A Model of the Safe Asset Mechanism

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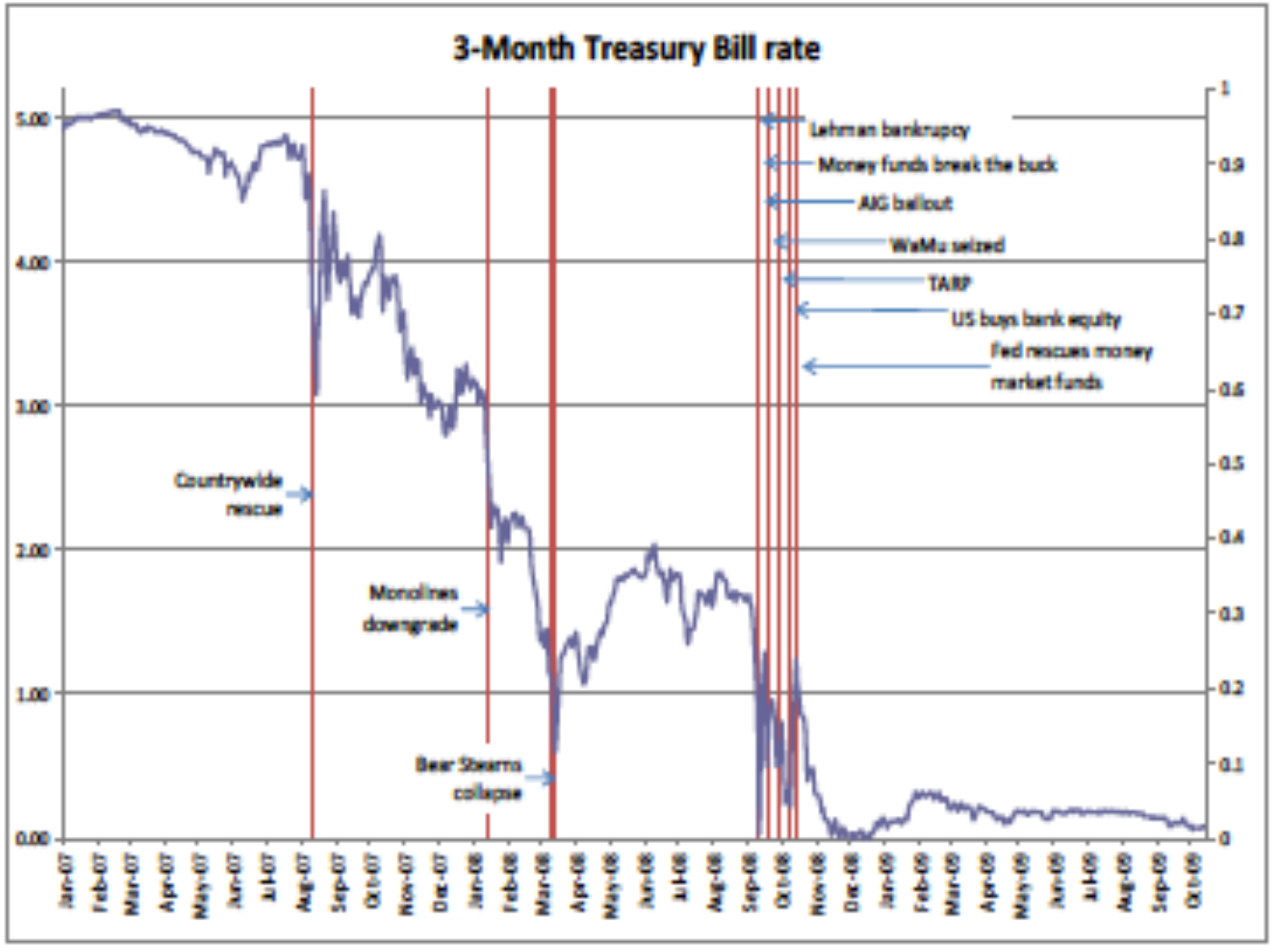
Safe Asset Shortage

	$ bn		% of World GDP	
	2007	2011	2007	2011
US Federal Government Debt held by the public	5,136	10,692	9.20%	15.80%
Held by the Fed	736	1,700	1.30%	2.50%
Held by private investors	4,401	8,992	7.90%	13.30%
GSE obligations	2,910	~~2,023~~	5.20%	~~3.00%~~
Agency- and GSE-backed mortgage pools	4,464	~~6,283~~	8.00%	~~9.30%~~
Private-issue ABS	3,901	~~1,277~~	7.00%	~~1.90%~~
German and French government debt	2,492	3,270	4.50%	4.80%
Italian and Spanish government debt	2,380	~~3,143~~	4.30%	~~4.70%~~
Safe assets	**20,548**	**12,262**	**36.90%**	**18.10%**

