# A Global Safe Asset
# for
# Emerging Market Economies

Markus K. Brunnermeier, Lunyang Huang and Yuliy Sannikov

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# Motivation – 3 Stylized Facts

1. Carry trade activity by EME corporations and households

2. Flight Safety cross-border capital flows

3. Official reserve holdings

# Carry Trades

- EME corporate treasuries borrow in Dollars



EME gross issuance of international debt securities in foreign currency by non-financial firms
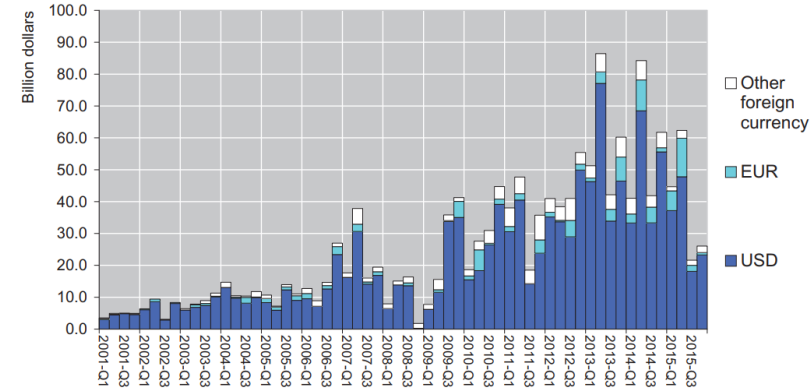
Bruno & Shin 2016

# Carry Trades

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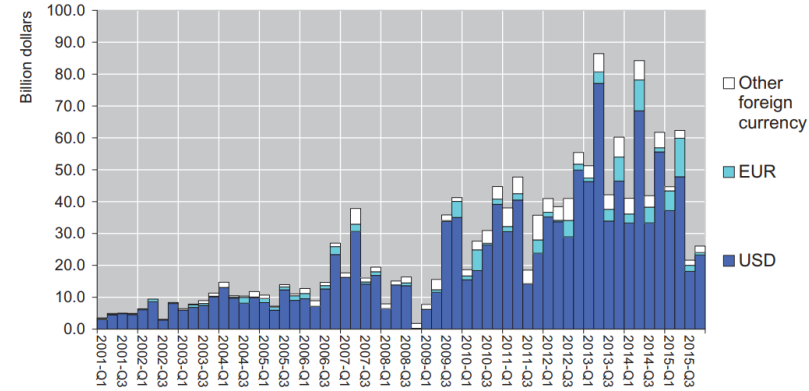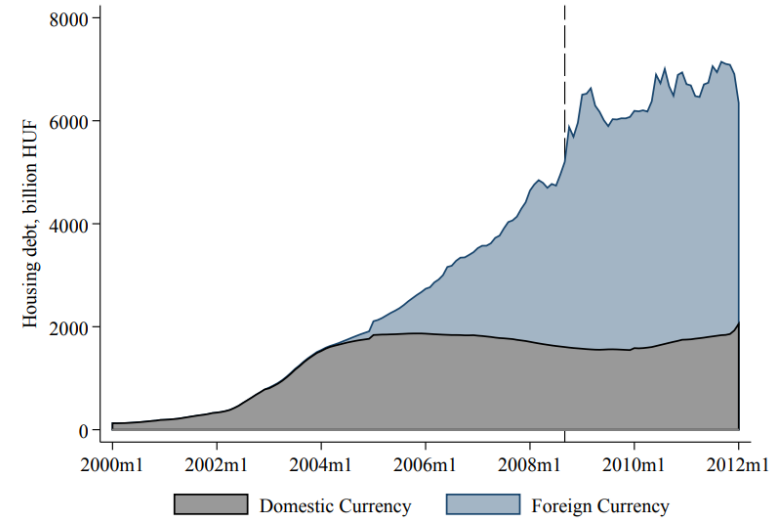
- Hungarian/Polish households borrow in Euros/Swiss Franc

Bruno & Shin 2016

(b) Housing debt in domestic and foreign currency

Verner 2017

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# Carry Trades

- EME corporate treasuries borrow in Dollars

- Hungarian/Polish households borrow in Euros/Swiss Franc

- Sudden Stops:
  Carry Trade skewness – "up the stairs, down the lift"
  - Brunnermeier, Nagel & Pedersen 2012
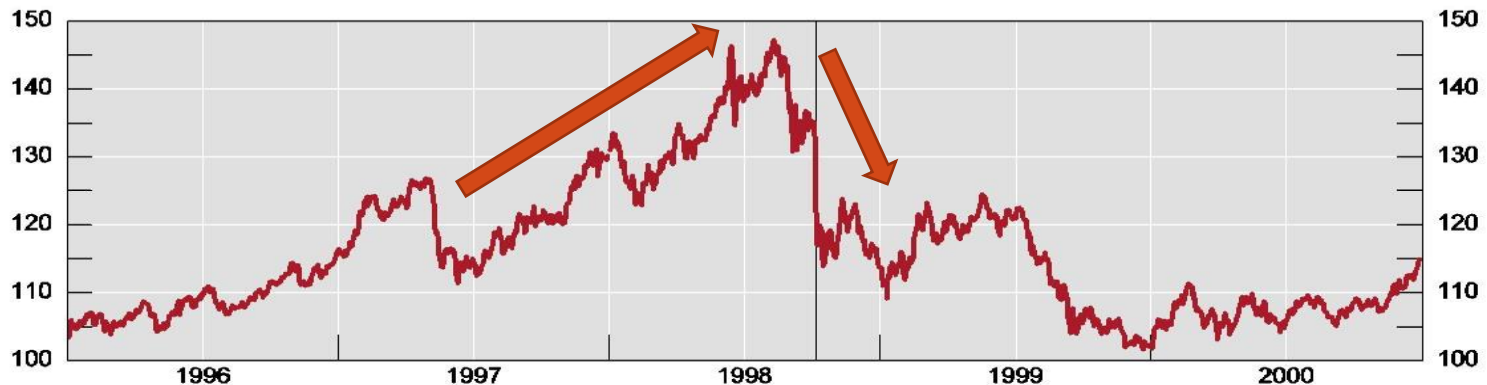
# Flight to Safety

