Leverage Cycles and the Anxious Economy

by Ana Fostel and John Geanakoplos

Presentation by Eric Giambattista
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Motivation

  - Periods when weekly primary issuance (over all emerging markets) 40% below trend for 3 consecutive weeks

- Fact 1 - Emerging Market sovereign bond spreads positively correlated with US High-yield spreads (Contagion)
- Fact 2 - During market closures, higher-rated emerging market spreads increase by less than low-rated (Differential Contagion)
- Fact 3 - During market closures, higher-rated emerging market issuance falls by more (Issuance Rationing)
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Focus

“Anxious Economy” not a crisis
- Bad news about US high-yield payoffs
- No additional information about emerging market payoffs
- If investors in emerging markets are liquidity constrained, may cut back their emerging market exposure to invest in US high-yield (“crossover” investors)
Construct heterogenous agent model (different beliefs and endowments) with incomplete markets capable of explaining Facts (1)-(3)

1) Simple Benchmarks
   - Representative Agent (No contagion)
   - Complete Markets (Contagion quantitatively small)
   - Incomplete Markets (Contagion)

2) Baseline Model With Leverage (Differential Contagion)

3) Baseline Model With Adverse Selection (Differential Contagion and Issuance Rationing)
Model - Overview

- Finite Horizon
- Lucas tree of states $s \in S$
- Heterogenous Agents with different endowments and subjective probabilities over future states
- Log Utility
Model - Timing

$B \leq G < 1, H < 1$
Consider only 1 Emerging Market asset (E), 1 High Yield asset (H)

Endowments: \( e = 2020 \) in every node, 2 units of H and E in node 1

Beliefs: \( q=0.9 \)

Terminal Payoffs in bad state: \( E=0.1, H=0.2 \)

No contagion: at node D future marginal utility is higher than at node U - higher prices for E

<table>
<thead>
<tr>
<th>Asset</th>
<th>( p_1 )</th>
<th>( p_u )</th>
<th>( p_D )</th>
<th>( (p_1 - p_D)/p_1 ) %</th>
</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>.9082</td>
<td>.9082</td>
<td>.9083</td>
<td>-.01</td>
</tr>
<tr>
<td>H</td>
<td>.9901</td>
<td>.9981</td>
<td>.9183</td>
<td>7.25</td>
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</table>
2 Agents: Optimists (q = 0.9) and Pessimists (q=0.5)

Endowments: $e^P = 2000$, $e^O = 20$ in every node, 1 Unit of each asset (H & E) in node 1

Agents can trade Arrow securities, High-yield, and Emerging Economy assets

Contagion Small: Pessimists much wealthier, especially at node D - prices reflect pessimists beliefs more strongly

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</tr>
</thead>
<tbody>
<tr>
<td>E</td>
<td>0.5527</td>
<td>0.5554</td>
<td>0.5499</td>
<td>0.5</td>
</tr>
<tr>
<td>H</td>
<td>0.8007</td>
<td>0.9985</td>
<td>0.5998</td>
<td>25.1</td>
</tr>
</tbody>
</table>
Model - Incomplete Markets

- Same endowments, beliefs, eliminate Arrow securities
- Contagion present
- Key mechanism: Increasing dispersion of beliefs - (optimists, pessimists) believe US High-yield asset will payout fully with probability (.99,.75) in initial state vs (.9,.5) in anxious state
  - Portfolio Effect - At node D optimists buy all of H, have less to spend on E

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<tbody>
<tr>
<td>E</td>
<td>.7954</td>
<td>.8630</td>
<td>.7273</td>
<td>8.56</td>
</tr>
<tr>
<td>H</td>
<td>.9097</td>
<td>.9986</td>
<td>.7364</td>
<td>19.05</td>
</tr>
</tbody>
</table>
Introduce non-contingent bond promising $\phi_s$ units consumption at each potential node next period

- Cannot default
- Collateral capacity of asset j: $\phi_j^s \leq \min_{t \in S(s)} [p_{tj} + D_{tj}]
- Cannot use endowment as collateral

∀s ∈ S, let $s^*$ denotes node prior to state s

x - consumption, y - asset holdings, $r_s$ - risk free rate
Agents Problem

\[
\max U^i = \sum_{s \in S} \bar{q}_s^i \left( \delta^i \right)^{t(s)-1} u^i(x_s)
\]

s.t. \( B^i(p, r) = \{(x, y, \phi) \in \mathbb{R}_{+}^S \times \mathbb{R}_{+}^{SJ} \times \mathbb{R}^S : \forall s, \)

\[
(x_s - e_s^i) + \sum_{j \in J} p_{sj} (y_{sj} - y_{s*}^j) \leq \frac{1}{1+r_s} \phi_s - \phi_s^* + \sum_{j \in J} y_{s*}^j D_{sj},
\]

\[
\phi_s \leq \sum_{j \in J^c} y_{sj} \min_{t \in S(s)} [p_{tj} + D_{tj}]
\]
A collateral equilibrium is a set of prices and allocations such that:

\[(p, r), (x^i, y^i, \phi^i)_{i \in I} \in \mathbb{R}^{SJ}_+ \times \mathbb{R}^{S}_+ \times (\mathbb{R}^{S}_+ \times \mathbb{R}^{SJ}_+ \times \mathbb{R}^{S}_+) : \forall s,\]

