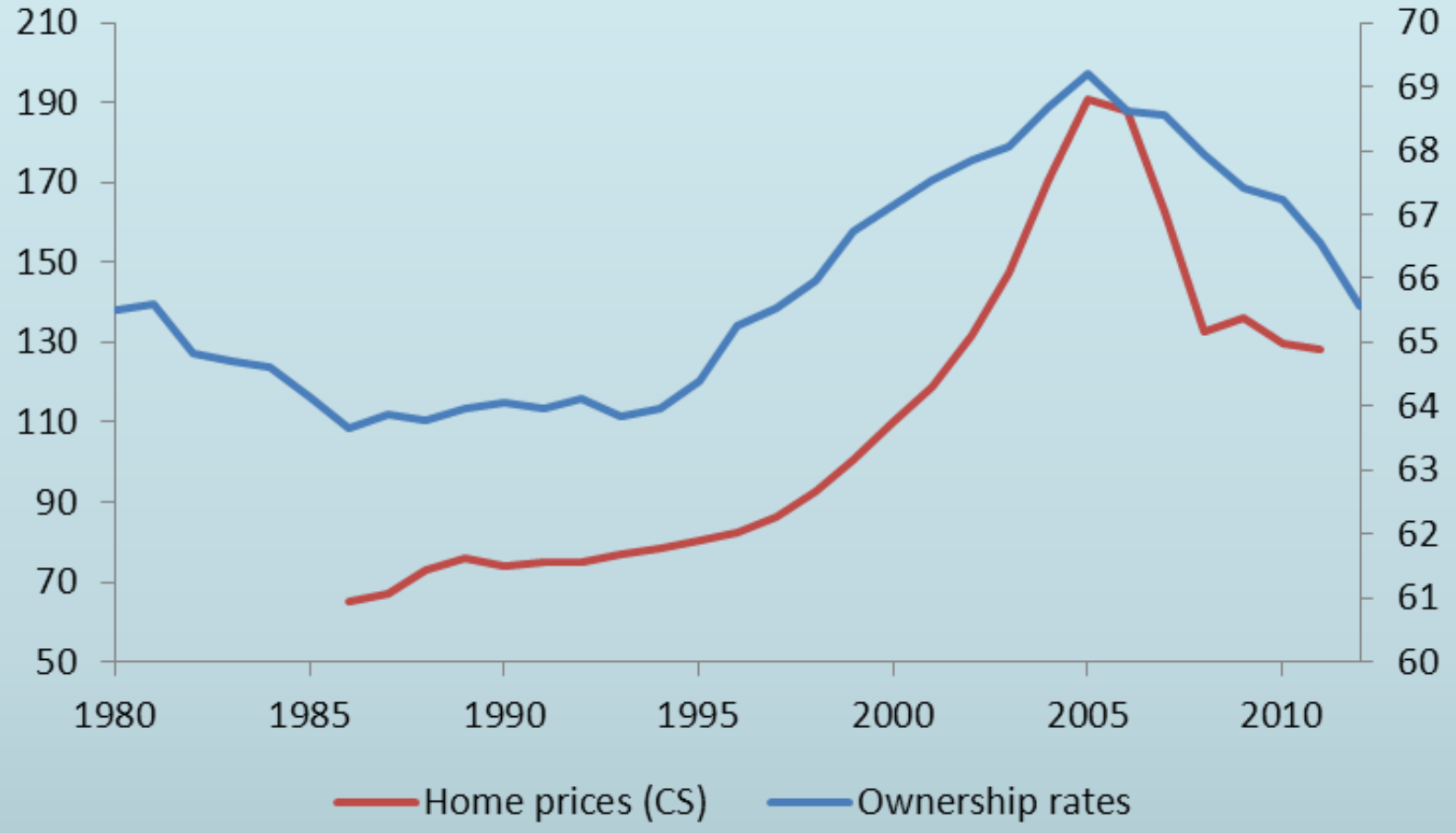
The Great Recession: An Autopsy

Real estate finance (RE641)