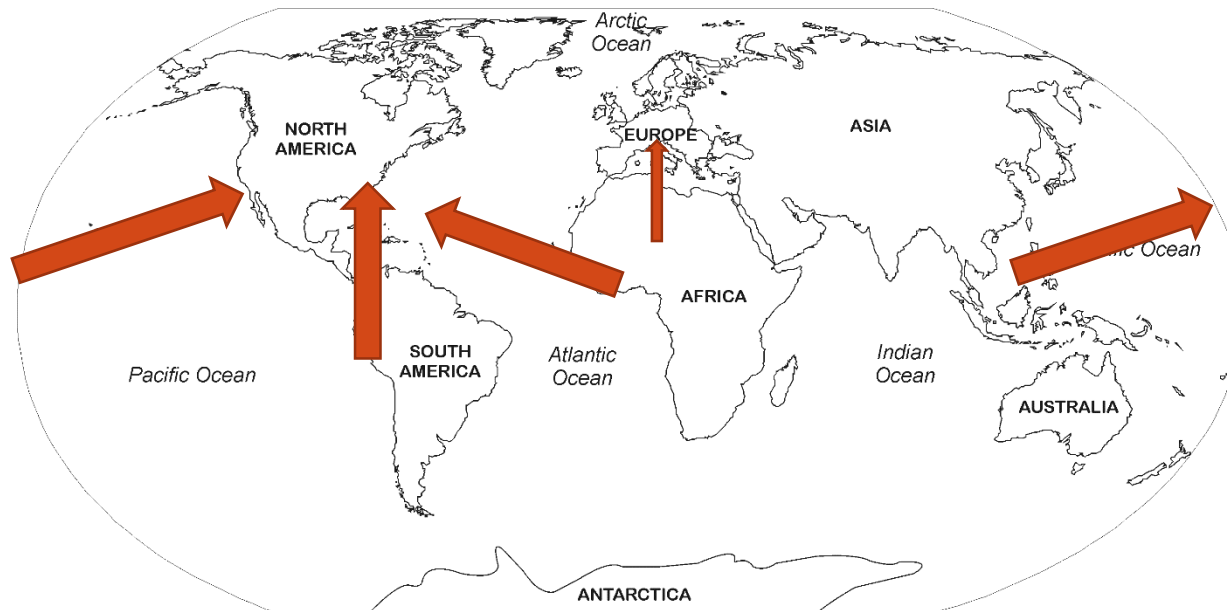■ Risk-on, Risk-off          Flight to safe asset

# Flight to Safety

- Risk-on, Risk-off          Flight to safe asset

- If *asymmetrically supplied* by AE

  Flight to safety     ➡     cross-border capital flows

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# Flight to Safety

- Risk-on, Risk-off      Flight to safe asset


- If *asymmetrically supplied* by AE

  Flight to safety   ➡   cross-border capital flows


- At times of global crisis, issuance of new debt
  - For AE    at inflated prices          eases conditions
  - For EME   at depressed prices        worsens conditions


- Question: Who insures whom? (rich the poor OR poor the rich?)
  - Correct insurance only if
    buffer is large (and debt long-term) enough
      so that no new debt issuance needed & sale off safe asset

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# Official Reserves

- Sudden Stop
- South East Asia crisis  ⇒        precautionary reserves



-$15 trillion
-$12 trillion
-$9 trillion
-$6 trillion
-$3 trillion
$0
$3 trillion
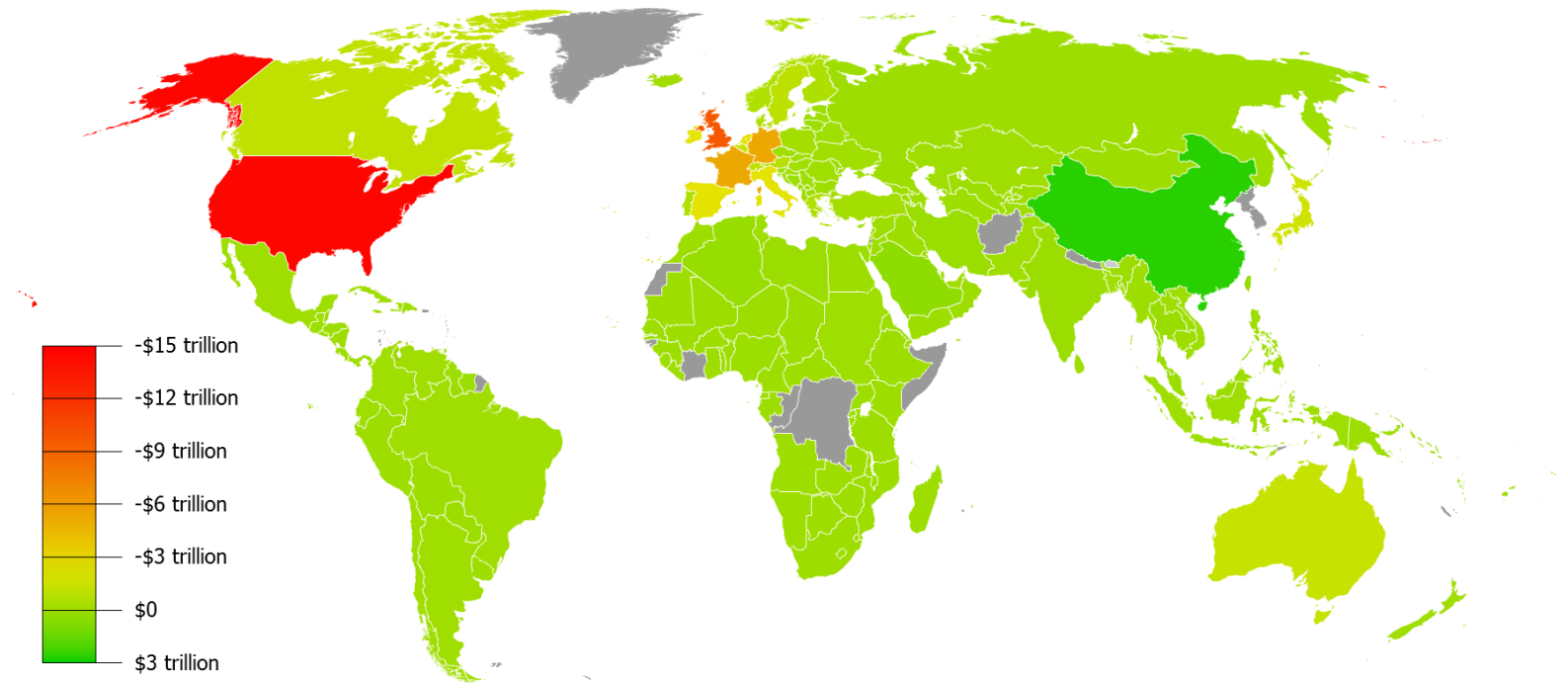
Source: Kieran (Wikipedia)
CIA World Factbook data 2011

