International Monetary System
and
Safe Assets

Markus K. Brunnermeier

Sebastian Merkel

Keynes Lecture

University of Cambridge

2024-05-10

Motivation

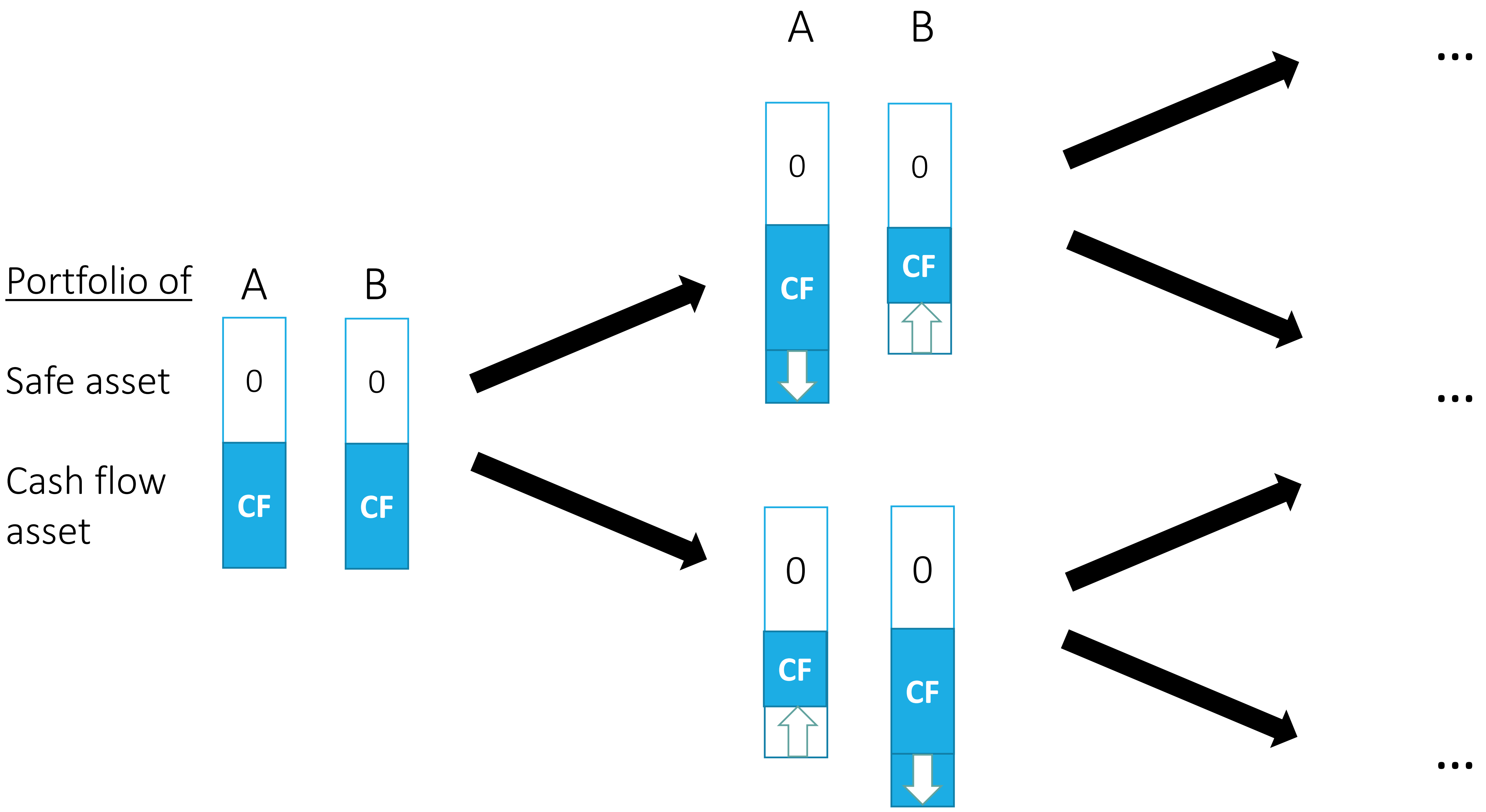
- Is the **International Monetary System**/Global Financial Architecture inherently **distortionary**?
  - Do the rich insure the poor or the other way around?
  - If so, why? How?
  - Who can run stimulus programs? Who is forced to run austerity programs?

- What role do **Safe Assets** play?
  - Who enjoys Exorbitant Privilege to Issue Safe Asset?
    - Can government spend without taxation? How much?
  - What are Safe Assets and its service flow?
  - Flight-to-safety phenomenon (negative β)
  - Is there a complementarity btw safe asset and bubbly asset?

What’s is a Safe Asset Service Flow?

- Safe asset = good friend
  - Idiosyncratic risk: provides partial insurance through re-trading

Based on BruMerSan 2024
“Safe Assets”



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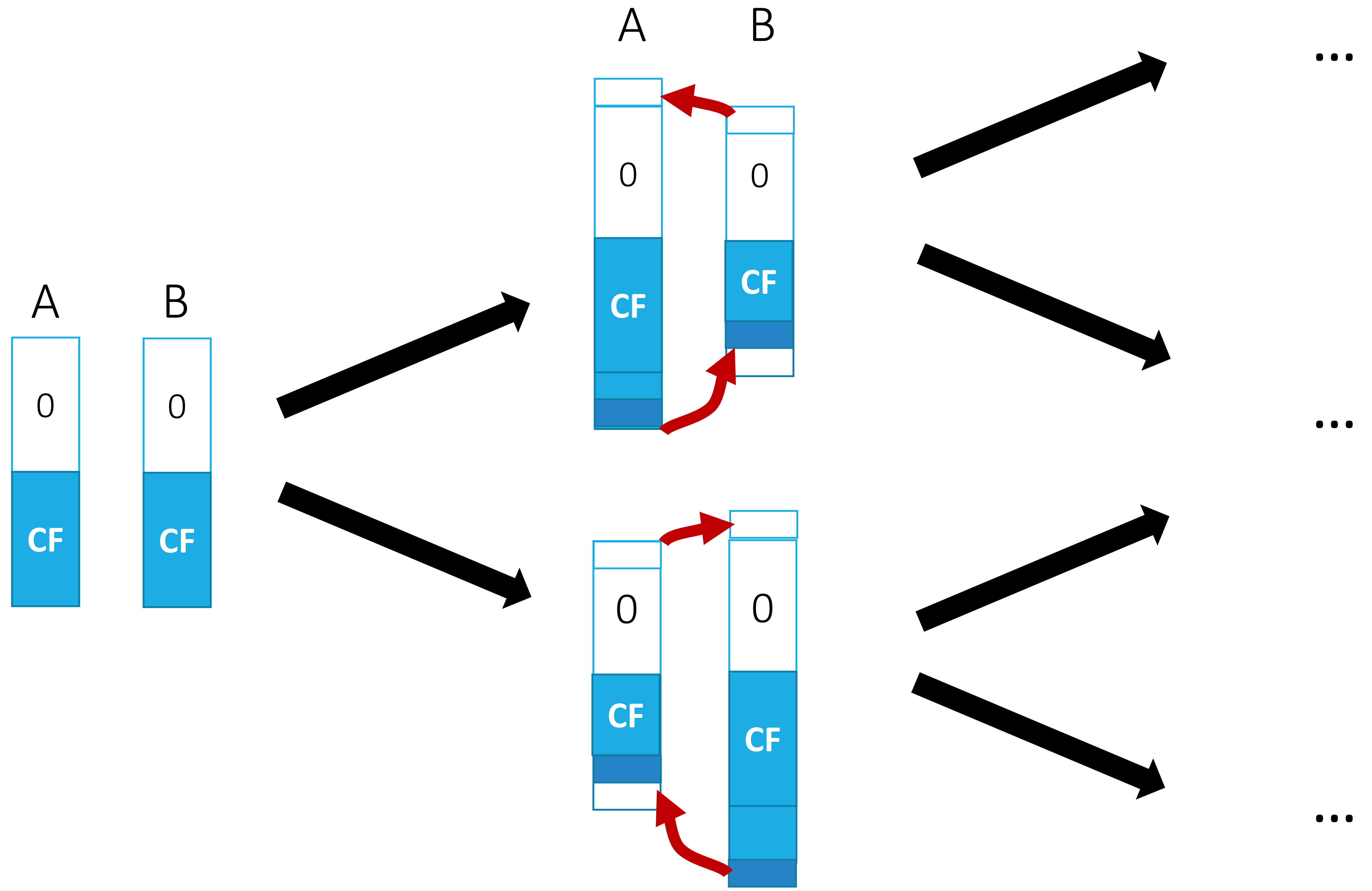
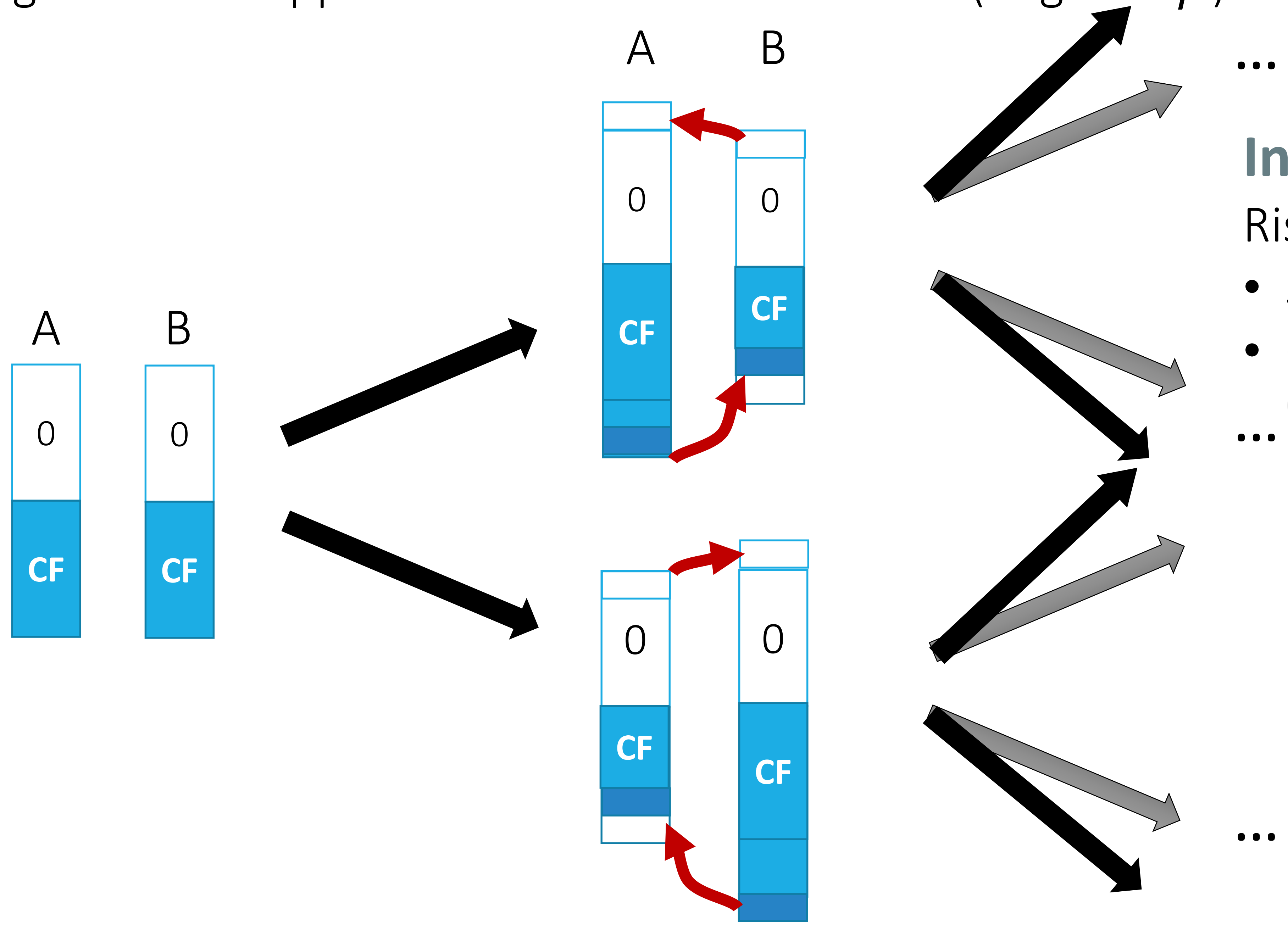


