Appetite for Treasuries, Debt Cycles, and Fiscal Inflation

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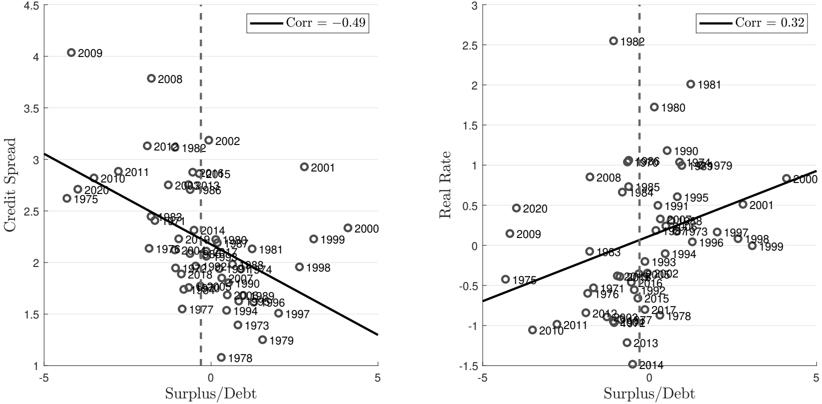
Motivation

- Recent U.S. observations
  - debt-GDP ratio nearly tripled since new millennium
  - short-term interest rates averaged well below 2%
  - inflation averaged less than 2% until post-pandemic era
  - long-term Treasury yields have been trending down
- Why haven't these been inflationary over past two decades?
  - in a phrase: bond-market pessimism
  - during crisis, investors have insatiable appetite for Treasuries
- What happens to inflation if such appetite is quenched?
  - in a word: goods-market euphoria
  - inflation soared over 9% this year

Fiscal Stance



- Low real yield on Treasuries due to appetite for safety/liquidity
- Overall profligate fiscal stance

Road Ahead

- I study state-dependent properties of inflation and fiscal stance that characterize U.S. debt cycles
  - estimate change-point Bayesian VAR with both fiscal and financial variables
  - uncover two alternating phases—persistent deficits and surpluses—of a debt cycle
  - *joint* with distinct patterns of inflation and fiscal stance
- I provide a structural interpretation
  - simple fiscal theory of price level (FTPL) model with household's preference for gov. bonds
  - passive monetary and broad range of active fiscal policy
  - flight to safety drives $r < g$, permitting permanent deficits without fiscal inflation

Change-Point Model

- Consider 2nd-order VAR model

$$y_t = \Phi_{0,s_t} + \Phi_{1,s_t} y_{t-1} + \Phi_{2,s_t} y_{t-2} + u_t, \quad u_t \sim \mathbb{N}(0, \Sigma_{s_t})$$

s_t follows a 3-state Markov chain [see Chib (1998)]

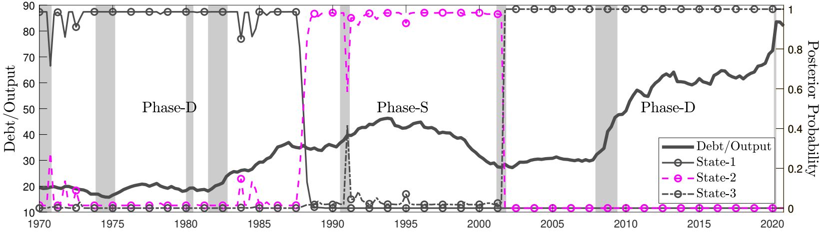
$$P = \begin{bmatrix} p_{11} & 1 - p_{11} & 0 \\ 0 & p_{22} & 1 - p_{22} \\ 0 & 0 & 1 \end{bmatrix}$$

- 1970–2020 quarterly data: GDP growth rate, inflation rate, nominal interest rate, surplus-debt ratio, credit spread