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# ▌Official Reserves (without China)



International Reserves and Foreign Currency Liquidity (IRFCL)

Mio
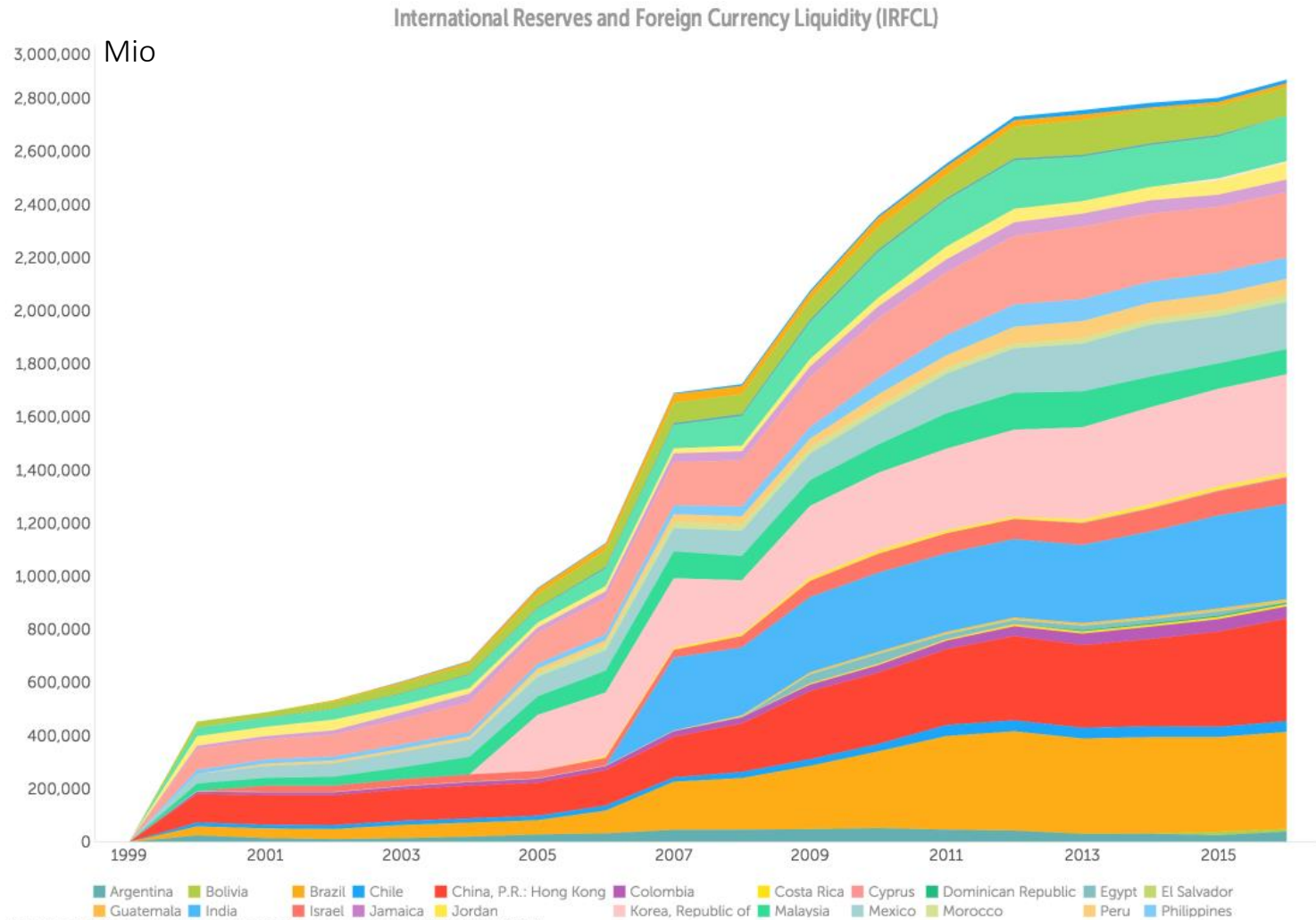
Source: International Reserves and Foreign Currency Liquidity (IRFCL) (11/14/2017)
Retrieved: 11/14/2017 5:21 PM from http://data.imf.org

Legend: Argentina, Bolivia, Brazil, Chile, China, P.R.: Hong Kong, Colombia, Costa Rica, Cyprus, Dominican Republic, Egypt, El Salvador, Guatemala, India, Israel, Jamaica, Jordan, Korea, Republic of, Malaysia, Mexico, Morocco, Peru, Philippines

http://data.imf.org/?sk=2DFB3380-3603-4D2C-90BE-A04D8BBCE237

# "Buffer Approach"

- Precautionary Reserves

*private*
Imbalances
Carry trades

*public*
Buffers
Reserves

Lowers funding costs

Lean against Sudden Stop outflows
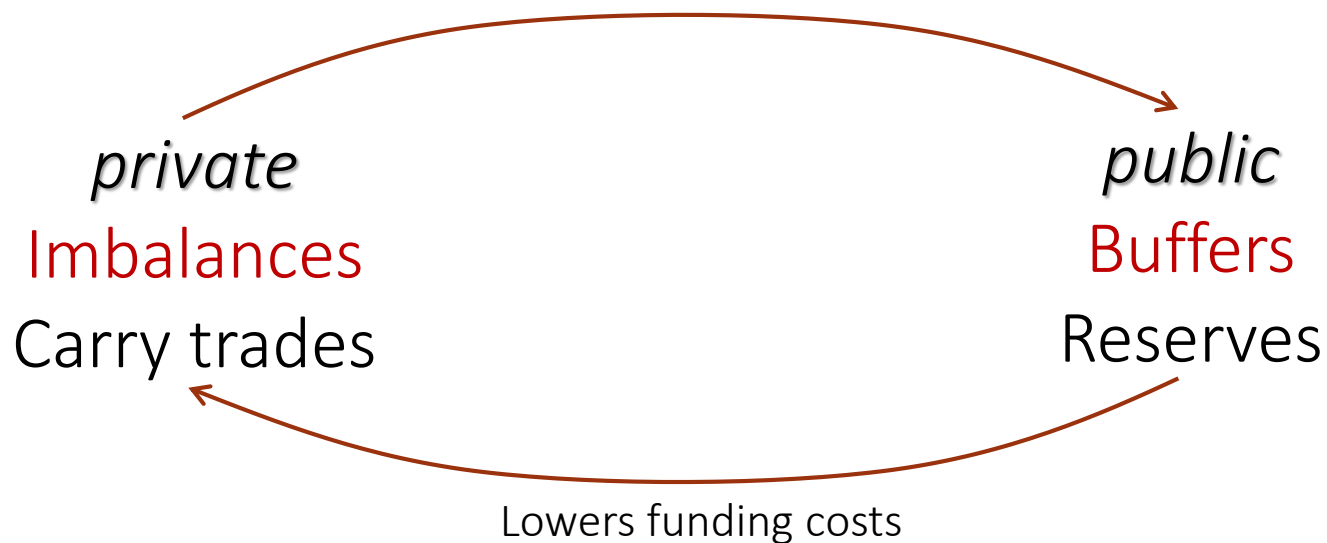
- Subsidizing carry trades