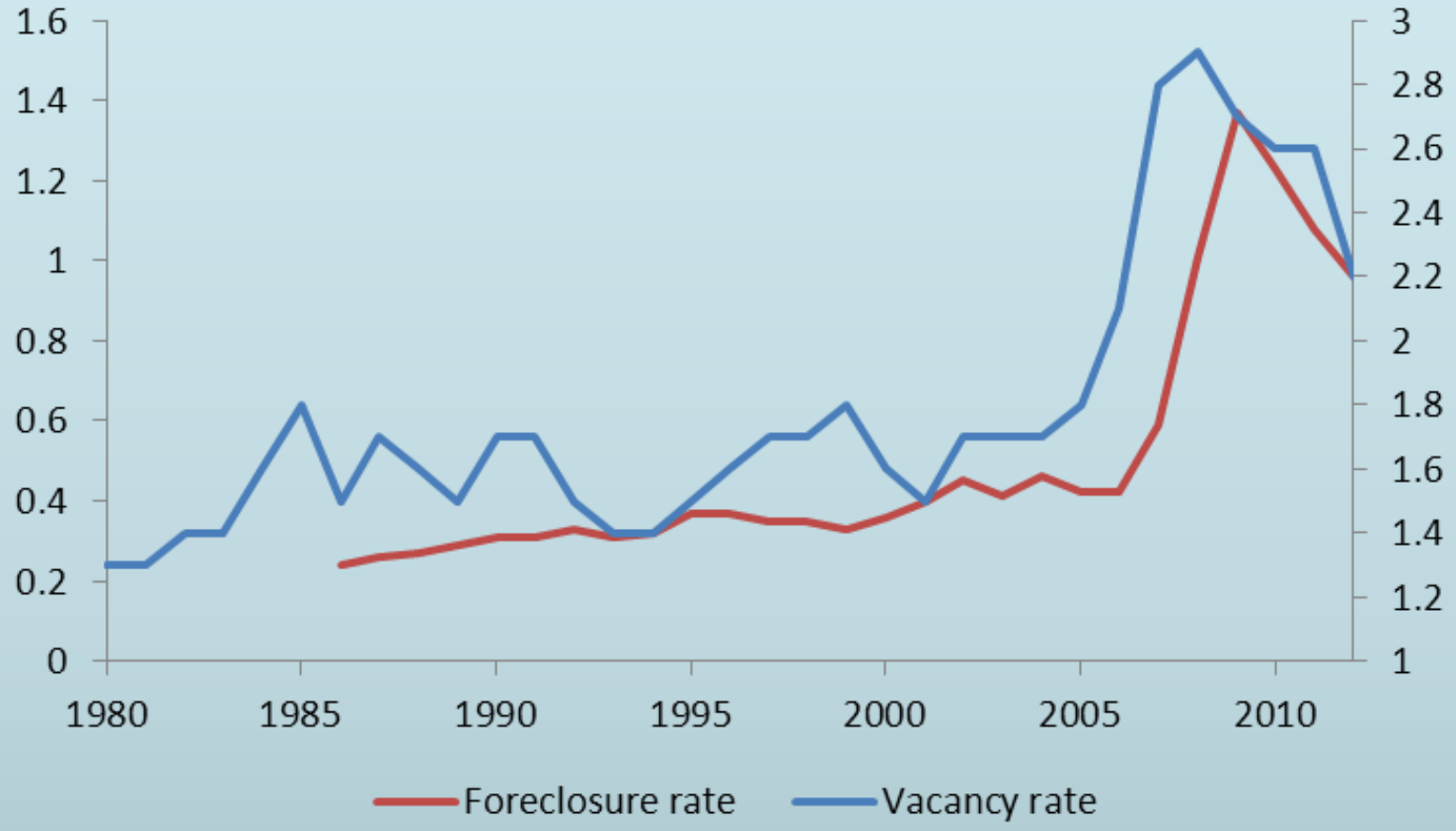
Part I: What we think we know

A housing boom, followed by a bust



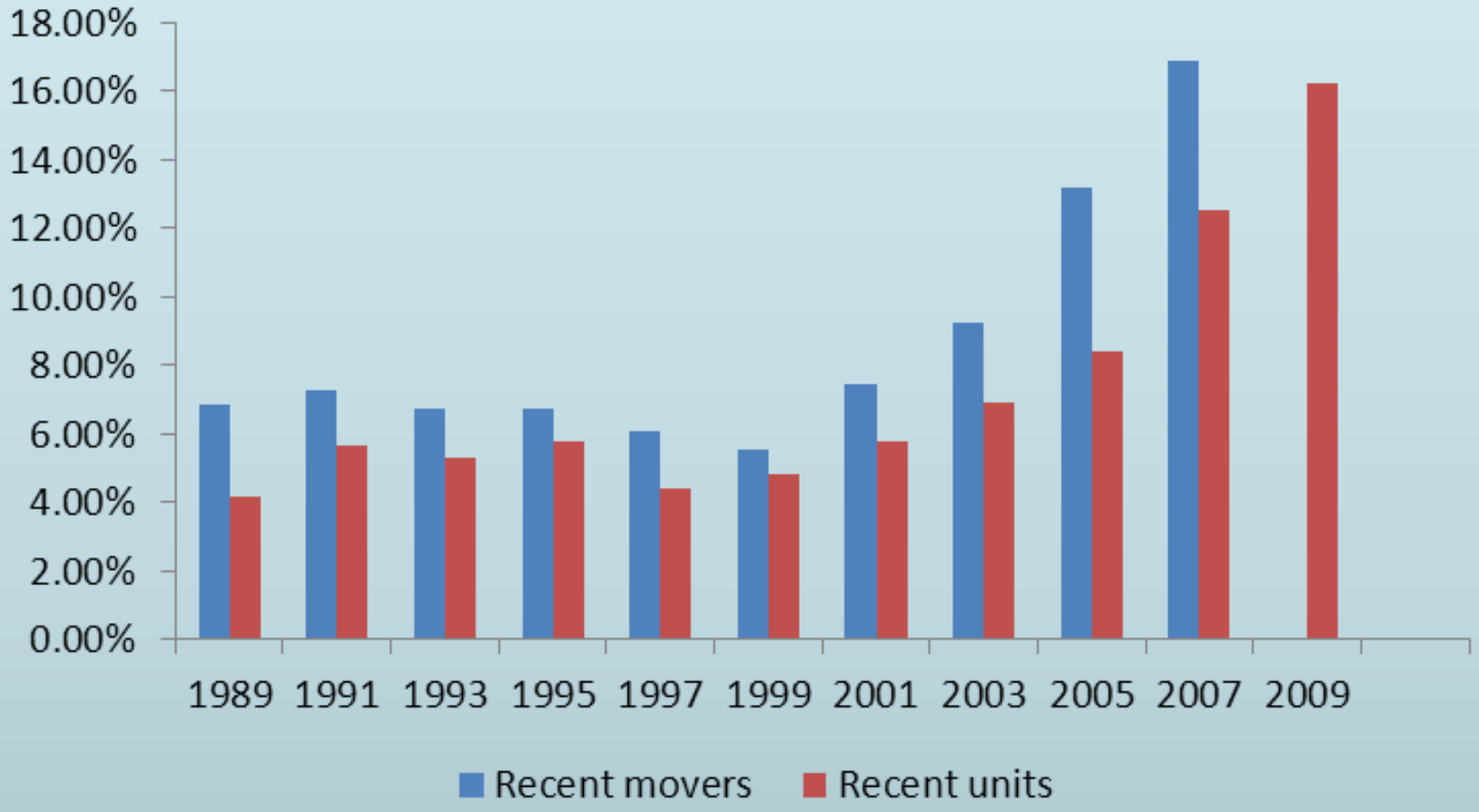
Sources: Bloomberg, Census Bureau

The mother of all foreclosure crises



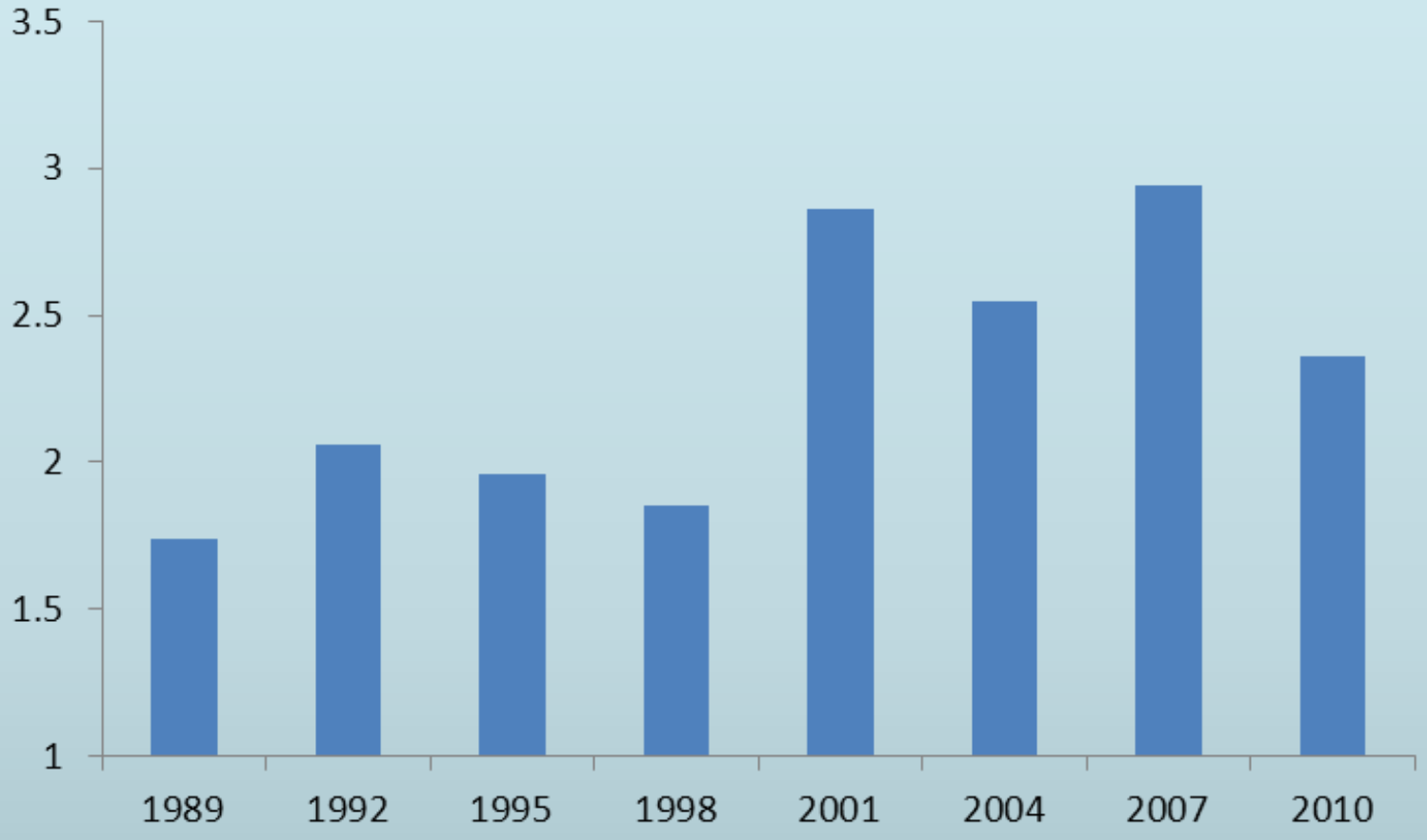
Sources: National Delinquency Survey, Census Bureau

