Debt as Safe Asset: Mining the Bubble

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2021-03-16
Questions of our times

- How much government debt can the market absorb?
- At what interest rate?
- Is there a limit, a “Debt Laffer Curve”?
- What is the impact on inflation?
- When can governments run a deficit without ever paying back its debt, like a Ponzi scheme, and nevertheless individual citizens’ transversality conditions hold?
- What is a safe asset? What are its features? Retrading?
- Why is government debt a safe asset?
- When do you lose safe asset status?
- Why is there debt valuation puzzle for US, Japanese?
- How do we have to modify representative agent asset pricing and the FTPL?
Valuating Government Debt

- Think of a representative agent holding all gov. debt
  - His cash flow is primary surplus
  
  \[ \mathbb{B}_t \mathbb{P}_t = E_t \int_t^\infty \frac{\xi_s}{\xi_t} (T_s - G_s) ds \quad (\xi_t = \text{SDF}) \]  
  [FTPL equation] (Jiang et al.)

- ... but Japan primary surplus was negative for 50 out of 60 years

- Can surpluses be negative forever? Yes, if gov. debt is safe asset
Primary surplus, r and g for the United States

- Primary surplus/GDP
- GDP growth
- r
- r - g
What’s a Safe Asset?

- Asset Price = E[PV(cash flows)] + E[PV(service flows)]
  
  dividends/interest  convenience yield
What’s a Safe Asset?

- **Asset Price** = \( E[\text{PV(cash flows)}] + E[\text{PV(service flows)}] \)
  - dividends/interest
  - convenience yield

<table>
<thead>
<tr>
<th>Portfolio of Asset</th>
<th>Safe asset</th>
<th>Cash flow asset</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>0</td>
<td>CF</td>
</tr>
<tr>
<td>B</td>
<td>0</td>
<td>CF</td>
</tr>
</tbody>
</table>

CF shocks

shocks

A

B

...
What’s a Safe Asset?

- Asset Price = \( E[PV(\text{cash flows})] + E[PV(\text{service flows})] \)
  - dividends/interest
  - convenience yield

- Value come from re-trading

A | B
---|---
0 | 0
CF | CF

A | B
---|---
0 | 0
CF | CF

...
What’s a Safe Asset?

- Asset Price = $E[\text{PV(cash flows)}] + E[\text{PV(service flows)}]$  
  - dividends/interest
  - convenience yield

- Value come from **re-trading**
- Insures by partially completing markets

- Can be “bubbly” = fragile

Diagram:

- A: 0, CF, 0
- B: CF, 0, CF

...
Safe Asset Pricing Equation, 2 $\beta$s, Fragility

- Asset Price = $E[PV(\text{cash flows})] + E[PV(\text{service flows})]$
  - dividends/interest
  - convenience yield

  - 2 $\beta$s
    - $\beta^{cf} > 0$
    - $\beta^{sf} < 0$

1. Good friend analogy (Brunnermeier Haddad, 2012)
   - When one needs funds, one can sell at stable price... since others buy
     - Idiosyncratic shock:
       - Partial insurance through retrading - low bid-ask spread
     - Aggregate (volatility) shock:
       - Appreciate in value – negative $\beta = \omega \beta^{cf} + (1 - \omega) \beta^{sf} < 0$

2. Safe Asset Tautology
   - Safe asset is a bubble from aggregate perspective - fragility
   - Other service flows: collateral constraint, double-coincidence of wants
## Models on Money as Store of Value

<table>
<thead>
<tr>
<th>Friction</th>
<th>OLG</th>
<th>Incomplete Markets + idiosyncratic risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk</td>
<td>deterministic</td>
<td>endowment risk borrowed constraint</td>
</tr>
<tr>
<td></td>
<td></td>
<td>return risk</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Risk tied up with Individual capital</td>
</tr>
<tr>
<td>Only money</td>
<td>Samuelson</td>
<td>Bewley</td>
</tr>
<tr>
<td>With capital</td>
<td>Diamond</td>
<td>Aiyagari</td>
</tr>
<tr>
<td></td>
<td>“I Theory without I”</td>
<td>Brunnermeier-Sannikov (AER PP 2016)</td>
</tr>
</tbody>
</table>
Literature