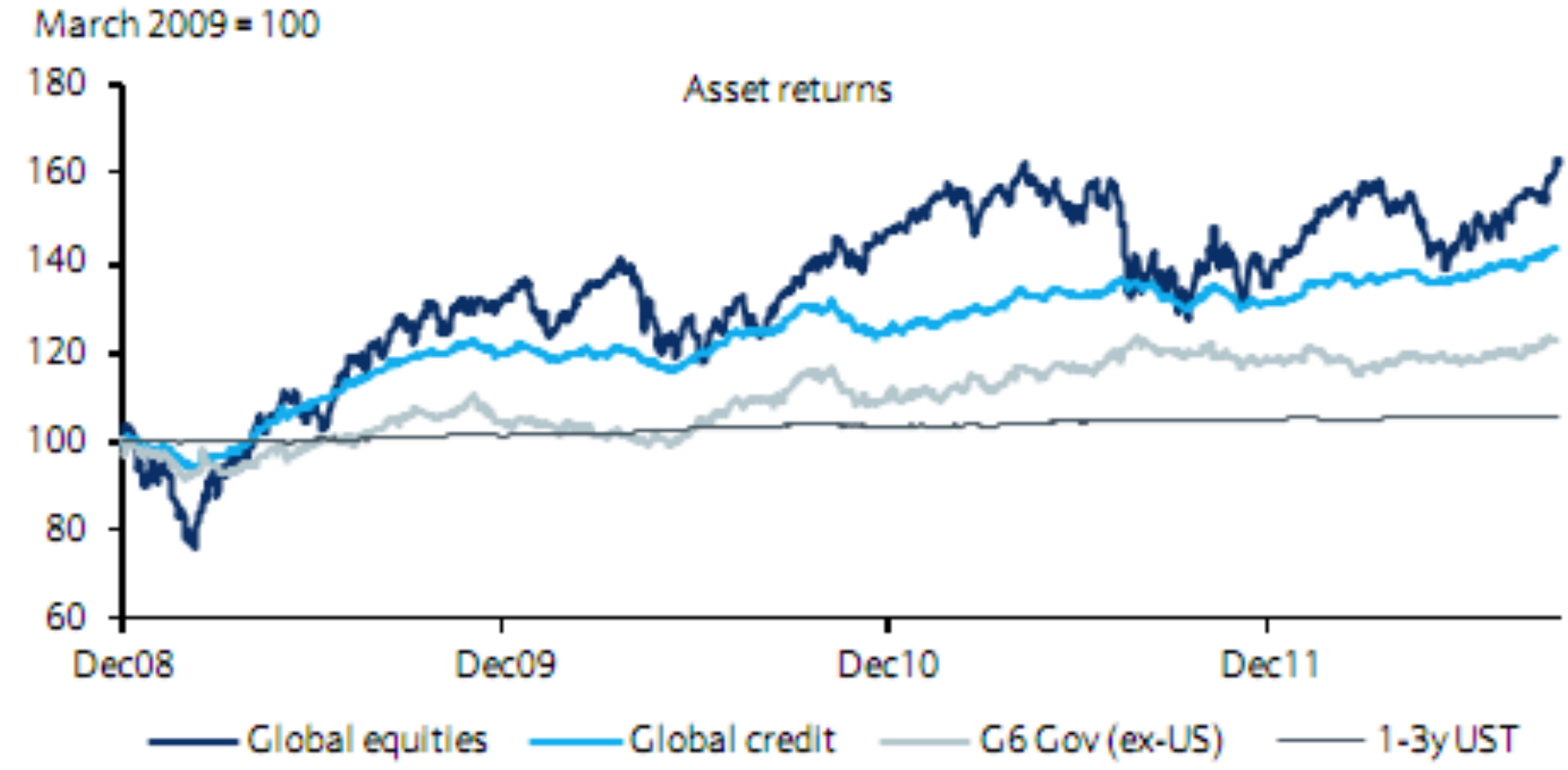
Note: Numbers are struck through if they are believed to have lost their "safe haven" status after 2007.
Source: Federal Reserve, Haver Analytics, Barclays Research

Drop in Safe Interest Rate



Source: Federal Reserve Bank of St. Louis.

