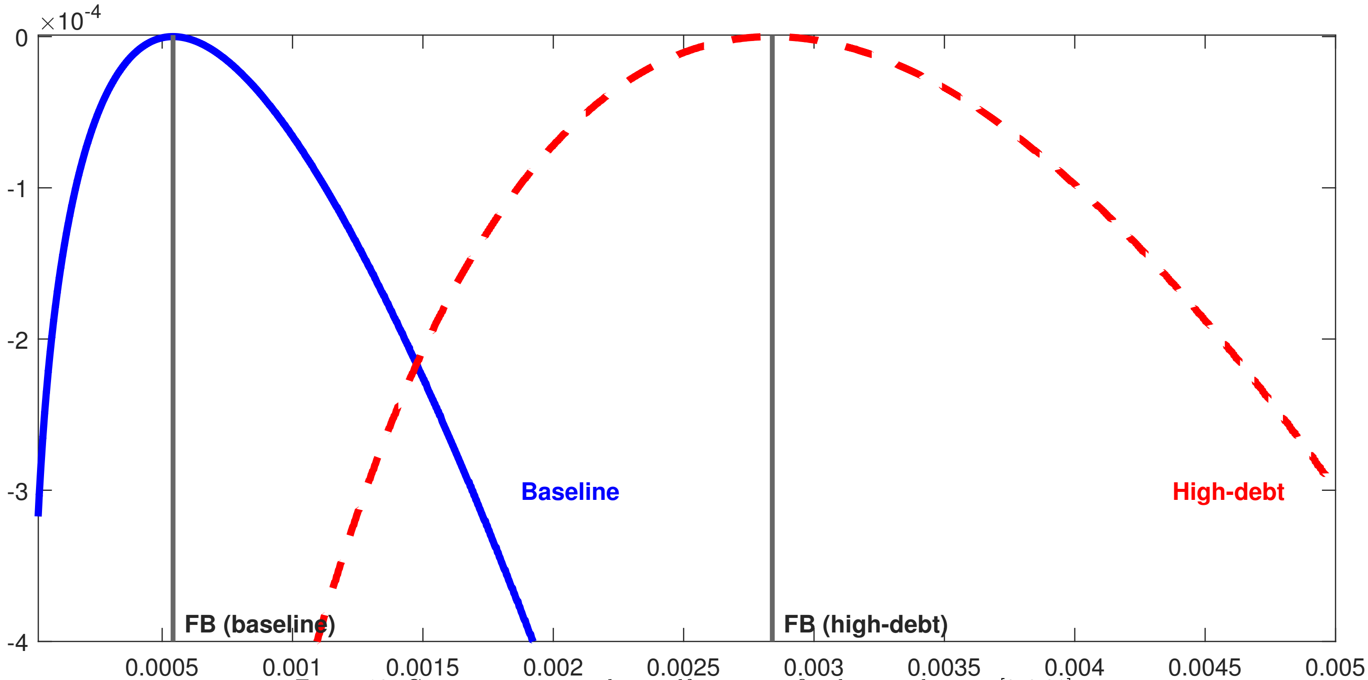

Figure 13: Consumption-equivalent welfare across fiscal strengths, $\alpha \in [0, 0.01]$.

This is is largely due to the fact that, in absolute terms, welfare is higher in the low-debt economy along its Ramsey plan than the high-debt economy along its Ramsey plan, which is apparent from the frontiers Figure 11.

The main takeaway from this section is that, while surprise inflation is costly, its benefits positively co-move with the government's outstanding debt stock.

B.2 Welfare's Sensitivity to Inflation

This section investigates how the baseline model's equilibrium changes after increasing θ, the parameter governing relative welfare costs to inflation. I compare the baseline model to one where θ is twice as large $\theta' = 2.344$ so that households are more sensitive to inflation. Figure 14 plots the relationship of the two economies' Pareto frontiers.