What's a Safe Asset? Exorbitant Privilege rises in Recessions

- Safe asset = good friend
  - Idiosyncratic risk: provides partial insurance through re-trading
  - Aggregate risk: appreciates in value in bad times (negative β)



In recessions:

Risk is higher

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

What's a Safe Asset?

- Good friend (relative to own net worth return $dr_t^{n^i}$) $Cov_t\left[SDF_t^j, dr_t^{safe} - dr_t^{n^i}\right] \geq 0$
  - Idiosyncratic risk
  - Aggregate risk $\beta \leq 0$ – appreciates in times of high risk

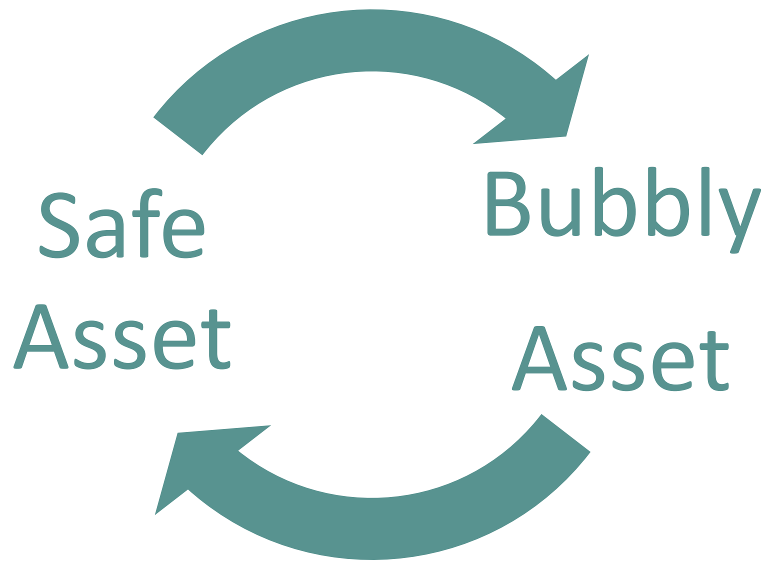
- Provides service flow (+ cash flow) in incomplete market settings

$$\frac{\mathcal{B}_t}{\wp_t} = E_t\left[PV_{\xi^{**}}(\text{primary surpluses})\right] + E_t\left[PV_{\xi^{**}}(\text{service flows})\right]$$

$\Rightarrow$ Lower cash flow interest rate on gov debt r [Gov. Debt Valuation Puzzle]

  - Low trading costs are important for service flow
    - Limited asymmetric information, info sensitivity, trading cost

Complementarity btw Safe Asset & Bubble



⇒ A bubbly asset is more likely a safe asset

- Bubble can expand in downturns (even when cash flow declines)
  ⇒ easier to satisfy: $Cov_t\left[SDF_t^j, dr_t^{safe} - dr_t^{n^i}\right] \geq 0, \quad \beta^{CAPM} \leq 0$

⇐ A safe asset is more likely a bubble

- Safe asset with $\beta^{CAPM} \leq 0$,
  has lower expected cash flow return as risk premium is negative
  ⇒ easier to satisfy bubble condition: $r_t^f + \underbrace{risk\ premium}_{\leq 0} \leq g_t$ (on average)
  - Also, r^f is depressed by precautionary savings (incl. uninsurable idiosyncratic risk)

- Bubble:
  - Issue *long-term asset*, whose value exceeds fundamental value (of e.g. zero)
- Ponzi scheme:
  - Rollover existing *short-term debt* with growing new (short-term) debt
    - Which needs to be rolled over again.

2 Country Setting

- Country N's exorbitant privilege > ½ > Country S's

- Steady state: N-gov. issues safe asset bonds (at low r) to S-citizens

- Global (idiosyncratic) risk ↑ shock: (⇒ macro + investment implications)

⇒ Fiscal Space of N ↑ of S ↓

due to flight to safety

tax^N ↓ tax^S ↑

capital
flow

Related Literature - Incomplete -

- Safe Asset (Shortage vs. Asymmetric Supply):
  - Global shortage: Caballero et al. (2016,17), …
  - Asymmetric Supply: BruMerSan (2024 “Safe Assets”), ESBies, GloSBies, …
  - Info sensitivity: Gorton Pennachi (1990), Dang et al. (2017),
- Public Debt Evaluation Puzzles/FTPL:
  - Jiang et al. (2020,2021), BruMerSan (2020 “FTPL”) Bubble
- Bubble and Macrofinance
  - Large r vs. g literature...
- US as (Levered) Financial Center, GFC
  - Kindleberger (1965), Gourinchas Rey (World Venture Capitalist) (2005),
  - Miranda-Agrippino and Rey (2022), Oskolkov (2024), …
- Reserve Paradox
  - Maggiori (2017), Jiang Krishnamurthy Lustig (2023), Devereux Engel Wu (2023)

Roadmap

- Motivation, Safe Asset: Intuition and Definition
- Two Country Model Setup
  - Symmetric Benchmark
- World Government (Bond)
  ⇒ "Safe Asset Pricing"
- Two countries with
  Constant Idiosyncratic Risk and
  ⇒ Asymmetric **Permanent Exorbitant Privilege**
- Risk Shock and its Transition
  ⇒ Insurance of S by N in the long-run
- Time-varying Idiosyncratic Risk $\tilde{\sigma}_t \in \{\tilde{\sigma}^L, \tilde{\sigma}^H\}$
  ⇒ **Flight-to-Safety Exorbitant Privilege** and $\beta^N < \beta^S$
  ⇒ EMDE Costly Stimulus Policy
- Future: "Battle for the Bubble" + Exchange Rate Policy with Sticky Prices

Ceteris Paribus Analysis

- Total symmetry, except in one dimension: share of safe asset "exorbitant privilege bubble"

Two Country Model: Overview

- Continuous time, infinite horizon, two consumption goods: (nuts and spices)
- 2 large countries: N and S ("north" and "south")
  - Both countries are symmetric *to highlight single difference*
  - Each country issues government bonds
- Continuum of citizens in each country
  - Operate capital with time-varying idiosyncratic risk, *AK* production technology
  - Can trade capital, government bonds of both countries
  - No citizen mobility
- Two Governments
  - Exogenous spending
  - Issues (nominal) bonds
  - Taxes output to close budget
- Financial Frictions: incomplete markets
  - Agents cannot insure idiosyncratic risk (must retain skin in the game)
- Aggregate risk: fluctuations in volatility of idiosyncratic risk (& capital productivity)

Two Country Model

- Citizens in (north) country N, $\tilde{\imath} \in [0, \frac{1}{2}]$ and in (south) country S, $\tilde{\imath} \in [\frac{1}{2}, 1]$

- Country N produces nuts, n Country S produces spices, s
  - With the same physical capital, $ak_t^{\tilde{\imath}}dt$, (constant return to scale)