Frequency of low-downpayment loans rises



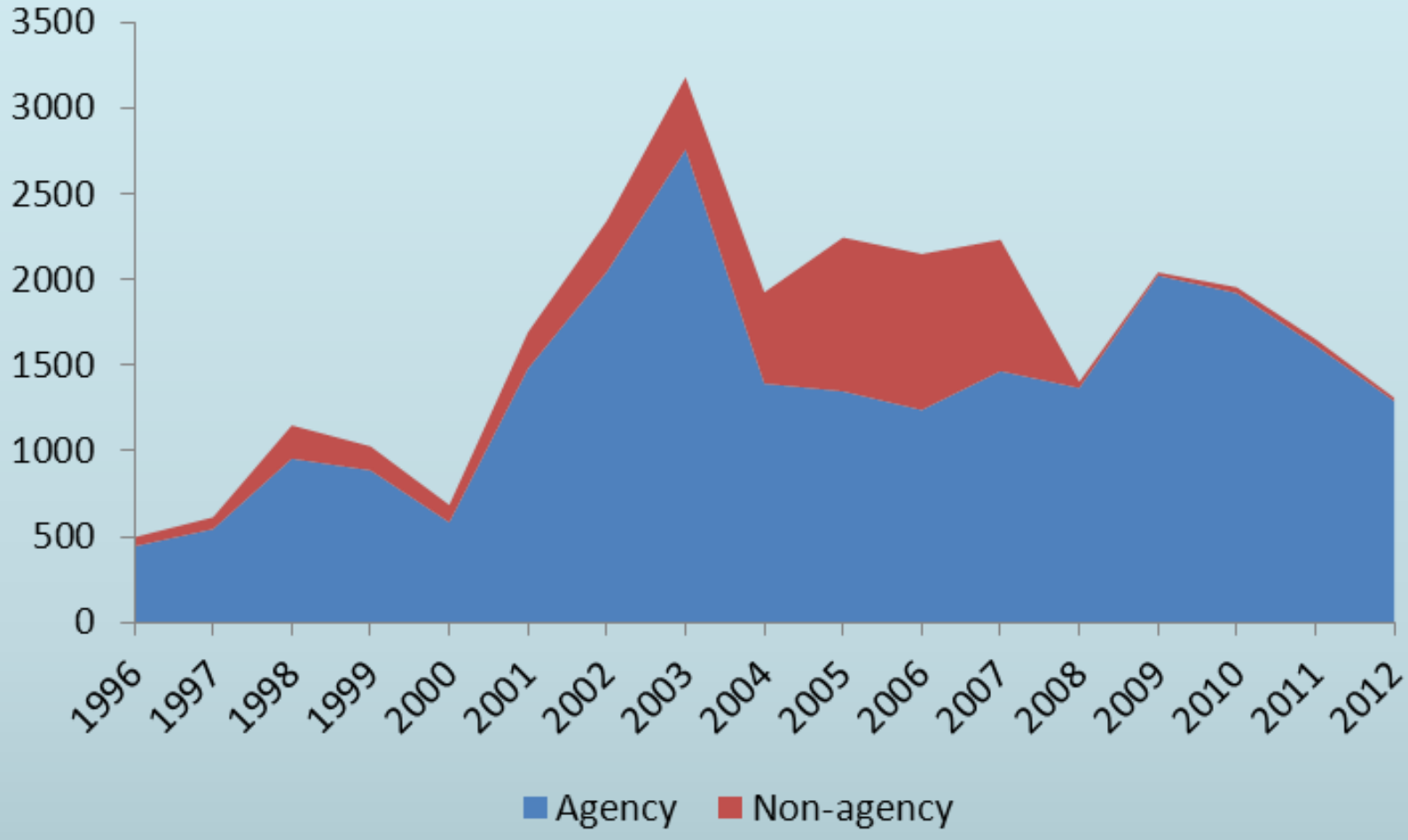
Sources: American Housing Survey

As do loan-to-income ratios



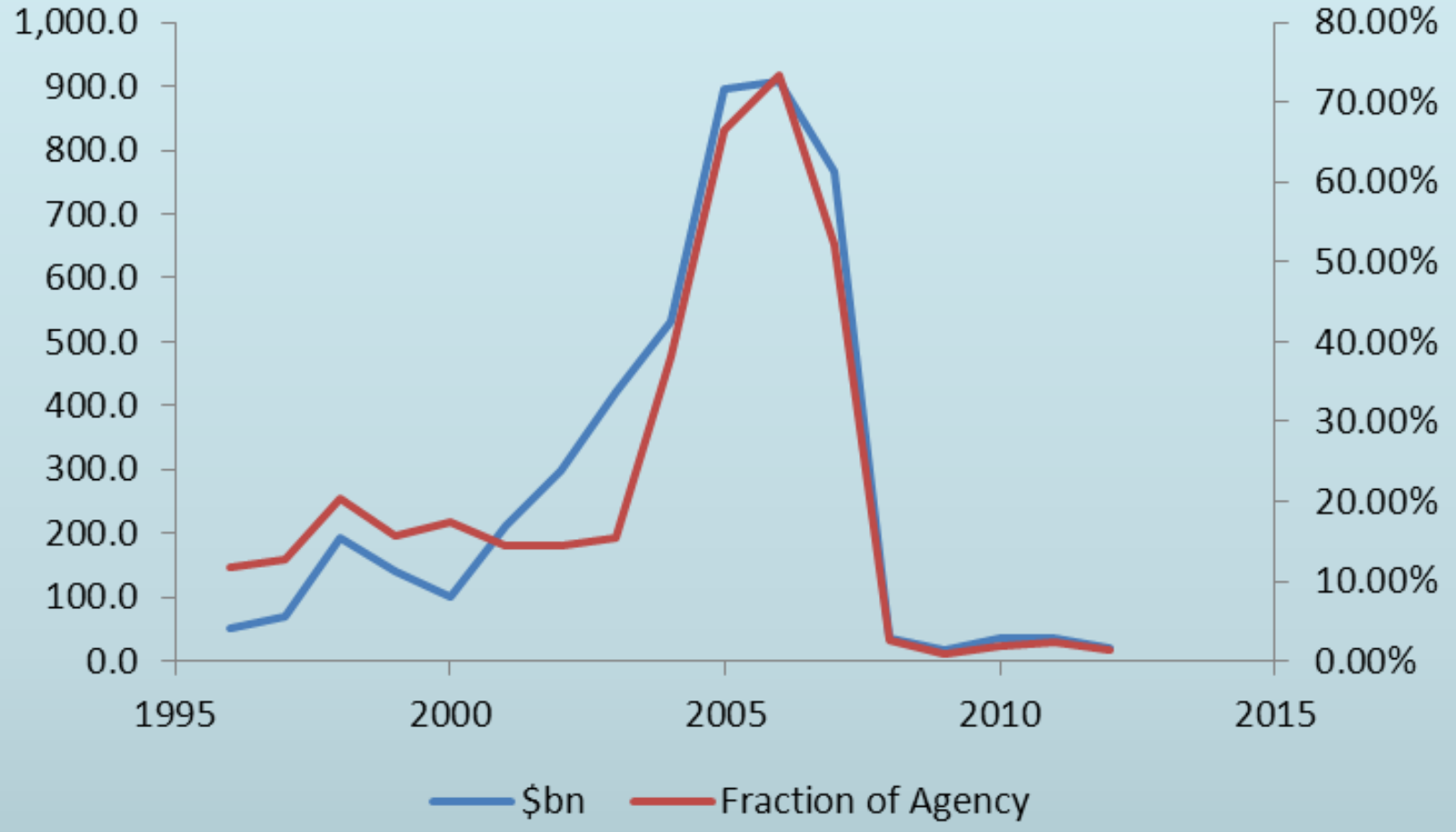
Sources: Survey of Consumer Finances

The rise and fall of mortgage-securitization



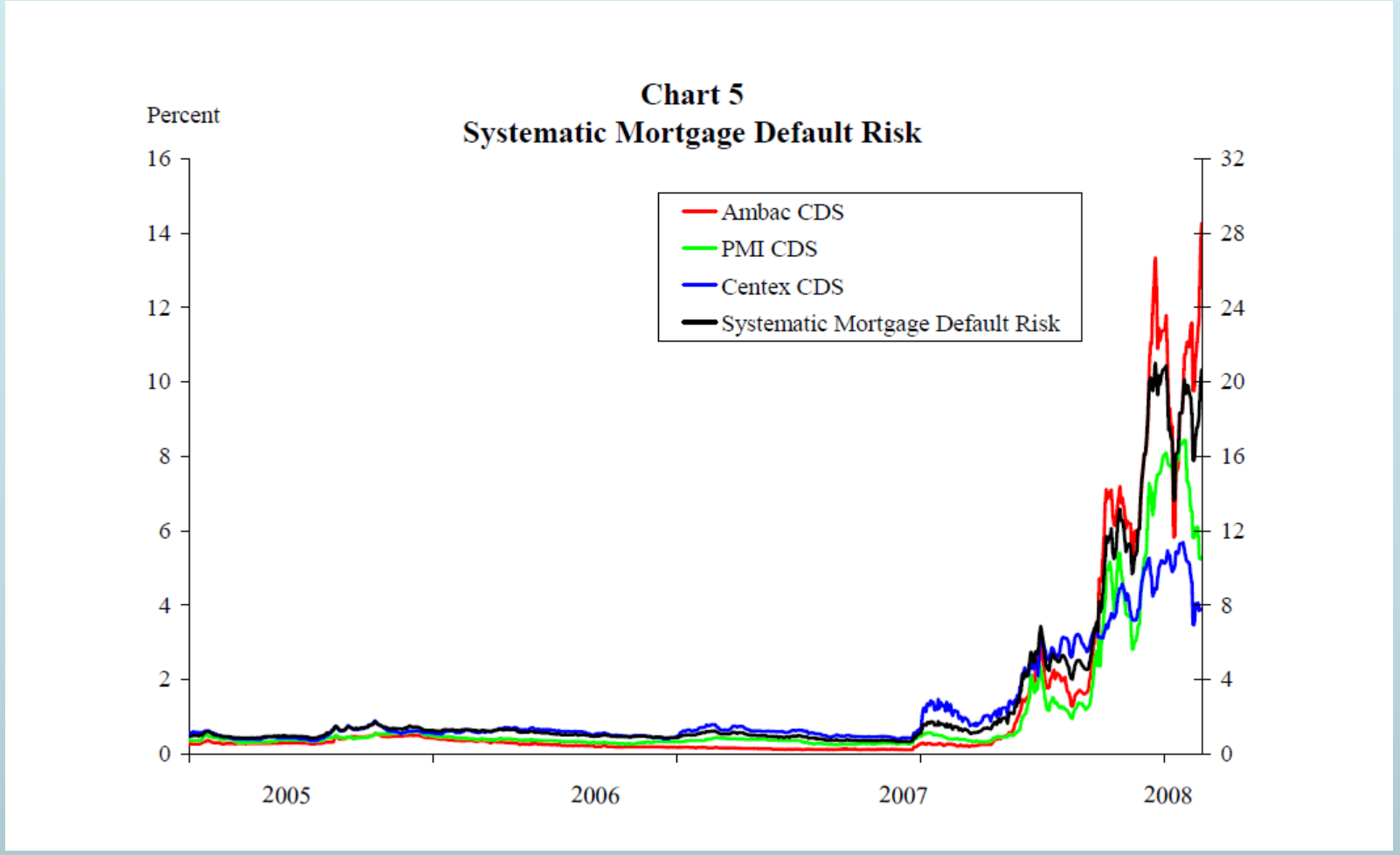
Sources: SIFMA

Private securitization takes over



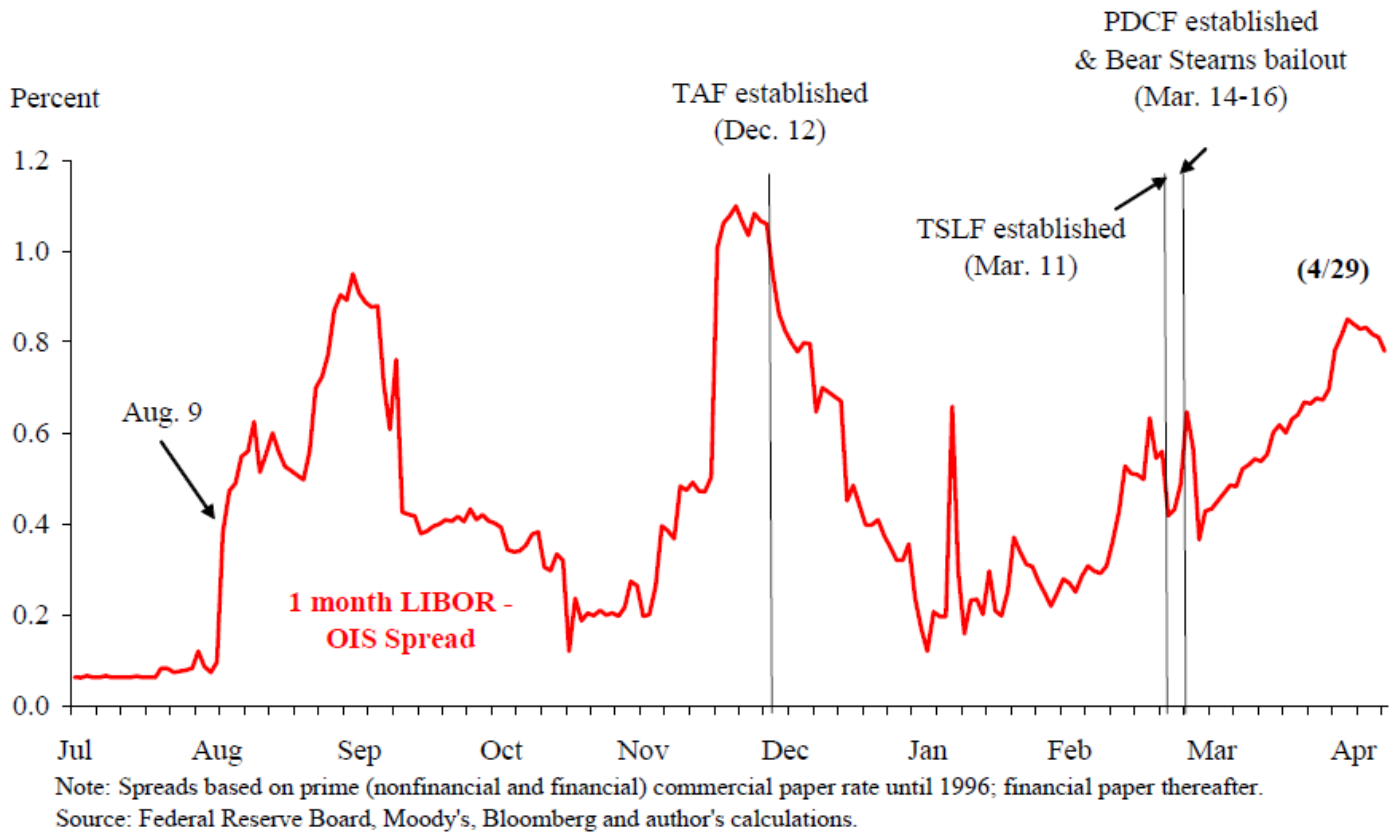
Sources: SIFMA

The end of the road



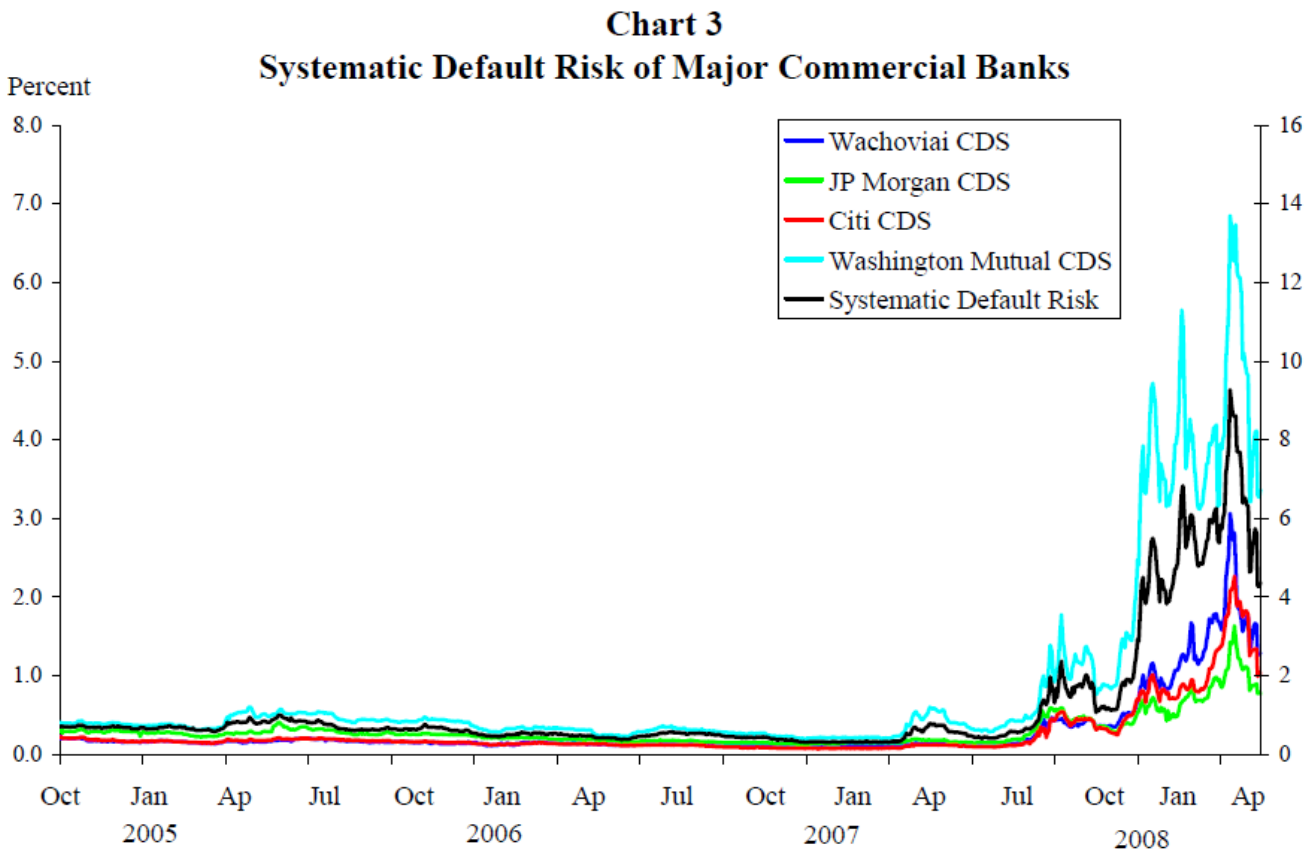
Sources: Wu, 2008

Nobody trusts anybody…



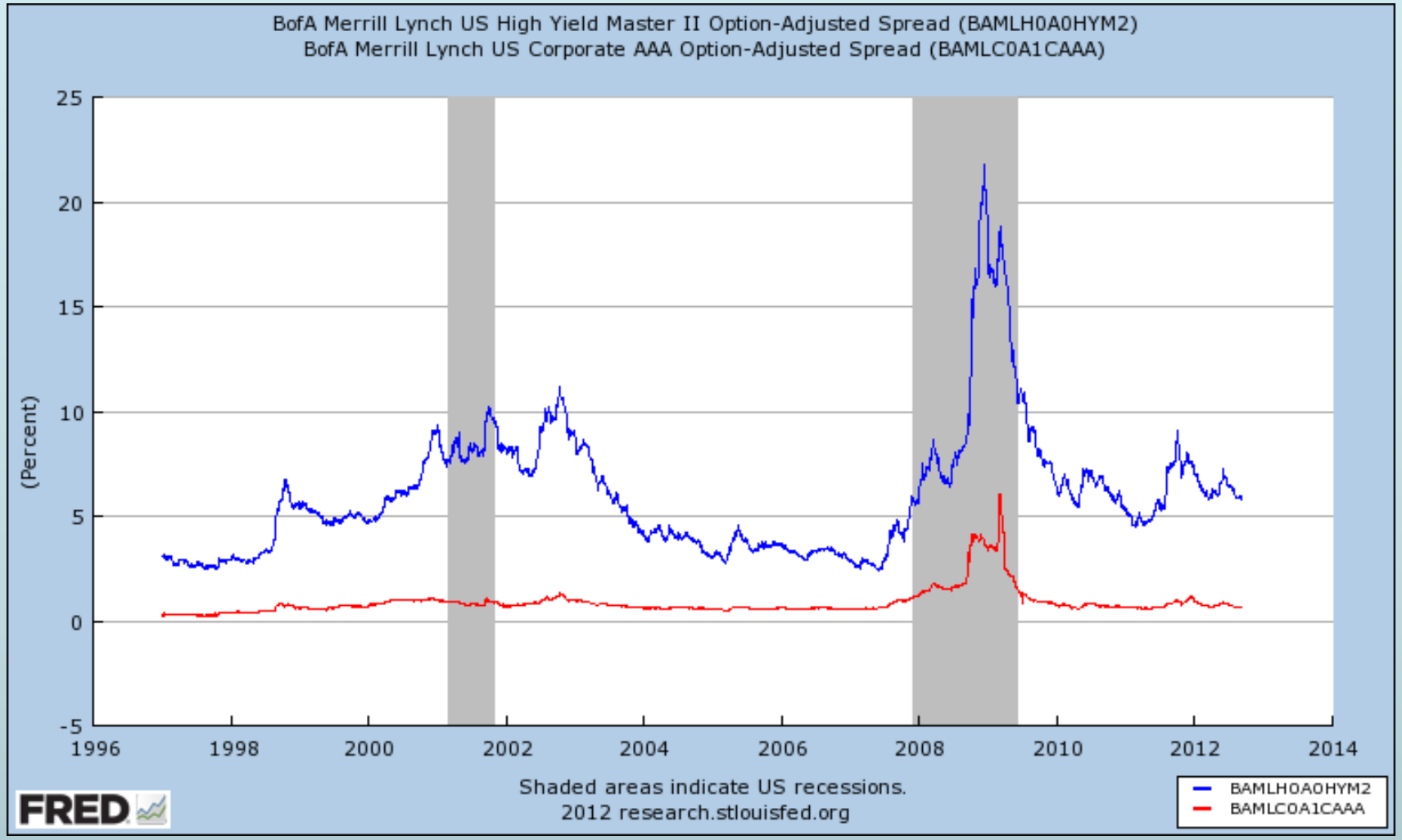
Sources: Wu, 2008

… especially if you made bad decisions



Sources: Wu, 2008

Financial Markets freak out



Sources: FRED

Part II: Boom-Busts in Housing Markets

Burnside et. al. (2011)

1. Booms are common across time and places
2. Often followed by busts, though not always
3. "*It is difficult to find observable fundamentals that are correlated with price movements.*"
4. "*It is difficult to generate protracted price movements in models with homogenous expectations*"
5. To address both "issues", they propose an elegant model where fads (hence, just about any price paths) are possible