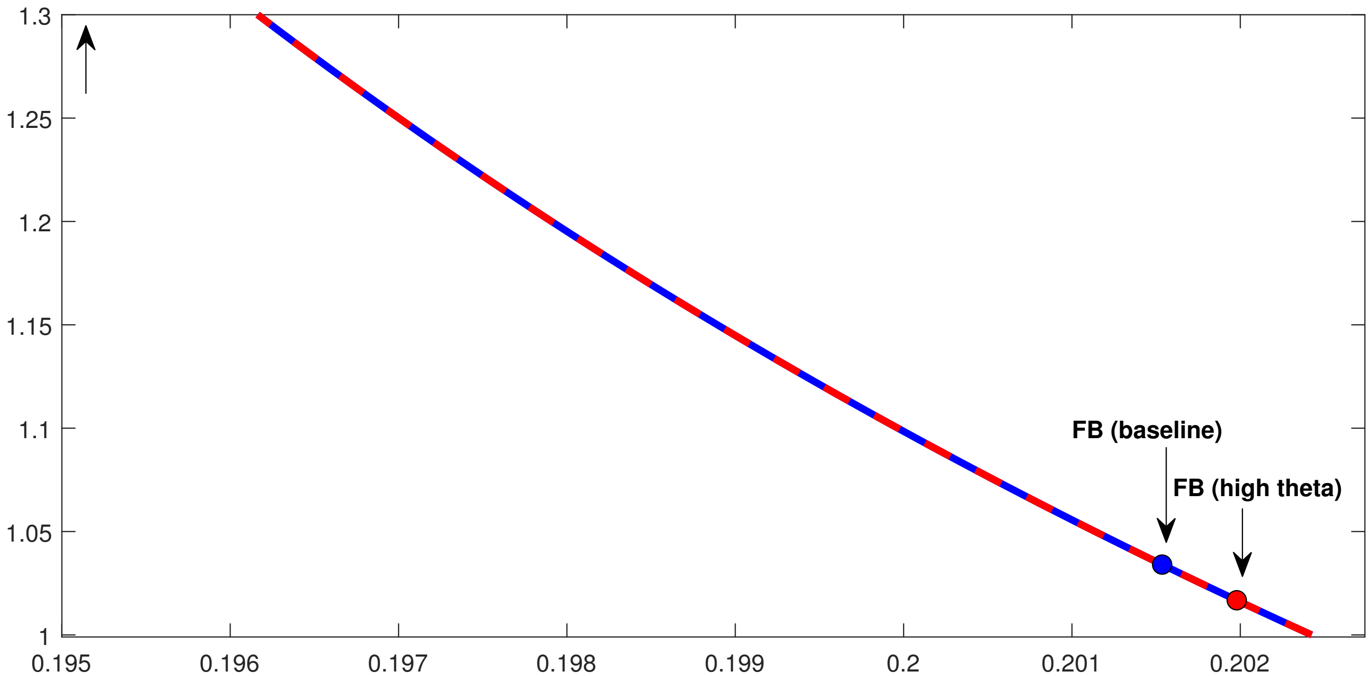

Figure 14: Pareto relationship between stationary tax rate $\bar{\tau}$ on the x-axis and time 0 inflation π_0 on the y-axis for baseline (blue solid line) and high-θ (red dotted line) economies. Feasible equilibria lie along the frontier: points to the left violate the household budget constraint (6) and points to the right violate household, government optimization (9), (17)–(20).

Adjusting θ does nothing to adjust either the ARC (1) or IC (12). The continuum of feasible equilibria (and supporting policy choices) is thus unchanged. Unsurprisingly, the welfare-maximizing policy mix adjusts to include more tax financing and less financing from surprise inflation. While using inflation is no more and no less advantageous for government financing in the high-θ economy, inflation is more welfare-reducing and thus used less by the Ramsey planner. Figure 15 visualizes the same frontier plotted as a function of fiscal strength.