- CES utility function, **elasticity of substitution** btw nuts and spices, ε

$$c_t = \left((c_t^n)^{\frac{\varepsilon-1}{\varepsilon}} + (c_t^s)^{\frac{\varepsilon-1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}}$$

  - Aggregate consumption good c_t for country I

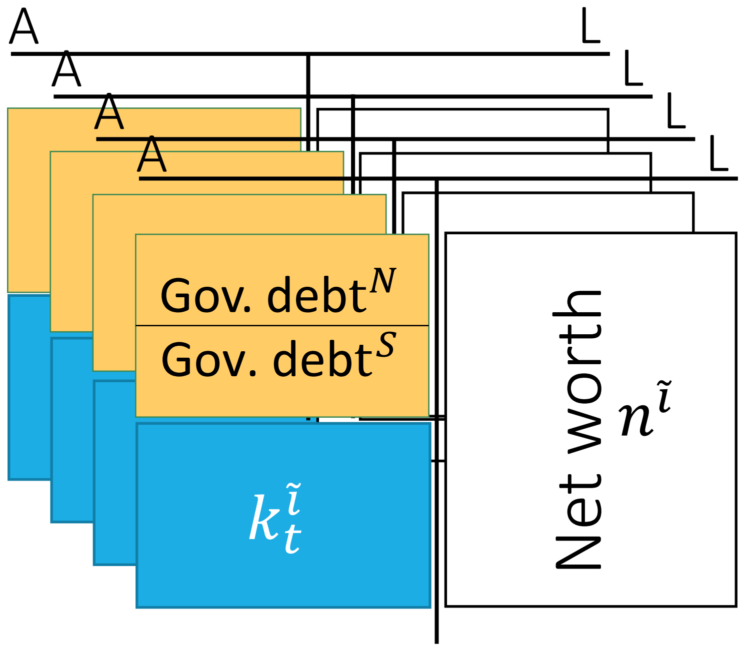
$$E\left[\int_0^\infty e^{-\rho t}\,(\log c_t^{I,\tilde{\imath}} + \log(g\tfrac{1}{2}K_t))dt\right]$$

Two Country Model

- Citizens $\tilde{\imath}$ in N, (country S symmetric)

$$E\left[\int_0^\infty e^{-\rho t}\,(\log c_t^{\tilde{\imath}} + \log(g\,\tfrac{1}{2}K_t))dt\right]$$ s.t. No Ponzi &

$$\frac{dn_t^{\tilde{\imath}}}{n_t^{\tilde{\imath}}} = -\frac{c_t^{\tilde{\imath}}}{n_t^{\tilde{\imath}}}dt + \theta_t^{\mathcal{B}^N,\tilde{\imath}}dr_t^{\mathcal{B}^N} + \theta_t^{\mathcal{B}^S,\tilde{\imath}}dr_t^{\mathcal{B}^S} + \left(1 - \theta_t^{\mathcal{B}^N,\tilde{\imath}} - \theta_t^{\mathcal{B}^S,\tilde{\imath}}\right)dr_t^{K,\tilde{\imath}}$$



- Each citizen operates physical capital $k_t^{\tilde{\imath}}$ in his country
  - Output in nuts: $ak_t^{\tilde{\imath}}dt$
    - Sold in at global market at nut price p^n in country N numeraire c^N.
  - $\frac{dk_t^{\tilde{\imath}}}{k_t^{\tilde{\imath}}} = \mu^K dt + \tilde{\sigma}_t d\tilde{Z}_t^{\tilde{\imath}} + d\Delta_t^{k,\tilde{\imath}}$

    κ = capital share of N
    - $d\tilde{Z}_t^{\tilde{\imath}}$ idiosyncratic Brownian

    η = net worth/wealth share of N
    - $\tilde{\sigma}_t \in \{\tilde{\sigma}^L, \tilde{\sigma}^H\}$ exogenous process with Poisson arrival rate
- **Frictions:**
  - Incomplete markets: no $d\tilde{Z}_t^{\tilde{\imath}}$-claims (risky equity claims)
  - Output goods, capital and government bonds can be traded across borders

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

- Policy Instruments
  - $g\frac{1}{2}K_t$ Government spending (with exogenous g) – identical in both countries
  - $\tau_t^N p_t^n a K_t^N$ Proportional output tax at rate τ_t^N, p_t^n is price of nuts in terms of world output good
  - $\frac{d\mathcal{B}_t^N}{\mathcal{B}_t^N} = \mu_t^{\mathcal{B}^N} dt$ Nominal government debt issuance
  - i_t^N Floating nominal interest rate on outstanding bonds ← Not market clearing, Payment/redistribution to bond holders $\mathcal{B}_t^N / \wp_t^N$ clears bond market
- Government budget constraint (BC)

$$\underbrace{\left(\mu_t^{\mathcal{B}^N} - i_t^N\right)}_{\breve{\mu}_t^{\mathcal{B}^N} :=} \mathcal{B}_t^N + \wp_t^N \underbrace{\left(\tau_t^N p_t^n a \kappa^N - \frac{1}{2} g_t\right)}_{s_t^N :=} K_t = 0$$

N's **primary surplus** of (per world K_t)

World capital stock

- Equilibrium selection: **No No-Ponzi constraint**

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World Government (Bond)

- Merge both countries
  - 1 government + 1 bond
- $\kappa = \eta = 1/2$ and # of nuts = # of spices
- Bond pricing as in “Safe Asset” BruMerSan-paper

Debt Valuation (FTPL) – Two Perspectives

Total symmetry of N and S (or in steady state)

- **Buy and Hold Perspective:**
  - $\frac{\mathcal{B}_0^I}{\wp_0^I} = \lim_{T\to\infty}\left(\mathbb{E}\left[\int_0^T \xi_t^i s_t^I K_t dt\right] + \mathbb{E}\left[\xi_t^i \frac{\mathcal{B}_T^I}{\wp_T^I}\right]\right)$
    - Valuation of strategy that buys and holds a fixed fraction of outstanding debt

- Agent i's SDF, ξ_t^i: $d\xi_t^i/\xi_t^i \quad = -r_t^f dt - \varsigma_t dZ_t - \tilde{\varsigma}_t^i d\tilde{Z}_t^i$, idiosyncratic consumption vol. $\tilde{\sigma}_t^c$

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- **Dynamic Trading Perspective:**
  - $\eta_0^i \frac{\mathcal{B}_0^I}{\wp_0^I} = \mathbb{E}[\int_0^\infty \quad \xi_t^i \eta_t^i \quad s_t^I K_t dt] + \mathbb{E}[\int_0^\infty \quad \xi_t^i \eta_t^i \quad (\tilde{\sigma}_t^c)^2 \frac{\mathcal{B}_t^I}{\wp_t^I} dt]$

  - Valuation of equilibrium cash flows from individual bond portfolios, incl. trading cash flows (aggregated over all agents i to obtain total value of debt)

  - Agent i's SDF, ξ_t^i: $d\xi_t^i/\xi_t^i \quad = -r_t^f dt - \varsigma_t dJ_t - \tilde{\varsigma}_t^i d\tilde{Z}_t^i$, idiosyncratic consumption vol. $\tilde{\sigma}_t^c$

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    - Valuation of strategy that buys and holds a fixed fraction of outstanding debt

- **Dynamic Trading Perspective:**
  - $$\frac{\mathcal{B}_0^I}{\wp_0^I} = \mathbb{E}[\int_0^\infty \underbrace{\left(\int_0^1 \xi_t^i \tilde{\eta}_t^i di\right)}_{=\xi_t^{**}} s_t^I K_t dt] + \mathbb{E}[\int_0^\infty \underbrace{\left(\int \xi_t^i \eta_t^i \, di\right)}_{=\xi_t^{**}} (\tilde{\sigma}_t^c)^2 \frac{\mathcal{B}_t^I}{\wp_t^I} dt]$$
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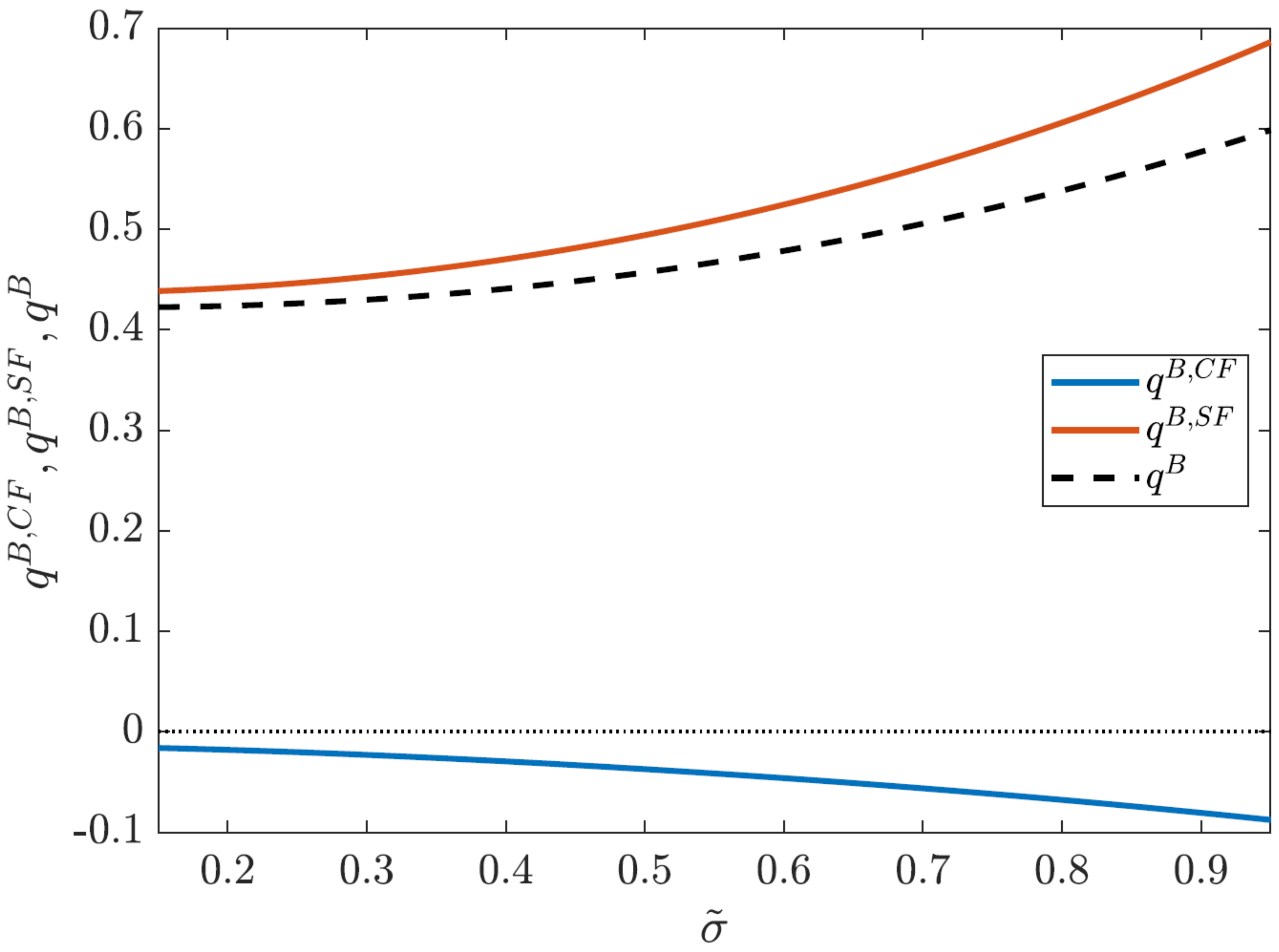
Safe Asset – Service flow >> Cash flow