Increase in Safety Premium

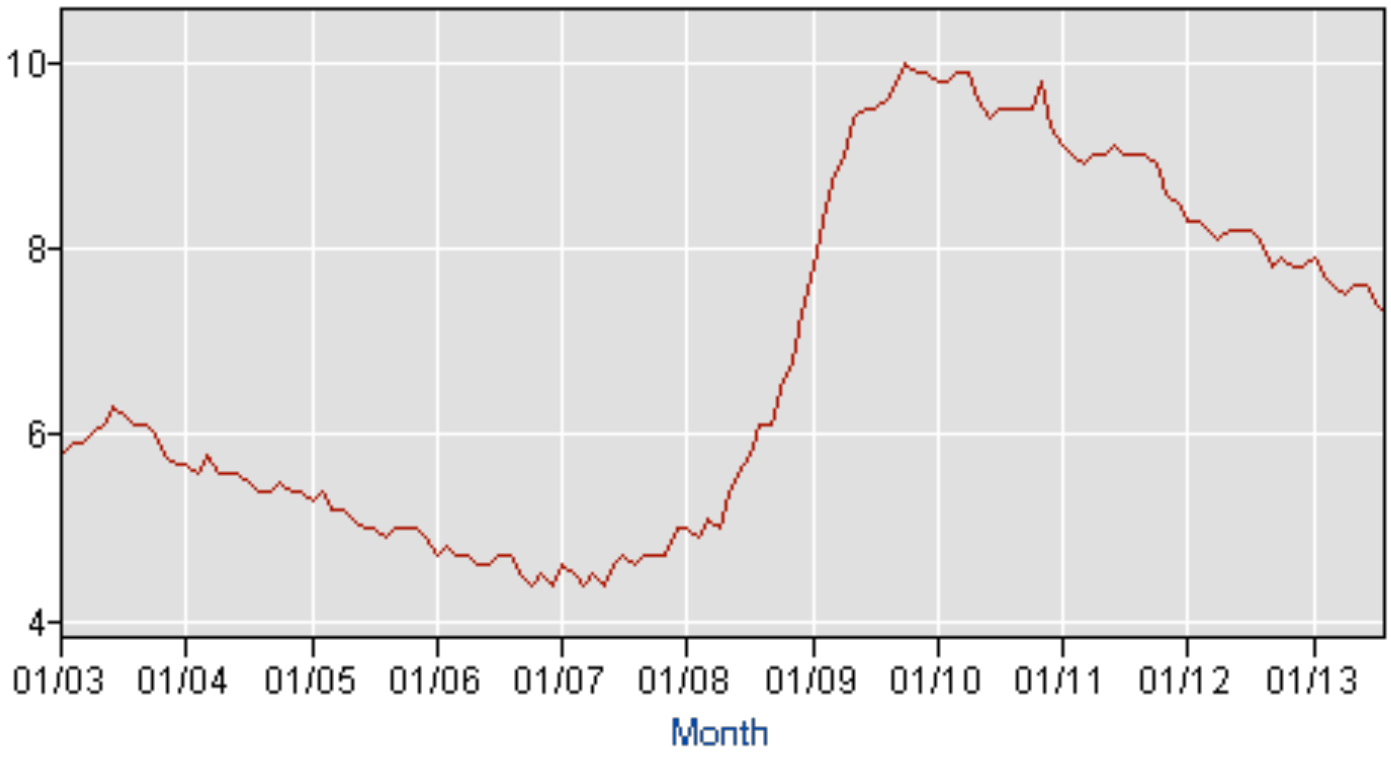


Source: MSCI, Bloomberg, Barclays Research

Safe Asset Shortage

- Benign view: moving up demand curve
- Malign view? Safe Asset Mechanism (SAM)

Increase in Unemployment



Kocherlakota (2013)

In my view, the biggest challenge for central banks is changes in the nature of asset demand and asset supply since 2007. Those changes are shaping current monetary policy, and are likely to shape policy for some time to come.
The demand for safe financial assets has grown greatly since 2007. At the same time, the supply of the assets perceived to be safe has shrunk over the past six years. Americans thought in 2007 that it was highly unlikely that American residential land, and assets backed by land, could ever fall in value by 30 percent. They no longer think that. Similarly, investors around the world viewed all forms of European sovereign debt as a safe investment. They no longer think that either.

The increase in asset demand, combined with the fall in asset supply, implies that households and firms spend less at any level of the real interest rate—that is, the interest rate net of anticipated inflation. It follows that the Federal Open Market Committee (FOMC) can only meet its congressionally mandated objectives for employment and prices by taking actions that lower the real interest rate relative to its 2007 level. The FOMC has responded to this challenge by providing a historically unprecedented amount of monetary accommodation.

What We Do

- Simple model
- Mechanics of SAM
- Connection to real activity
- Policy remedies

What We Do

- Simple model
- Mechanics of SAM
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- Policy remedies

Related Literature

- Safe asset shortage, savings glut and global imbalances

  Bernanke (05), Caballero (06,10), Caballero-Farhi-Gourinchas (08a,b), Caballero-Krishnamurthy (09), Farhi-Gourinchas-Rey (11), Bernanke (11), Obstfeld (12), Barclay's (12)

- Incentives to create safe assets and systemic implications

  Gorton-Metrick (10,12), Gorton (10), Stein (12), Greenwood-Hanson-Stein (12), Woodford (12), Gennaioli-Shleifer-Vishny (12), Gorton-Ordonez (12)

- Liquidity trap

  Keynes (36), Krugman (98), Eggertsson-Woodford (03), Christiano-Eichenbaum-Rebelo (11), Correia-Farhi-Nicolini-Teles (12), Werning (12), Eggertsson-Krugman (12), Guerrieri-Lorenzoni (12)

- Macro liquidity

  Woodford (90), Holmtrom-Tirole (98)

Basic Model

- Endowment X unless Poisson shock μX ($\mu < 1$)
- Poisson intensity λ ($\lambda \to 0$)

- OLG "perpetual youth" with birth/death Poisson rate θ
- Agents earn income at birth, save it, and consume at death

- Dividend δX and income of newborns $(1-\delta)X$

Knightians and Neutrals

- Fraction α of Knightians (infinite instantaneous risk aversion)
- Fraction $1-\alpha$ of Neutrals (risk neutral)
- Total and respective wealth $W_t = W_t^K + W_t^N$

