Debt as Safe Asset
"Fiscal Debt and Inflation"

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Motivation

- What is a safe asset? What are its features: Retrading?

- How much government debt can the market absorb?
  - "Debt Laffer Curve" and debt sustainability analysis?
  - When can governments run a deficit without ever paying back its debt, like a Ponzi scheme?

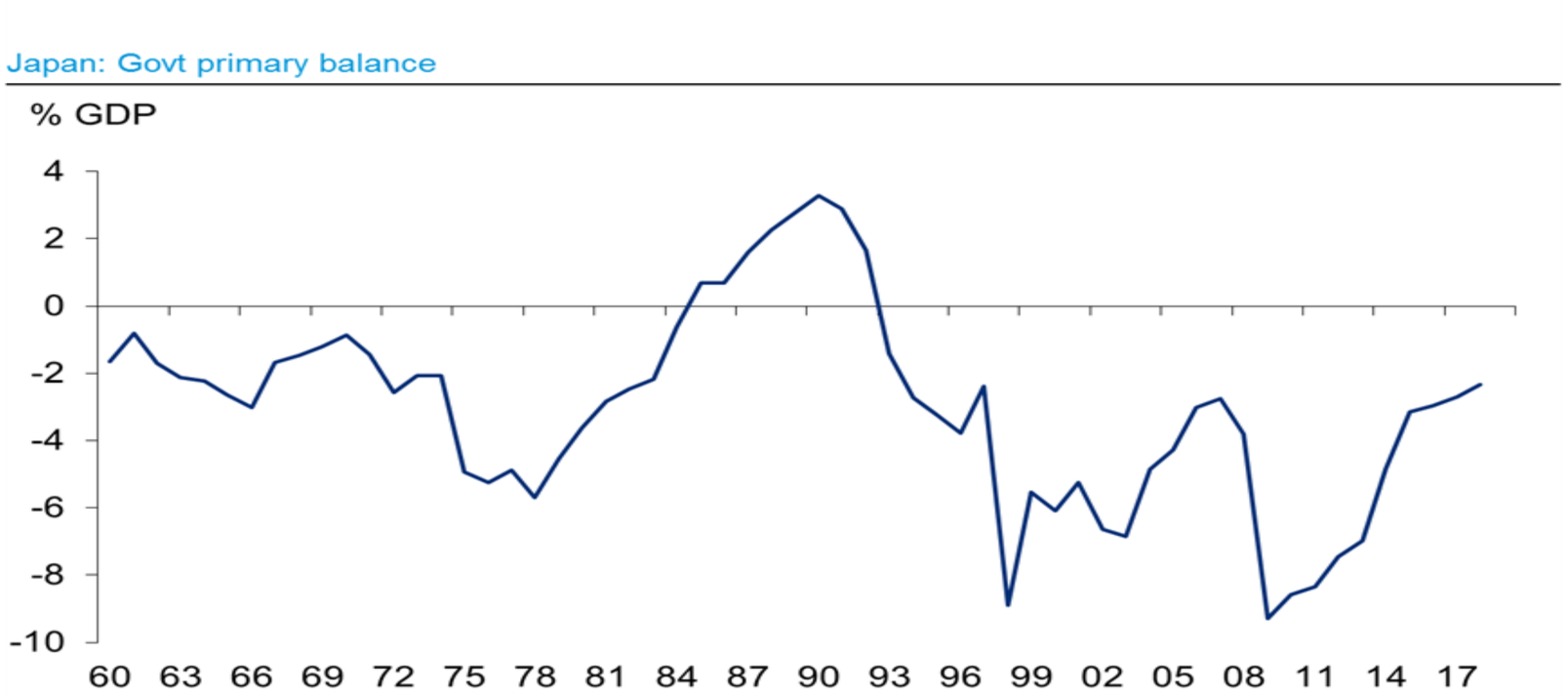
- Why is there debt valuation puzzle for US, Japanese,…?

- This paper: safe asset nature of government debt
  - Model of government debt as a countercyclical safe asset (negative β)
  - Safe asset nature matters qualitatively and quantitatively for debt valuation

- Central bank intervention
  Loss of safe asset status ≠ rollover risk (multiplicity)