- IMF liquidity lines
- Central Swap line arrangements

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# "Rechanneling Approach"

- Root cause: safe asset is supplied asymmetrically

- Create globally supplied safe asset via pooling & tranching

A                                    L

Pooling

Pool of Sovereign Bonds

Senior Bond

Junior Bond

Tranching
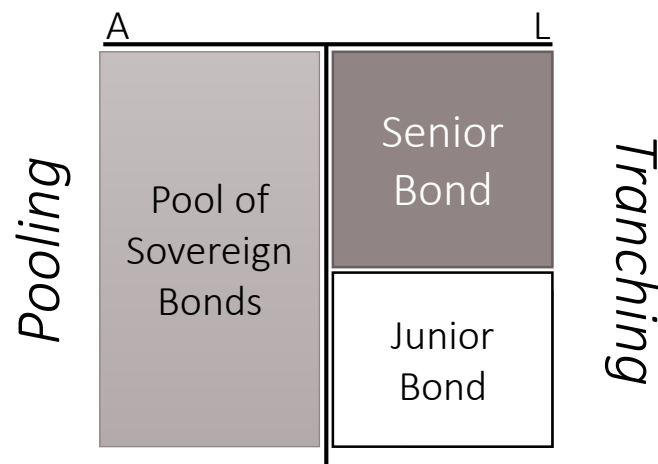
*Rechannel:*
Instead of cross-border
Across asset classes

- Expand ESBies idea for euro area to EME:
  "SBBS (Sovereign-Bond Backed Securities) for the world"
    Brunnermeier et al. 2011, 2016

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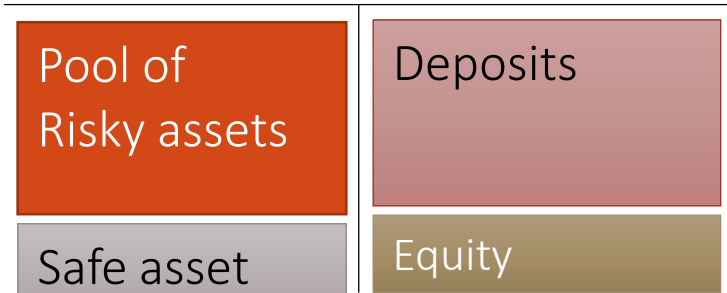
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# Overview

- Motivation

- <span style="color:red">What's a safe asset?</span>

- Model
  - Autarky
  - Reserves and FX carry trades

- Sudden stop
  - Sufficient reserves to deter sudden stops
  - Insufficient reserves
    - Unanticipated sudden stops
    - Anticipated sudden stops

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# Safe assets

- "Good friend analogy" - like reserve assets

- "Safe asset tautology"

# Safe assets

- "Good friend analogy" - like reserve assets
  - Safe/available at any horizon - "when it counts"
  - Precautionary buffer
    - held in addition to more risky assets
    - Risk↑ ⇒ demand for safe assets↑

| Pool of Risky assets | Deposits |
|---|---|
| Safe asset | Equity |

# Safe assets

- "Good friend analogy" - like reserve assets
  - Safe/available at any horizon - "when it counts"
  - Precautionary buffer
    - held in addition to more risky assets
    - Risk ↑ ⇒ demand for safe assets ↑



- "Safe asset tautology"
  - safe because it is "perceived to be safe"
  - safe independent of fundamentals
    - US Treasury downgrade by S&P in 2011 ⇒ yield ↓
    - German CDS spread ↑ ⇒ yield ↓ during Euro crisis
  - Multiple equilibria
  - Bubble



German Sovereign 5Y CDS and 10Y Yield

Source: Bloomberg
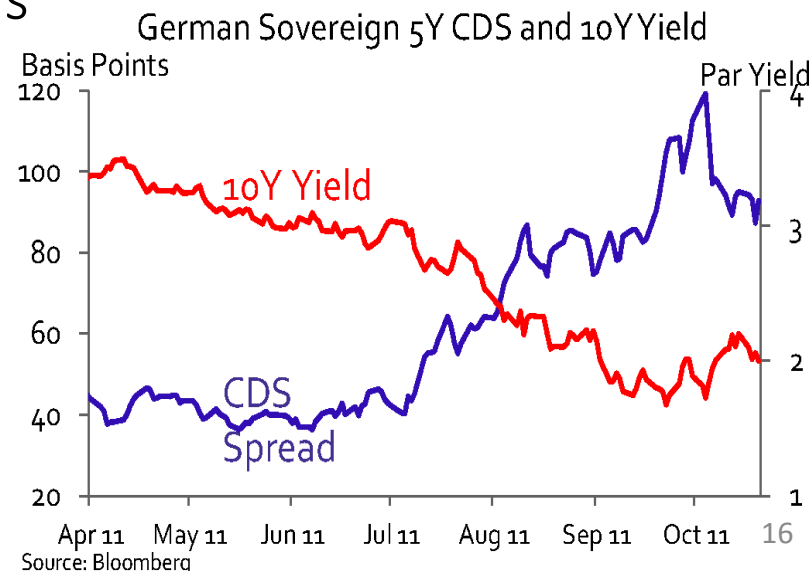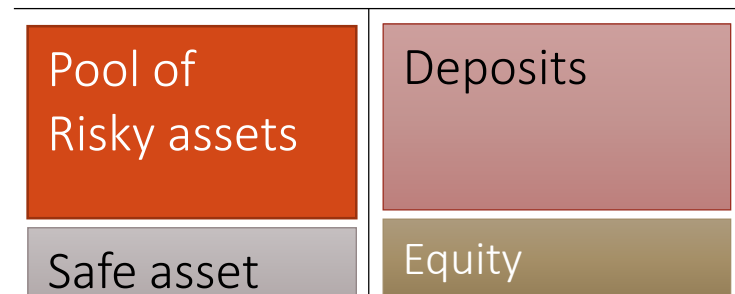
# Overview

- Motivation

- What's a safe asset?