Safe and Risky Assets

- Lucas trees (claims to dividends)
- Fraction ρ can be tranched into safe and risky tranches

  see paper for role of pooling
- Total and respective value of assets $V_t = V_t^r + V_t^\mu$
- Value of safe assets $V_t^\mu = \rho\mu\frac{X}{\theta}$

Safe and Risky Interest Rates

- Neutrals can hold safe and risky assets
- Knightians can only hold safe assets $W_t^K \leq V_t^\mu$
- Safe and risky interest rates $r_t^K \leq r_t$

Equilibrium Equations

$$r_t^K V_t^\mu = \delta_t^\mu X_t + \dot{V}_t^\mu$$

$$r_t V_t^r = (\delta - \delta_t^\mu) X_t + \dot{V}_t^r$$

$$\dot{W}_t^K = -\theta W_t^K + \alpha (1-\delta) X + r_t^K W_t^K$$

$$\dot{W}_t^N = -\theta W_t^N + (1-\alpha)(1-\delta) X + r_t W_t^N$$

$$W_t^K + W_t^N = V_t^\mu + V_t^r$$

$$V_t^\mu = \rho \mu \frac{X}{\theta} \quad \text{and} \quad W_t^K \leq V_t^\mu$$

Total Wealth and Assets

- Goods market clearing:

$$W_t = \frac{X}{\theta}$$

- Asset market clearing:

$$V_t = W_t$$

Safe vs. Risky: Two Regimes

- Unconstrained regime if $\alpha \leq \rho\mu$:

$$r = r^K = \delta\theta$$

- Constrained regime if $\alpha > \rho\mu$:

$$r^K = \delta\theta - (1-\delta)\,\theta\frac{\alpha-\rho\mu}{\rho\mu} < \delta\theta < \delta\theta + (1-\delta)\,\theta\frac{\alpha-\rho\mu}{1-\rho\mu} = r$$

with safety premium

$$r - r^K = (1-\delta)\,\theta\frac{\alpha-\rho\mu}{\rho\mu\,(1-\rho\mu)} > 0$$

Safety Traps

- If lower bound $\underline{r}^K$ on r^K ...disequilibrium:
  - excess demand for safe assets
  - excess supply on goods market

- Actual output below potential $\xi X < X$ where $\xi = \frac{\underline{\alpha}}{\underline{\rho\mu}} \frac{\rho\mu}{\alpha}$

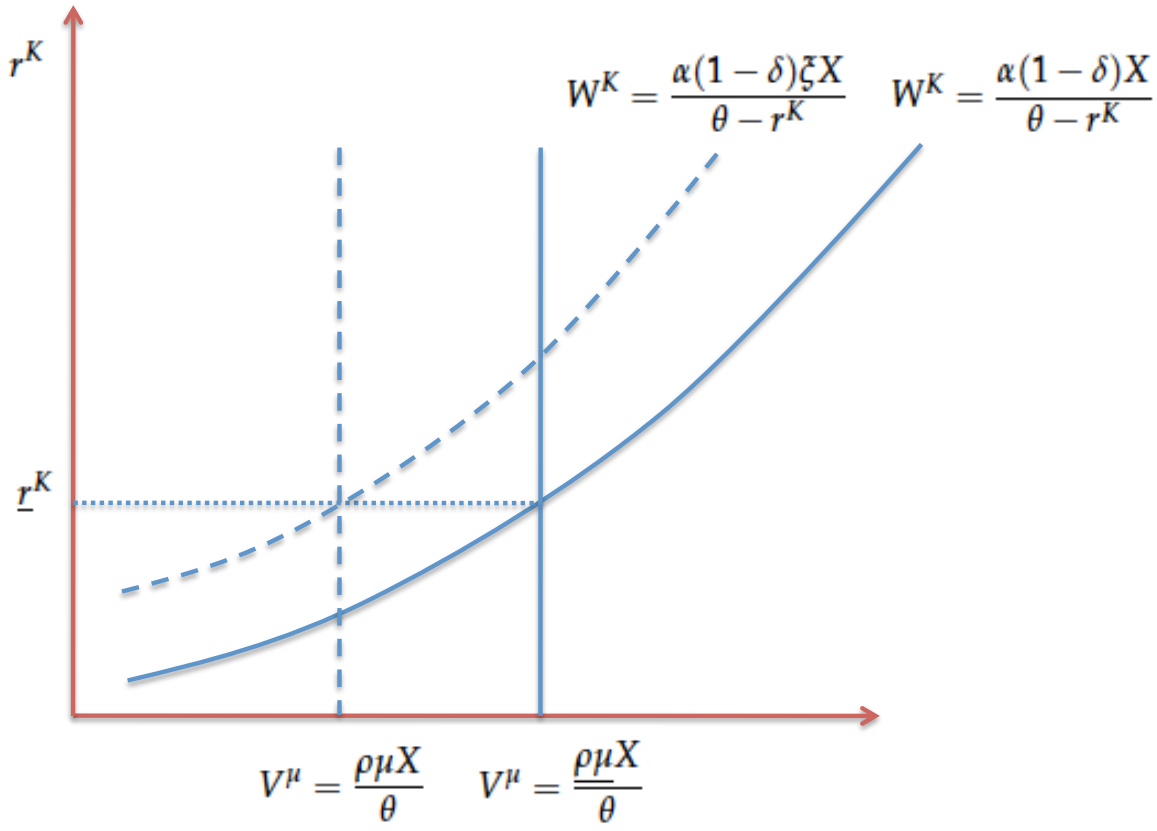

Figure : Safety trap.