The real estate cycle

1. Market Value exceeds Replacement Cost
2. Investment boom
3. Vacancies rise, rents fall, market value falls below replacement cost
4. Supply only responds with a lag
5. Vacancy and rents bottom out
6. Until market value exceeds replacement cost
7. And on we go

"It is difficult to find observable fundamentals that are correlated with price movements."

- That's what Shiller says (and, to his credit, said before the crisis)
- Real rents, if anything, were falling before the crisis, while the real interest rate wasn't
- => Irrational overpricing, he screamed (A bubble!!!)
- Himmelberg et. al. (2005) disagreed: imputed rents near market rents
- That tells us, at least, that the notion that fundamentals "obviously" pointed to overpricing is a stretch
- But more importantly, fundamentals are expected rents and current discount rates. Where do we observer the former?

"It is difficult to generate protracted price movements in models with homogenous expectations."

- That's false
- OG models (Rocheteau and Wright, 2010) and models of informational overshooting (Chatterjee, 2011), to name but two frameworks, can give you whatever you want, with homogenous expectations

Why I don't (and you shouldn't) use the word "Bubble"

- Bubbles occur when an asset's current value cannot be rationalized by future fundamentals
- Virtually untestable
- Bubbles are most certainly not deviations from what the value should be in some frictionless world
- Theory (Santos and Woodford, 1997) says that it's tough for models to produce bubbles

Informational overshooting

- P=E(D+P')/(1+r) where r is the return investors require from a particular investment
- Assume that investors know:
  1. that D will grow by 15% for the next 5 periods;
  2. that they could continue doing so for another 10;
  3. but could stop growing with probability 50% in periods 6,7…15
- Perfectly rational Boom-bust! (See excel file)

Part III: Bank and Repo Runs

Classical bank runs

- Banks transform short-term liquid funds into long-term investments
- Deposits for commercial banks, 24-hour collateralized loans (repos) for investment banks
- A correlated call on liquidity can cause even solvent banks to fail (see Diamond-Dybvig model)
- Banking crisis were common in the US until the introduction of deposit insurance in the 1930s
- Investment banks enjoy no such protection