- Model setup
  - Autarky
  - Add reserve holdings and FX carry trades

- Sudden stop
  - Sufficient reserves to deter sudden stops
  - Insufficient reserves
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# Baseline model – autarky -

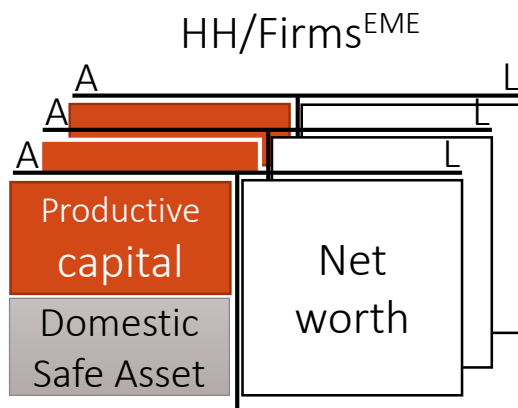- Each household can only operate one firm
  - Physical capital
  $$\frac{dk_t^i}{k_t^i} = \Phi(\iota_t^i)dt + \tilde{\sigma}d\tilde{Z}_t^i$$
  - Output
  $$y_t^i = Ak_t^i$$
  of which $\iota_t^i k_t^i$ is used to produce new physical capital

- Demand for safe asset

HH/Firms$^{EME}$

Stationary Equilibrium
- $qK_t$ value of physical capital
  - $dr^{k,i} = \frac{A-\iota}{q}dt + \Phi(\iota^i)dt + \tilde{\sigma}d\tilde{Z}_t^i$
- $pK_t$ value of safe asset (absent inflation)
  - $dr^D = \underbrace{\Phi(\iota)}_{g} dt$

# Optimality (=) for $E\left[\int_0^\infty e^{-\rho t} \log c_t^i \, dt\right]$

- Investment rate, $\iota^i$

- Portfolio choice, $x^{k,i}$

- Consumption, $c^i$

# Optimality (=)

- **Investment rate,** $\iota^i$
  - Tobin's q: $\Phi'(\iota) = \dfrac{1}{q}$ (static problem)
    - For $\Phi(\iota) = \iota^0 + \frac{1}{\kappa}\log[\kappa(\iota - \iota^0) + 1] \Rightarrow \iota = \iota^0 + \frac{1}{\kappa}(q - 1)$

- **Portfolio** choice, $x^{k,i}$

- **Consumption,** $c^i$

# Optimality (=)

- **Investment rate, $\iota^i$**
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- **Portfolio choice, $x^{k,i}$**
  - $E[dr^K - dr^D]/dt = Cov\Big[dr^k - dr^D, \ \underbrace{\dfrac{dn_t}{n_t}}_{dr^K + x^{k,i}(dr^k - dr^D)}\Big] = x^{k,i}(\tilde\sigma)^2$

$$x^{k,i} = \frac{E\big[dr^K - dr^D\big]/dt}{(\tilde\sigma)^2} = \frac{(A-\iota)/q}{(\tilde\sigma)^2}$$

  - Dividend yield on capital must be $\rho$
- **Consumption, $c^i$**

# Optimality (=)

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  - Dividend yield on capital must be $\rho$
- **Consumption, $c^i$**
  - Demand $\rho N_t = \rho(q + p)K_t$

# Optimality (=) & market clearing (=)

- **Investment rate, $\iota^i$**
  - Tobin's q:   $\Phi'(\iota) = \dfrac{1}{q}$              (static problem)
    - For $\Phi(\iota) = \frac{1}{\kappa}\log(\kappa\iota + 1) \Rightarrow \kappa\iota = q - 1$

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$$x^{k,i} = \frac{E[dr^K - dr^D]/dt}{(\tilde{\sigma})^2} = \frac{(A-\iota)/q}{(\tilde{\sigma})^2} \underset{\uparrow}{=} \frac{q}{q+p}$$

<span style="color:red">Capital market clearing</span>

  - Dividend yield on capital must be $\rho$

- **Consumption, $c^i$**

<span style="color:red">Output market clearing</span>

  - Demand $\rho N_t = \rho(q + p)K_t = (A - \iota)K_t$   Supply

$$q = \underbrace{\left(\frac{q}{q + p}\right)}_{= x^{k,i}} (A - \iota)/\rho$$
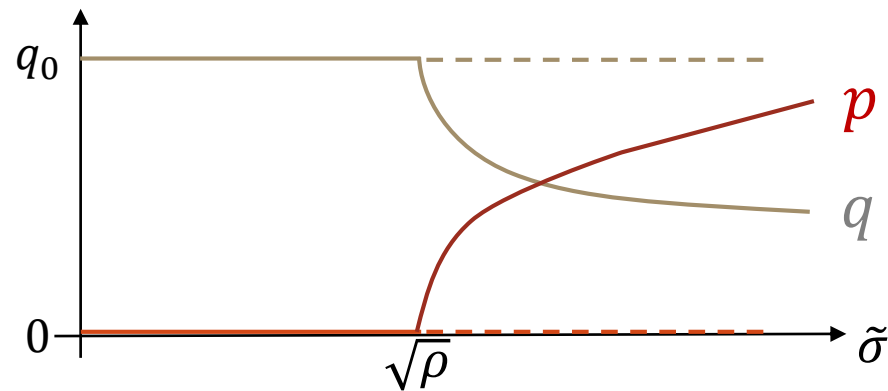
# Equilibrium

| Equilibrium w/o Safe Asset | | Safe Asset equilibrium |
|:---:|:---:|:---:|
| $p_0 = 0$ | | $p = \frac{\tilde{\sigma} - \sqrt{\rho}}{\sqrt{\rho}} q$ |
| $q_0 = \frac{\kappa(A - \iota^0) + 1}{\kappa \rho + 1}$ | $>$ | $q = \frac{\kappa(A - \iota^0) + 1}{\kappa \sqrt{\rho} \tilde{\sigma} + 1}$ |
| | | |