Recession caused by a decrease in the supply of safe assets. The safe asset supply curve shifts left ($\rho\mu < \underline{\rho\mu}$), the endogenous recession shifts the safe asset demand curve left ($\xi < 1$), the safe interest rate remains constant at $\underline{r}^K$.

Safety Traps

- Two phases:
  - instantaneous fire sale (immediate adjustment in W^K)
  - persistent recession (adjustment in growth of W^K)

A New Keynesian Cash-In-Advance Example

- New-Keynesian (NK) Cash-In-Advance (CIA) example
- Microfoundation for main model
- Two key features:
  - output demand-determined (NK)
  - zero lower bound (CIA)

NK: Monopolistic Competition

- Differentiated non-traded inputs indexed by $k \in [0,1]$ used to produce different varieties of goods x_k
- Index trees by $i \in [0,\delta]$ so that each tree yields X units of non-traded input i
- Index newborns by $j \in [\delta,1]$ so that each newborn has X units of non-traded input j
- Each variety of goods x_k:
  - produced and sold by monopolistically competitive firm
  - firm posts price p_k in units of numeraire

NK: Monopolistic Competition

- Differentiated goods value by consumers according to a Dixit-Stiglitz aggregator

$$\xi X = \left(\int_0^1 x_k^{\frac{\sigma-1}{\sigma}} dk \right)^{\frac{\sigma}{\sigma-1}}$$

- Consumption expenditure $P\xi X = \int_0^1 p_k x_k dk$
- Price index $P = \left(\int_0^1 p_k^{1-\sigma} dk \right)^{\frac{1}{1-\sigma}}$
- Resulting demand for good k is $x_k = \left(\frac{p_k}{P} \right)^{-\sigma} \xi X$

NK: Nominal Rigidities

- Extreme form of nominal rigidity $p_k = P$ fixed ($P = 1$)
- Monetary authority sets safe nominal interest rate i^K
- Because prices are rigid, $r^K = i^K$
- Output demand-determined $x_k = \xi X$

CIA: Introducing Money

- Individuals with wealth w_t and money holdings m_t can only consume $\min(w_t, \frac{m_t}{\varepsilon})$
- Zero lower bound $i^K \geq 0$
- When $i^K > 0$, money only held for transaction purposes
- When $i^K = 0$, money also held as safe store of value
- Money supply is
  - $\varepsilon M^{\varepsilon}$ with $M^{\varepsilon} = \frac{X}{\theta}$ before Poisson shock
  - $\varepsilon M^{\varepsilon,\mu}$ with $M^{\varepsilon,\mu} = \mu \frac{X}{\theta}$ after Poisson shock
  - buying back money requires fiscal capacity...taxes on dividends

Microfoundation of Main Model

- Cashless limit $\varepsilon \to 0$
- New-Keynesian converges to model above:
  - output demand determined
  - zero lower bound

Remedies

- Balance-sheet policies:
  - debt issuance
  - Quantitative Easing (QE)...QE1, LTRO, LOLR interventions
  - Operation Twist (OT)...QE2, QE3
- Fiscal Policy:
  - government spending...short-run stimulus and long-run consolidation
  - redistribution from Knightian to Neutrals
- Monetary policy: forward guidance

QE: Introducing Short-Term Public Debt

- Government:
  - taxes dividends τ_t
  - issues short term risk free bonds that pay r_t^K
  - rebates initial debt issue to agents
- Debt supply

$$D = \tau^{\mu} \mu \frac{X}{\theta}$$

- Fiscal capacity τ^{μ}...acts like tranching...set $\rho = 0$

QE

- Government purchases trees and issues short-term debt

$$\hat{D} = \hat{\tau}^{\mu}(1-\hat{\beta}^{g})\mu\frac{X}{\theta} + \hat{\beta}^{g}\mu\frac{X}{\theta}$$

- Increases supply of safe assets if

$$\hat{\tau}^{\mu}(1-\hat{\beta}^{g}) + \hat{\beta}^{g} > \tau^{\mu}$$

- In a safety trap, increases output from ξX to $\hat{\xi}$X where

$$\hat{\xi} = \frac{\hat{D}}{D}\xi > \xi$$

- Decreases risky interest rate r
- Government comparative advantage as long as $\rho < 1$: "safety transformation"
  Holmstrom-Tirole (98), Stein (12), Greenwood-Hanson-Stein (12)

Forward Guidance

- Introduce possibility of good shock $\gamma X > X$, with Poisson intensity λ^G, stopping time τ

- Forward guidance: commit to low interest rate after good shock:
  - Set interest rate i_t below natural rate $\delta\theta$ for $t \in [\tau, \tau + T]$
  - Output $\zeta_t \gamma X$ above potential for $t \in [\tau, \tau + T]$

Forward Guidance

- Before Poisson shock, in safety trap:
  - no effect on output ξX
  - no effect on asset values
  - increase in $r = \frac{\xi\delta\theta - \underline{r}^K\rho\mu + \lambda^G(\gamma\zeta_\tau - \xi)}{\xi - \rho\mu}$
- Attempt and fail to reflate risky assets (inflation caveat)
- What would work: lowering interest rates after bad shock...possible?