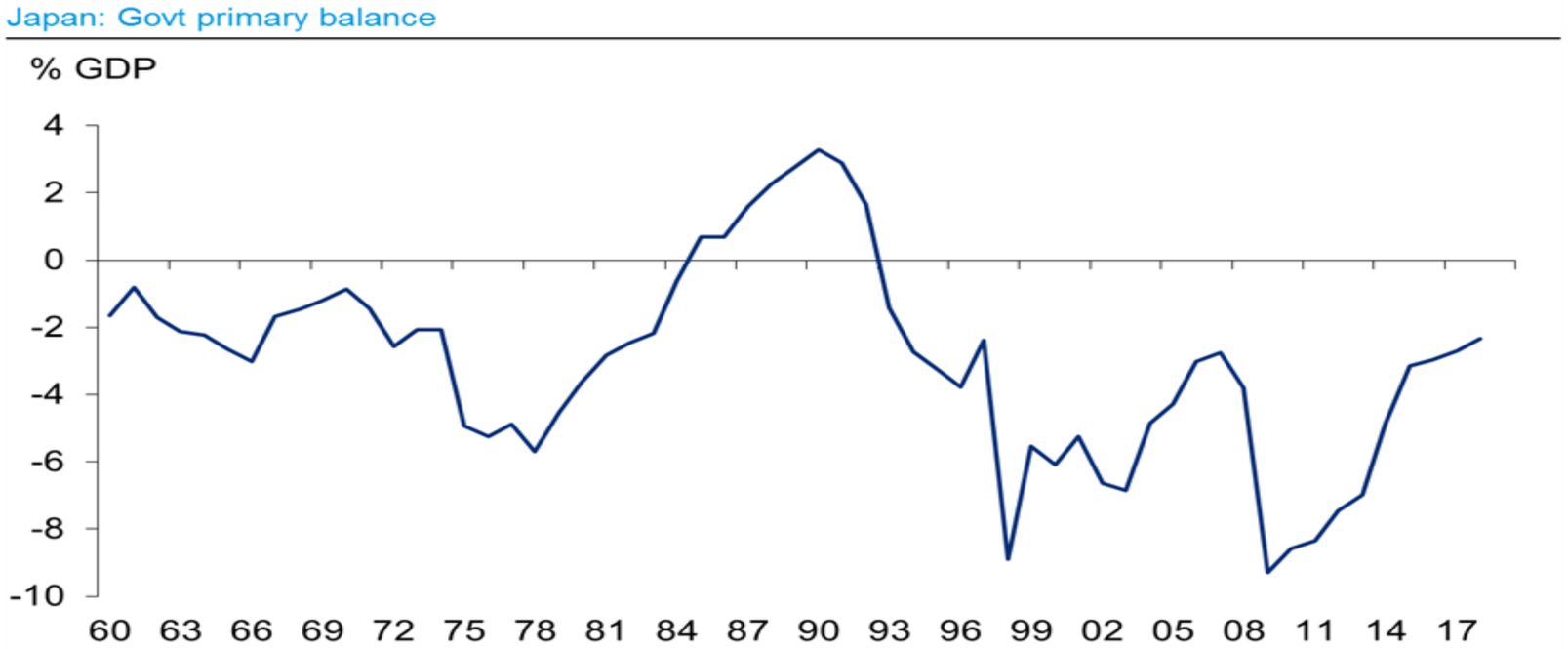
Valuating Government Debt

- Think of a representative agent holding all gov. debt
  - His cash flow is primary surplus
  - $\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_r(\text{primary surpluses})] + \cdots$ [FTPL]
  - … link to inflation
  - Can surpluses be negative forever?



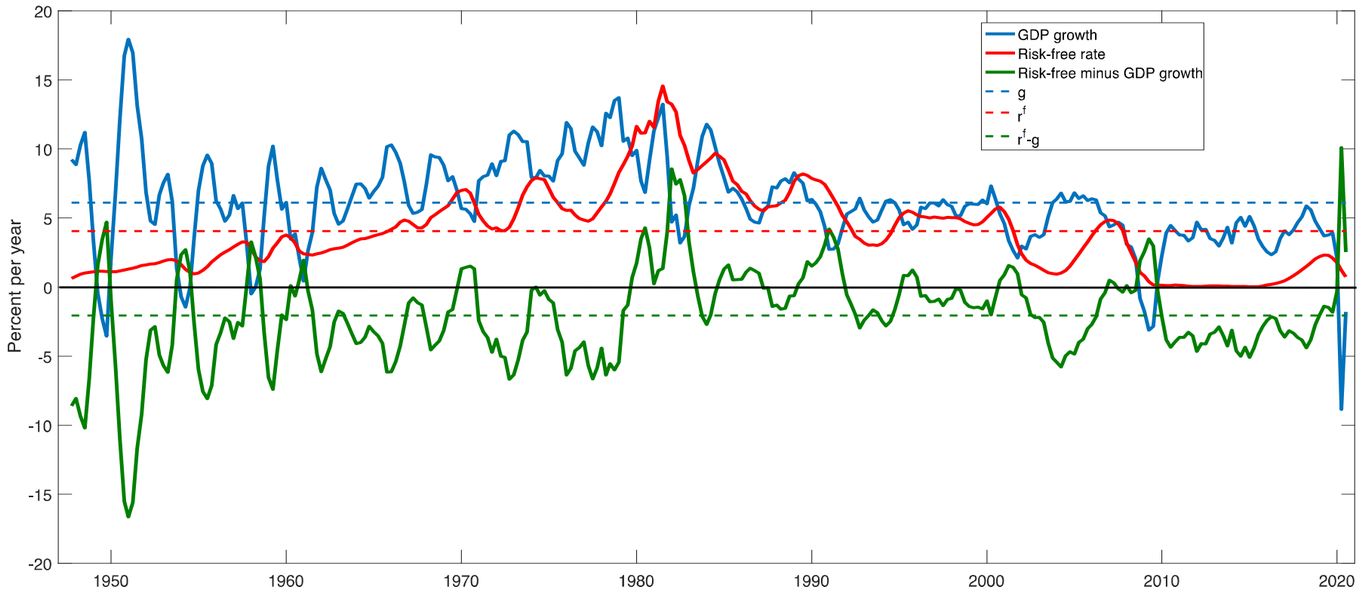
Valuating Government Debt

- Think of a representative agent holding all gov. debt
  - His cash flow is primary surplus
  - $\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_r(\text{primary surpluses})] + \boldsymbol{Bubble}$ [FTPL]
  - … link to inflation
  - Can surpluses be negative forever? Yes, if $r < g$ (e.g. due to safe asset nature)



Primary surplus, r and g for the United States

- Primary surplus/GDP
  - Negative surplus in recession



- g GDP growth
- r
- $r - g$

Negative primary surplus forever?

- without creating inflation (devaluing debt)?
- Yes, if $r < g$
- $$\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_r(\text{primary surpluses})] + \underbrace{\lim_{T\to\infty} PV_r \frac{\mathcal{B}_T}{\wp_T}}_{\text{Bubble}}$$

  discount at r (agents' SDF)

  grows at g with constant deficit/GDP $\to -\infty$

  Bubble $\to +\infty$

To determine real value of gov. debt and price level
FTPL equation is not enough
(goods market clearing and wealth effect)

Negative primary surplus forever?

- without creating inflation (devaluing debt)?
- Yes, if $r < g$
- $$\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_r(\text{primary surpluses})] + \underbrace{\lim_{T\to\infty} PV_r \frac{\mathcal{B}_T}{\wp_T}}_{\text{Bubble}}$$

  discount at r (agents' SDF); grows at g with constant deficit/GDP $\to -\infty$; Bubble $\to +\infty$
- Discount at a different rate $r^{**} > g$ instead, so that

  $$\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_{r^{**}}(\text{primary surpluses})] + E_t[PV_{r^{**}}(\text{service flow})]$$

  $> -\infty$ $\quad$ $< +\infty$
  - Both terms meaningful
  - Discount rate r^{**} = representative agents' risk-free rate $\neq m$ (Reis)

What's a Safe Asset? What is its Service Flow?