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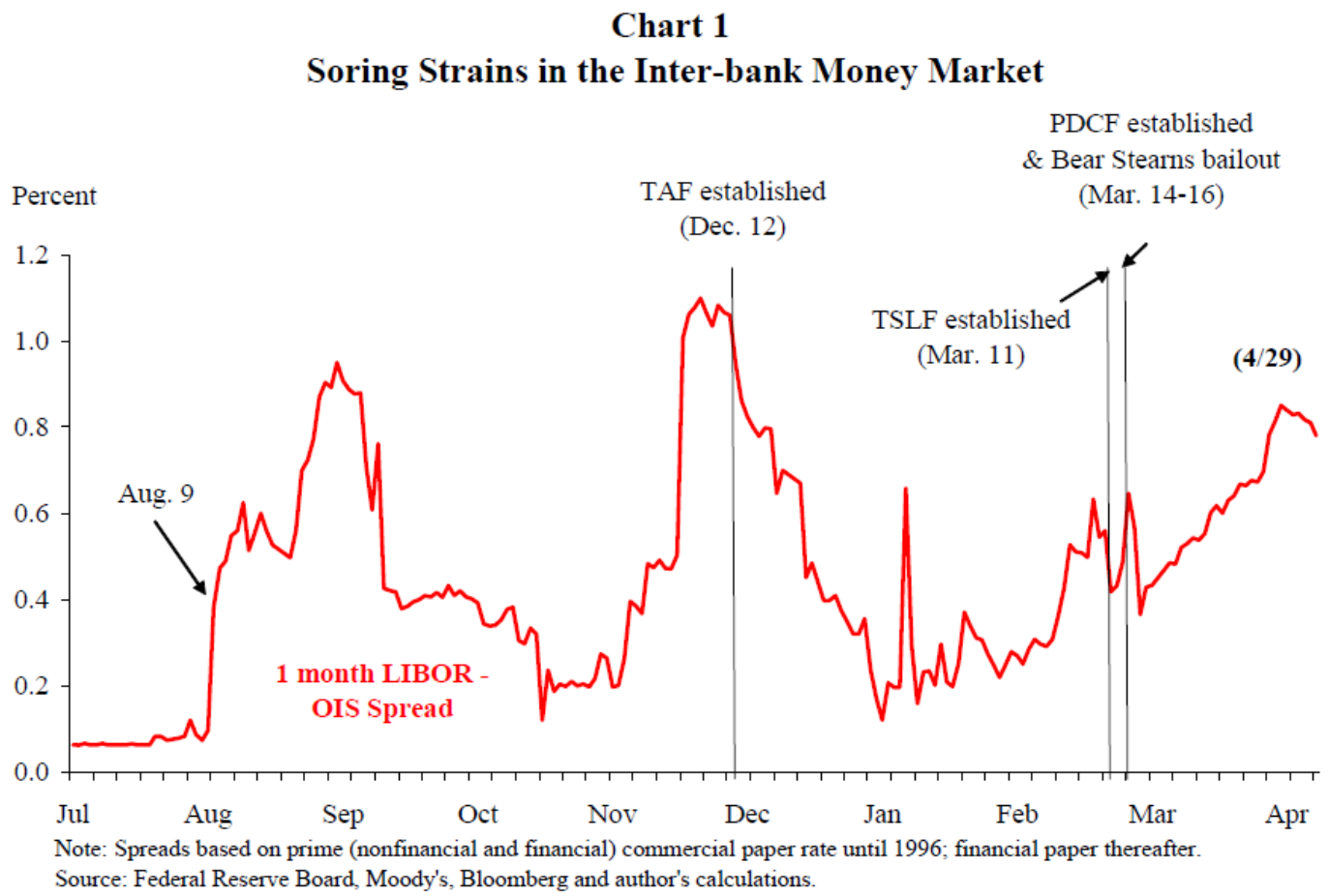
Repo primer

- Institutions need to park cash in a safe, liquid place
- In a repo deal, cash is exchanged for a AAA-rated bond, transaction is reversed 24 hours later
- "Haircut" = Value of Loan / Value of Collateral
- Collateral often gets used in new repo deal ("Re-hypothecation")
- Haircut bounds the volume of loans a $ of collateral can generate
- Creates a "repo chain", which is potentially fragile
- Yet another source of fragility before the crisis is that investment banks tend to use MBS paper as collateral, rather than treasuries

The Fed's liquidity facilities

- With short-term funding markets in distress, the Fed stepped in to serve as the provider of liquidity of last resort via:
  1. traditional open market operations
  2. the discount window (progressive reduction of the Bagehot penalty)
  3. Auction facilities (TAF, TSLF, TALF…)