- Public Debt Evaluation Puzzles
  - Jiang et al. (2020), Jiang et al. (2021)
  - FTPL: Sims, Woodford, Leeper, Cochrane,

- Safe asset
  - Brunnermeier et al. (ESBies), Gourinchas, Caballero et al.

- Fiscal debt sustainability and r vs. g
  - Idio endowment risk: Bewley, Aiyagari-McGretten (1992), Aiyagari-Gertler 92,
  - Idio capital risk models: Angeletos (2006) (no safe asset),
    Brunnermeier Sannikov (2016), DiTella (AER), Kiyotaki-Moore, Reis (2020) ...
  - Bohn (1995), ...
Roadmap

- Model without stock market
- The 2 perspectives of discounting and TVC
- The Debt Laffer Curve
- Flight to Safety

- Model with stock market and stochastic idiosyncratic risk
- Calibration
- Safe Asset with negative $\beta$
- Stock market mutual fund with positive $\beta$

- Equilibrium selection + Misc.
Model with Capital + Safe Asset

- Each heterogenous citizen $\bar{i} \in [0,1]$
  
  $$E \left[ \int_0^\infty e^{-\rho t} \log c_t^{\bar{i}} \, dt \right] \quad \text{s.t.} \quad \frac{dn_t^{\bar{i}}}{n_t^{\bar{i}}} = -\frac{c_t^{\bar{i}}}{n_t^{\bar{i}}} \, dt + dr_t^B + (1 - \theta_t^{\bar{i}}) \left( dr_t^{K^{\bar{i}}} (i_t^{\bar{i}}) - dr_t^B \right)$$

- Each citizen operates one firm
  
  - Output
    $$y_t^{\bar{i}} = a_t k_t^{\bar{i}}$$
  
  - Physical capital
    $$k_t^{\bar{i}}$$

  - $\frac{dk_t^{\bar{i}}}{k_t^{\bar{i}}} = (\Phi(i_t^{\bar{i}}) - \delta) \, dt + \tilde{\sigma}_t \, d\tilde{Z}_t^{\bar{i}}$
Model with Capital + Safe Asset

- Each heterogenous citizen $\tilde{i} \in [0,1]$
  \[ E \left[ \int_0^\infty e^{-\rho t} \log c_t^{\tilde{i}} \, dt \right] \quad \text{s.t.} \quad \frac{d n_t^{\tilde{i}}}{n_t^{\tilde{i}}} = -\frac{c_t^{\tilde{i}}}{n_t^{\tilde{i}}} \, dt + dr_t^B + (1 - \theta_t^{\tilde{i}}) \left( dr_t^{K,i}(i_t) - dr_t^B \right) \]

- Each citizen operates one firm
  - Output $y_t^{\tilde{i}} = a_t k_t^{\tilde{i}}$
  - Physical capital $k_t^{\tilde{i}}$
  - $\frac{dk_t^{\tilde{i}}}{k_t^{\tilde{i}}} = (\Phi(i_t^{\tilde{i}}) - \delta) \, dt + \tilde{\sigma}_t \, d\tilde{Z}_t^{\tilde{i}}$

- Aggregate risk: $\tilde{\sigma}_t, a_t, g_t$ exogenous process with aggregate shock $dZ_t$

- Financial Friction: Incomplete markets: citizens cannot trade claims on $d\tilde{Z}_t^{\tilde{i}}$
Taxes, Bond/Money Supply, Gov. Budget