- Asset Price = E[PV(cash flows, primary surplus sK_t)] + E[PV(service flows)]



What is Quasi-SDF $\xi_t^{**} = \int \xi_t^i \eta_t^i di$?

- **Buy and Hold Perspective:**

  Expected bond return (*for log utility*)

  $$= \underbrace{\underbrace{\rho + \gamma \mathbb{E}[g_c] - \tfrac{1}{2}\gamma(\gamma+1)\{Var_t[g_c] + Var_t[\tilde{g}_c]\}}_{\text{Risk-free rate } r^f =} + risk\ premium}_{\text{Discount rate}} - convience\ yield$$

- **Dynamic Trading Perspective:**

  Expected bond return

  $$= \underbrace{\underbrace{\rho + \gamma \mathbb{E}[g_c] - \tfrac{1}{2}\gamma(\gamma+1)\{Var_t[g_c]\}}_{\text{Risk-free rate } r^{f**} =} + riskpremium}_{\text{Discount rate}} - \underbrace{\{Var_t[\tilde{g}_c] + convience\ yield\}}_{\text{“Service Flow”}}$$

  Idiosyncratic consumption growth risk

- $$\underbrace{q_t^K K_t + q_t^B K_t}_{\text{total (net) wealth}} = \mathbb{E}_t\Big[\int_t^\infty \underbrace{\frac{\int \xi_s^i \eta_s^i di}{\int \xi_t^i \eta_t^i di}}_{\frac{\xi_s^{**}}{\xi_t^{**}}} C_s ds\Big]$$

Two Debt Valuation Puzzles = Bubble Test

- 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: $E\left[PV_{\xi}(surpluses)\right] < 0$, 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 Issuance Rate $\check{\mu}^{\mathcal{B}}$ ⇒ Fiscal Policy/Tax s, Bubble (r vs. g)

- Recall
  - Gov. Budget constraint $\quad \check{\mu}_t^{\mathcal{B}} \mathcal{B}_t^N + \wp_t^N \underbrace{\left(\tau_t^N p_t^n a \kappa_t^N - \frac{1}{2} \mathscr{g}_t\right)}_{s_t^N :=} K_t = 0$
  - Real risk-free rate $\quad r^f = \underbrace{\mu^K}_{\substack{growth \\ rate}} - \check{\mu}^{\mathcal{B}}$

- $\check{\mu}^{\mathcal{B}} \geq 0 \Rightarrow s \leq 0$ and $r^f < \mu^K$ primary deficit $\forall t$ ⇒ Bubble
  - "Mine the Bubble" $\quad$ as long as $\frac{\mathcal{B}_t^A}{\wp_t^A} > 0$

- $\check{\mu}^{\mathcal{B}} < 0 \Rightarrow s > 0$ and $r^f > \mu^K$ primary surplus $\forall t$ ⇒ No Bubble, but service flow
  - $\frac{\mathcal{B}_t^A}{\wp_t^A} = \mathbb{E}_t\left[PV_{r^f}(sK_t)\right]$

Roadmap

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  - Symmetric Benchmark
- World Government (Bond)
  $\Rightarrow$ "Safe Asset Pricing"
- Constant Idiosyncratic Risk $\Rightarrow$ Gov. Bonds Perfect Substitutes
  $\Rightarrow$ Asymmetric **Permanent Exorbitant Privilege**
- Risk Shock and its Transition
  $\Rightarrow$ Insurance of S by N in the long-run
- Time-varying Idiosyncratic Risk $\tilde{\sigma}_t \in \{\tilde{\sigma}^L, \tilde{\sigma}^H\}$
  $\Rightarrow$ **Flight-to-Safety Exorbitant Privilege** and $\beta^N < \beta^S$
  $\Rightarrow$ EMDE Costly Stimulus Policy
- Future: "Battle for the Bubble" + Exchange Rate Policy with Sticky Prices

Government Bonds Perfect Substitutes ⇒ G-Bond Portfolio

- For a given debt issuance $\breve{\mu}_t^{\mathcal{B}^I} = \mu_t^{\mathcal{B}^I} - i_t^I$ the country's primary surplus s_t^I (and tax rate τ_t^I) is determined by country's government budget constraint.
- For simplicity consider the case where both $\breve{\mu}_t^{\mathcal{B}^N}$ and $\breve{\mu}_t^{\mathcal{B}^S}$ are constant.
- **Lemma:**
  $\breve{\mu}_t^{\mathcal{B}^N} = \breve{\mu}_t^{\mathcal{B}^S}$, since otherwise one bond has zero value.
  - Real returns on both bonds must be the same,
    i.e. if bond dilution is higher $\mu_t^{\mathcal{B}^I}$, country has to offer higher bond interest rate i_t^I
  - Citizens in both countries are indifferent between both country's gov. bonds.

⇒ Portfolio choice reduces to capital vs. gov bond portfolio: θ_t^K vs. $(1 - \theta_t^K)$

- *Aside:* less strict if there is a home bias in bond holdings

- Share of one country in the bond portfolio ϑ^N is constant
  - In symmetric setting $\vartheta^N = ½$

Optimal Choices & Market Clearing

- Consumption

Goods market

  - $\boldsymbol{c}_t =: \rho n_t \Rightarrow C_t = \rho \underbrace{\left(q_t^K K_t + \mathcal{B}_t^N / \wp_t^N + \mathcal{B}_t^S / \wp_t^S\right)}_{N_t} = a p^n K_t^N + a p^s K_t^S - \mathscr{g} K_t$

- Portfolio

Capital market

  - For country N

$$1 - \theta_t^{\mathcal{B}^N,\tilde{\imath}} - \theta_t^{\mathcal{B}^S,\tilde{\imath}} = \frac{q_t^K K_t^N}{N_t^N} =: \frac{\kappa^N}{\eta_t^N}(1 - \vartheta_t)$$

  - For country S
    - …
  - Solve for various θ_ts using for all $\tilde{\imath}$

ϑ_t:= fraction of world net worth in nominal claims

$$= \frac{\mathcal{B}_t^N / \wp_t^N + \mathcal{B}_t^S / \wp_t^S}{N_t},$$

$$\eta_t^N := \frac{N_t^N}{N_t}.$$

Price of risk

$$\frac{\mathbb{E}_t\left[dr_t^{K,\tilde{\imath}}\right]}{dt} - \frac{\mathbb{E}_t\left[dr_t^{\mathcal{B}}\right]}{dt} = \underbrace{\tilde{\sigma}_t^{n,\tilde{\imath}}}_{\left(1-\theta_t^{\mathcal{B}^N,\tilde{\imath}}-\theta_t^{\mathcal{B}^S,\tilde{\imath}}\right)\tilde{\sigma}} \tilde{\sigma}$$

Risk premium (idio)

Equilibrium: 3 Key Equations

- $\boldsymbol{\kappa}$ **Capital Share Allocation** (static, period-per-period)

$$\kappa = f\left(\begin{array}{c}\text{production efficency}\\ \text{maximized at}\\ \kappa = 1/2\end{array}, \begin{array}{c}\text{tax incentive tilt}\\ \text{towards country with}\\ \text{lower capital taxes}\end{array}\right). \quad \rho \frac{\kappa_t^{-1/\varepsilon} - (1-\kappa_t)^{-\frac{1}{\varepsilon}}}{\kappa_t^{1-1/\varepsilon} + (1-\kappa_t)^{1-\frac{1}{\varepsilon}}} + \left(\frac{\vartheta_t^N}{\kappa_t} - \frac{1-\vartheta_t^N}{1-\kappa_t}\right)\vartheta \check{\mu}_t^{\mathcal{B}} = 0$$