Remedies

- Balance-sheet policies:
  - debt issuance
  - Quantitative Easing (QE)...QE1, LTRO, LOLR interventions
  - Operation Twist (OT)...QE2, QE3
- Fiscal Policy:
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More in Paper

- Safe asset status and self-fulfilling debt crises
- Feedback loop between flight to safety and fiscal capacity
- Two regions...exorbitant privilege

- Future research:
  - search for yield
  - "fake" safe assets creation
  - sowing the seeds of the next crisis

Introducing Long-Term Public Debt

- After Poisson shock, tax revenues $\tau^{\mu}\mu\delta X$ split $(1-\phi,\phi)$ for (short-term debt,long-term debt)...values:

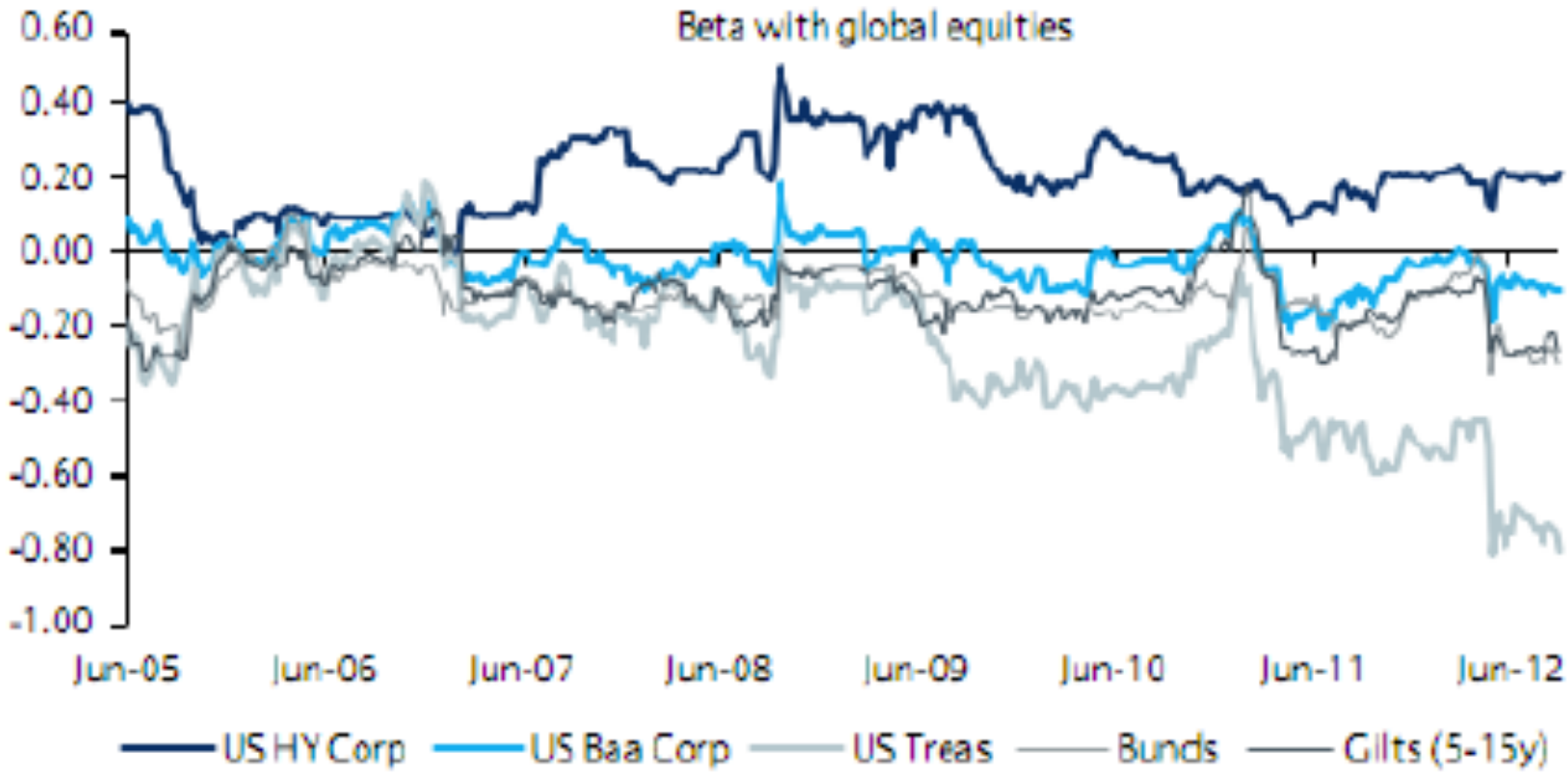
$$(1-\phi)\tau^{\mu}\mu\frac{X}{\theta} \quad \text{and} \quad \phi\tau^{\mu}\mu\frac{X}{\theta}$$