- Government policy Instruments
  - Government spending $g_t K_t$
  - Proportional tax $\tau_t k_t$ on capital
  - Nominal government debt supply
    \[
    \frac{dB_t}{B_t} = \mu^B_t dt
    \]
- Nominal interest rate $i_t$
- Government budget constraint (BC)
  \[
  \left(\mu^B_t - i_t\right)B_t + g_t K_t \left(\tau_t - g_t\right) = 0
  \]
- Assume here:
  - Gov. chooses $\mu^B$, $i$; while $\tau_t$ adjusts to satisfy (BC)
- Goods market clearing:
  \[
  C_t + g_t K_t = (a_t - \iota_t)K_t
  \]
  Let $\bar{a}_t := a_t - g_t$
Real prices and returns

- $q_t^K K_t$ value of physical capital
  - Return $dr_{t}^{K,\hat{\nu}} = \left( \frac{a(1-\tau) - u_t^\nu}{q_t^K} + \Phi(u_t^\nu) - \delta + \mu_t^q K \right) dt + \sigma_t^q dZ_t + \tilde{\sigma}_t d\tilde{Z}_t$

- $q_t^B K_t$ real value of gov. debt
  - $B_t / \phi_t = q_t^B K_t$
  - Return $dr_{t}^B = (i - \mu_t^B + \Phi(u_t) - \delta - \mu_t^{qB}) dt + \sigma_t^{qB} dZ_t$

- $\hat{\nu}$’s dynamic trading strategy of gov. bond
  - Inflow (outflow) from selling (buying) bond
  - Reduces (increases) future payoffs
Optimality

- Optimal real investment rate: (Tobin’s q)  
  \[ \iota_t = \frac{1}{\phi} (q^K_t - 1) \]

- Optimal consumption:  
  \[ c_t = \rho n_t \]

- Optimal portfolio choice \( \theta_t \):  
  \[ E \left[ \frac{dr^K}{dt} - \frac{dr^B}{dt} \right] = \zeta_t \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) + \tilde{\zeta}_t \tilde{\sigma}_t \]

  \[ \frac{a_t - \iota_t}{q^K_t} + \mu^B = \left[ \sigma_t^{q^B} + (1 - \theta_t) \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) \right] \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) + \]

  \[ + (1 - \theta_t) \tilde{\sigma}_t^2 \]
Optimality and market clearings

- Optimal real investment rate: (Tobin’s q) \( \iota_t = \frac{1}{\phi}(q^K_t - 1) \)

- Optimal consumption: \( C_t = \rho N_t = (a_t - \iota_t - \varrho_t)K_t \)

- Optimal portfolio choice \( \theta_t \):
  \[
  E \left[ \frac{dr^K}{dt} - \frac{dr^B}{dt} \right] = \varsigma_t \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) + \varsigma_t \tilde{\sigma}_t 
  \]

  \[
  \frac{a_t - \iota_t}{q^K_t} + \tilde{\mu}^B = \left[ \sigma_t^{q^B} + \frac{(1 - \theta_t)}{1-\theta_t} \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) \right] \left( \sigma_t^{q^K} - \sigma_t^{q^B} \right) + \\
  + \frac{(1 - \theta_t)}{1-\theta_t} \tilde{\sigma}_t^2 
  \]
## Two Stationary Equilibria (for $K_0 = 1$ and constant $\tilde{\sigma}$)

<table>
<thead>
<tr>
<th>Gordon-Growth Formula</th>
<th>Closed Form Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>$q^K = \frac{(1-\tau)a - i}{E[dr^K]/dt - g}$</td>
<td>$q^K = \frac{\sqrt{\rho + \tilde{\mu}^B}}{\sqrt{\rho + \tilde{\mu}^B + \phi \tilde{\sigma} \rho}} (1 + \phi \tilde{a})$</td>
</tr>
<tr>
<td>$\frac{B}{\phi} = \frac{s}{E[dr^m]/dt - g} + \frac{(1 - \theta)^2 \tilde{\sigma}^2 B}{\phi}$</td>
<td>$q^B K_t = \frac{(\tilde{\sigma} - \sqrt{\rho + \tilde{\mu}^B})(1 + \phi \tilde{a})}{\sqrt{\rho + \tilde{\mu}^B + \phi \tilde{\sigma} \rho}} K_t$</td>
</tr>
<tr>
<td>$\dot{t} = \frac{\rho a \sqrt{\rho + \tilde{\mu}^B - \tilde{\sigma} \rho}}{\sqrt{\rho + \tilde{\mu}^B + \phi \tilde{\sigma} \rho}}$</td>
<td></td>
</tr>
</tbody>
</table>