ADJUST SOLUTION FOR OUR PHI FUNCTION

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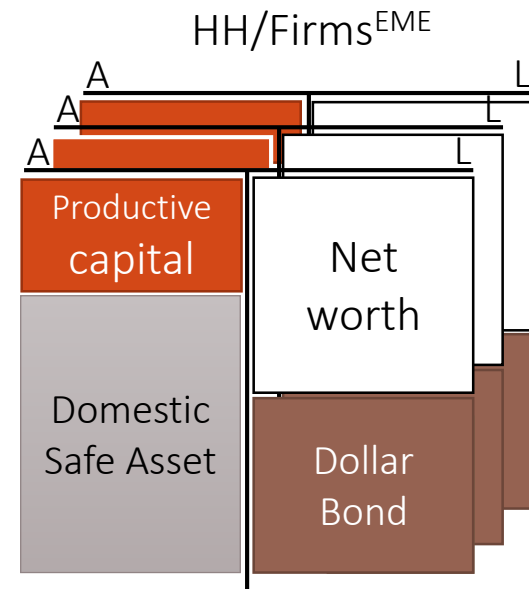- Global Safe Asset from & for Emerging Market Economies

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# Our global economy
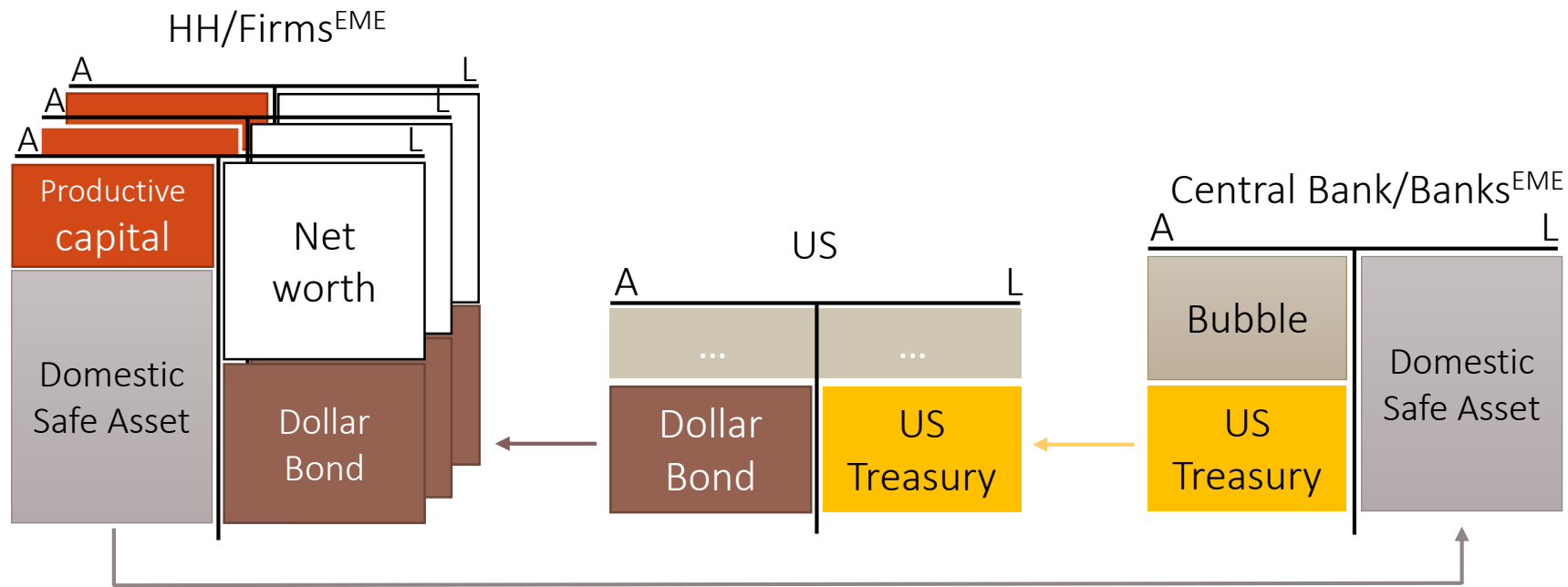


■ Later we will have many EMEs

# EME Firms/Households

HH/Firms$^{EME}$

- includes carry trades
  - $x^{k,i}$,
  - $x^{D,i}$
  - $x^{\$,i} < 0$ … negative since borrowing at rate $\bar{r}^\$$

- Carry trade, since $r^D = \Phi(\iota) > \bar{r}^\$$
  - Limited by \$-borrowing constraint (capital controls)

$$B_t^{\$,i} \geq -\phi q k_t^i = -\phi n_t^i x^{k,i}$$

  - $x^{\$,i} = -\phi x^{k,i}$

- Capital holding
  - $E[dr^k + \underbrace{\phi(r^D - \bar{r}^\$)}_{\text{collateral boost}} - dr^D] = Cov[dr^k - dr^D, \frac{dn_t^i}{n_t^i}]$
  - $\frac{dn_t^i}{n_t^i} = x^{k,i} dr^k + (1 - x^{k,i} - x^{\$,i})dr^D + x^{\$,i}\bar{r}^\$ dt - \frac{c_t^i}{n_t^i} dt$
  - $x^{k,i} = \frac{1}{\tilde{\sigma}^2}\left(\frac{A-\iota}{q} + \Phi(\iota) - r^D + \phi(r^D - \bar{r}^\$)\right)$



A   L

Productive capital

Net worth

Domestic Safe Asset

Dollar Bond

# EME Central Bank and Banks

$$B_t + FX_t = D_t = pK_t$$

Central Bank/Banks$^{EME}$

A                   L

$1-\alpha$ — Bubble

Domestic Safe Asset

$\alpha$ — US Treasury

- Bubble grows $dB_t = B_t\Phi(\iota)dt$

- $FX_t$ US Treasuries
  earn a real interest rate of $\underline{r}^{\$}$
  $$dFX_t = \underline{r}^{\$}FX_t dt + \Delta FX_t$$
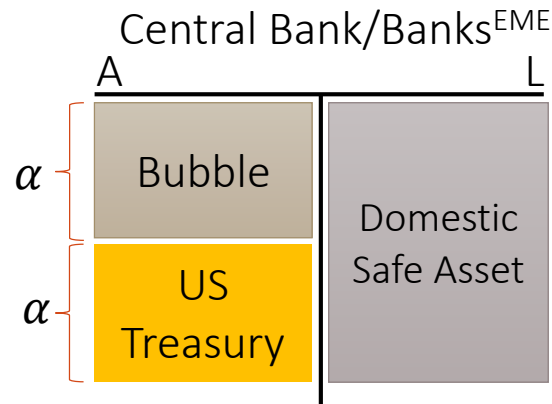
  Newly acquired US Treasuries

