Discussion of BCS Paper on SBC

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Overview

- Develop complete model of financial boom/bust cycle

- Requires non-linear computational approach
  - Asymmetries present with financial crises
  - "Shock-elasticities" vary with credit conditions
    * With linear approx: shock elasticities depend on credit conditions within a local region of the steady state
Overview (con’t)

• Burgeoning literature on non-linear comp. of financial crises model:
  – Mendoza, Bianchi, Brunnermeier/Sannikov, He/Krishnamurthy

• Bottom line: Important research agenda

• Key issues involving mapping to real world
  – Main limitation of non-linear methods: restricted state space
  – How well can models capture what really happened
Model Basics

- Two states: tfp $z_t$ and capital $k_t$
- $k_t$ allocated between firms and storage
- Households lend capital to firms via banks
- Inter-bank market reallocates capital from inefficient to efficient banks
- Crisis: Inter-bank market collapses if return to capital $R_t < \bar{R}$
  - Only efficient banks lend capital to firms
  - Inefficient banks use storage technology $\rightarrow$ output collapse
Inter-bank Market

\( \rho \equiv \text{inter-bank rate}; \ \phi \equiv \text{leverage}; \ p \in [0, 1] \equiv \text{bank efficiency} \)

- bank profits (per unit of assets)
  \[
  \max \{ pR_t + (pR_t - \rho_t)\phi_t, \ \rho_t \}
  \]

- moral hazard:
  - borrowing bank can renege on debt
  - can divert \( 1 + \theta\phi_t \) to a storage technology earning \( \gamma \leq 1 \)

- private information: \( p \) unknown to lender
Inter-bank Market (con’t)

• Only way to align incentives:
  
  – make lending in IB market more attractive than borrowing and re-neging:

  \[ \rho_t \geq \gamma(1 + \theta \phi_t) \]

• Key implication: leverage ratio \( \phi_t \) INCREASING in interbank rate

  \[ \phi_t = \frac{\rho_t - \gamma}{\gamma \theta} \]

  – Crucial for why low value of \( R_t \) leads to market collapse

• Key to result: Private information about bank’s franchise value \( pR_t + (pR_t - \rho_t)\phi_t \).
Inter-bank Market (con’t)

- Without private information about franchise value:

\[ pR_t + (pR_t - \rho_t)\phi_t \geq \gamma(1 + \theta\phi_t) \]

⇒ Leverage ratio DECREASING in inter-bank rate

\[ \phi_t = \frac{pR_t - \gamma}{\theta - (pR_t - \rho_t)} \]

- Empirical question as to which approach is appropriate
  - Inter-bank rates do vary by bank (suggesting franchise value matters).
  - Alfonso/Kovner (2010): No clear link between volume and rate in IB market
Crisis (Inter-bank Market Breakdown)

• drop in $R_t$ $\Rightarrow$ banks at margin shift from borrowing to lending
  
  – $\Rightarrow$ interbank rate $\rho_t$ declines as relative supply of interbank funds rises

  – $\Rightarrow$ decline in $\rho_t$ reduces leverage (which reduces demand)

• Below threshold $\bar{\rho}$ the market collapses

  – Loan demand falls with $\rho_t$ due to leverage effect

  – $\Rightarrow$ decline in $\rho_t$ cannot eliminate excess supply

• $\bar{\rho}$ implies threshold for $\bar{R}$ for $R_t$
Mechanics of Crisis Probability

- After solving out for $n_t$ and imposing parameter values $\Rightarrow$ no crisis region

$$R_t = \alpha z_t^2 k_t^{−1/3} + 1 - \delta \geq \overline{R}$$

- Crisis probability $\pi_t$: effective probability innovation in $z_t$ $\Rightarrow R_t \leq \overline{R}$
  
  - Key point: $\pi_t$ is increasing in $k_t$

- To move into crisis region (starting at $SS$)
  
  - $z_t$ has to drop $6 - 7\%$ (holding $k$ constant)
  
  - $k_t$ has to increase $35 - 40\%$ (holding $z$ constant).
Some Implications

1. Endogenous vulnerability (due to high \( k_t \)) takes a long time (decades) to build up.
   
   (a) One percent in \( k_t \) leads to small reduction in \( R_t \) (\( \sim 4 \) to \( 5 \) basis points)
   
   (b) Big percentage increases in \( k_t \) can occur slowly over time.

