## Rollover Crisis in DSGE Models

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# Why Didn't DSGE Models Forecast the Financial Crisis and Great Recession?

- Bernanke (2009) and Gorton (2008):
  - By 2005 there existed a very large and highly-levered Shadow Banking system.
    - It relied on short-term debt to fund long-term liabilities.
    - So, it was vulnerable to a run.
- The overwhelming majority of academics, regulators and practitioners simply did not recognize this development, or understand its significance.
- The widespread belief (baked into DSGE models) was that if a country had deposit insurance, bank runs were a thing of the past.

#### Integrating Rollover Crisis into DSGE Models

- Will talk, at an intuitive level, about Gertler-Kiyotaki (AER2015).
- More full-blown models by Gertler-Kiyotaki-Prestipino

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It was a rollover crisis in a shadow (invisible to normal people) banking system.



### Rolling over

• Consider the following bank:

Assets	Liabilities	
120	Deposits: 100	
	Banker net worth 20	

- This bank is 'solvent': at current market prices could pay off all liabilities.
- Suppose that the bank's assets are long term mortgage backed securities and the liabilities are short term (six month) commercial paper.
  - The bank relies on being able to *roll over* its liabilities every period.
  - Normally, this is not a problem.

### Rolling over

- Now suppose the bank cannot roll over its liabilities.
- In this case, the bank would have to sell its assets.
  - If only one bank had to do this: no problem, since the bank is solvent.
- But, suppose all banks face a roll over problem.
  - Now there may be a *big* problem!
  - In this case, assets must be sold to another part of the financial system, a part that may have no experience with the assets (mortgage backed securities).

#### Rollover crisis (Nash) equilibrium

- Suppose an individual depositor, Jane, believes all other depositors will refuse to roll over.
- Suppose Jane believes that the fire sales of assets will wipe out bank net worth.
  - Then, Jane can expect to lose money on the deposit she made with the bank in the previous period.
  - But, that loss is *sunk*, and nothing can be done about it.
  - Need some other friction to guarantee that Jane will herself refuse to roll over her deposit.

### Rollover crisis (Nash) equilibrium

- Absent other frictions, Jane would just renew her own deposit and the rollover crisis would *not* be a Nash equilibrium.
- So, Gertler-Kiyotaki assume that bankers can run away with a fraction of bank assets.
  - With zero net worth, banks would definitely run away.
  - This is why Jane would choose not to roll over her deposit, if she believed everyone else would also choose not to roll over.
- The logic of the rollover crisis equilibrium is a little different from the bank run equilibrium:
  - Suppose Jane thinks everyone else will take their money out of the bank.
  - Then, it makes sense for Jane to run faster than everyone else, to get to the front of the line.

## The Drama of a Roll Over Crisis Brought to Life in Some Great Movies!





### Why firesales?

- A rollover crisis: when all banks in an industry (e.g., mortgage backed securities industry) are unable to roll over their liabilities.
- The only buyers of the securities have no experience with them, so they won't buy without a price cut (*firesale*).
- Interestingly, the buyers of the securities will all complain at how *complex* they are and how *non-transparent* they are.
  - But, the real problem is that buyers in a fire sale are simply inexperienced.
  - The rollover crisis hypothesis contrasts with the *Big Short hypothesis*: assets were fundamentally *bad* (Mian and Sufi).

#### Rollover crisis

• When the whole industry has to sell, then bank balance sheets could suddenly look like this:

	Assets	Liabilities
Fire cale value of accets:	90	Deposits: 100
FILE Sale value of assets.		Banker net worth -10

• Multiple equilibrium: balance sheet could be the above, with run, or the following, with no run:

Assets	Liabilities	
120	Deposits: 100	
	Banker net worth 20	

- A run could happen, or not.
- This is exactly the sort of financial fragility that regulators want to avoid!
  - Under rollover crisis hypothesis, this was the situation in summer 2007.

#### Rollover Crisis: Role of Housing Market

- What matters is the actual value of assets and their firesale value.
- If bank is solvent under (firesale value), then probability of run is zero.

Pre-housing market correction

Assets	Liabilities		
120 (105)	Deposits: 100		
	Banker net worth 20 (5)		

#### Rollover Crisis: Role of Housing Market

- What matters is the actual value of assets and their firesale value.
- If bank is solvent under (firesale value), then probability of run is zero.

Pre-housing market correction

Post-housing market correction

Assets	Liabilities		Assets	Liabilities
120 (105)	120 (105) Deposits: 100		110 (95)	Deposits: 100
	Banker net worth 20 (5)			Banker net worth 10 (-5)

- Rollover Crisis Hypothesis:
  - pre-2005, no crisis possible,
  - post-2005 crisis possible.





Shaded areas indicate U.S. recessionaurces: S&P Dow Jones Indices LLC, U.S. Bureau of Labor Statistics myf.red/g/oTWK





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## How to think about regulation when the risk is of a rollover crisis.

- One possibility: model the rollover crisis directly.
- Serious model of rollover crisis at this time: Gertler-Kiyotaki (AER2015).
  - They adapt the rollover crisis model of sovereign debt created by Cole-Kehoe (JIE1996).
  - Cole-Kehoe related to Diamond-Dybvig.





#### Policy Use of Model

- Investigate the impact on financial stability of leverage restrictions.
- But, this analysis is hard! Clearly, it is only in its infancy...
- At the heart of the analysis:
  - Assume that people know what can happen in a crisis, together with the associated probabilities.
  - This seems implausible, given the fact that a full-blown crisis is a two or three times a century rare event.
  - Safe to conjecture that factors such as aversion to 'Knightian uncertainty' play an important role driving fire sales in a crisis.
  - Still, research on various types of crises is proceeding at a rapid pace, and we expect to see substantial improvements in DSGE models on the subject.

#### Conclusion

- Models of rollover risk seem important in light of the crisis.
- These models are in their infancy, a long way from being operational for quantitative policy analysis.
- Possibility: assume that governments will always act as lender of last resort.
  - Use toy models to illustrate the idea of rollover crisis.
  - For quantitative analysis, use models that do not allow rollover crisis, but do capture moral hazard implications of bailouts.
  - Monitor the Shadow Banking system closely.