- $\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_{r^{**}}(\text{primary surpluses})] + E_t[PV_{r^{**}}(\text{service flow})]$

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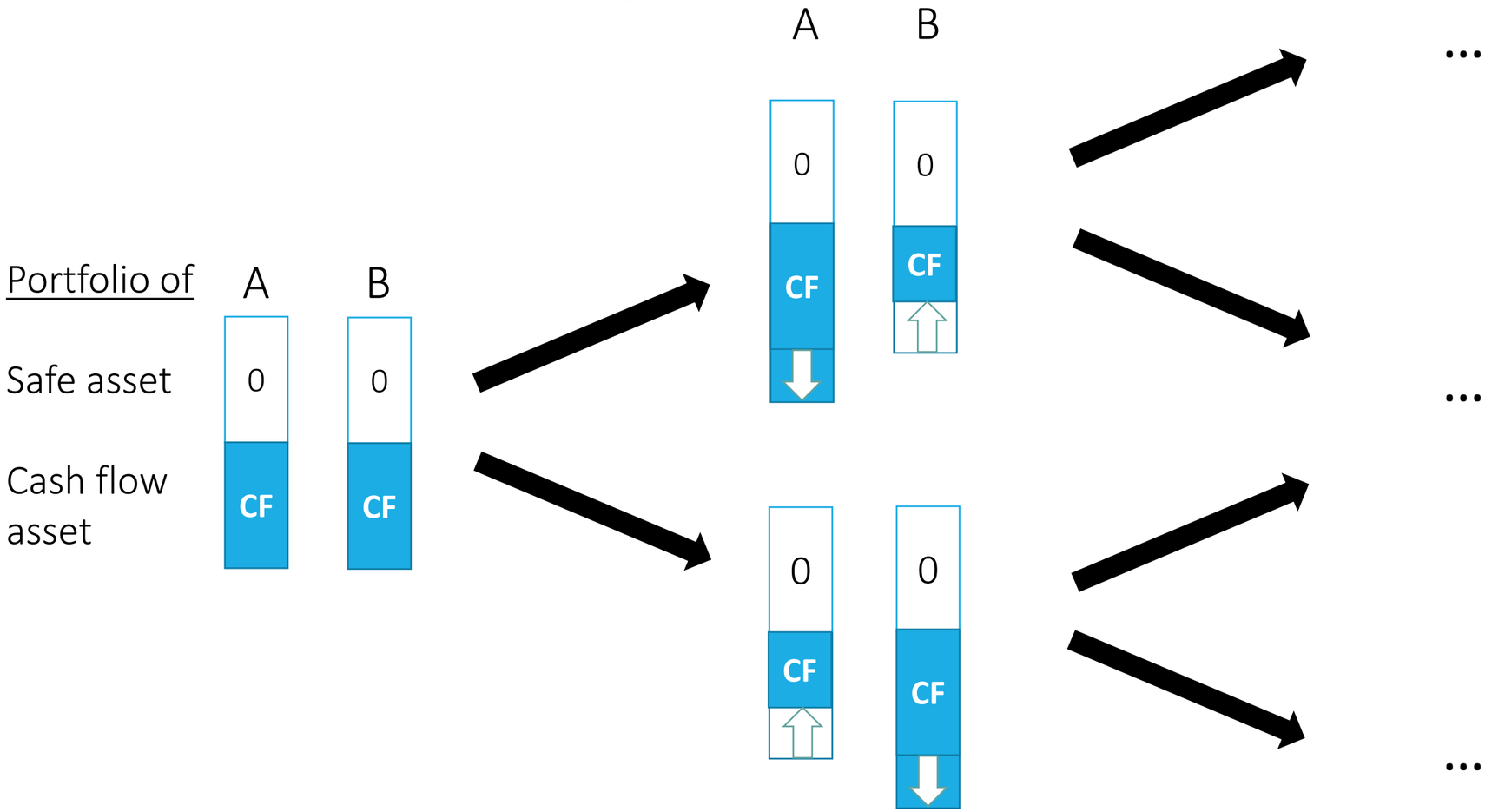
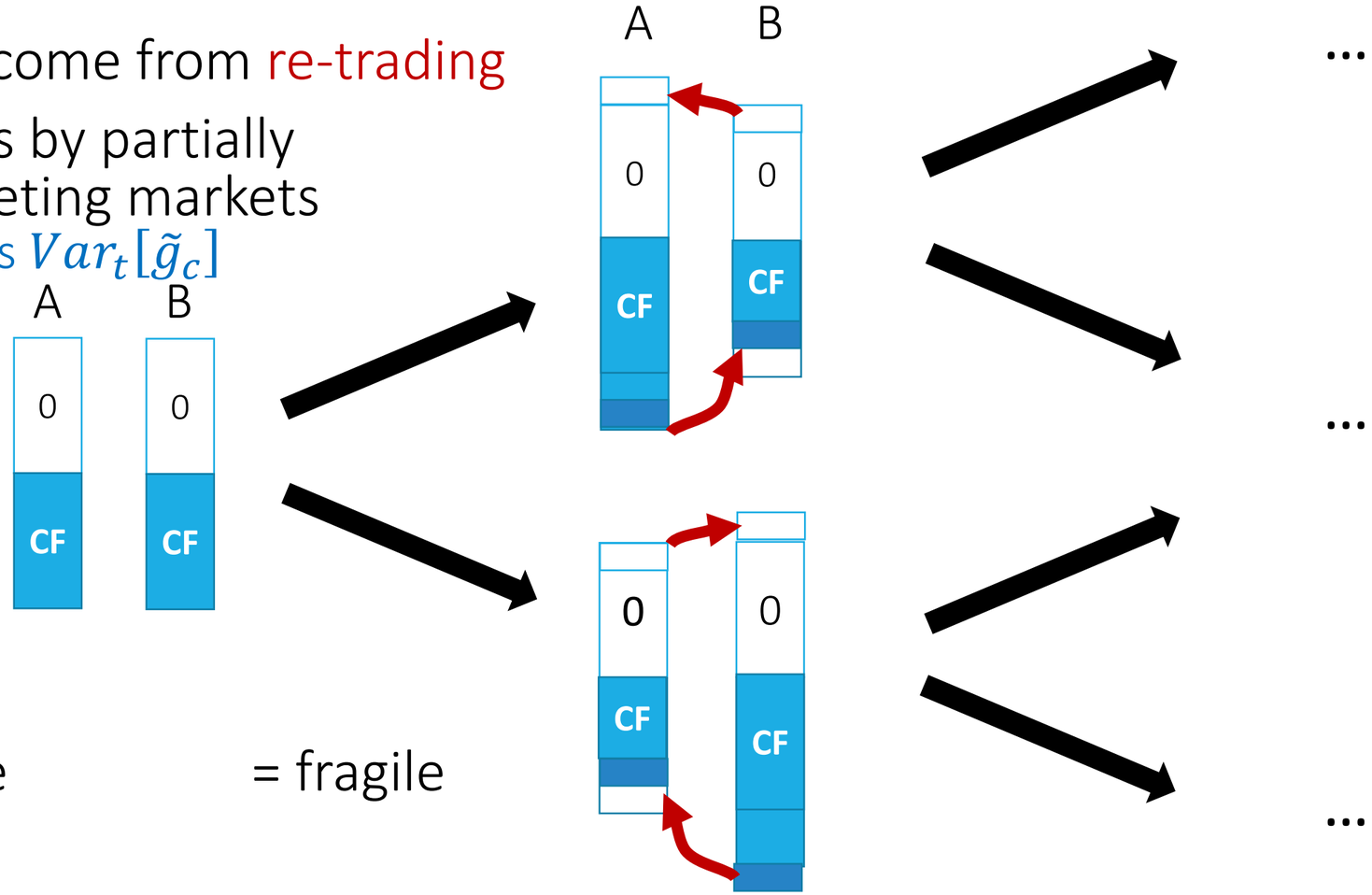
Example: = 0