- Before Poisson shock:

$$D^{short} = (1-\phi)\tau^{\mu}\mu\frac{X}{\theta} \quad \text{and} \quad D^{long} = \psi\phi\tau^{\mu}\mu\frac{X}{\theta}$$

- $\psi \in (0,1)$ captures bearish aspect of long-term debt
  see paper for alternative mechanisms

Bearish Nature



Note: 6-mo moving beta of asset returns against the MSCI global index. Source: Barclays Research

Safe Asset Multiplier

- Value of assets increases with ϕ

$$V = [1 - \tau^{\mu}\mu(1 - (1 - \psi)\phi)]\frac{X}{\theta}$$

- Long-term debt enables private safe asset creation through portfolio construction (trees + long-term debt)
- Safe asset multiplier

$$V^{\mu} = \Gamma(\phi, \psi, \mu, \tau^{\mu})\tau^{\mu}\mu\frac{X}{\theta}$$

where

$$\Gamma(\phi, \psi, \mu, \tau^{\mu}) = 1 + \frac{\phi(1 - \psi)(1 - \tau^{\mu})\mu}{1 - \mu + \phi(1 - \psi)\tau^{\mu}\mu} \geq 1$$

- Safe interest rate

$$r^{K} = \delta\theta - (1 - \delta)\,\theta\frac{\alpha - \Gamma(\phi, \psi, \mu, \tau^{\mu})\tau^{\mu}\mu}{\Gamma(\phi, \psi, \mu, \tau^{\mu})\tau^{\mu}\mu}$$

Operation Twist

- Swap of long-term for short-term public debt
- Shorten maturity of debt $\hat{\phi} < \phi$
- Reduces supply of safe assets (wastes safe asset multiplier)
- In safety trap, decreases output from ξX to $\hat{\xi} X$ where

$$\hat{\xi} = \frac{\Gamma\left(\hat{\phi}, \psi, \frac{\mu}{\xi}, \tau^{\mu}\right)}{\Gamma\left(\phi, \psi, \frac{\mu}{\hat{\xi}}, \tau^{\mu}\right)} \xi < \xi$$

Redistribution

- Differentiated tax on labor income (rather than capital income)

$$\tau = \tau^K \alpha + \tau^N (1 - \alpha)$$

- Safe interest rate

$$r^K = \theta - \alpha (1 - \delta) \left(1 - \tau^K\right) \frac{\theta}{\frac{(1-\delta)\tau^\mu}{\delta + (1-\delta)\tau^\mu} \mu}$$

- Redistribution from Knightians to Neutrals $\hat{\tau}^K > \tau^K$ and $\hat{\tau}^N < \tau^N$
- Reduces demand for safe assets
- In safety trap, increases output from ξX to $\hat{\xi} X$ where

$$\hat{\xi} = \xi \frac{1 - \tau^K}{1 - \hat{\tau}^K} > \xi$$

Fiscal Stimulus and Fiscal Consolidation 1/2

- Government spending G and G^{μ} before and after Poisson shock
- Debt is now

$$D = \frac{\tau^{\mu}\delta - G^{\mu}}{\delta - G^{\mu}} \mu \frac{X(1-G^{\mu})}{\theta}$$

- Safe interest rate

$$r^{K} = \delta\theta - \theta(1-\delta)\left(\frac{\alpha}{\frac{\tau^{\mu}\delta - G^{\mu}}{\delta - G^{\mu}}\mu}\frac{1}{1-G^{\mu}} - 1\right)$$

- In safety trap:
  - short-run stimulus ineffective (output ξX invariant to G)
  - long-run consolidation effective (output ξX decreasing in G^{μ})...$\hat{G}^{\mu} < G^{\mu}$ increases output from ξX to $\hat{\xi} X$ where

$$\hat{\xi} = \xi \frac{\left(1-\hat{G}^{\mu}\right)\frac{\tau^{\mu}\delta - \hat{G}^{\mu}}{\delta - \hat{G}^{\mu}}}{(1-G^{\mu})\frac{\tau^{\mu}\delta - G^{\mu}}{\delta - G^{\mu}}} > \xi$$

Fiscal Stimulus and Fiscal Consolidation 2/2

- Non-Ricardian environment, distribution and timing of taxes matter....
- Tax on labor income instead of capital income
- In safety trap:
  - short-run stimulus effective (output ξX increasing in G)
  - long-run consolidation effective (output ξX decreasing in G^{μ})
- Key difference, short-run stimulus financed by labor taxes reduces demand for safe assets

Safety Traps vs. Liquidity Traps

- Simple model of liquidity trap
- Only Neutrals ($\alpha = 0$)
- Allow for $\lambda > 0$
- Interest rate

$$r = \delta\theta - \lambda(1-\mu)$$

- If zero lower bound $\underline{r} = 0$ binds, output ξX below potential
- Compare safety traps vs. liquidity traps

Safety Traps vs. Liquidity Traps

- Interest rate
$$r = \delta\theta - \lambda(1-\mu)$$
- If zero lower bound $\underline{r} = 0$ binds, output ξX below potential with
$$0 = \delta\theta - \lambda\left(1 - \frac{\mu}{\xi}\right)$$
i.e.
$$\xi = \frac{\mu}{1 - \frac{\delta\theta}{\lambda}}$$

QE and OT

- No effect of QE and OT
- Essentially Ricardian
- Caveat: taxing labor income...non-Ricardian effects...