- Posterior sampling via data augmentation

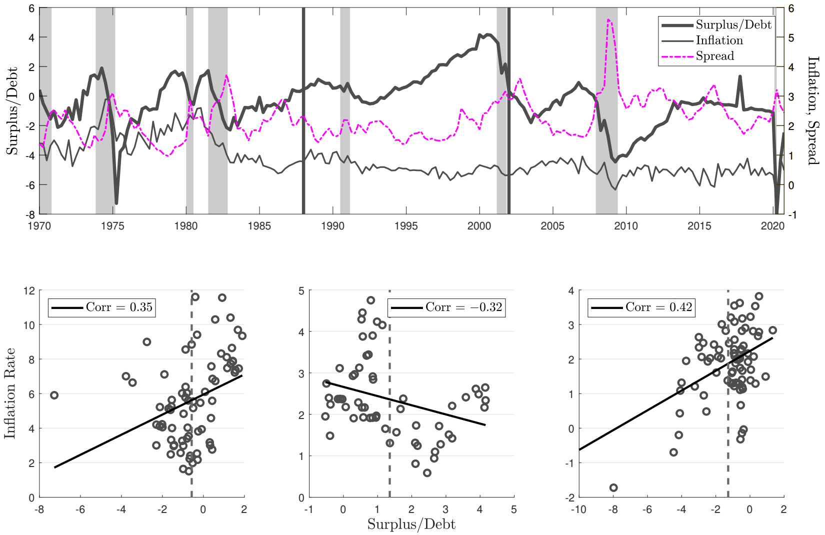
$$p(\{\Phi_i, \Sigma_i\} | Y, \{s_t\}), \quad p(P | \{s_t\}), \quad p(\{s_t\} | Y, \{\Phi_i, \Sigma_i\}, P)$$

Posterior Estimates



	State-1: 1970–1987		State-2: 1988–2001		State-3: 2002–2020	
Observables	Mean	70% HPD	Mean	70% HPD	Mean	70% HPD
GDP growth	0.29	[0.21, 0.45]	0.67	[0.06, 1.02]	0.13	[0.05, 0.31]
Inflation	1.45	[1.25, 1.71]	0.63	[0.39, 1.15]	0.42	[0.36, 0.51]
Interest rate	2.52	[1.72, 2.49]	1.50	[0.55, 2.55]	−0.04	[−0.26, 0.31]
Surplus/debt	−0.25	[−1.01, −0.22]	1.73	[−6.61, 6.99]	−1.89	[−2.26, −0.86]
Credit spread	0.52	[0.44, 0.53]	0.49	[0.09, 0.80]	0.72	[0.62, 0.77]

Fiscal (Dis)inflation



Archetypal Debt Cycle

- Phase-D features
  - prolonged period of fiscal imbalance
  - rising debt-GDP ratio, elevated financial stress
  - fiscal events: Ford tax cut of 1975; Reagan recovery plan of 1981; Bush tax relief of 2001 and 2003; Obama recovery plan of 2009; Trump Covid-19 relief of 2020
  - positive correlation b/w inflation & fiscal stance
- Phase-S features
  - sustained and growing primary surpluses, e.g., later 1990s under Clinton
  - higher output growth, modest inflation and interest rate, stabilized debt-GDP ratio, lower credit spread
  - negative correlation b/w inflation & fiscal stance

Endowment Economy

- Private sector optimization

$$\mathbb{E}_0 \sum_{t=0}^{\infty} \beta^t \left(\ln \frac{C_t}{g^t} + \chi_t \ln \frac{B_t}{g^t R_t P_t} \right)$$

$$P_t C_t + \frac{B_t}{R_t} + T_t = P_t Y_t + B_{t-1}$$

Stead-state real interest rate

$$r = \frac{R}{\pi} = \frac{g\lambda}{\beta}, \qquad \lambda = 1 - \frac{\chi}{b/y}$$

- Public sector budget constraint

$$\frac{B_t}{R_t} + S_t = B_{t-1}$$

Stead-state surplus-debt ratio

$$\frac{s}{b} = \frac{r}{g} - 1 = \frac{\lambda}{\beta} - 1$$

Calibration

Steady states	State-1: 1970–1987	State-2: 1988–2001	State-3: 2002–2020
s/b, surplus-debt ratio	-0.0025	0.0173	-0.0189
b/y, debt-GDP ratio	0.8918	1.5428	2.0040
λ, discount on interest rate	0.9776	0.9970	0.9615
χ, preference for Treasuries	0.0200	0.0047	0.0772
Credit spread	0.52%	0.49%	0.72%
γ^*, determinacy boundary	8.3333	1.1765	1.0811

- Long-run implications for observables
  - surplus-debt ratio averages to net real debt return
  - higher χ drives $r < g$, allowing fiscal authority to run persistent deficits at low real cost
  - higher χ alleviates inflationary pressure of rising debt-GDP ratio even without fiscal discipline