- Deposit rate on (domestic safe asset)
  $$\underline{r}^{\$}FX_t dt + B_t\Phi(\iota)dt - r^D pK_t dt = Tdt$$
  - set aggregate transfer $Tdt = 0$
  - $\Rightarrow \quad r^D = \alpha\underline{r}^{\$} + (1-\alpha)\Phi(\iota)$

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# Market Clearing – on balance growth path

- Balanced growth path: $\dfrac{dD_t}{D_t} = \dfrac{dB_t^{\$}}{B_t^{\$}} = \dfrac{dK_t}{K_t} = \Phi(\iota)dt$

- <span style="color:red">Goods market</span>

$$\rho N_t = (A - \iota)K_t - \left(\frac{dD_t}{D_t} - r^D D_t\right) - \left(\frac{dB_t}{B_t} - \bar{r}^{\$} B_t^{\$}\right)$$

$$\rho\left(q + p + b^{\$}\right) = A - \iota - \left(\Phi(\iota) - r^D\right) - \left(\Phi(\iota) - \bar{r}^{\$}\right)b^{\$}$$

- <span style="color:red">Capital markets</span>

$$q = \left(q + p + b^{\$}\right)x^k$$

- <span style="color:red">Safe asset market</span>

$$p = \left(q + p + b^{\$}\right)(1 - x^k - x^{\$})$$

- <span style="color:red">US dollar</span> (debt) market clears by Walras' Law

# Equilibrium effects

$$q = \frac{A - \iota}{\tilde{\sigma}\sqrt{\rho + \Phi(\iota) - r^D} - (\Phi(\iota) - r^D) - \phi(r^D - \bar{r}^\$)},$$

$$\iota = \iota^0 + \frac{1}{\kappa}(q - 1),$$

$$r^D = \alpha \underline{r}^\$ + (1 - \alpha)\Phi(\iota)$$

$$x^k = \frac{1}{\tilde{\sigma}^2}\left(\frac{A - \iota}{q} + \Phi(\iota) - r^D + \phi(r^D - \bar{r}^\$)\right)$$

$$p = \frac{1 - x^k}{x^k}q.$$

- Two effects of reserves holding
  - Reserves upkeep
    Reserves only grow at $r^\$$ --- have to constantly buy US Treasuries …
  - Portfolio rebalancing effect
    domestic safe asset holding is less attractive – increases q
- Effects of carry trades
  - As capital serves as collateral, it is attractive -> increases q
  - Requires larger reserves ($\alpha$) -> effects above

# Overview

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- What's a safe asset?

- Model
  - Autarky
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- <span style="color:red">Sudden stop</span>
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- Global Safe Asset from & for Emerging Market Economies

# Sudden Stop with high reserves

- Sun-spot which potentially triggers US investors not to fund anymore

- Threshold depends on maturity structure of $ corporate bonds
  - Conservative: very short-term corporate bonds

- Proposition: With sufficient reserves,
$$\alpha p K_t \geq B_t^{\$} \iff \alpha p(\alpha) \geq b^{\$}(\alpha),$$
self-fulfilling suddens stops do not occur

# Sudden Stop with insufficient reserves

- Public reserves are used up. Hence, $\alpha^+ = 0$

Peso held by US investors

- Jump of the exchange rate by

$$j^e = \frac{D_t^+ + (-B_t^\$ - \alpha D_t)}{D_t} = \frac{p^+ - b^\$}{p} - \alpha$$

- New steady state is

$$q = \frac{A - \iota^+}{\tilde{\sigma}\sqrt{\rho + \Phi(\iota) - r^D - (\Phi(\iota) - r^D) - \phi(r^D - \bar{r}^\$)}},$$

$$\iota = \iota^0 + \frac{1}{\kappa}(q^+ - 1),$$

$$r^D = \alpha \underline{r}^\$ + (1 - \alpha)\Phi(\iota),$$

$$x^{k,+} = \frac{\sqrt{\rho}}{\tilde{\sigma}},$$

$$p^+ = \left(\frac{\tilde{\sigma}}{\sqrt{\rho}} - 1\right)\frac{A - \iota^+}{\tilde{\sigma}\sqrt{\rho}}.$$

# Unanticipated vs. anticipated Sudden Stop

- $\lambda$ = arrival rate of sunspot -> potential jump



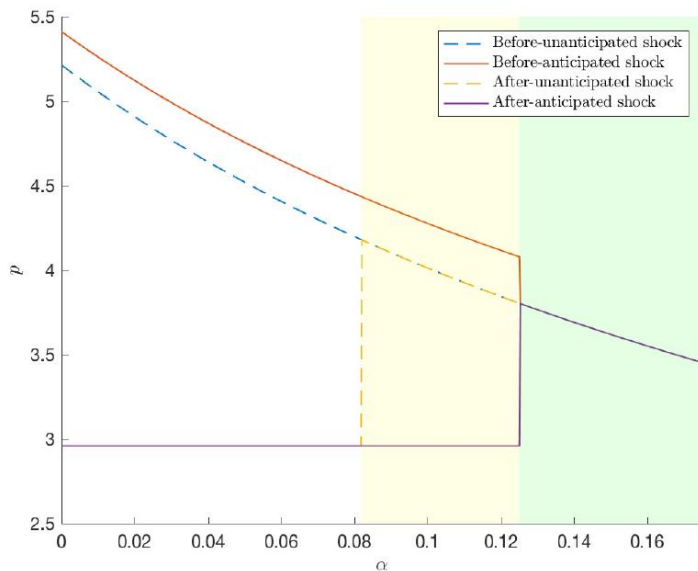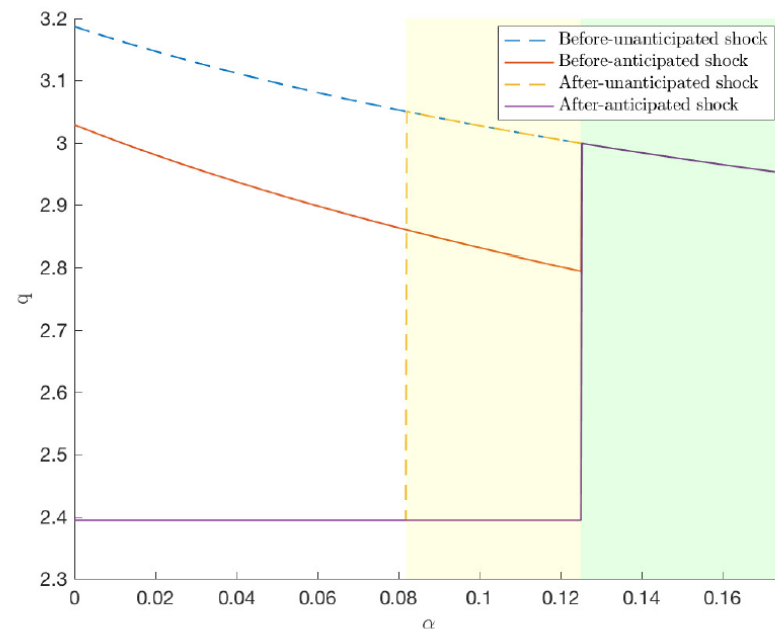Figure 5: Deposit value (deposit-capital ratio) before and after cr