2. Feeding U.S. data into model: Minimal endogenous vulnerability before recent crisis.
   
   (a) Pattern of TFP shocks \( \Rightarrow k_t \) and \( z_t \) near steady state in 2007.
   
   (b) Crisis due to large negative TFP shocks. (not utilization adjusted).
it clear that the economy does not experience any systemic banking crisis. Even though the corporate loan rate eventually falls below its steady state value as the household accumulates assets, at no point in the dynamics does it fall below $\bar{R}$ (i.e. 2.43%). In effect, the positive technology shock does not last long enough to have the household accumulate assets beyond banks’ absorption capacity. We obtain similar (mirror) results after a negative one standard deviation productivity shock. Most of the time, the model behaves like a standard financial accelerator model; crises are indeed rare events that occur under specific conditions, as we show in the next section.

5.2 Typical Path to Crisis

The aim of this section is to describe the typical conditions under which systemic banking crises occur. As we already pointed out (see Section 4.2), banking crises may break out in bad as well as in good times in the model. It is therefore not clear which type of shocks (negative/positive, large/small, short/long lived) are the most conducive to crises. Starting from the average steady state (i.e. $z_t = 1$), we simulate the model over 500,000 periods, identify the years when a crisis breaks out, and compute the median underlying technological path in the 40 (resp. 20) years that precede (resp. follow) a crisis. This path corresponds to the typical sequence of technology shocks leading to a crisis. We then feed the model with this sequence of shocks. The left panel of Figure 8 reports the typical path for the technology shock, along with its 66% confidence interval. The red part of the path corresponds to crisis periods, the black one is associated with normal times. One striking result that emerges from this experiment is that the typical banking crisis is preceded by a long period during which total factor productivity is above its mean. In some 20% of the cases, crises even occur at a time when productivity is still above mean. This reveals one important and interesting aspect of the model: the seeds of the crisis lie in productivity being above average for an unusually long time. The reason is that a long period of high productivity gives the household enough
above trend until the early 80s and has fluctuated below trend since then. We find similar results when we use Fernald’s TFP series corrected for the rate of factor utilization, or when we detrend the series of TFP using a break in the trend to account for a structural US productivity slowdown in the mid 70s (see the companion technical appendix).

6 Discussion

6.1 Sensitivity Analysis

We now turn to the sensitivity of the properties of the model to the parameters. We simulate the model for 500,000 periods, compute the means of some key quantities across these simulations, and compare the results with our benchmark calibration (see Table 4).

**Risk Averse Economies Are Prone to Crises:** We first vary the utility curvature parameter $\sigma$ from our benchmark 4.5 to values 2 and 10, therefore changing the degree of risk aversion of the household. By making the household more willing to accumulate assets for precautionary motives, *ceteris paribus*, the increase in $\sigma$ works to raise the quantity of assets banks have to process without affecting banks’ absorption capacity — leaving banks more exposed to adverse shocks. The probability of a crisis is thus higher than in the benchmark (5.4% versus 2.7%). In other words, the risk averse economy is paradoxically more prone to systemic banking crises. It also experiences deeper and longer crises than the benchmark economy, with output falling by 1.1 percentage point more from peak to trough and crises lasting 1.4 year longer. The main reason is that, by accumulating more assets, the economy builds up larger imbalances that make it difficult to escape crises once they occur. Accordingly, the banking sector of the risk averse economy is also less efficient, with an interest rate spread of 2.09%, against 1.71% in the benchmark. In contrast, less risk averse economies are
Private credit/GDP ratio and property prices
United States

Vertical shaded areas indicate the starting years of system-wide banking crises.

1 In per cent.  2 Aggregated index including residential and commercial property prices; 1985 = 100.

Source: National data.
Mechanics of Recent Boom/Bust Episode

- Conventional "financial accelerator" mechanism accounts for bust
  - Asset price contractions hit leveraged borrowers in key sectors (banks, households)
  - Weakened balance sheets tighten credit constraints, and so on.

- Other "nonlinear" approaches incorporate financial accelerator mechanism
  - Mendoza, Bianchi, Brunnermeir/Sanikov, He/Krishmumrthy
  - Explain bust but lack good explanation for build-up in vulnerability

- Possible sources of rapid asset price/credit booms
  - Deregulation/ Relaxed Lending Standards (while keeping "Too-Big-Too-Fail")
  - Bubbles/News Shocks (see Bernanke/Gertler 1999 and Christiano et. al 2010 for early attempts.)
Summary

• Interesting contribution to important literature

• More work on mapping from model to data would be useful