\[\sum_{i \in I}(x^i_s - e^i_s) = \sum_{i \in I} \sum_{j \in J} y^i_{s^*j} D_{sj},\]

\[\sum_{i \in I}(y^i_{sj} - y^i_{s^*j}) = 0, \forall j,\]

\[\sum_{i \in I} \phi^i_s = 0,\]

\[(x^i, y^i, \phi^i) \in B^i(p, r), \forall i,\]

\[(x, y, \phi) \in B^i(p, r) \implies U^i(x) \leq U^i(x^i), \forall i.\]
Liquidity Wedge $\omega^i_s$:

$$\frac{1}{1+\omega^i_s} \frac{1}{1+r_s} = \frac{\sum_{\sigma \in B(s)} \delta^i q^i_{s\sigma} MU^i(x^i_{s\sigma})}{MU^i(x^i_s)} = \sum_{\sigma \in B(s)} sdf^i_{s\sigma} q^i_{s\sigma}$$

Measures wedge between rates borrowers willing to pay and lenders willing to take (given that payment is guaranteed)

Effective collateral capacity:

$$\phi^i_{sj} = 1\{\text{Collateral Constraint Binds}\} \min_{t \in S(s)} [p_{tj} + D_{tj}]$$
Decompose Asset price into payoff value and collateral value:

- **Payoff Value:**
  \[ PV_{sj}^i = \sum_{\sigma \in B(s)} sdf_{s\sigma}^i [p_{s\sigma j} + D_{s\sigma j}] q_{s\sigma}^i \]

- **Collateral Value:**
  \[ CV_{sj}^i = \left[ \frac{1}{1+r_s} - \frac{1}{1+\omega_s} \frac{1}{1+r_s} \right] \phi_{sj}^i \]

- **Price:**
  \[ p_{sj} = PV_{sj}^i + CV_{sj}^i \] if agent i holds asset j

- **Higher \( \omega \) increases collateral value, decreases payoff value**
## Simulation Results - Collateral Equilibrium

### Table 1: Simulation Results

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<tr>
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<tbody>
<tr>
<td>E</td>
<td>.8511</td>
<td>.8695</td>
<td>.7416</td>
<td>12.9</td>
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<tr>
<td>H</td>
<td>.9316</td>
<td>.9985</td>
<td>.7306</td>
<td>21.6</td>
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<tr>
<th>Asset</th>
<th>( p_1 )</th>
<th>( p_u )</th>
<th>( p_D )</th>
<th>( \frac{U-D}{p_U} ) %</th>
<th>( \frac{1-D}{p_1} ) %</th>
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<tbody>
<tr>
<td>E</td>
<td>PV</td>
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<tr>
<td>CV</td>
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<td>Margin</td>
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<td>.8852</td>
<td>.8651</td>
<td></td>
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<tr>
<td>H</td>
<td>PV</td>
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<td>.9985</td>
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</tr>
<tr>
<td>CV</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Margin</td>
<td>1</td>
<td>1</td>
<td>1</td>
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The Leverage Cycle

▶ During good times next periods price volatility low - enables high leverage and lowers liquidity wedge - asset prices rise
▶ Leverage does not cause lower absolute prices in anxious economy
  ▶ Collateral Value makes emerging economy asset more valuable in economy with leverage
▶ Leverage causes larger price drop from 1 to D (due to higher asset prices in period 1, not lower period 2 asset prices)
Differential Contagion

- Extend previous model to include 2 emerging market assets (G,B) with payoffs (.2, .05)
- 2 Emerging Market Asset model without leverage exhibits contagion but not differential contagion
- Leverage allows for differential contagion through “flight to collateral”
  - Alternative explanation to “flight to quality”
  - In anxious economy liquidity wedge high, and dispersion of margins between assets high

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<td>.7726</td>
<td>11.2</td>
</tr>
<tr>
<td>B</td>
<td>.8458</td>
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<td>.7298</td>
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<td>.9311</td>
<td>.9985</td>
<td>.7332</td>
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Extension - Adverse Selection

- Extend model to include issuance choice by emerging market
- 2 country types (G, B), private information
- Governments issue assets promising fraction $z$ of next periods dividend to finance current-period consumption
- Price Schedule: $\vec{p}_s = \{(z_s, p_s(z_s)) : z_s \in (0, 1], p_s \in \mathbb{R}_+\}$
- Country i’s budget set: $B^{ks}(\vec{p}_s) = \{(x, z) \in \mathbb{R}_+^{1+|S_T(s)|} \times \mathbb{R}_+ : x_s \leq p_s(z)z, z \leq 1, \forall a \in S_T(s) : x_\alpha = e_\alpha^k + (1 - z)D_{\alpha k}\}$. 
Issuance Rationing

- A separating equilibrium exists: good government signals type by issuing less assets.
- Anxious economy exhibits issuance rationing - larger price spread for good/bad types increases incentive for bad type to mimic good type - good types issuance must drop.

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<tr>
<td>G</td>
<td>.8149</td>
<td>.8409</td>
<td>.6957</td>
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<tr>
<td>H</td>
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<td>.6326</td>
<td>28.5</td>
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