$dr^m = \theta dr^B + (1 - \theta) dr^K$

- $\rho$ time preference rate
- $\phi$ adjustment cost for investment rate
- $\tilde{\mu}^B = \mu^B - i$ bond issuance rate beyond interest rate
- $\tilde{a} = a - g$ part of TFP not spend on gov.)
Safe Asset Valuation Equation: 2 Perspectives

- **Individual Perspective** \( \frac{d\xi^i_t}{\xi^i_t} = -r_t^f dt - \zeta_t dZ_t - \tilde{\zeta}^i_t d\tilde{Z}^i_t \)
  - Bond as part of a dynamic trading strategy
  - Cash flow from selling (buying) after negative (positive) idiosyncratic shock

- **Aggregate Perspective** \( d\bar{\xi}_t/\bar{\xi}_t = -r_t^f dt - \zeta_t dZ_t \)

\( \eta_t \) and \( \xi_t \) are negatively correlated \( \Rightarrow \) depresses weighted SDF (higher discount rate)

Safe Asset Valuation Equation: 2 Perspectives
Safe Asset Valuation Equation: 2 Perspectives

- **Individual Perspective**
  \[ \frac{d\xi_t^i}{\xi_t^i} = -r_t^f \, dt - \varsigma_t \, dZ_t - \tilde{\varsigma}_t \, d\tilde{Z}_t \]

- Bond as part of a dynamic trading strategy
  - Cash flow from selling (buying) after negative (positive) idiosyncratic shock
  - Price “bond-part” of portfolio
  - Integrate over citizens weighted by net worth share \( \eta_t^i \)
    - \( \xi^i \) and \( \eta^i \) are negatively correlated \( \Rightarrow \) depresses weighted SDF (higher discount rate) \( E[dr^n]/dt = r^f + \varsigma + \tilde{\varsigma} \)

- **Aggregate Perspective**
  \[ \frac{d\bar{\xi}_t}{\bar{\xi}_t} = -r_t^f \, dt - \bar{\varsigma}_t \, d\bar{Z}_t \]

- Without aggregate risk \( \bar{\xi}_t = e^{-r_f t} \)

Safe Asset Valuation Equation:

"Partial insurance Service"

\[ \frac{B_0}{P_0} = \mathbb{E} \left[ \int_0^\infty \left( \int \xi^i \eta^i \, di \right) s_t K_t \, dt \right] + \mathbb{E} \left[ \int_0^\infty \left( \int \xi^i \eta^i \, di \right) (1 - \vartheta^i_1)^2 \sigma^2 \frac{B_t}{P_t} \, dt \right] \]

\[ \frac{\rho}{\bar{\rho}} = \frac{s}{E[dr^n]/dt - g} + \frac{(1 - \vartheta)^2 \sigma^2 B_t}{E[dr^n]/dt - g} \]

\( \rho + g = \text{discount rate} \)
Safe Asset Valuation Equation: 2 Perspectives

- **Individual Perspective** 
  \[ \frac{d\xi}{\xi} = -r_t^f dt - \zeta_t dZ_t - \tilde{\zeta}_t d\tilde{Z}_t \]
  - Bond as part of a dynamic trading strategy
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    - \( \xi^i \) and \( \eta^i \) are negatively correlated \( \Rightarrow \) depresses weighted SDF (higher discount rate) \( E[dr^n]/dt = r^f + \zeta + \tilde{\zeta} \)