The feasible set of tax/inflation combinations that satisfy the joint-government's relevant constraints overlap everywhere as in Figure 15. Welfare-maximizing monetary policy is all-powerful $\alpha \to 0$ when households are infinitely sensitive to inflation $\theta \to \infty$. The symmetric case also holds: optimal fiscal policy is all-powerful $\alpha \to 1$ when households do not care about inflation $\theta \to 0$.

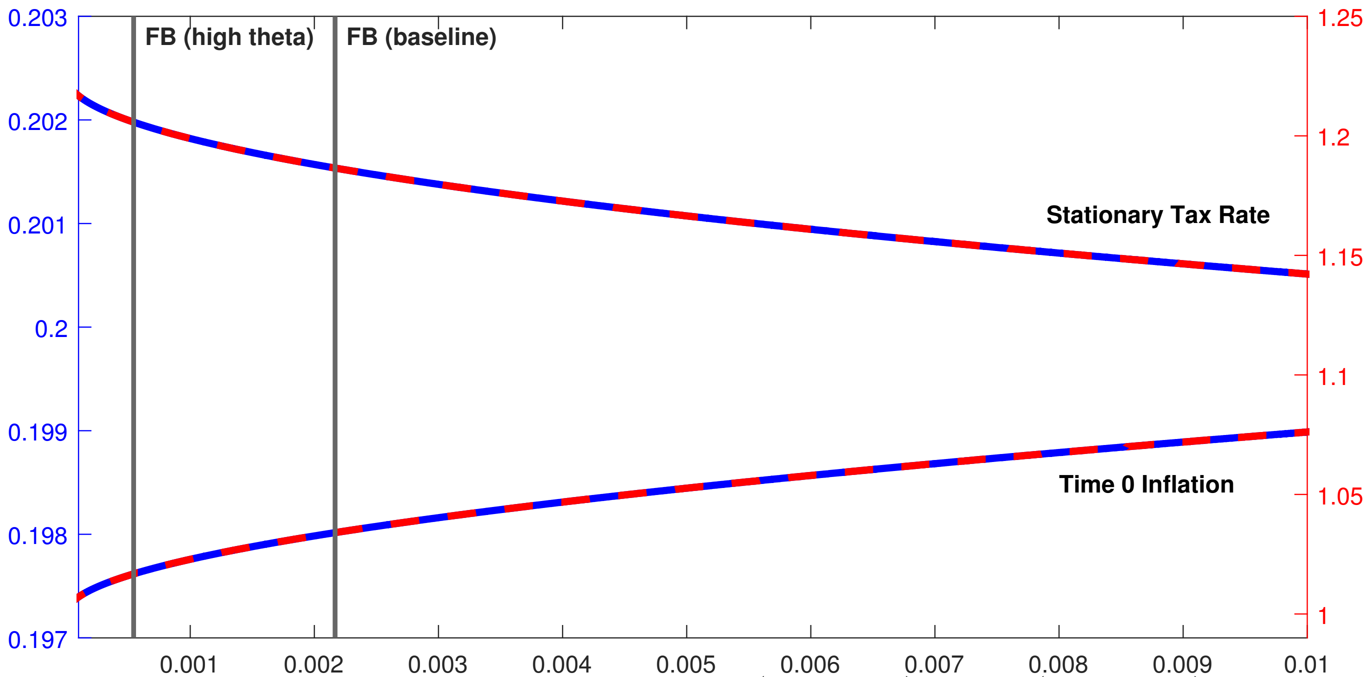

Figure 15: Stationary tax rate $\bar{\tau}$ and time 0 inflation π_0 for baseline (blue solid line) and high-θ (red dotted line) economies across fiscal strengths, $\alpha \in [0, 0.01]$.