What's a Safe Asset? What is its Service Flow?

- $\frac{\mathcal{B}_t}{\wp_t} = E_t[PV_{r^{**}}(\text{primary surpluses})] + E_t[PV_{r^{**}}(\text{service flow})]$

- Value come from re-trading
- Insures by partially completing markets
  Reduces $Var_t[\tilde{g}_c]$



- Can be = fragile

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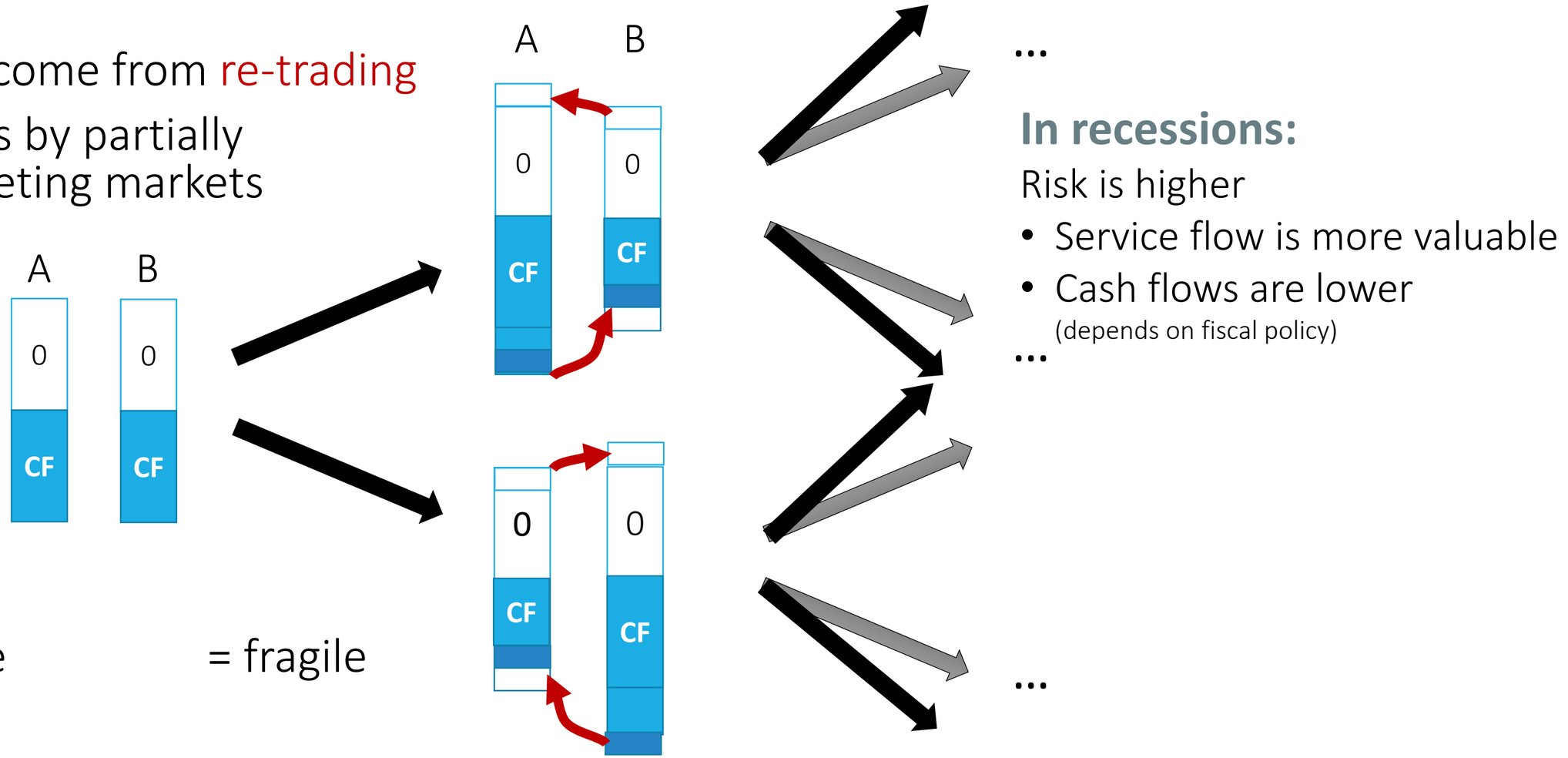