Figure 4: Capital price before and after crisis

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# Unanticipated vs. anticipated Sudden Stop

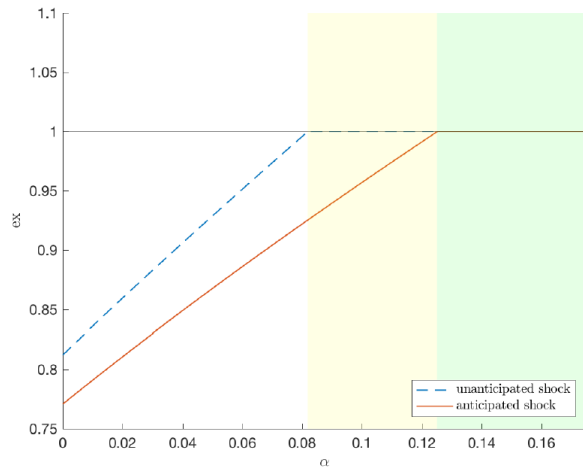- $\lambda$ = arrival rate of sunspot -> potential jump
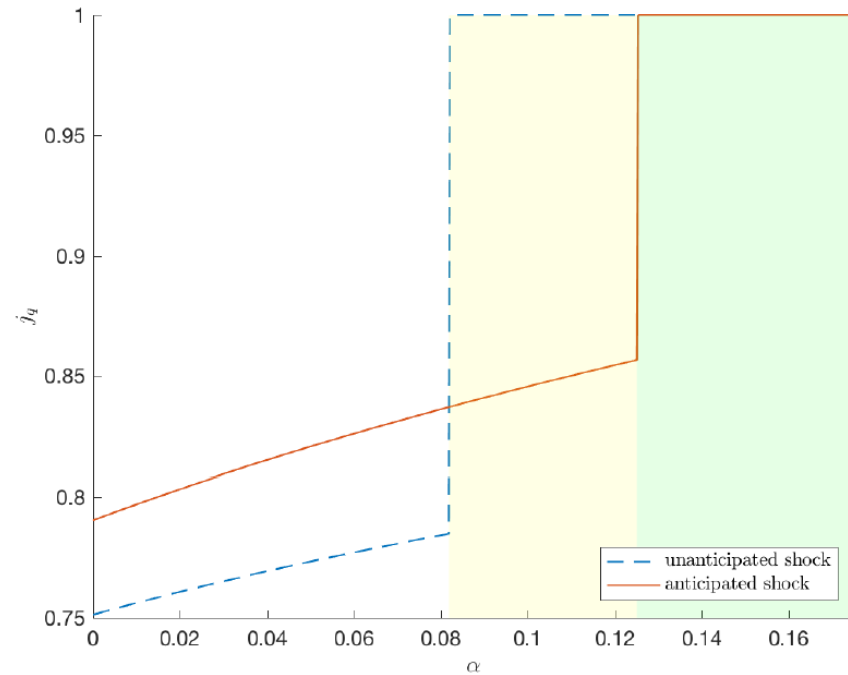


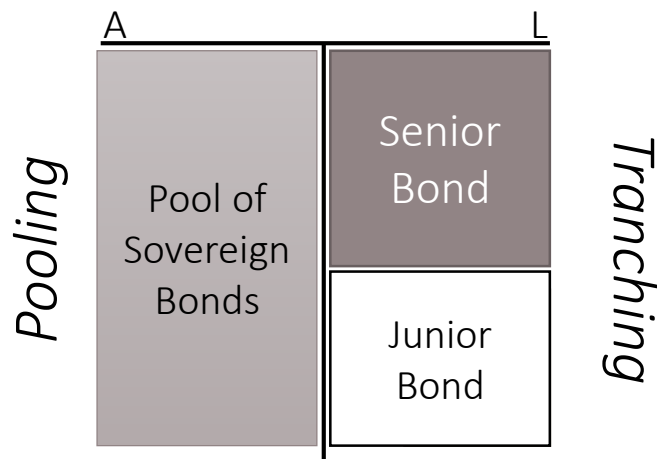Figure 6: Jump of Exchange Rate



Figure 7: Jump of Capital Price

# Global Safe Asset

- Many emerging market economies
- Sunspot has potential to trigger systemic sudden stop
  - For $\Delta$ fraction of EMEs



- $r^{senior} = r^{junior} = \Phi(\iota)$
- $q_{GSA} =$

$$q_{gsa} = \frac{A - \iota_{gsa}}{\tilde{\sigma}\sqrt{\rho} - \phi(\Phi(\iota_{gsa}) - \bar{r}^{\$})},$$

$$\iota_{gsa} = \iota^0 + \frac{1}{\kappa}(q_{gsa} - 1),$$

$$r^D_{gsa} = \Phi(\iota_{gsa}).$$

# Global Safe Asset – Conclusion

1. Carry trade activity by EME corporations and households

2. Flight Safety cross-border capital flows

3. Official reserve holdings

- Distorts World Economy

- "Rechannelling" Approach
instead of "buffer Approach" (reserves, IMF, swaplines)

- Root cause solution