

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).

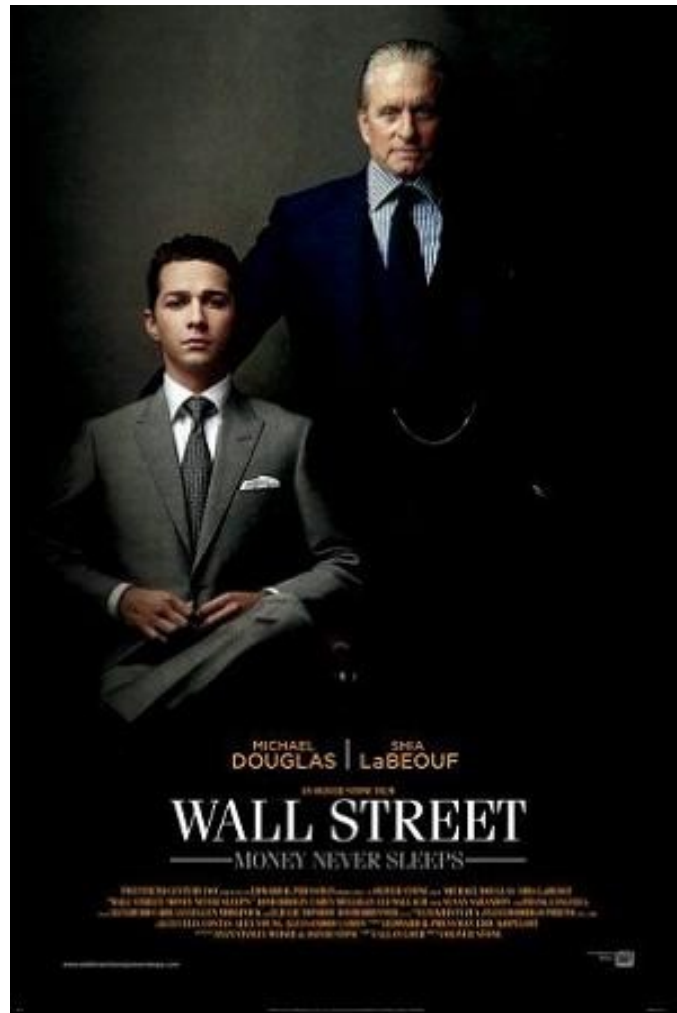
Rollover crisis (Nash) equilibrium

- 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 fire sales?

- 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:

Fire sale value of assets:



Assets	Liabilities
90	Deposits: 100
	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

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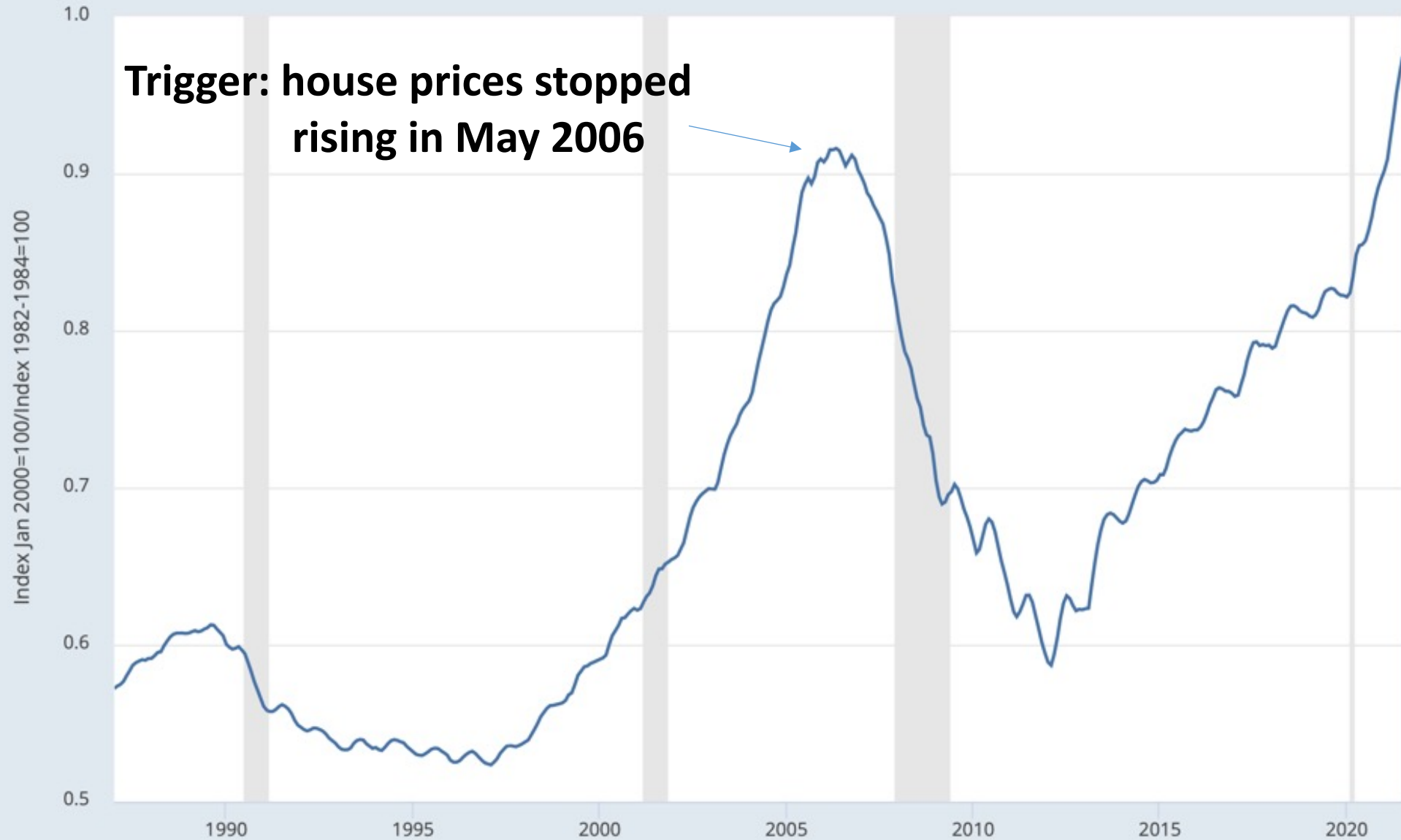
Pre-housing market correction