- Can be = fragile

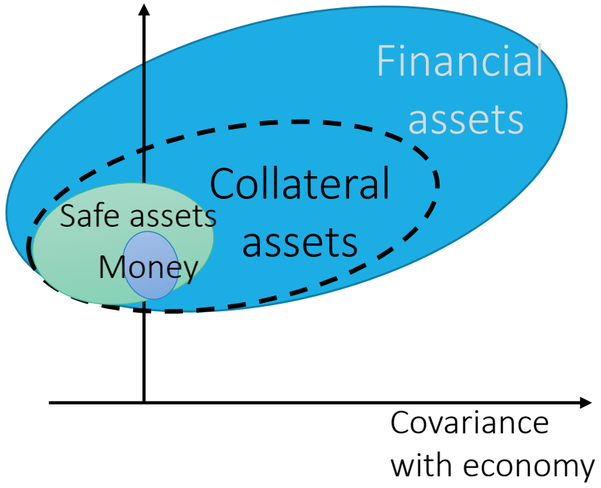
In recessions:

Risk is higher

- Service flow is more valuable
- Cash flows are lower
  (depends on fiscal policy)

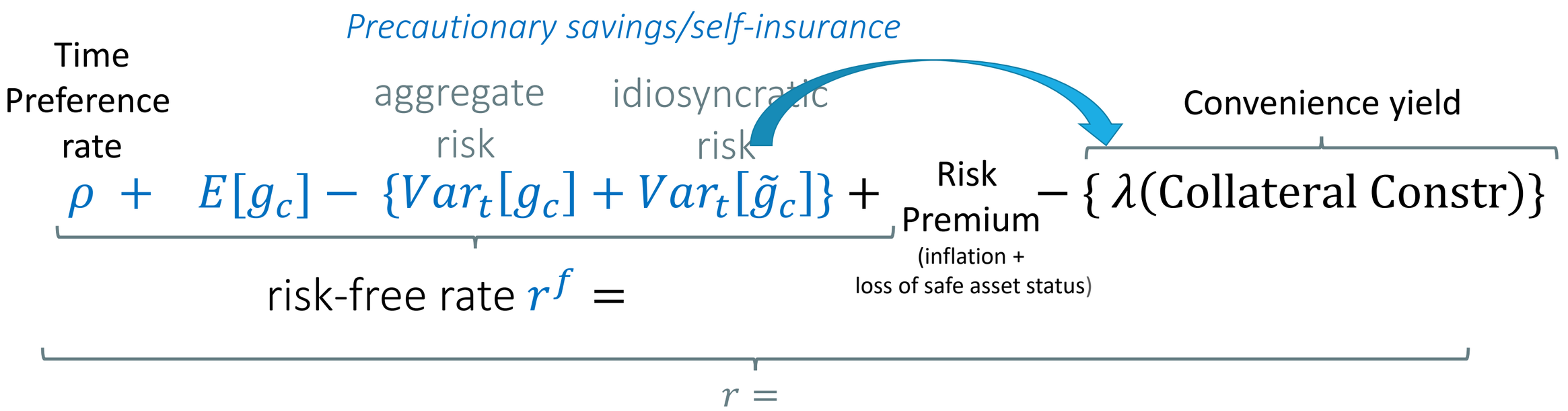
Safe Assets ⊇ (Narrow) Money

- Asset Price $= E_t[PV_{r^{**}}(\text{cash flow})] + E_t[PV_{r^{**}}(\text{service flow})]$
  dividends/interest
  - Service flows/convenience yield
    1. Collateral: relax constraints (Lagrange multiplier)
    2. Safe asset: [good friend analogy]
       - When one needs funds, one can sell at stable price … since others buy
       - Partial insurance through retrading - market liquidity!
    3. Money (narrow): relax double-coincidence of wants
  - Higher Asset Price = lower expected return



- Problem: safe asset + money status might burst like a bubble
  - Multiple equilibria: [safe asset tautology]

From r^f to r^{f**} for log utility, $\gamma = 1$



Outline

- Model
  - Setup
  - Closed-Form Solution for Steady State
  - Debt Valuation - Two Perspectives

- Countercyclical Safe Asset and Valuation Puzzles
  - Calibrated Model Solution
  - Debt Valuation Puzzles

- Safe Asset and the Stock Market

Model Overview

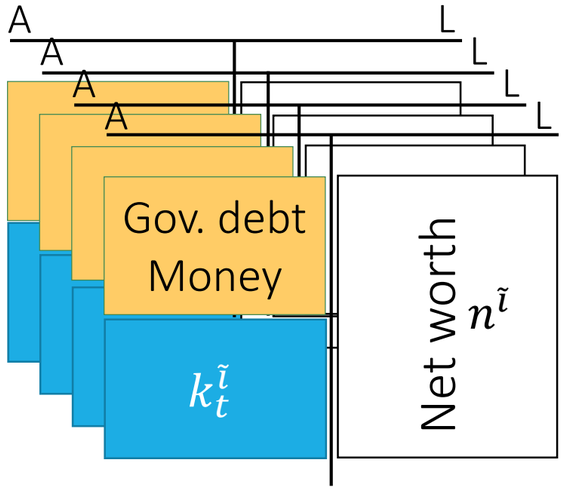
- Continuous time, infinite horizon, one consumption good
- Continuum of agents
  - Operate capital with time-varying idiosyncratic risk, AK production technology
  - Can trade capital and government bond, Extension: add diversified equity claims
- Government
  - Exogenous spending
  - Taxes output
  - Issues (nominal) bonds
- Financial Frictions: incomplete markets
  - Agents cannot trade idiosyncratic risk
  - Extension with equity: must retain skin in the game
- Aggregate risk: fluctuations in volatility of idio risk (& capital productivity)