$\tilde{\sigma}$ $\uparrow$ N with higher safe asset share ϑ^N

- $\boldsymbol{d\eta}$ **Net worth Share Evolution** (Forward equation)
  - $d\eta_t = \eta_t(1-\eta_t)\left[\left(\frac{\kappa_t}{\eta_t}\right)^2 - \left(\frac{1-\kappa_t}{1-\eta_t}\right)^2\right](1-\vartheta_t)^2\tilde{\sigma}^2 dt$ = difference in "earned risk premia"

Steady state: $d\eta = 0 \Rightarrow \eta = \kappa$

- $\boldsymbol{\vartheta}$ **Safe Asset Pricing Equation (world)** (Backward equation)
  - $\vartheta_t = \left(\mathcal{B}_t^N/\wp_t^N + \mathcal{B}_t^S/\wp_t^S\right)/N_t$ "safe asset wealth share"
    - $\mathcal{B}_t^N/\wp_t^N = \mathbb{E}_t\left[PV^{**}\left(primary\ surpluses^N\right)\right] + \mathbb{E}_t[PV^{**}(service\ flows^N)]$
  - Fraction that is part of country N's ϑ^N: fixed exogenously (equilibrium selection/market coordination)

Stationary Steady Sate $d\eta_t = 0$ – in closed form

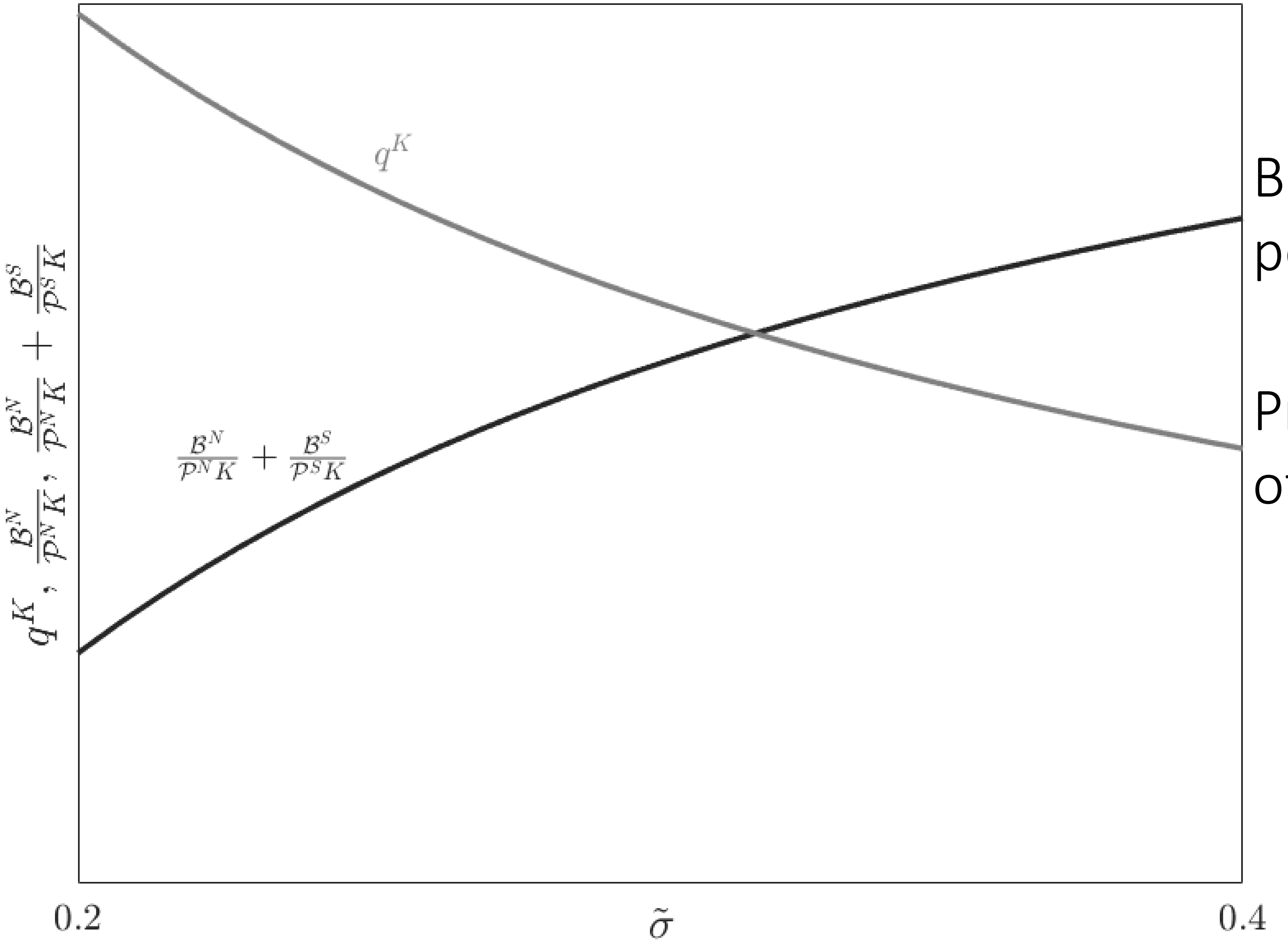
Monetary
$q^K K_t = \underbrace{\frac{\sqrt{\rho+\check{\mu}^{\mathcal{B}}}}{\tilde{\sigma}}}_{1-\vartheta} \underbrace{\frac{\bar{a}-g}{\rho} K_t}_{N_t}$
$\frac{\mathcal{B}_t^N}{\wp_t^N} = \vartheta^N \underbrace{\left(1-\frac{\sqrt{\rho+\check{\mu}^{\mathcal{B}}}}{\tilde{\sigma}}\right)}_{\vartheta} \frac{\bar{a}-g}{\rho} K_t$
$\frac{\mathcal{B}_t^S}{\wp_t^S} = (1-\vartheta^N)\left(1-\frac{\sqrt{\rho+\check{\mu}^{\mathcal{B}}}}{\tilde{\sigma}}\right)\frac{\bar{a}-g}{\rho} K_t$

Recall:
N_t= world net worth
ϑ = fraction of world net worth in nominal claims

- $\bar{a} = \kappa p^n(\kappa) a + (1-\kappa) p^s(\kappa) a$, where $\kappa = \kappa^N$, $1-\kappa = \kappa^S$ and in SS $\eta = \kappa$
- ρ time preference rate; $r^f = \rho + \mu^K + (1-\vartheta)\tilde{\sigma}^2$;
- $\check{\mu}^{\mathcal{B}} = \mu_t^{\mathcal{B}^I} - i_t^I$ bond issuance rate beyond interest rate, same in both countries.

Capital & Bond Price (Steady State) for Different SS $\tilde{\sigma}$

- World

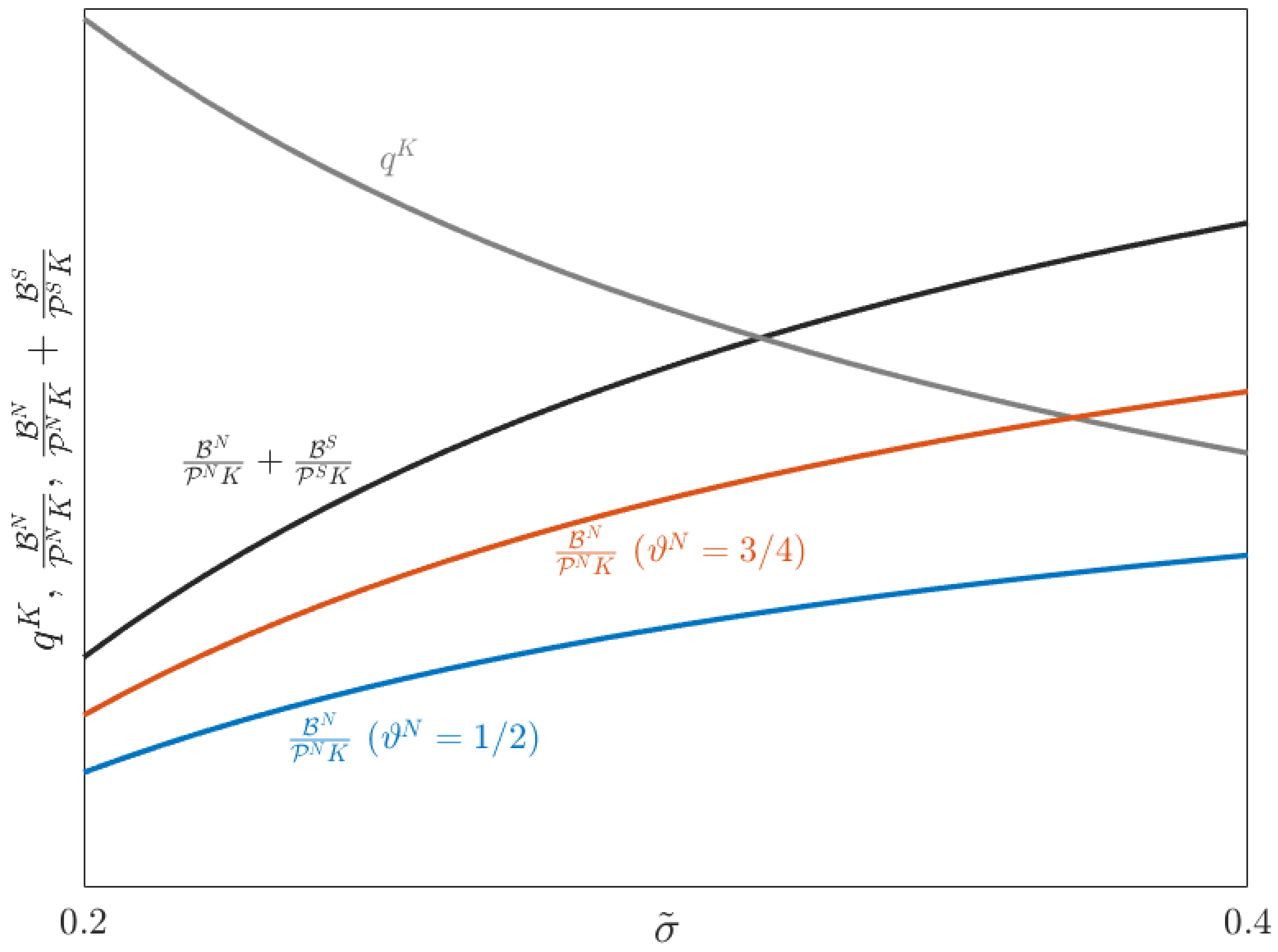


Bond price (real) per unit of K_t

Price (real) of capital unit

Capital & Bond Price (Steady State) for Different SS $\tilde{\sigma}$

- $\vartheta^N = \frac{3}{4}, \vartheta^S = \frac{1}{4}$



- Benchmark: $\vartheta^N = \frac{1}{2} = \vartheta^S$

Steady State Exorbitant Privilege

Theorem: Country N has a steady state Exorbitant Privilege if $\vartheta^N > 1/2$,
since it can run a Ponzi Scheme on citizens of country S.