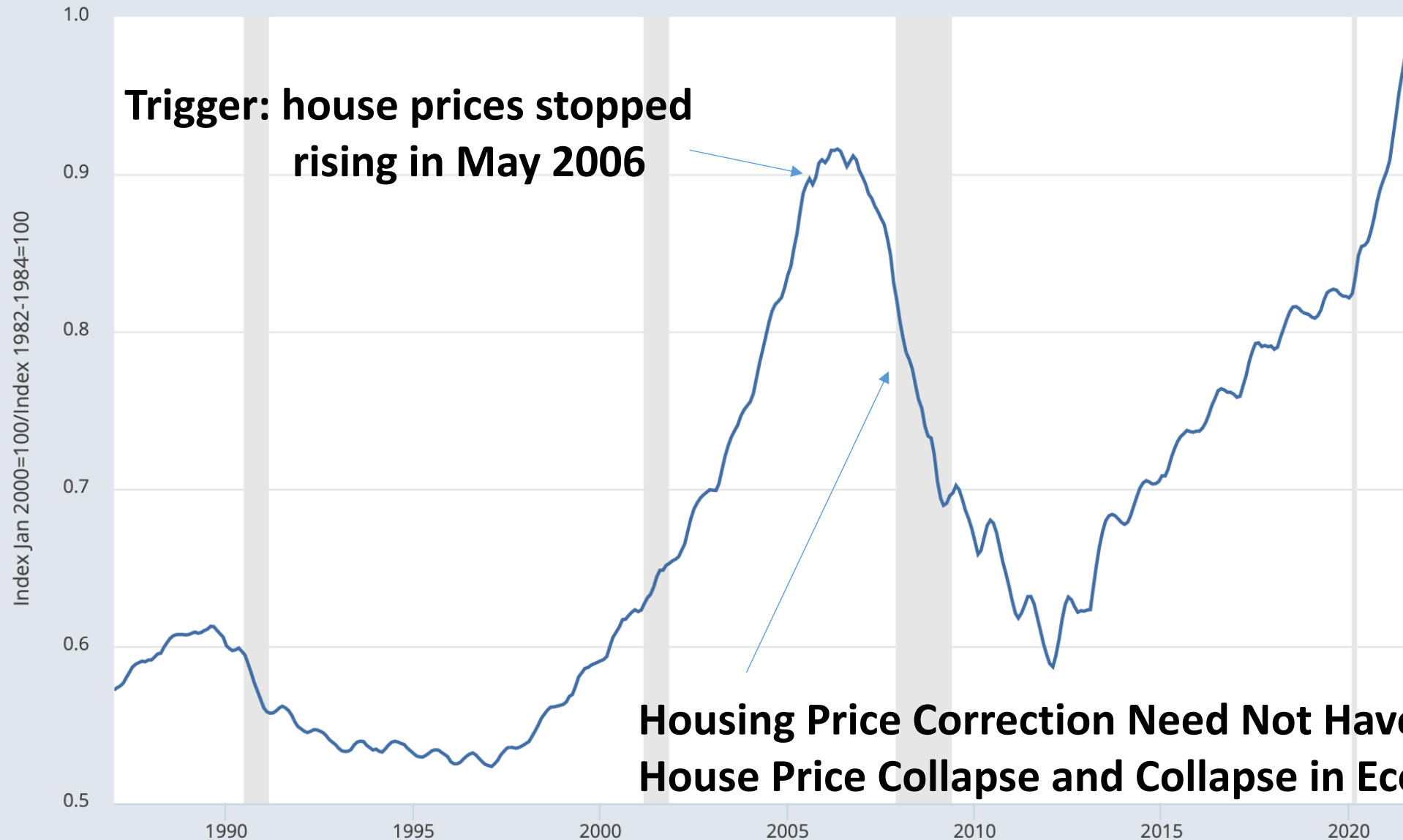
Assets	Liabilities
120 (105)	Deposits: 100
	Banker net worth 20 (5)