Model with Capital + Safe Asset

- Each heterogenous citizen $\tilde{\imath} \in [0,1]$

$$E\left[\int_0^\infty e^{-\rho t}\log c_t^{\tilde{\imath}}\,dt\right] \text{ s.t. } \frac{dn_t^{\tilde{\imath}}}{n_t^{\tilde{\imath}}} = -\frac{c_t^{\tilde{\imath}}}{n_t^{\tilde{\imath}}}dt + dr_t^{\mathcal{B}} + \left(1-\theta_t^{\tilde{\imath}}\right)\left(dr_t^{K,\tilde{\imath}}\left(\iota_t^{\tilde{\imath}}\right) - dr_t^{\mathcal{B}}\right)$$

- Each citizen operates physical capital $k_t^{\tilde{\imath}}$
  - Output (net investment) $y_t^{\tilde{\imath}} = \left(a_t - \iota_t^{\tilde{\imath}}\right)k_t^{\tilde{\imath}}dt$
  - Output tax $\tau_t a_t k_t^{\tilde{\imath}}dt$
  - $\frac{dk_t^{\tilde{\imath}}}{k_t^{\tilde{\imath}}} = \left(\Phi\left(\iota_t^{\tilde{\imath}}\right) - \delta\right)dt + \tilde{\sigma}_t d\tilde{Z}_t^{\tilde{\imath}} + d\Delta_t^k$
    - $d\tilde{Z}_t^{\tilde{\imath}}$ idiosyncratic Brownian



- Aggregate risk:
  $\tilde{\sigma}_t$, a_t, g_t exogenous process by aggregate Brownian dZ_t
- Financial Friction: Incomplete markets: no $d\tilde{Z}_t^{\tilde{\imath}}$ claims

Government: Taxes, Bond/Money Supply, Gov. Budget

- Policy Instruments ($K_t := \int k_t^{\tilde{\imath}} d\tilde{\imath}$)
  - Government spending $g_t K_t$ (with exogenous g_t)
  - Proportional output tax $\tau_t a_t K_t$
  - Nominal government debt supply $\frac{d\mathcal{B}_t}{\mathcal{B}_t} = \mu_t^{\mathcal{B}} dt$
  - Floating nominal interest rate i_t on outstanding bonds
- Government budget constraint (BC)

$$\underbrace{\left(\mu_t^{\mathcal{B}} - i_t\right)}_{\breve{\mu}_t^{\mathcal{B}} :=} \mathcal{B}_t + \wp_t K_t \underbrace{\left(\tau_t a_t - g_t\right)}_{s_t :=} = 0$$

Primary surplus (per K_t)

Calibration

- Exogenous processes:
  Recessions feature high idiosyncratic risk and low consumption
  - $\tilde{\sigma}_t$: Heston (1993) model of stochastic volatility
$$d\tilde{\sigma}_t^2 = -\psi\left(\tilde{\sigma}_t^2 - \left(\tilde{\sigma}^0\right)^2\right)dt - \sigma\tilde{\sigma}_t dZ_t$$
  - a_t: $a_t = a(\tilde{\sigma}_t)$ such that in equilibrium
$$\frac{C}{K}(\tilde{\sigma}_t) = \alpha_0 - \alpha_1\tilde{\sigma}_t$$
  - $g_t = 0$

- Government (bubble-mining policy)
$$\check{\mu}_t^{\mathcal{B}} = -\nu_0 + \nu_1\tilde{\sigma}_t$$

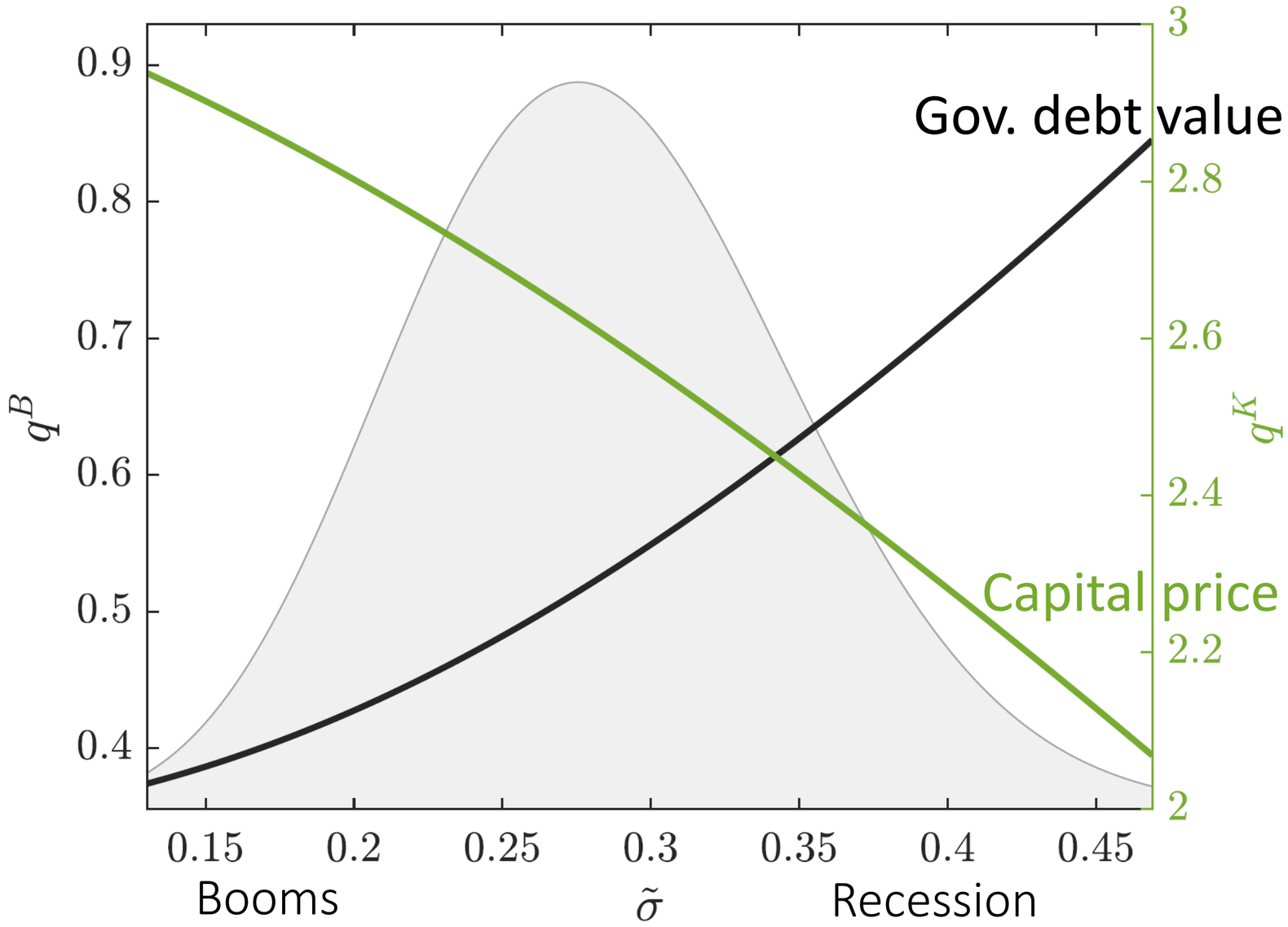
- Calibration to US data (1966-2019, period length is one year)