Redistribution

- Labor income taxes τ^K and τ^N
- Redistribution from Knightians to Neutrals $\hat{\tau}^K > \tau^K$ and $\hat{\tau}^N < \tau^N$
- Before Poisson shock, in liquidity trap, no effect on output
- Relevant dimension of redistribution: low mpc to high mpc

Fiscal Stimulus

- Government expenditure G and G^{μ}
- Interest rate

$$r = \frac{(\delta - G)\,\theta - \lambda\left((1-G) - \mu\left(1-G^{\mu}\right)\right)}{(1-G)}$$

- In liquidity trap, as long as $\frac{\theta}{\lambda} < 1$, an increase in G increases output
- In liquidity trap, a decrease in G^{μ} increases output

Monetary Policy Commitments

- Add good shock with Poisson intensity λ^G
- Forward guidance: commit to low interest rate after good shock
- Stimulate output after good shock

$$\zeta_\tau = e^{\int_t^{\tau+T}(\delta\theta - i_s)ds} > 1$$

- Before Poisson shock in liquidity trap, increases output to $\hat{\xi}X$ where

$$\hat{\xi} = \xi \frac{\frac{\lambda}{\lambda+\lambda^G}\mu + \frac{\lambda^G}{\lambda+\lambda^G}\zeta_\tau\gamma}{\frac{\lambda}{\lambda+\lambda^G}\mu + \frac{\lambda^G}{\lambda+\lambda^G}\gamma} > \xi$$

- Wealth effect through increase in asset values

Two Regions

- Two regions U and R, relative output shares x^U and x^R
- Asymmetry: public debt safe in U but not in R

Exorbitant Privilege (Steady State)

- Disproportionate share of U assets in world portfolio

$$TV^U = \frac{X}{\theta}\left[x^U + (1-x^U)(1-\delta)\frac{\alpha - \tau^\mu \mu x^U}{\alpha(1-\delta)+\delta-\tau^\mu \mu x^U}\right] > x^U \frac{X}{\theta}$$

- U's share of wealth

$$W^U = \frac{x^U X}{\theta}$$

- Trade balanced

$$TB^U = X^U - \theta W^U = 0$$

- Negative Net Foreign Asset Position

$$NFA^U = W^U - TV^U = x^U \frac{X}{\theta} - TV^U < 0$$

Exorbitant Privilege (Transition)

- Transition to long run starting at $W_0^U = TV^U$

$$TB_t^U < 0 \quad \text{and} \quad CA_t^U < 0$$

- Exorbitant privilege

Safe Asset Status and Self-Fulfilling Debt Crisis

- Small open economy facing interest rates r, r^K and r^μ
- When Poisson shock hits, agents anticipate flow ω of debt repudiated per unit of time
- Fiscal cost η per unit of repudiated debt
- Self-fulfilling if country against fiscal capacity $\tau^\mu = \bar{\tau}^\mu$

$$D = \frac{\delta \bar{\tau}^\mu \mu X}{r^\mu + \eta \omega}$$

- If fiscal slack $\tau^\mu < \bar{\tau}^\mu$, can rule out shifts

$$\omega \leq \bar{\omega} \text{ where } \bar{\omega} = \delta \left(\bar{\tau}^\mu - \tau^\mu \right) \mu X$$

- If upper bound ω^{max} , then countries with enough fiscal slack immune to self-fulfilling crises

Safe Asset Status and Self-Fulfilling Debt Crisis

- Before Poisson shock, start against fiscal capacity with $\omega = 0$
- Debt and taxes

$$\bar{D} = \frac{\delta \bar{\tau}^{\mu} \mu X}{r^{\mu}} \quad \text{and} \quad \tau \delta X = r^{K} \bar{D}$$

- Suddenly expectations shift to $\omega > 0$
- Self fulfilling loss of safe asset status...interest rate jumps from r^{K} to r
- Debt dynamics depends on how fast taxes can be raised

$$\dot{D}_t = r D_t - \tau_t \delta X \quad \text{and} \quad D_0 = \bar{D}$$

- If taxes cannot be raised enough to eventually stabilize debt, then default

Fiscal Capacity and Global Instability

- Back to two-region world U and R
- Higher growth in R
- Plausible response, U runs up debt...
- ...eventually against fiscal capacity...
- ...vulnerable to self-fulfilling loss of safe asset status

- Formalizes Triffin dilemma