Bare-Bones FTPL Equations

- Bond demand curve

$$(1-\lambda)(\hat{b}_t - \epsilon_t^b) = \lambda(\hat{R}_t - \mathbb{E}_t \hat{\pi}_{t+1})$$

- Monetary policy (MP) rule

$$\hat{R}_t = \alpha \hat{\pi}_t + \epsilon_t^R$$

- Fiscal policy (FP) rule

$$\hat{s}_t = \gamma \hat{b}_{t-1} + \epsilon_t^s$$

- Government budget constraint

$$\hat{b}_t = (\lambda/\beta)(\hat{b}_{t-1} + \hat{R}_{t-1} - \hat{\pi}_t) - (\lambda/\beta - 1)\hat{s}_t$$

- Determinacy depends on $(\lambda, \alpha, \gamma)$

Closed-Form Solution

Proposition

For $\lambda \in (0,1]$, define $\gamma^* = (1-\beta)/|\lambda - \beta|$. Given passive MP $\alpha \in [0,1)$, there are two determinacy regions of (λ, γ):

1. *Region-D (permanent deficits): $\lambda \in (0,\beta)$ and $\gamma \in (-\gamma^*, 0]$;*
2. *Region-S (permanent surpluses): $\lambda \in (\beta, 1]$ and $\gamma \in [0, \gamma^*)$.*

Under both regions, equilibrium inflation and real debt follow

$$\begin{bmatrix} \hat{\pi}_t \\ \hat{b}_t \end{bmatrix} = \begin{bmatrix} \frac{L}{1-\alpha L} & -\frac{|\beta/\lambda - 1|}{1-\alpha L} & \frac{\lambda-1}{\lambda(1+\gamma\beta-\gamma\lambda)} \frac{\beta-(\lambda+\gamma\beta-\gamma\lambda)L}{1-\alpha L} \\ 0 & 0 & \frac{1-\lambda}{1+\gamma\beta-\gamma\lambda} \end{bmatrix} \begin{bmatrix} \epsilon_t^R \\ \epsilon_t^s \\ \epsilon_t^b \end{bmatrix}$$

where L denotes lag operator and ϵ_t^s is primary surplus shock.

Model Dynamics

- Moving average solution

$$\hat{\pi}_t = \sum_{k=1}^{\infty} \underbrace{\alpha^{k-1}}_{\geq 0} \epsilon^R_{t-k} + \sum_{k=0}^{\infty} \underbrace{-|\beta/\lambda - 1|\alpha^k}_{\leq 0} \epsilon^s_{t-k} + \underbrace{(\lambda - 1)(\beta/\lambda)}_{\leq 0} \epsilon^b_t \ldots$$

$$\ldots + \sum_{k=1}^{\infty} (\lambda - 1)(\alpha\beta/\lambda - 1)\alpha^{k-1} \epsilon^b_{t-k}$$

$$\hat{b}_t = \underbrace{(1 - \lambda)}_{\geq 0} \epsilon^b_t$$

- Intertemporal equilibrium relation

$$\hat{b}_{t-1} + \hat{R}_{t-1} - \hat{\pi}_t = |1 - \beta/\lambda| \sum_{k=0}^{\infty} \beta^k \mathbb{E}_t \hat{s}_{t+k}$$

- Impulse response functions
  - MP contraction ($\epsilon^R_t \uparrow$) or FP expansion ($\epsilon^s_t \downarrow$) $\Rightarrow$ inflation
  - flight to safety ($\epsilon^b_t \uparrow$ or $\lambda \downarrow$) $\Rightarrow$ rising debt + disinflation

Concluding Remarks

- Why fiscal inflation remained nil over past 20 years?
  - worldwide appetite towards safety and liquidity
  - investors happily hold onto expanding USD/Treasuries
  - low interest rate substantially reduces fiscal financing cost
  - positively correlated inflation & fiscal stance in phase-D
- What happens to inflation if such appetite is quenched?
  - shift in appetite towards currency/sovereign debt of competing world powers, e.g., China \$2.5T$\uparrow$ vs. U.S. \$1.5T$\uparrow$ in 2022
  - interest rate normalization significantly raises debt service
  - negatively correlated inflation & fiscal stance in phase-S
- Appropriate fiscal backing is central for Fed to temper inflation today