- Country N's gov. bond supply > country S's if $\vartheta^N > 1/2$.
- N-citizens gov bond holding < Country N's bond supply
- S-citizens also hold bubbly safe asset of gov. country S.

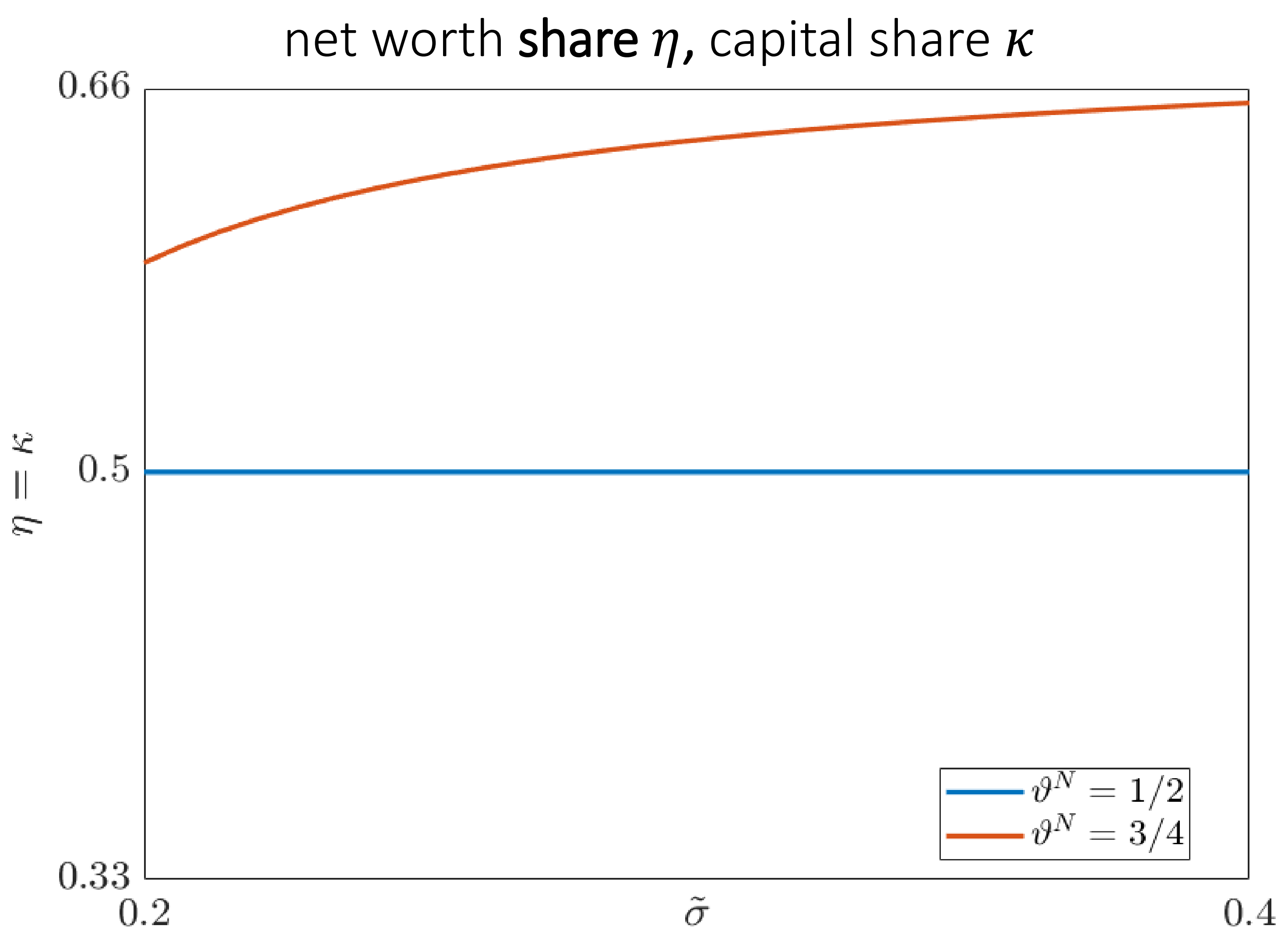
$\Rightarrow$ Country N can "mine the N-bubble" (safe asset) at the expense of S-citizens.

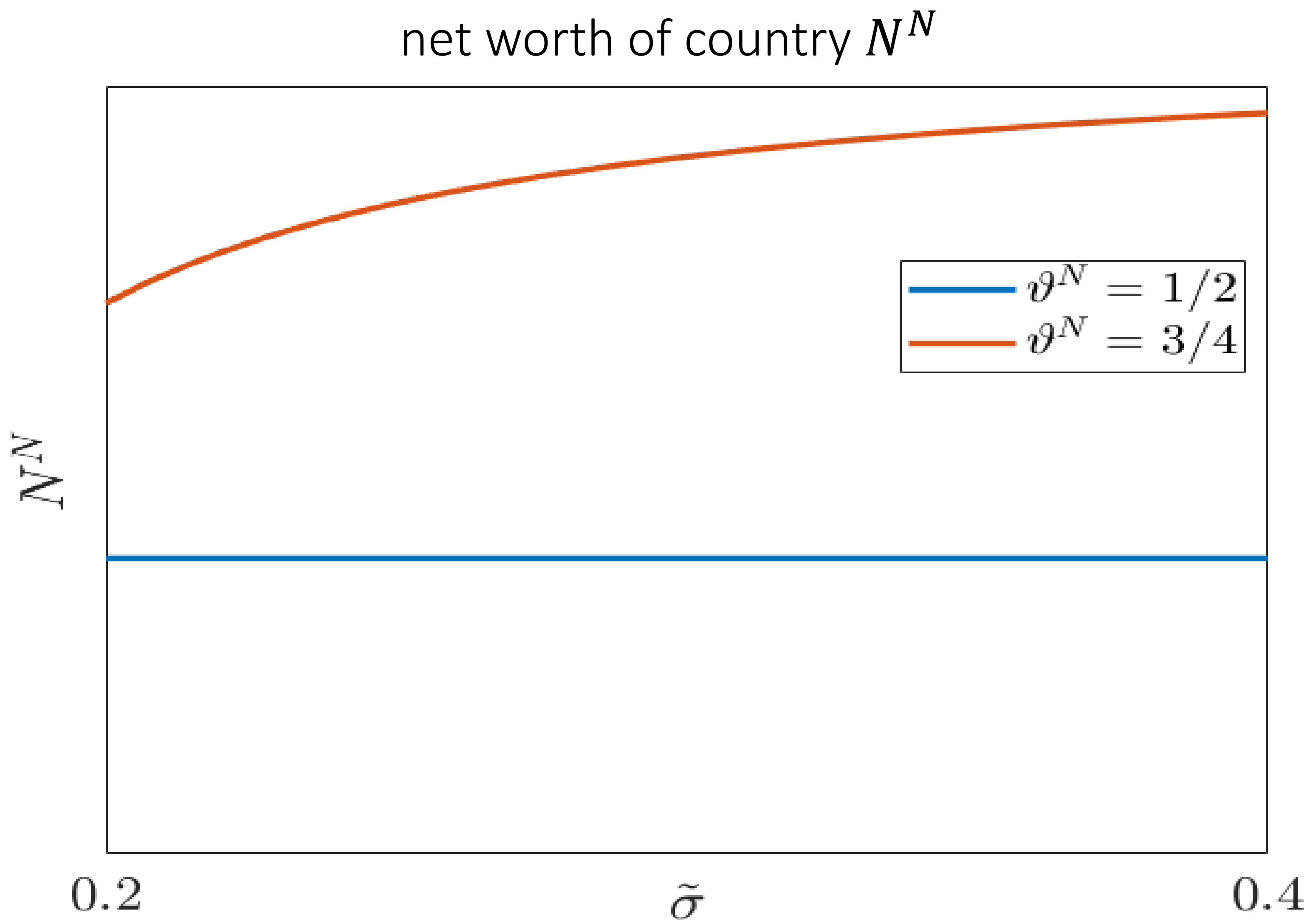
Proof:

Since $p^n < p^s$ for $\kappa > 1/2$, $\Rightarrow \kappa = \eta < \vartheta^N$, i.e. $\kappa^S = \eta^S > \vartheta^S$ (wealth>bubble share)
(apples are cheaper than bananas)
Since portfolio share of bonds θ^S is the same for all citizens across the world,
S-citizens for safe asset/gov. bond exceeds the one issued in country S.