Post-housing market correction

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

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





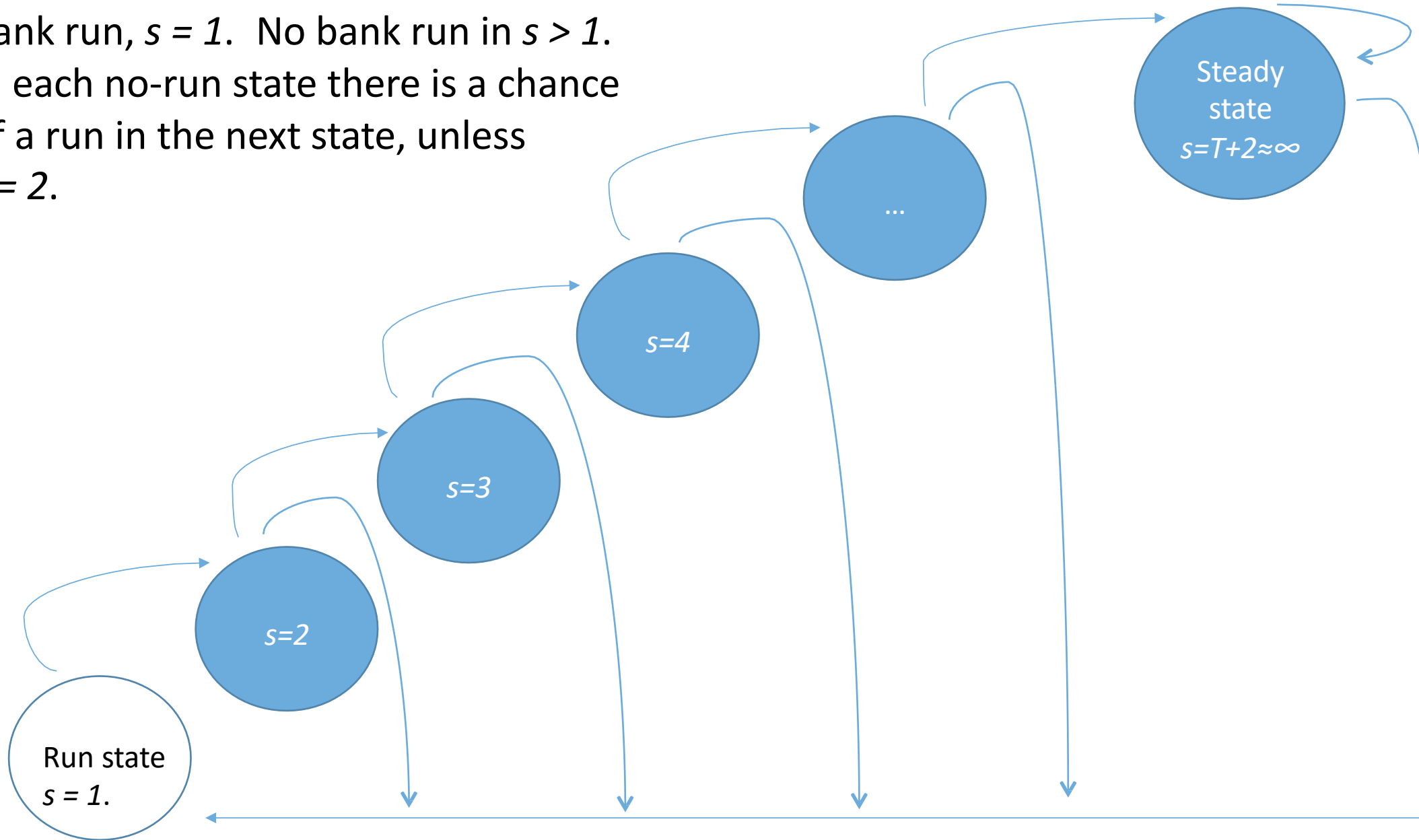
How to think about regulation when the risk is of a rollover crisis.

- 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.