Two Debt Valuation Puzzles

- Properties of US primary surpluses
  - Average surplus ≈ 0
  - Procyclical surplus (> 0 in booms, < 0 in recessions)

- Two valuation puzzles from standard perspective:
  (Jiang, Lustig, van Nieuwerburgh, Xiaolan, 2019, 2020)
  1. "Public Debt Valuation Puzzle"
     - Empirical: $E[PV(surpluses)] < 0$, yet $\frac{\mathcal{B}}{\wp} > 0$
     - Our model: bubble/service flow component overturns results
  2. "Gov. Debt Risk Premium Puzzle"
     - Debt should be positive β asset, but market don't price it this way
     - Our model: can be rationalized with countercyclical bubble/service flow

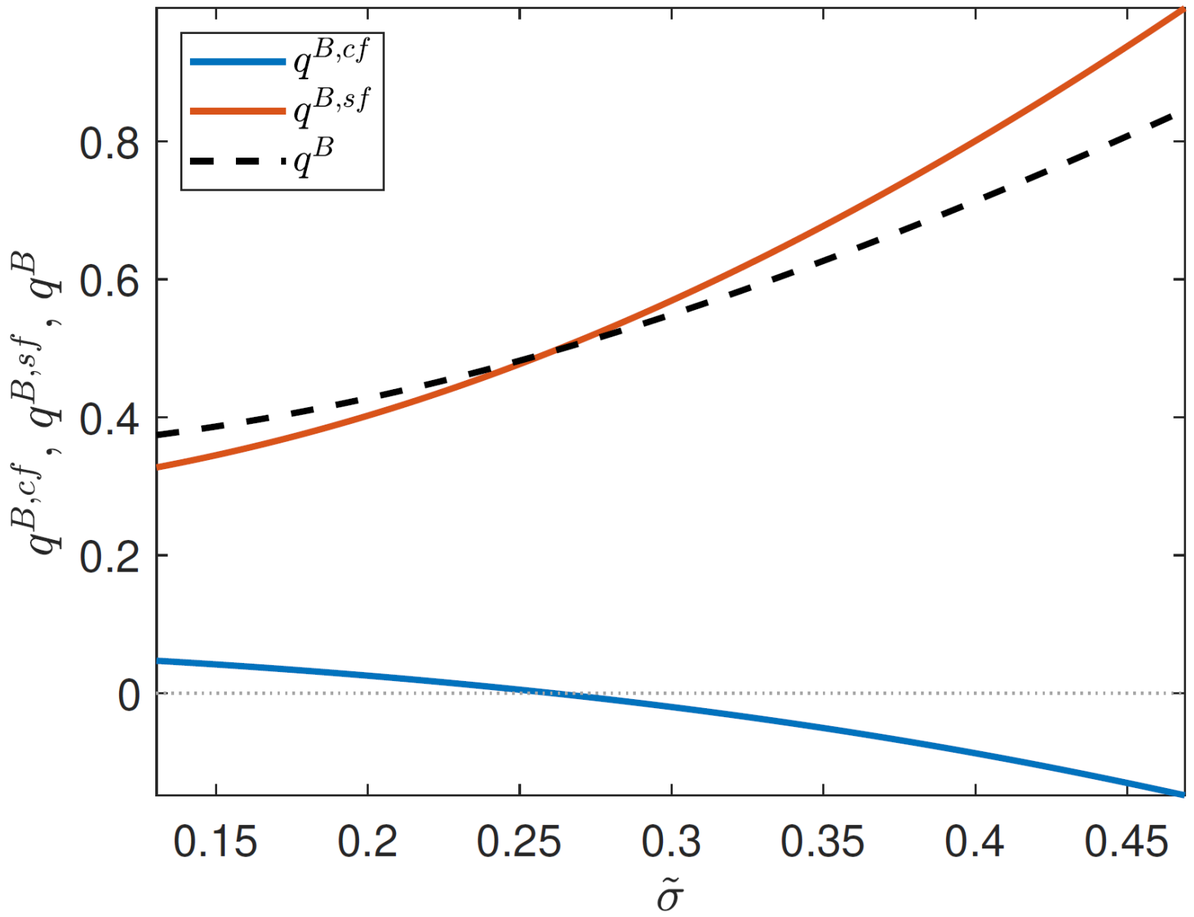
Bond and Capital Value for time-varying idiosyncratic risk $\tilde{\sigma}_t$