CNE	α	$\bar{\tau}$	π_0
All-powerful central bank	0	0.2024	1
Ramsey plan (high-θ)	0.0005	0.2020	1.0168
Ramsey plan (baseline)	0.0022	0.2015	1.0340
All-powerful debt-manager	1	0.1665	∞

Table 5: Fiscal strengths, stationary tax rates and time 0 inflation rates in corner and first-best CNE for baseline and high-θ economies.

Figure 16 plots economy-specific consumption-equivalent welfare along the fiscal strength continuum. While more inflation-sensitive households imply a stronger welfare-maximizing central bank, deviations from first-best joint-policy become more costly in such economies. For low values of θ, policy away from first-best is less welfare-reducing.

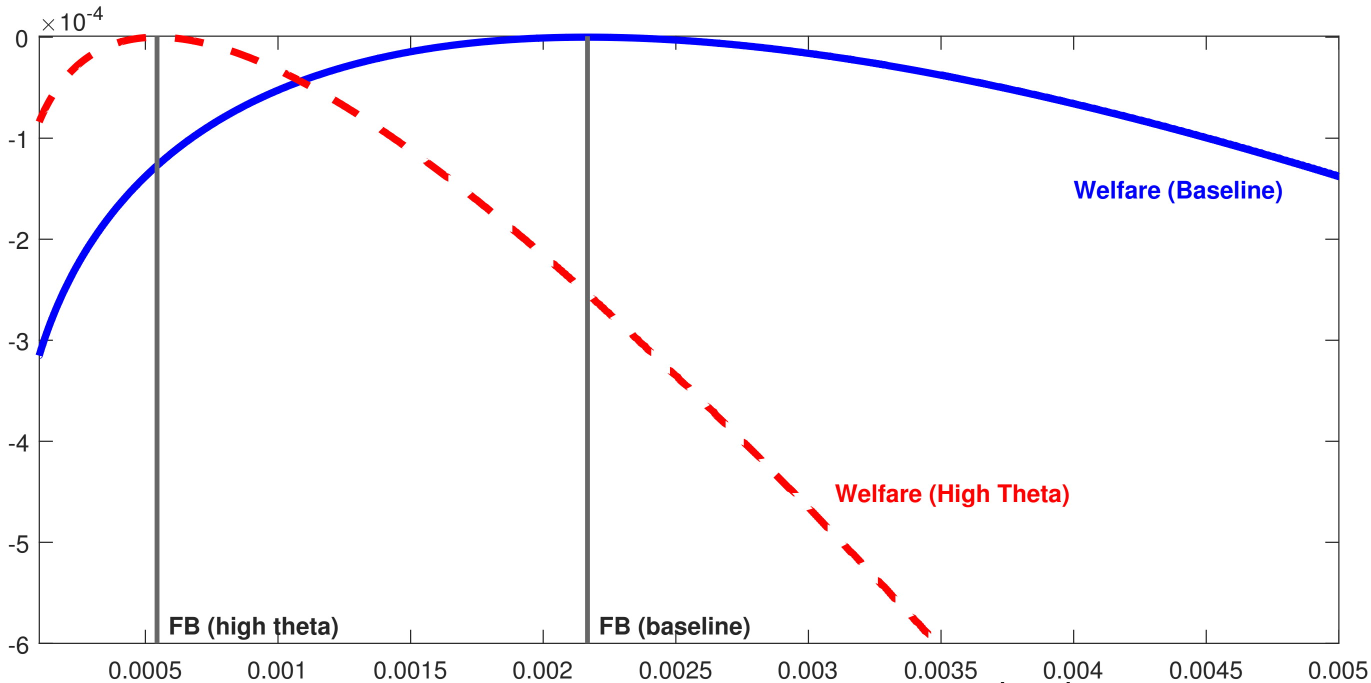

Figure 16: Consumption-equivalent welfare across fiscal strengths, $\alpha \in [0, 0.01]$.