- **Aggregate Perspective** 
  \[ \frac{d\tilde{\xi}}{\xi} = - r_t^f dt - \zeta_t dZ_t \]
  - Without aggregate risk \( \tilde{\xi}_t = e^{-r^f_t} \)
  - Lower social discount rate + Bubble term

\[ \frac{B_0}{P_0} = E \left[ \int_0^\infty \left( \int \tilde{\xi}_t^i \eta_t^i d\eta_t^i \right) s_t K_t dt \right] + E \left[ \int_0^\infty \left( \int \tilde{\xi}_t^i \eta_t^i d\eta_t^i \right) (1 - \theta_t)^2 \tilde{\sigma}_t^2 B_t \right] \frac{B_t}{P_t} \].

\[ \frac{B}{\tilde{P}} = \frac{s}{E[dr^n]/dt - g} + \frac{(1 - \theta)^2 \tilde{\sigma}^2 B}{E[dr^n]/dt - g} \]

\[ \rho + g = \text{discount rate} \]

\[ \frac{B}{\tilde{P}} = \frac{s}{r^f - g} \]

\[ g - \hat{\mu} = \text{discount rate} \]

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Bubble/Ponzi Scheme and **Transversality**

- Gov. Debt is a Ponzi scheme/bubble (in aggregate perspective)
  - Service flow – partial insurance to overcome market incompleteness

- Why does transversality condition not rule out the bubble?
  - **Individual Perspective**
    - High individual discount rate (low SDF) since net worth
    \[
    \lim_{T \to \infty} E[\xi_T n_T^i] = 0
    \]
  - **Aggregate perspective**
    - Low “social” discount rate (high SDF)
    \[
    \lim_{T \to \infty} E[\bar{\xi}_T n_T^i] > 0
    \]
\( r^f \) versus \( g \) for different \( \tilde{\mu}^B \)

- When primary deficit forever \( s < 0 \ \forall t \iff \tilde{\mu}^B > 0 \? \) Japan?
  - Higher issuance rate \( \Rightarrow \) higher inflation tax \( \Rightarrow \) lower real return \( \Rightarrow r^f < g \)

\[
g = \frac{1}{\phi} \log \frac{\sqrt{\rho + \tilde{\mu}^B} (1 + \phi a)}{\sqrt{\rho + \tilde{\mu}^B + \phi \sigma \rho}} - \delta
\]

\[
r^f = \frac{\Phi(i) - \delta - \tilde{\mu}^B}{g} = g
\]

\[a = .27, g = \frac{a}{3}, \delta = .1, \rho = .02, \sigma = .25, \phi = 3,\]
Higher issuance rate, $\hat{\mu}^B \Rightarrow$ higher inflation tax
But real value of bonds, $\frac{B}{\kappa}$, declines $\Rightarrow$ lower “tax base”
Flight to Safety: Comparative static w.r.t. $\tilde{\sigma}$

- Flight to safety into bubbly gov. debt
  - $q^B$ rises (disinflation)
  - $q^K$ falls and so does $\iota$ and $g$

- Similar with stochastic idiosyncratic volatility
$r^f$ vs. $g$ vs. $E[dr^K]/dt$ for different $\tilde{\sigma}$

$a = .27, g = \frac{a}{3}, \delta = .1, \rho = .02, \kappa = 3, \bar{\mu}^B = .005$

- $E[dr^K]/dt > r^f > g$ for small $\tilde{\sigma}/\sqrt{\rho}$
- $E[dr^K]/dt > g > r^f$ for large $\tilde{\sigma}/\sqrt{\rho}$
- $E[dr^K]/dt < g$ can never happen
Roadmap

- Model without stock market
- The 2 perspectives of discounting and TVC
- The Debt Laffer Curve
- Flight to Safety