Steady State Capital Share = Net Worth Share for Different $\tilde{\sigma}$

- $\vartheta^N = \frac{3}{4}, \vartheta^S = \frac{1}{4}$ … Country N has higher net worth share and higher total net worth the higher idiodyncratic risk environment

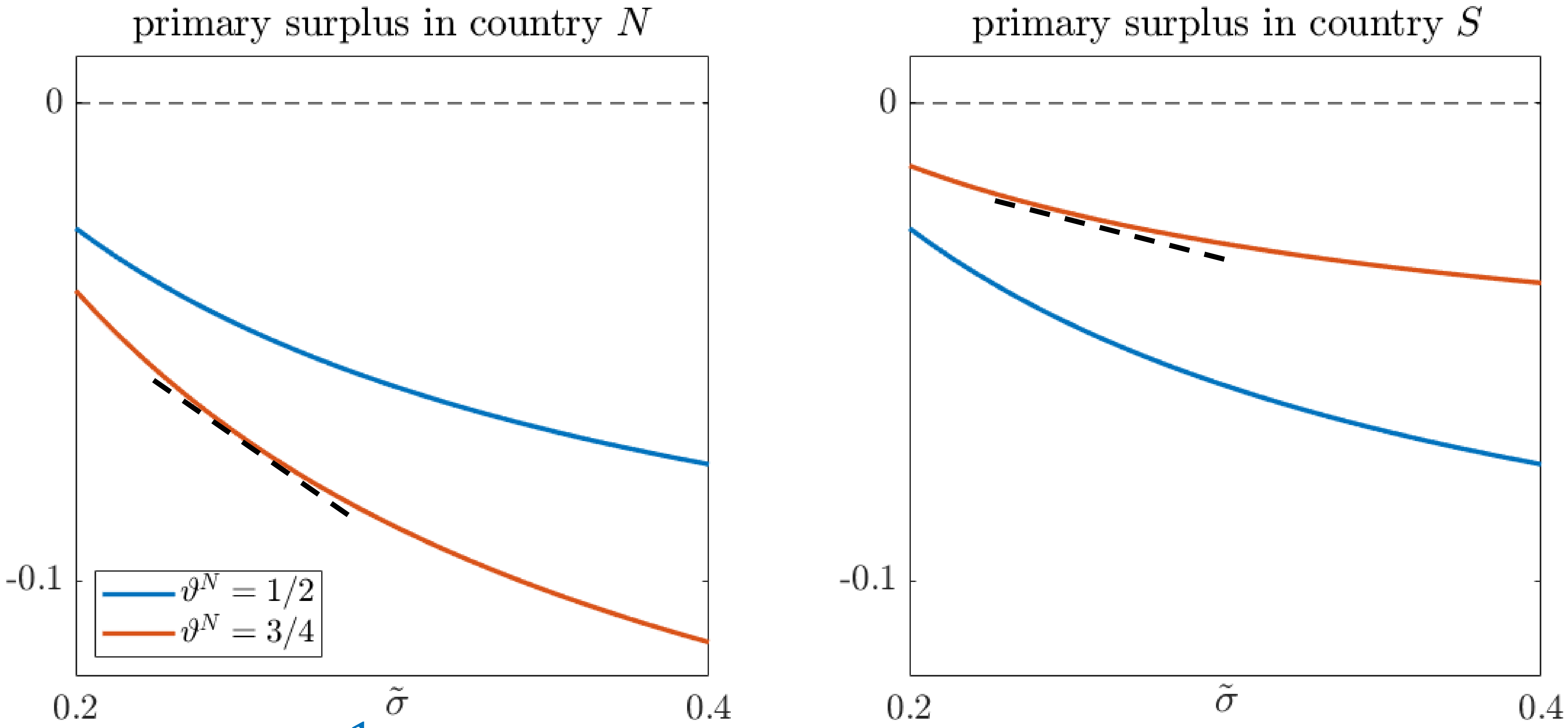




- Benchmark: $\vartheta^N = \frac{1}{2} = \vartheta^S$

Steady State Gov. Primary Surplus for Different $\tilde{\sigma}$

- $\vartheta^N = \frac{3}{4}, \vartheta^S = \frac{1}{4}$ … Country N fiscal deficit is higher and increases more with the higher idio risk environment



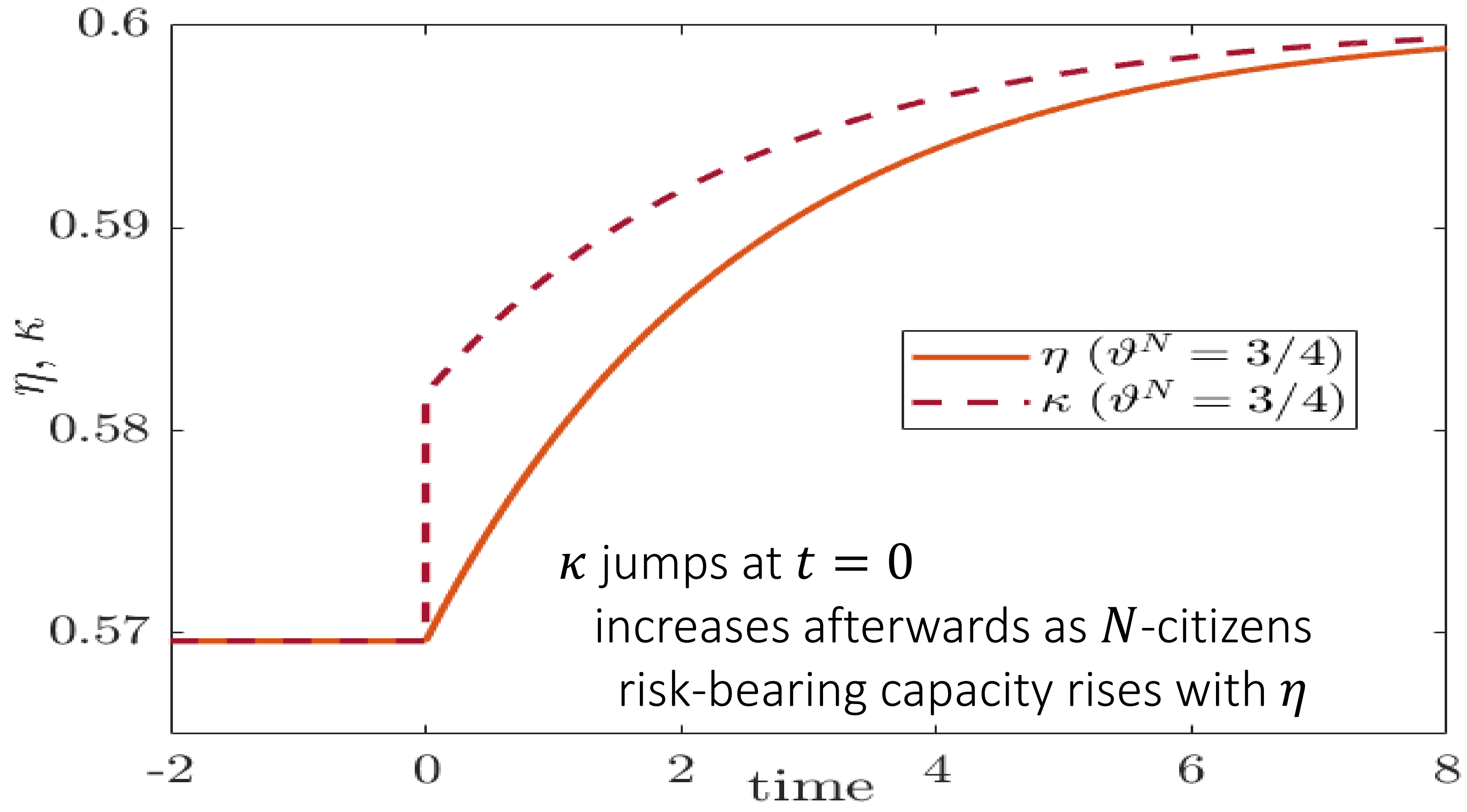
- Benchmark: $\vartheta^N = \frac{1}{2} = \vartheta^S$

Roadmap

- Motivation, Safe Asset: Intuition and Definition
- Two Country Model Setup
  - Symmetric Benchmark
- World Government (Bond)
  ⇒ "Safe Asset Pricing"
- Time-invariant Idiosyncratic Risk and
  ⇒ Asymmetric **Permanent Exorbitant Privilege**
- $\tilde{\sigma}_t$-Risk Shock and its Transition
  ⇒ Insurance of S by N in the long-run
- Time-varying Idiosyncratic Risk $\tilde{\sigma}_t \in \{\tilde{\sigma}^L, \tilde{\sigma}^H\}$
  ⇒ **Flight-to-Safety Exorbitant Privilege** and $\beta^N < \beta^S$
  ⇒ EMDE Costly Stimulus Policy
- Future: "Battle for the Bubble" + Exchange Rate Policy with Sticky Prices

After $\tilde{\sigma}$-shock: "Poor Insure the Rich"

- Unanticipated shock (MIT shock)
- Convergence to new steady state with higher $\tilde{\sigma}$



- At shock impact: Insurance in the short-run, since there no impact on η
  (started at steady state or η-derivatives)
- After the shock: No insurance of long-run risk
  Country N's net worth share and net worth grows subsequently