C Appendix: Model with a Maturity Structure

The debt-manager chooses (issues) a maturity structure $\boldsymbol{B}_t^{dm} = \left\{ \boldsymbol{B}^{(t+j),dm} \right\}_{j=1}^{2}$ and the central bank simultaneously chooses debt holdings $\boldsymbol{B}_t^{cb} = \left\{ \boldsymbol{B}^{(t+j),cb} \right\}_{j=1}^{2}$ to maximize their respective objectives (3)–(4). Debt markets continue to clear according to (5).

The household budget constraint now reads

$$P_t c_t + \sum_{j=1}^{2} Q_t^{(t+j)} \left(B_t^{(t+j)} - B_{t-1}^{(t+j)} \right) \leq P_t \left(1 - \tau_t\right) n_t + B_{t-1}^{(t)}$$

and the no-Ponzi condition now reads

$$B_t^{(t+j)} \in \left[\underline{B}, \overline{B} \right] \quad \forall \; t, j \in \{1, 2\}$$

where the sum on the left side of the household budget constraint represents new household borrowing across maturities.

Household optimization is now governed by

$$1 - \tau_t = \frac{v'\left(n_t\right)}{u'\left(c_t\right)} \quad \text{and} \quad Q_t^{(t+j)} = \beta^j \mathbb{E}_t \left[\frac{u'\left(c_{t+j}\right) P_t}{u'\left(c_t\right) P_{t+j}} \right] \quad \forall \; j \in \{1, 2\}$$

which implies a new TVC, reading

$$\lim_{i \to \infty} \left(\frac{\sum_{j=0}^{1} \beta^{j+i} \mathbb{E}_t \left[\frac{u'\left(c_{t+j+i}\right) P_t}{u'\left(c_t\right) P_{t+j+i}} \right] B_{t-1+i}^{(t+j+i)}}{P_t} \right) = 0$$

and where the household FOC on taxes τ_t is unchanged from (9).

Define a household's real (indexed) debt holdings as $b_t^{(t+j)} \equiv \frac{B_t^{(t+j)}}{P_t}$ and the government's real debt supplied as $\boldsymbol{b}_t^{(t+j)} \equiv \frac{\boldsymbol{B}_t^{(t+j)}}{P_t}$, and define the vector of real debt allocations held by households as $b_t \equiv \left\{ b_t^{(t+j} \right\}_{j=1}^{2}$ and supplied by the government as $\boldsymbol{b}_t \equiv \left\{ \boldsymbol{b}_t^{(t+j)} \right\}_{j=1}^{2}$. Again combine the ARC (1), household budget constraint and FOCs, forward-iterate on the probability-weighted sum of maturing government debt and apply the TVC to express the new economy's IC as

$$\underbrace{\frac{1}{\pi_t}\left\{b_{t-1}^{(t)}+\beta\mathbb{E}_t\left[\frac{1}{\pi_{t+1}}\frac{u'\left(c_{t+1}\right)}{u'\left(c_t\right)}\right]b_{t-1}^{(t+1)}\right\}}_{\text{MV(debt)}/P_t}=\underbrace{\frac{1}{u'\left(c_t\right)}\mathbb{E}_t\sum_{i=0}^{\infty}\beta^i\left[u'\left(c_{t+i}\right)c_{t+i}-v'\left(n_{t+i}\right)n_{t+i}\right]}_{\mathbb{E}_t[\text{PV(primary surpluses)}]}$$

