International Recessions

Fabrizio Perri
University of Minnesota and Federal Reserve Bank of Minneapolis

Vincenzo Quadrini
University of Southern California

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Feature of the 2007-2008 crisis

High degree of real and financial co-movement in industrialized countries.
FINANCIAL CO-MOVEMENT

Growth in net business debt

Percentage of loan officers easing credit - % tightening
WHAT DOES EXPLAIN CO-MOVEMENT?

1. Shocks could be correlated (global shocks).

2. Country-specific shocks propagate to other countries (spillover).
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1. Shocks could be correlated (global shocks).

2. Country-specific shocks propagate to other countries (spillover).

3. Our proposal: propagation mechanism that makes shocks correlated.
WHAT DO WE DO?

We propose a two-country model where

- Credit expansions and contractions are generated by self-fulfilling expectations (*multiple equilibria*).

- Multiple equilibria arise because of *occasionally binding constraints*.

- Credit contractions generate sharp recessions while the macroeconomic impact of credit expansions is more gradual (*asymmetry*).

- Recessions are more severe after long periods of credit and macroeconomic expansions (*history dependence*).

- The model generates large movements in *asset prices*. 
MODEL WITH SEGMENTED MARKETS

• Two types of agents (sectors):
  – **Investors**: They are the shareholders of firms and consume dividends.
    \[
    \max E \sum_{t=0}^{\infty} \beta^t u(d_t)
    \]
  – **Workers**: Supply labor and lend funds to firms with bonds.
    \[
    \max E \sum_{t=0}^{\infty} \delta^t U(c_t, h_t)
    \]

• Different discount factors: \( \beta < \delta \).
FIRMS

• There is unit mass of firms owned by investors.

• ‘Concave’ production function $F(\bar{k}, h_t)$. Fixed capital for the moment.

• Budget constraint: $b_t + d_t = \frac{b_{t+1}}{R_t} + F(h_t) - w_t h_t$.

• Discount factor: $m_{t+1} = \frac{\beta u_c(d_{t+1})}{u_c(d_t)}$.

• Also borrow intra-temporally for working capital $l_t = F(h_t)$.

• Limited enforcement: $\xi_t \cdot \bar{k} \geq \frac{b_{t+1}}{R_t} + l_t$
RECURSIVE PROBLEM FOR THE FIRM

\[ V(s; b) = \max_{d, h, b'} \left\{ d + E m' V(s'; b') \right\} \]

subject to:

\[ b + d = \frac{b'}{R} + F(h) - w h \]

\[ \xi \cdot \bar{k} \geq \frac{b'}{R} + F(h) \]
First order conditions

\[ F_h(h) = w \cdot \left( \frac{1}{1 - \mu} \right) \]

\[ REM' = 1 - \mu \]

\[ \mu \quad \Rightarrow \quad \text{Multiplier for the enforcement constraint.} \]

\[ \text{Positive if binding.} \]
OPEN ECONOMY

- Two symmetric countries.

- Households borrow and lend internationally. They own domestic bonds, \( b_t \), and foreign bonds, \( n_t \).

- Investors are allowed to hold shares of domestic and foreign firms. The implication is full diversification.
OPEN ECONOMY

• Because of investors’ diversification, the common discount factor is:

\[ m_{t+1} = \frac{\beta u_c (d_{t+1}^1 + d_{t+1}^2)}{u_c (d_t^1 + d_t^2)} \]

• Back to first order conditions of firms:

\[ F_{h}(h^1) = w^1 \cdot \left( \frac{1}{1 - \mu^1} \right) \quad F_{h}(h^2) = w^2 \cdot \left( \frac{1}{1 - \mu^2} \right) \]

\[ Rem' = 1 - \mu^1 \quad Rem' = 1 - \mu^2 \]
PROPERTY WITH EXOGENOUS $\xi_t$

**Proposition.** An unexpected change in $\xi_t$ (domestic credit shock) has the same impact on employment and output of domestic and foreign countries.
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**HOWEVER**

Unless shocks are internationally correlated, the model does not generate co-movement in financial flows.
ENDOGENOUS $\xi_t$

- The enforcement constraint is occasionally binding,

$$\xi_t \cdot \bar{k} \geq \frac{b_{t+1}}{R_t} + F(h_t)$$

- Capital can be sold to households at price $\xi_t = \underline{\xi}$.

- Alternatively, capital can be sold to firms at price $\xi_t = \overline{\xi}$.

- However, firms can make the purchase only if they have liquidity.
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Alternatively, capital can be sold to firms at price $\xi_t = \bar{\xi}$.

However, firms can make the purchase only if they have liquidity.

Multiple equilibria:

- If the market expects $\xi_t = \bar{\xi}$, firms will not borrow up to the limit and the ex-post price of the liquidated capital is $\xi_t = \bar{\xi}$.
- If the market expects $\xi_t = \underline{\xi}$, firms will borrow up to the limit and the ex-post price of the liquidated capital is $\xi_t = \underline{\xi}$. 

ENDOGENOUS $\xi_t$
PROPERTY WITH ENDOGENOUS $\xi_t$

**Proposition.** A credit contraction in the domestic country (decline in $\xi_t$) is always associated with a credit contraction in the foreign country (decline in $\xi_t^*$). Thus, both countries experience the same responses in macroeconomic and financial variables.
Result 1: Asymmetry

Credit contractions have larger macroeconomic and asset price effects than expansions
Result 2: Recessions led by credit booms

The severity of crises increases with the duration of the credit expansion
Result 3: Employment and asset price volatility

Credit shocks generate large fluctuations in employment and asset prices
## Business cycle statistics

<table>
<thead>
<tr>
<th></th>
<th>Credit shocks only</th>
<th>Productivity shocks only</th>
<th>Both shocks</th>
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<tbody>
<tr>
<td></td>
<td>Standard deviations</td>
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<td>Output</td>
<td>0.88</td>
<td>0.76</td>
<td>1.16</td>
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<tr>
<td>Consumption</td>
<td>0.68</td>
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<tr>
<td>Labor</td>
<td>1.26</td>
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<td>Investment</td>
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<td>Tobin’s q</td>
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<td>Stock market value</td>
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<td>Interest rate</td>
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<td>Return on equity</td>
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<td></td>
<td>Expected returns (% annualized)</td>
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<td>Interest rate</td>
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<td>Return on equity</td>
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<td>Equity risk premium</td>
<td>1.56</td>
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<td>Nonbinding constraints, %</td>
<td>96.44</td>
<td>99.99</td>
<td>96.04</td>
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HETEROGENEOUS DYNAMICS OF LABOR

GDP

Private Consumption

Gross Fixed Capital Formation

Employment

Note: Data for GDP, private consumption, gross fixed capital formation are from OECD Quarterly National Accounts in PPP constant dollars. Data for employment are from OECD Main Economic Indicators. All series are normalized to 1 in the fourth quarter of 2007.
Result 4: Heterogeneous responses of labor

Heterogeneous response of employment but similar responses of financial variables and other real variables
CONCLUSION

• At a broad level a model with endogenous credit shocks and financial integration helps understanding the recent macroeconomic development:

1. Non-productivity driven recessions,
2. High international correlation in real and financial variables.

• The next step is to ask whether policies can do something about them?