The Fed says it worked

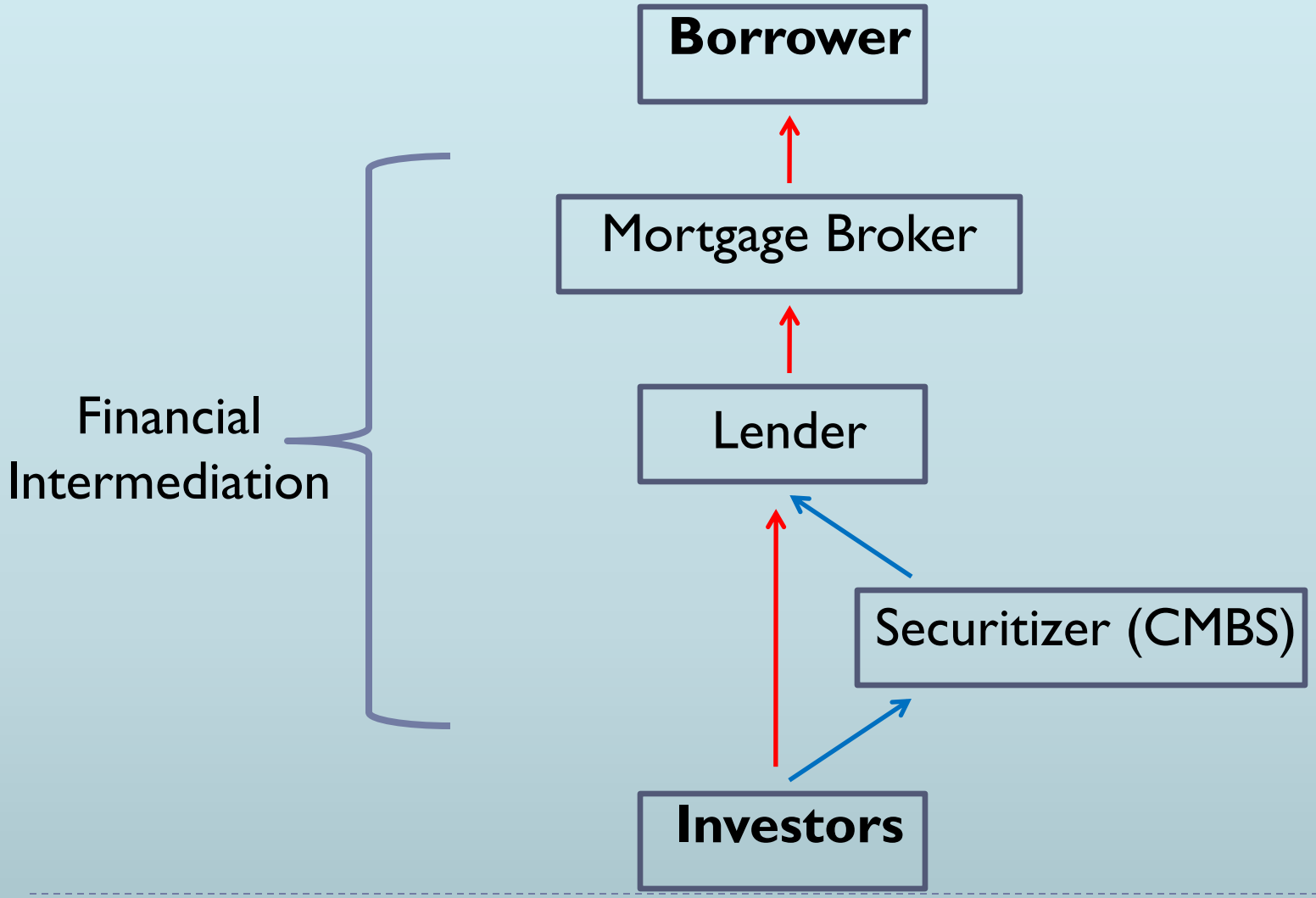


Part IV: The role of non-traditional mortgages

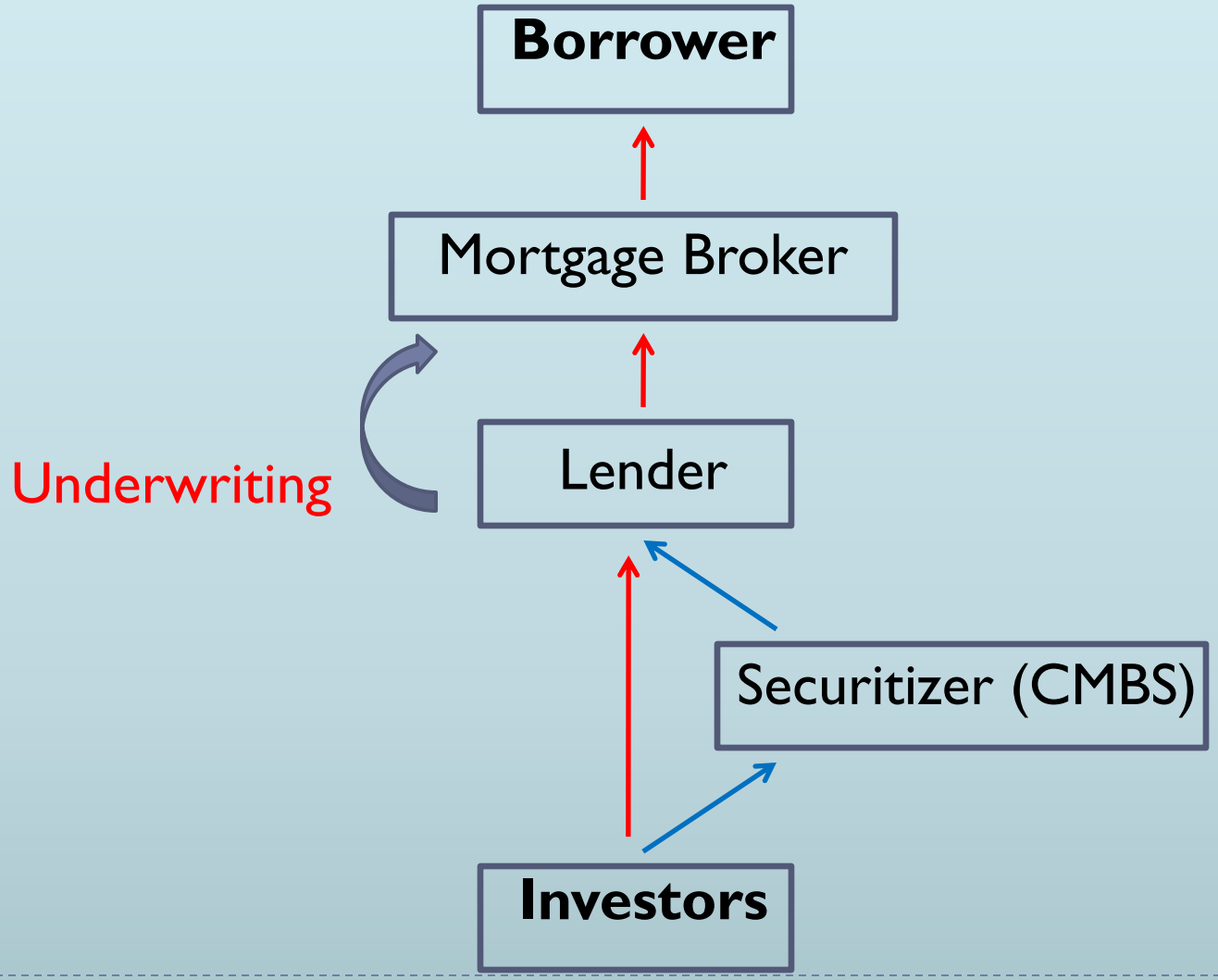
Underwriting gone wild

- The frequency of non-traditional mortgages rose a lot after 2000:
  1. High-risk borrowers (subprime loans)
  2. High LTV (low down-payment)
  3. Delayed amortization
- After the crash, plain-vanilla contracts dominate once again (>90% of originations.)

The mortgage process



Underwriting criteria



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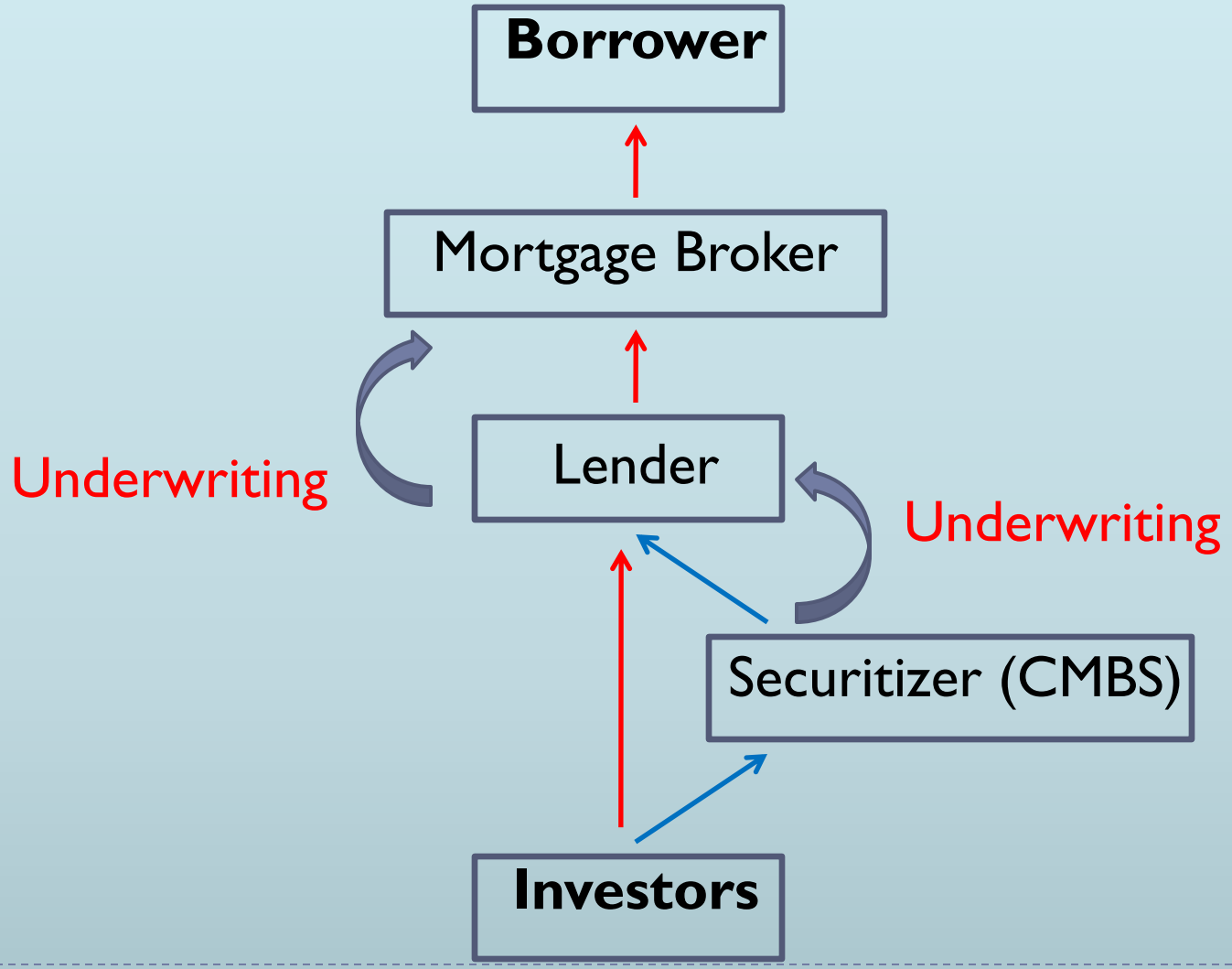