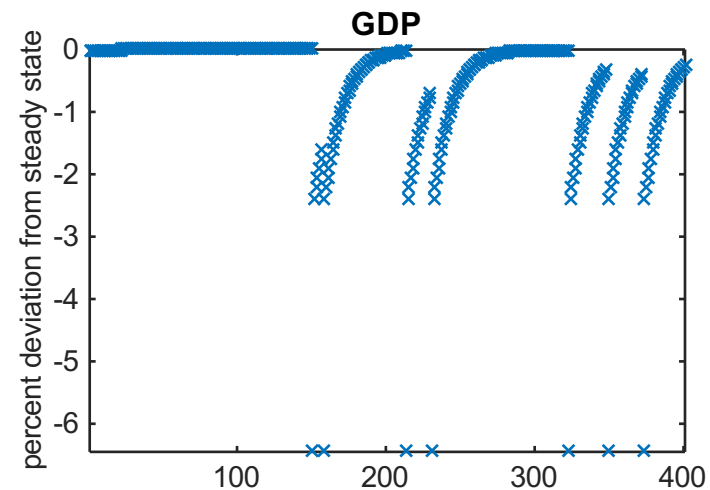
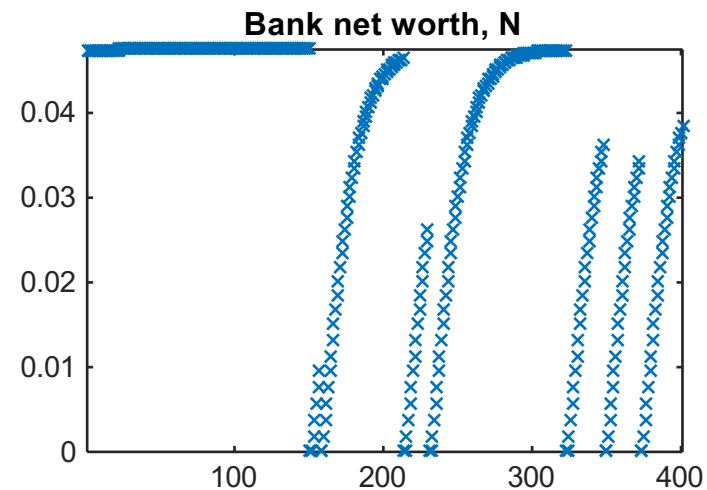
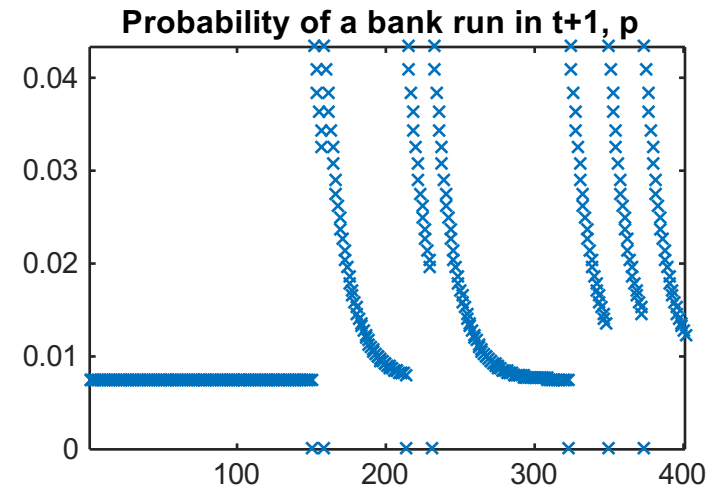
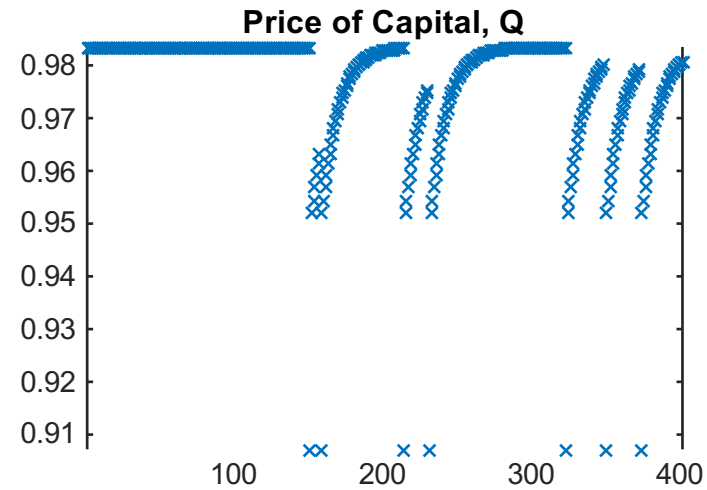
Possible states: $s = 1, 2, 3, \dots, T+2$.

Bank run, $s = 1$. No bank run in $s > 1$.

In each no-run state there is a chance of a run in the next state, unless $s = 2$.



One Hundred Year Stochastic Simulation



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.

