Discussion of "Bank Risk Dynamics and Distance to Default" by Nagel and Purnanandam

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Summary

- Simple and forceful point: The assets sitting on banks are different from non-financial sector
  - They are loans/debt backed by non-financial sector
  - In particular, strong feature of stochastic volatility—low volatility in good times but high volatility in bad times

- How much could traditional Merton models (with constant volatility) go wrong?

- What are the policy implications?
Setting

- Underlying firm asset, $A_0 = 1$

$$\frac{dA^i_t}{A^i_t} = (r - \delta) dt + \sigma \left( \sqrt{\rho} dW_t + \sqrt{1 - \rho} dZ^i_t \right)$$

- Firm’s debt with maturity $T$ is bank’s asset, with face value $F$ and value $L$ ($=0.3$ if firms, $0.8$ if housing)
  - Annual interest rate log $(F/L) / T$ endogenous given
- Bank’s debt (deposits) $D$, say equals $0.9L < F$
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\[
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\]

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- Bank’s debt (deposits) \( D \), say equals \( 0.9L < F \)
- Staggered loan structure
  - \( T = 10 \), and the bank has 1, 2, ..., 10 year-to-maturity loans
  - When a cohort of loan matures, reinvesting the proceeds
  - It leads to smoothing (which is relevant practically)
  - But introduces history-dependence....not tractable
Modified Merton Model

\[ E^f = \text{Call} (S = A, K = F) \]
\[ E^b = \text{Call} (S = A, K = F) - \text{Call} (S = A, K = D) \]
Equity Volatility: Financials and Non-Financials (1)

volatility of equity return

\[ \text{vol}(dE_b/E_b) \]
\[ \text{vol}(dE_f/E_f) \]

\[ T = 10 \]
\[ r = 0.05 \]
\[ \sigma = 0.25 \]
\[ F = 0.3 \]
\[ D = 0.2 \]
will be nice to show $\frac{\text{vol}(E^b \text{ return})}{\text{vol}(E^f \text{ return})}$ goes up when $A$ drops.
Connection to stochastic volatility literature

- Basically, bank asset has a stronger "leverage effect" than non-financial firms
- Two reduced-form specifications in the literature
  - Leverage effect with $\theta < 1$
    $$\frac{dS_t}{S_t} = (r - \delta) \, dt + \sigma S_t^{\theta-1} \, dW_t$$
    - In the data, for individual non-financial stocks $\theta \approx 0.9$ (Cheung and Ng, 1992)
  - Or, stochastic volatility (McQuade 2014).
    $$\frac{dS_t}{S_t} = (r - \delta) \, dt + \sigma_t \, dW_t$$
    $$d\sigma_t = (\bar{\sigma} - \sigma_t) \, dt + \sqrt{\sigma_t} \, dW_t^{\sigma}, \quad \text{corr} \left( dW_t^{\sigma}, dW_t \right) < 0$$
- Modified Merton is more structural, with much better motivated primitive parameters
- For regulators/practitioners where reduced-form models have great value, maybe useful to come up with
  - a better stochastic process of bank equity, and/or
  - more accurate parameters
Connection to literature which uses Merton model (by mistake)

- In what way this paper changes our understanding of risk of the banking sector?
  - For sure quantitatively (and for those CDS traders who use KMV models); but qualitatively?

- Acharya, Anginer, Warburton 2015
  - Emphasize that credit spreads of big banks behave differently than small peers
  - The use Merton’s implied distance-to-default as an regression input...
  - Less subject to mismeasurement issue, as long as Merton’s DD is monotone with Modified Merton’s DD

- Duffie, Saita, and Wang (2007), Bharath and Shumway (2008): Merton’s distance-to-default has predictive power
  - Redo their analysis, run horse races?
Another related paper (1)

- Atkeson, Eisfeldt, Weill 2014, who propose a measure of Distance to Insolvency

\[
DI = \frac{1}{vol\left(\frac{dE}{E}\right)} = \frac{1}{\sigma_E}
\]

- Though \(DI\) is driven by both leverage and stochastic asset volatility \(\sigma_A\), they show the main driver is time-varying \(\sigma_A\)

- Andrea just showed that there is little difference in \(\sigma_A\) variations between financial and non-financial’s

- But, compare to non-financial firms, GBLFI institutions exhibit wilder movement in \(\frac{1}{\sigma_E}\), consistent with this paper
  - GBLFI: Government Backed Large Financial Institutions (commercial banks?)
Another related paper (2)
Conclusion

- An important, relevant, and (unfortunately) overlooked issue

- Will be more interesting to do more comparisons between financial and nonfinancial firms

- Important missing part: the fragility due to bank’s liability structure
  - well, MM holds in Merton model
  - We DO know a lot about the potential qualitative effect of liability structure on banks.....