The Ramsey planner's FOCs on $\{c_t\}$ and $\{n_t\}$ now combine to yield

$$\begin{aligned}
u'\left(c_0\right)\left[1+\lambda_0\right]+\lambda_0\left[u''\left(c_0\right)\left(c_0-\frac{b_{-1}^{(0)}}{\pi_0}\right)\right]&=v'\left(n_0\right)\left[1+\lambda_0\right]+\lambda_0 v''\left(n_0\right)n_0 &&\text{and}\\
u'\left(c_1\right)\left[1+\lambda_0\right]+\lambda_0\left[u''\left(c_1\right)\left(c_1-\frac{b_{-1}^{(1)}}{\pi_0\pi_1}\right)\right]&=v'\left(n_1\right)\left[1+\lambda_0\right]+\lambda_0 v''\left(n_1\right)n_1 &&\text{and}\\
u'\left(c_t\right)\left[1+\lambda_0\right]+\lambda_0 u''\left(c_t\right)c_t&=v'\left(n_t\right)\left[1+\lambda_0\right]+\lambda_0 v''\left(n_t\right)n_t &&\forall\ t>1
\end{aligned}$$

The Ramsey planner's FOCs on $\{\pi_t\}$ are now

$$\begin{aligned}
w'\left(\pi_0\right)\pi_0^2&=\lambda_0\left\{u'\left(c_0\right)b_{-1}^{(0)}+\beta\mathbb{E}_0\left[\frac{u'\left(c_1\right)}{\pi_1}\right]b_{-1}^{(1)}\right\} &&\text{and}\\
w'\left(\pi_1\right)\pi_1^2&=\lambda_0\mathbb{E}_0\left[\frac{u'\left(c_1\right)}{\pi_0}\right]b_{-1}^{(1)} &&\text{and}\\
\pi_t&=1 &&\forall\ t>1
\end{aligned}$$

As in the economy with state contingent debt, institutional FOCs are identical to Ramsey FOCs with the exception of the Lagrange multipliers.

The debt-manger's FOCs on $\{c_t\}$ and $\{n_t\}$ now imply

$$\begin{aligned}
u'\left(c_0\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}\left[u''\left(c_0\right)\left(c_0-\frac{b_{-1}^{(0)}}{\pi_0}\right)\right]&=v'\left(n_0\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}v''\left(n_0\right)n_0 &&\text{and}\\
u'\left(c_1\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}\left[u''\left(c_1\right)\left(c_1-\frac{b_{-1}^{(1)}}{\pi_0\pi_1}\right)\right]&=v'\left(n_1\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}v''\left(n_1\right)n_1 &&\text{and}\\
u'\left(c_t\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}u''\left(c_t\right)c_t&=v'\left(n_t\right)\left[1+\lambda_0^{dm}\right]+\lambda_0^{dm}v''\left(n_t\right)n_t &&\forall\ t>1
\end{aligned}$$

The central bank's FOCs on $\{\pi_t\}$ are now

$$\begin{aligned}
w'(\pi_0)\,\pi_0^2 &= \lambda_0^{cb}\left\{u'(c_0)\,b_{-1}^{(0)} + \beta\mathbb{E}_0\left[\frac{u'(c_1)}{\pi_1}\right]b_{-1}^{(1)}\right\} && \text{and} \\
w'(\pi_1)\,\pi_1^2 &= \lambda_0^{cb}\mathbb{E}_0\left[\frac{u'(c_1)}{\pi_0}\right]b_{-1}^{(1)} && \text{and} \\
\pi_t &= 1 && \forall\ t > 1
\end{aligned}$$

A government may use linear combinations of debt maturities to implement complete markets allocation paths when $J \geq S$, understanding how ex-post, un-matured debt prices move in each potential future state.[18] Buera and Nicolini (2004) prove that the $S \times J$ (payoff) matrix of ex-post debt prices being invertable along such a path is necessary and sufficient for this result to hold under a Markovian stochastic process.

Given that the matrix

$$\begin{bmatrix} \left(\frac{1}{\pi_t}|s=1\right) & \beta\mathbb{E}_t\left(\frac{u'(c_{t+1})}{u'(c_t)\,\pi_t\pi_{t+1}}|s=1\right) \\ \left(\frac{1}{\pi_t}|s=2\right) & \beta\mathbb{E}_t\left(\frac{u'(c_{t+1})}{u'(c_t)\,\pi_t\pi_{t+1}}|s=2\right) \end{bmatrix}$$

is invertable for every period and possible state along a complete-markets path of allocations, such an equilibrium is implementable using linear combinations of nominal debt.[19] This matrix is always invertable in the calibrated version of this economy.