- Model with stock market and stochastic idiosyncratic risk
- Calibration
- Safe Asset with negative $\beta$
- Stock market mutual fund with positive $\beta$

- Equilibrium selection + Misc.
Countercyclical Safe Asset

  - Stochastic idiosyncratic volatility:
    \[ d\tilde{\sigma}_t^2 = -\psi \left( \tilde{\sigma}_t^2 - (\tilde{\sigma}^0)^2 \right) dt - \sigma\tilde{\sigma}_t dZ_t \]
  - Stochastic TFP:
    \[ a_t = a(\tilde{\sigma}_t) \text{ s.t. } \frac{c}{K}(\tilde{\sigma}_t) = \alpha_0 - \alpha_1 \tilde{\sigma}_t \text{ linear} \]
- Policy (surpluses decrease in \( \tilde{\sigma}_t \)):
  \[ \ddot{\mu}_t^B = -\nu_0 + \nu_1 \tilde{\sigma}_t \]
- Equity issues up to \((1 - \bar{\chi})\)
  + mutual fund

Replace in formulas \( \tilde{\sigma} \) with \( \bar{\chi}\tilde{\sigma} \)

Epstein-Zin preferences for calibration (EIS=1)

\[ V_t^i = E_t \left[ \int_t^\infty (1 - \gamma)\rho V_s^i \left( \log(c_s^i) - \frac{1}{1 - \gamma} \log \left( (1 - \gamma) V_s^i \right) \right) ds \right] \]
## Calibration - Parameter choice

<table>
<thead>
<tr>
<th>parameter</th>
<th>description</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\tilde{\sigma}^0$</td>
<td>$\tilde{\sigma}^2_t$ stoch. steady state</td>
<td>0.29</td>
</tr>
<tr>
<td>$\psi$</td>
<td>$\tilde{\sigma}^2_t$ mean reversion</td>
<td>0.15</td>
</tr>
<tr>
<td>$\sigma$</td>
<td>$\tilde{\sigma}^2_t$ volatility</td>
<td>0.037</td>
</tr>
<tr>
<td>$\tilde{\chi}$</td>
<td>undiversifiable idio. risk</td>
<td>0.5</td>
</tr>
<tr>
<td>$\phi$</td>
<td>capital adjustment cost</td>
<td>6</td>
</tr>
<tr>
<td>$\gamma$</td>
<td>risk aversion</td>
<td>7.5</td>
</tr>
<tr>
<td>$\rho$</td>
<td>time preference</td>
<td>0.17</td>
</tr>
<tr>
<td>$\alpha_0$</td>
<td>$C/K$ intercept</td>
<td>0.59</td>
</tr>
<tr>
<td>$\alpha_1$</td>
<td>negative of $C/K$ slope</td>
<td>0.2</td>
</tr>
<tr>
<td>$\nu_0$</td>
<td>$\tilde{\mu}^B$ intercept</td>
<td>-0.085</td>
</tr>
<tr>
<td>$\nu_1$</td>
<td>$\tilde{\mu}^B$ slope</td>
<td>0.25</td>
</tr>
</tbody>
</table>

Bloom et al. (2018)

Private Equity wealth in US

Match volatility of
- Output
- Consumption
Surplus-output ratio
Equity premium
Equity Sharpe ratio
## Calibration – Quantitive model fit