Roadmap

- Motivation, Safe Asset: Intuition and Definition
- Two Country Model Setup
  - Symmetric Benchmark
- World Government (Bond)
  $\Rightarrow$ "Safe Asset Pricing"
- Constant Idiosyncratic Risk and
  $\Rightarrow$ Asymmetric **Permanent Exorbitant Privilege**
- $\tilde{\sigma}_t$-Risk Shock and its Transition
  $\Rightarrow$ Insurance of S by N in the long-run
- Time-varying Idiosyncratic Risk $\tilde{\sigma}_t \in \{\tilde{\sigma}^L, \tilde{\sigma}^H\}$
  $\Rightarrow$ **Flight-to-Safety Exorbitant Privilege** and $\beta^N < \beta^S$
  $\Rightarrow$ EMDE Costly Stimulus Policy
- Future: "Battle for the Bubble" + Exchange Rate Policy with Sticky Prices

Gov. Bonds with Different Risk Profiles

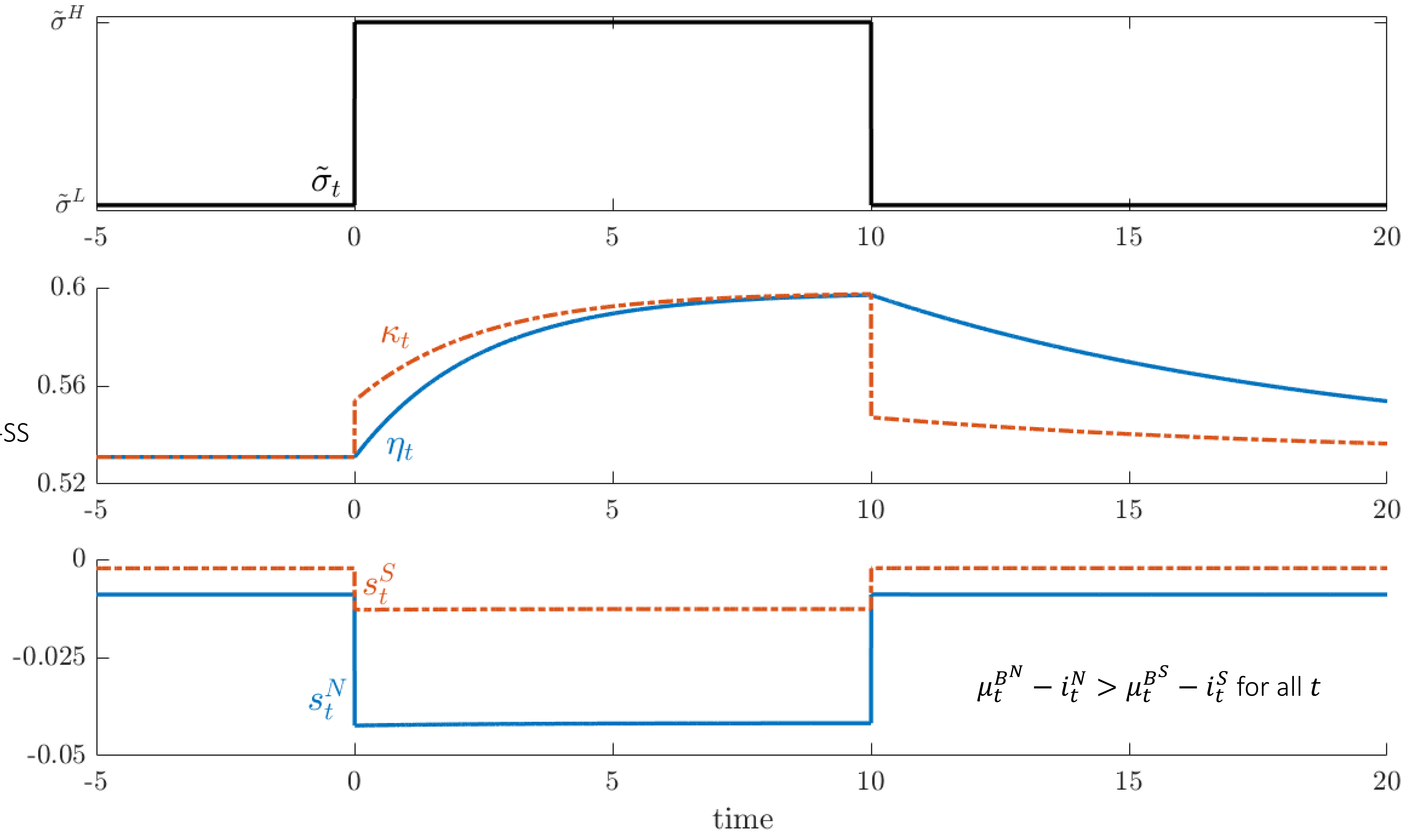
- Full Dynamic model
  - $\tilde{\sigma}_t$ is time-varying and jumps between $\tilde{\sigma}^L$ and $\tilde{\sigma}^H$, and jumps are anticipated.
  - Gov. bonds are different, have different β
- Asymmetry in level $\vartheta^N > \vartheta^S$ and in slope $\underbrace{\vartheta^N(\tilde{\sigma}^H) - \vartheta^N(\tilde{\sigma}^L)}_{\Delta\vartheta^N :=} > \underbrace{\vartheta^S(\tilde{\sigma}^H) - \vartheta^S(\tilde{\sigma}^L)}_{\Delta\vartheta^S :=}$

Theorem: "Flight-to-Safety Exorbitant Privilege"
If $\vartheta^N > 1/2$ and $\Delta\vartheta^N > \Delta\vartheta^S$
higher N-bond issuance (lower taxes)
"on average" or
even in both states, $\mu^{\mathcal{B}^N}(\tilde{\sigma}^H) > \mu^{\mathcal{B}^S}(\tilde{\sigma}^H)$ and $\mu^{\mathcal{B}^N}(\tilde{\sigma}^L) > \mu^{\mathcal{B}^S}(\tilde{\sigma}^L)$.

- Intuition: Beliefs that ϑ^N rises in high-risk environment
$\Rightarrow \beta^N$ more negative and β^S less negative
enables gov. N to issue more bonds (lower taxes) all the time.

Full Model: $\tilde{\sigma}$-realization: 2 Exorbitant Privileges

Start at $\tilde{\sigma}^L$-SS



Country S's Countercyclical Stimulus Policy is Costly

- Suppose country S would like to run fiscal stimulus in high-risk environment $\tilde{\sigma}^H$ as opposed to following N's $\check{\mu}_t^{\mathcal{B}^N}$.

- Result: Country S can enjoy a **fiscal stimulus** policy in high-risk environment $\tilde{\sigma}^H$ **only at** the **expense** of significantly raising taxes in low-risk environment.

  - Intuition:
    $\check{\mu}_t^{\mathcal{B}^N}(\tilde{\sigma}^H)\uparrow$, i.e. issuing more S-bonds at state $\tilde{\sigma}^H$ increases S-bonds β^S, (lowering its safety).
    To keep S-bond attractive relative to N-bond, $\check{\mu}_t^{\mathcal{B}^N}(\tilde{\sigma}^L)\downarrow\downarrow$, N-bond issuance has to drop significantly in low risk environment.

Conclusion – Main Takeaways

- Safe Asset = good friend provides “service flow”
  - **Individually:** allows self-insurance through retrading
  - **Aggregate:** appreciates in bad times (negative β)
- Safe Asset Exorbitant Privilege makes IMS “unbalanced”
  - Permanent wealth transfer: Country N can “mine the bubble” held by S-citizens
  - Risk shock ⇒ “poor insure the rich”
    - No immediate redistribution, but N’s net worth share grows (long-run risk)
- “Flight-to-Safety Exorbitant Privilege” (2nd Privilege)
- Country S running countercyclical fiscal stimulus is very costly and risk losing its own safe asset status
- Extension: Battle for the Bubble depends on policy space and commitment power
- Extension: FX intervention with sticky prices + home bias
  - Contrasting: US vs. Switzerland (currency manipulation or correction?)

CH has larger incentive to share privilege

Safe Asset: Issuance Privilege vs. Burden

- At normal times: lower r possibly $< g$
- At times of elevation risk:
  + Flight-to-Safety issuance benefits ↑ interest rate r ↓
  - Exchange rate ↑ export/import ↓

- What does it depend on?
  + Fraction on world safe asset share (relative to country size)
  - (1) price stickiness (form of)
    (2) home goods bias
    (3) elasticity of substitution btw. home & foreign goods

FX Interventions: Preview

- Safe asset providing country
  - Holds a common "stock" of foreign bond
  - Increases its holdings in an elevated risk environment

  Is not manipulative but stabilizing, as the country shares privilege/"Bubble mining" revenue (helps to keep interest rate low)

- Switzerland has larger incentive to share privilege than US
  - As it helps to stabilize its output gap more

- Conjecture: Buying foreign equity shares adds risk
  - β of safe asset is less negative

Price Stickiness ⇒ **Exchange Rate Distortions: Overview**

- So far, country A's funding costs declined as $\tilde{\sigma}$ rises ⇒ Positive effect
- With price stickiness, exchange rate matters too
  higher safe asset demand for country A debt
  ⇒ larger demand for A currency
  ⇒ A currency appreciates
  - Strong currency hits export and favors imports
  - **Output gap** becomes negative ⇒ Negative effect

Introducing Price Stickiness

- Prices are sticky in producers' currency
  - Apple prices are sticky in country A, banana prices are sticky in country B
- Demand effect leads to output gap
  - (over/under) utilization of capital stock

- Contrast **two** extreme **cases**:
  - With perfect home bias (America)
  - Without home bias (Switzerland)

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  - Exchange rate ↑ export/import ↓
- What does it depend on?
  + Fraction on world safe asset share (relative to country size)
  - (1) price stickiness (form of)
    (2) home goods bias *low* (America vs. Switzerland)
    (3) elasticity of substitution btw. home & foreign goods *high*
- Rationale for FX intervention: beneficial, but can be loss making for A
- Implication for Monetary Policy Framework (added FX target)