[18] Angeletos (2002) and Buera and Nicolini (2004) are the first to point this equivalence out. When $J = S$ the implementing debt maturity combination is unique.

[19] This requirement is satisfied when inflation is always 1 as $u'(c_t)$ differs across potential time t spending states when taxes are smooth.

D Appendix: Data Sources

Apart from Drechsel's (2024) data on president-Fed official meetings, which is available on his website, this paper uses three main time series: U.S. inflation (1943–2023), U.S. spending-to-GDP (1943–2023) and U.S. par value debt-to-GDP (1942–2022).

- U.S. Inflation (1943–2023)
  - Growth rate in annual GDP deflator. Section 1, table T10109-A, line 1 in the NIPA from the BEA. Found at `https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1`
- U.S. Spending-to-GDP (1943–2023)
  - GDP: Annual nominal GDP. Section 1, table T10105-A, line 1 in the NIPA from the BEA. Found at `https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1`
  - Spending: Annual nominal spending. Calculated as (Total expenditures) - (Interest payments) + (Interest receipts) - (federal employee pension interest accrual), as in Hall and Sargent (2022).
    * Total expenditures. Section 3, table T30200-A, Line 43 in the National Income and Product Accounts (NIPA) from the BEA and found at `https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1`.
    * Interest payments: Section 3, table T30200-A, line 33 in the National Income and Product Accounts (NIPA) from the BEA and found at `https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1`.
    * Interest receipts: Section 3, table T30200-A, line 14 in the National Income and Product Accounts (NIPA) from the BEA and found at `https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1`.
    * Federal employee pension interest accrual: Section 3, table T31800(A,B)-A, line 22 in the National Income and Product Accounts (NIPA) from the BEA and found at

https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1.

- U.S. Par Value Debt-to-GDP (1942–2022)
  - Calculated as (Reserves Outstanding) + (Privately-Held Treasurys). All reserves outstanding is considered <1 year duration.
    - GDP: Annual nominal GDP. Section 1, table T10105-A, line 1 in the NIPA from the BEA. Found at https://apps.bea.gov/iTable/?isuri=1&reqid=19&step=4&categories=flatfiles&nipa_table_list=1
    - Reserves Outstanding (2002–2022). calculated as (Federal Reserve Notes, Net of F.R. Bank Holdings) + (Deposits with F.R. Banks, Other Than Reserve Balances) + (Other Deposits at the Fed) + (Term Deposits Held by Depository Institutions) - (U.S. Treasury, Supplementary Financing Account) - (Treasury balance in TGA) + (Reverse Repurchase Agreements).
      - Federal Reserve Notes, Net of F.R. Bank Holdings. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLFN.
      - Deposits with F.R. Banks, Other Than Reserve Balances. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WDFOL.
      - Other Deposits at the Fed. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLODL.
      - Term Deposits Held by Depository Institutions. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/TERMT.
      - U.S. Treasury, Supplementary Financing Account. Table H.4.1.T5 on the Fed's weekly balance sheet and found at https://fred.stlouisfed.org/series/WLSFAL.

  - Treasury balance in TGA. Daily Treasury Statements, found at `https://fsapps.fiscal.treasury.gov/dts/issues`.
  - Reverse Repurchase Agreements. Table H.4.1.T5 on the Fed's weekly balance sheet and found at `https://fred.stlouisfed.org/series/WLRRAL`.

* Reserves Outstanding (1942–2001). Calculated as the average reserves outstanding/GDP from 2002–2022 multiplied by GDP from 1942–2001.
* Privately-Held Debt (1942–2022). Center for Research in Security Prices (CRSP) U.S. Treasury Database