<table>
<thead>
<tr>
<th>symbol</th>
<th>moment description</th>
<th>model</th>
<th>data</th>
<th>data</th>
<th>data</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\sigma(Y)$</td>
<td>output volatility</td>
<td>0.019</td>
<td>0.014</td>
<td>0.010</td>
<td></td>
</tr>
<tr>
<td>$\sigma(C)$</td>
<td>consumption volatility</td>
<td>0.010</td>
<td>0.008</td>
<td>0.007</td>
<td></td>
</tr>
<tr>
<td>$\sigma(S/Y)$</td>
<td>surplus volatility</td>
<td>0.004</td>
<td>0.009</td>
<td>0.011</td>
<td></td>
</tr>
<tr>
<td>$\rho(Y, C)$</td>
<td>correlation of output and consumption</td>
<td>0.977</td>
<td>0.826</td>
<td>0.83</td>
<td></td>
</tr>
<tr>
<td>$\rho(Y, S/Y)$</td>
<td>correlation of output and surpluses</td>
<td>0.927</td>
<td>0.471</td>
<td>0.710</td>
<td></td>
</tr>
<tr>
<td>$E[C/Y]$</td>
<td>average consumption-output ratio</td>
<td>0.667</td>
<td>0.615</td>
<td>0.614</td>
<td></td>
</tr>
<tr>
<td>$E[S/Y]$</td>
<td>average surplus-output ratio</td>
<td>0.007</td>
<td>0.007</td>
<td>0.004</td>
<td></td>
</tr>
<tr>
<td>$E[q^K K/Y]$</td>
<td>average capital-output ratio</td>
<td>3.206</td>
<td>$\approx 3$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$E[q^B K/Y]$</td>
<td>average debt-output ratio</td>
<td>0.672</td>
<td>0.578</td>
<td>0.714</td>
<td></td>
</tr>
<tr>
<td>$E[dr^E - dr^B]$</td>
<td>average equity premium</td>
<td>5.6%</td>
<td>$\approx 6.4%$</td>
<td></td>
<td></td>
</tr>
<tr>
<td>$\frac{E[dr^E - dr^B]}{\sigma(dr^E - dr^B)}$</td>
<td>equity sharpe ratio</td>
<td>0.436</td>
<td>$\approx 0.5$</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Policy variation: **Countercyclical vs. constant** Bubble Mining

- Same average surpluses across both policies

Taxpayers is insured with blue policy
- Safe asset less negative $\beta$
  - makes safe asset more valuable
  ($\theta > \theta$ for most $\tilde{\sigma}$)
Safe Asset – Cash flow and Service flow

- Asset Price = E[PV(cash flows)] + E[PV(service flows)]
Safe Asset – Cash flow and Service flow

- Asset Price = $E[\text{PV(cash flows)}] + E[\text{PV(service flows)}]$
- $\beta_{B,CF} > 0$
- $\beta_{B,SF} > 0$
Loss of Safe Asset Status

- Bubbles can pop

- Able to prop up the bubble/safe-asset status by (off-equilibrium) hiking taxes (fiscal space)

- Market maker of last resort to secure low bid-ask spread
  - 10 year US Treasury in March 2020

- Competing safe asset
  - Interest rate policy of competing central banks
  - “least ugly horse”
When $\tilde{\sigma}$ rises,

- Citizens want to hold more of safe asset
- Insider premium rises, fraction of output distributed to outside equity holder declines

Equity mutual fund - Excess volatility and P/D-predictability
Equilibrium selection

- No bubble equilibrium

- Debt valuation puzzle
  - Level
  - Insuring tax payers and bond holders

- Possibility to insure bondholders and tax payers simultaneously

- Equilibrium selection
  - Bubble on the equity mutual fund
  - Central bank as market maker of last resort – to ensure retrading

- Bubbles can pop: Loss of flight to safe asset status
Conclusion

- Asset Pricing
  - Safe asset is different – provides service flow
  - Risk sharing via precautionary saving and constant retrading
  - 2 terms: cash flow + service flow
  - Split depends on perspective (individual vs. aggregate)
    - different discount rates
    - \(2 \beta s\)
- Flight to safety creates countercyclical Safe Asset Valuations
  - negative \(\beta\)
- Bubble mining for government
  - Negative primary surpluses for decades (like in Japan)
  - But has its limits (unlike MMT)
- Bubbles can pop: Loss of flight to safe asset status
  - Fiscal capacity to fend off + Market maker of last resort