rises in recessions

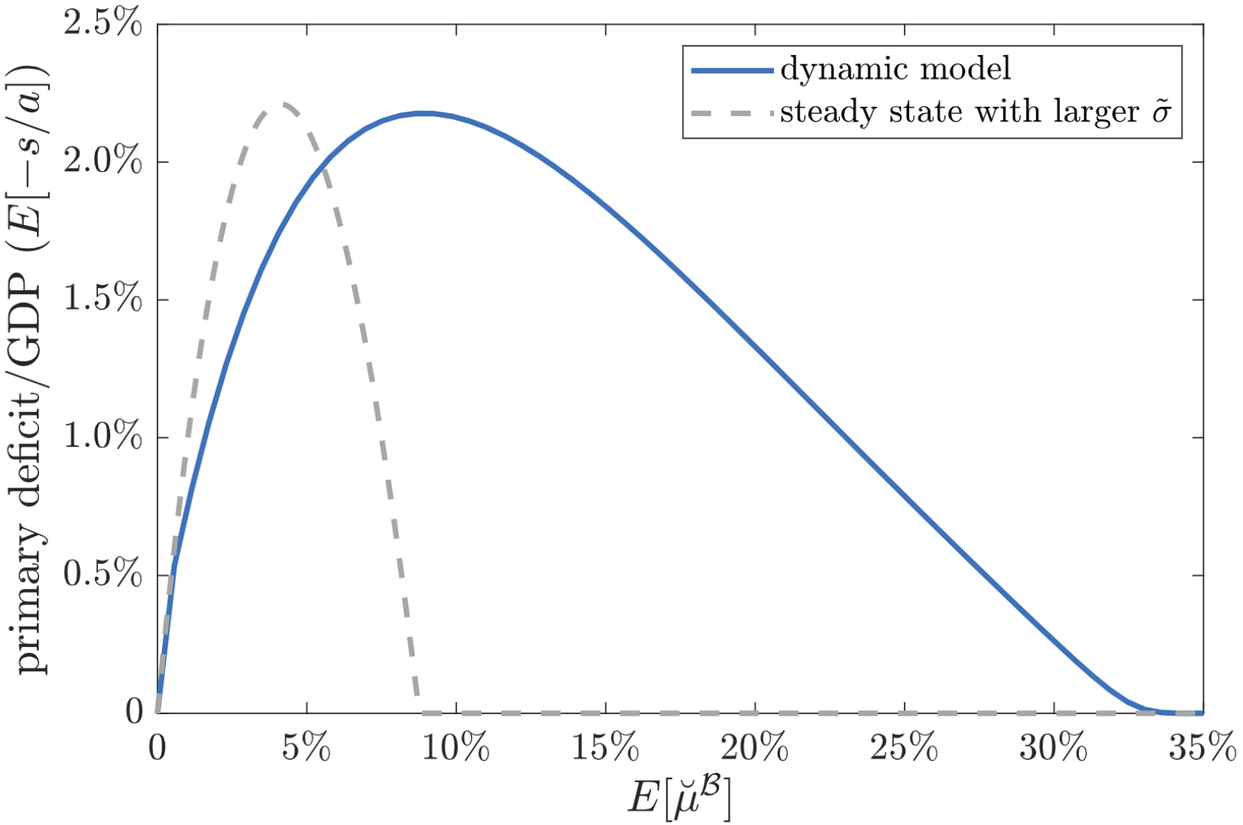
Safe Asset – Cash flow and Service flow

- Asset Price = E[PV(cash flows)] + E[PV(service flows)]



Debt Laffer Curve ≠ MMT Debt Sustainability Analysis 1

- Issue bonds at a faster rate $\check{\mu}^B$ (esp. in recessions)
  - ⇒ tax precautionary self insurance ⇒ tax rate ↑
  - ⇒ real value of bonds, $\frac{\mathcal{B}}{\wp}$, ↓ ⇒ "tax base" ↓
    - Less so in recession due to flight-to-safety



Loss of Safe Asset Status – Equilibrium selection

- When government debt has a (stationary) bubble, other equilibria possible
  - Stationary no bubble equilibrium
  - Nonstationary equilibria that converge to the no bubble equilibrium

- Implies fragility: bubbles may pop, loss of safe asset status

- Are there policies to prevent a loss of safe asset status?
  1. Create a "fundamentally safe asset"
     - Raise (positive) surpluses to generate safe cash flow component $q_t^{B,CF}$
     - If surpluses always exceed a (positive) fraction of total output, no bubble
     - But: gives up revenues from bubble mining
  2. Off-equilibrium tax backing
     - Sufficient to (credibly) promise policy 1 off equilibrium
     - See "FTPL with a Bubble"

Role of Central Banks: 2 Layers of Multiplicity

- Liquidity (Rollover Risk) Multiplicity
  - Replace short-term government debt with Reserves
    - Infinite maturity — more like equity (no rollover risk)
    - Zero duration — more like overnight debt
    - Banking system can't offload it
      - Financial Repression

- Safe Asset Multiplicity – arises even absent of rollover risk
  - Central Bank as Market Maker of Last Resort **ONLY**
    - Simply promote tradability: keep bid-ask spread of government bond low

Conclusion

- Safe Asset = good friend
  - **Individually:** allows self-insurance through retrading
  - **Aggregate:** appreciates in bad times (negative β)
- Fiscal Debt Sustainability Analysis
  - Gov can "mine the bubble" within limits (max 2% of GDP)
  - Extra space, but Debt Laffer Curve (≠ MMT)
  - Bubble can pop: loss of safe asset status
  - Central Banks: Loss of safe-asset-status ≠ rollover risk multiplicity
- Asset pricing with safe assets
  - Service Flow term >> convenience yield
  - Flight to Safety creates
    - Countercyclical safe asset valuation
    - Large stock market volatility
- **Remark:** Competing Safe Assets
  - Within country private bonds are partial safe assets
  - Across countries ⇒ Spillover of US Monetary Policy