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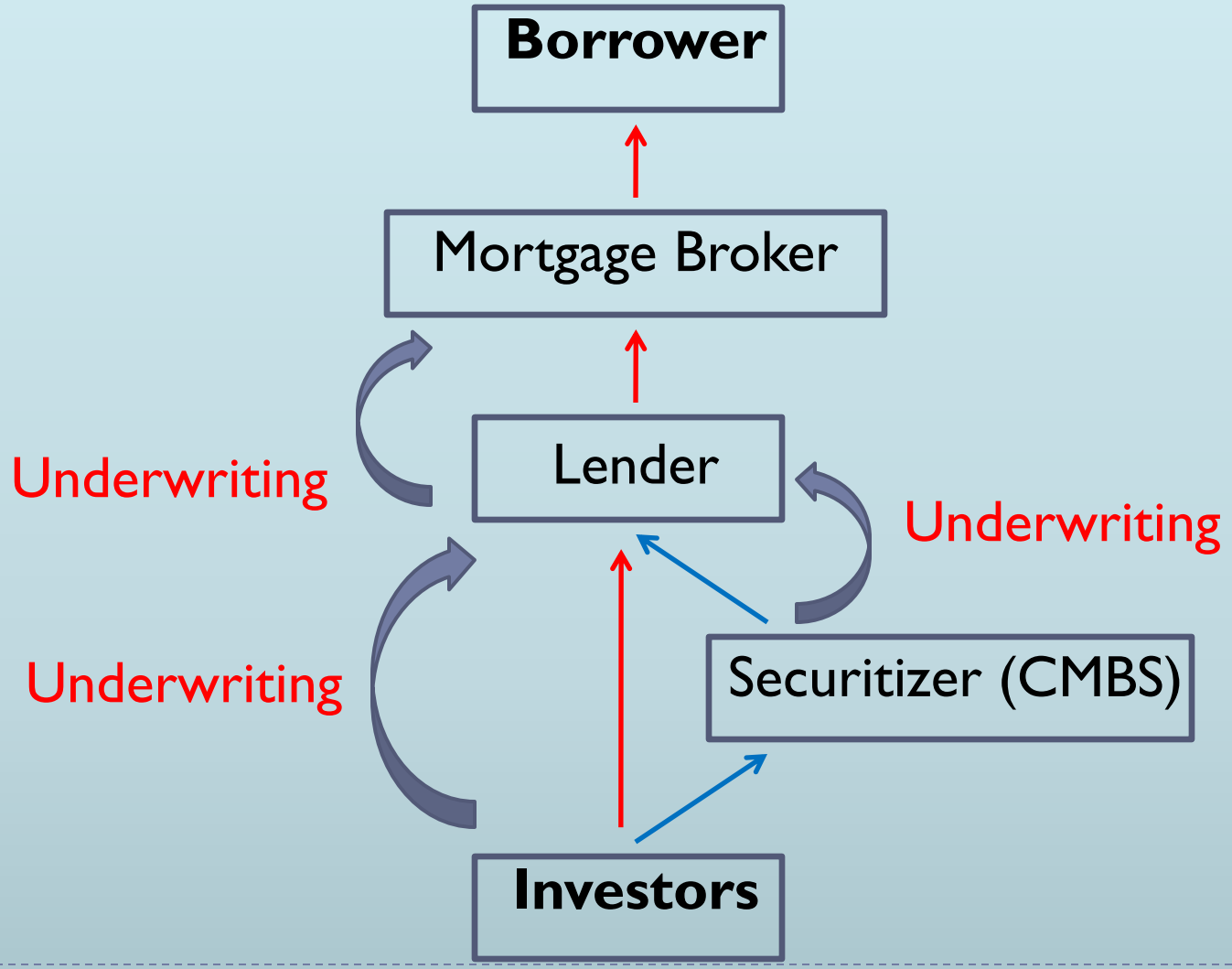


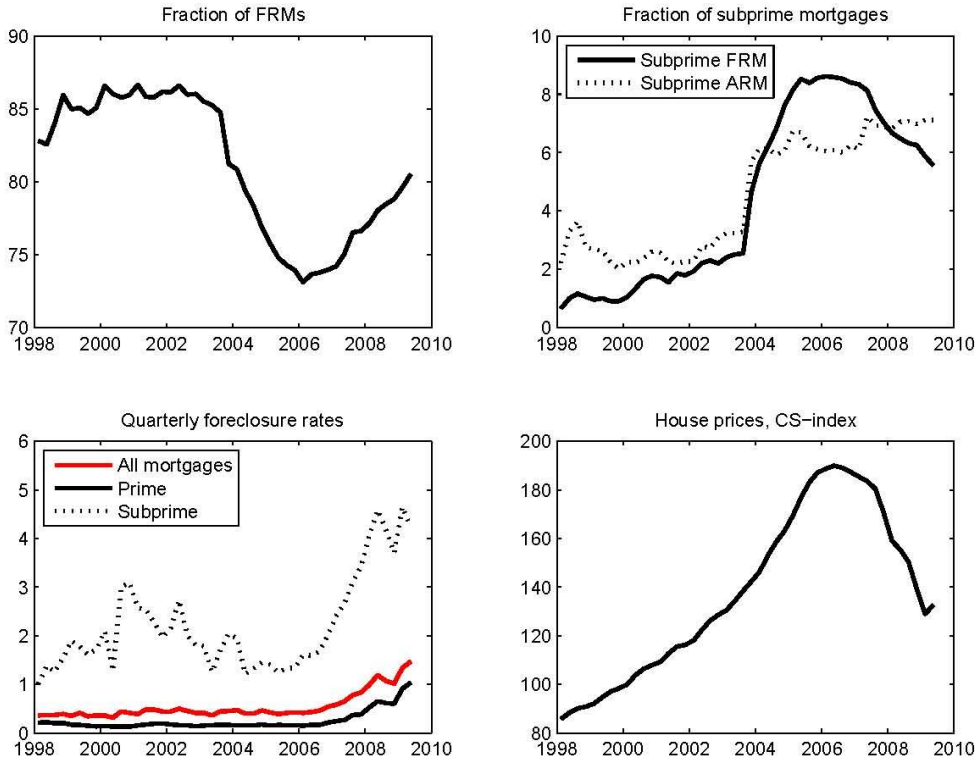
Underwriting criteria

- Lenders tell brokers what they'll fund:
  1. Leverage (loan-to-value ratio)
  2. Credit worthiness of borrowers
  3. Proper documentation
  4. Ratio of projected cash-flows to debt-service
  5. …
- Likewise, securitizers tell lenders what they'll buy
- When secondary markets are involved, lenders pass underwriting standards on to brokers

The foreclosure crisis

- Between 2004 and 2006, underwriting standards were greatly loosened in the residential market
- Low-down payment, delayed amortization products gained ground
- High-risk borrowers entered market, and products with slow build-up of equity proliferated
- When house prices collapsed in mid-2006, foreclosure rates skyrocketed like never before

Recent trends in US housing



Source: National Delinquency Survey, Mortgage Bankers Association

Solving the foreclosure crisis

- Almost all foreclosure involve negative equity…
- … but most households with negative equity do NOT foreclose absent something else
- Second trigger: income difficulties (e.g. job loss)
- Obama plan subsidizes loan modification. It won't help much.
- Instead, plan should offer mortgage payment vouchers to households with verifiable income difficulties
- This is the Wi-Fur/Boston Fed plan

Mortgage math

- Mortgage: debt contract secured by a real estate property
- Characteristics:
  1. Initial balance or principal (b_0)
  2. Maturity (T)
  3. Yield (or contract rate) structure (r_t, for all periods t)
  4. Payment structure (m_t, for all periods t)
- Mechanics:
  1. At a given date, interest due is $b_{t-1}\ r_t$
  2. $b_t = b_{t-1} + b_{t-1}\ r_t - m_t$
  3. If $b_T > 0$, balance is due in one *balloon payment*

Some language, and notes

- Mortgage whose balance is zero after T periods ($b_T=0$) are called *fully amortizing*
- Yield can be fixed, vary on a fixed schedule, or according to some other market rate
- Amortization can be negative -- balance can grow -- from one period to the next (if $m_t<b_{t-1}\ r_t$)
- *Interest-only mortgages* (IOMs) have payments equal interest due ($m_t=b_{t-1}\ r_t$) for part of the contract

FRMs: fixed-rate, fully amortizing mortgages

- For all t:
  1. $r_t = r$
  2. $m_t = m$
- Fully amortizing: $b_T = 0$
- What must m be? (Fixed annuity formulae)
- $m = b_0 \, r \, / (1-(1+r)^{-T})$

Fixed payment example

- 100K, monthly payments, 10 years, r=7%

1. With full amortization: m=$1,161.08
2. With 30K balloon: m=$ 987.76

The lender's perspective

- Full amortization means:

$$b_T = 0, \quad \text{or, equivalently,} \quad b_0 = \sum_{t=1,..T} m_t / (1+r)^t$$

- More generally:

$$b_0 = \sum_{t=1,..T} m_t / (1+r)^t + b_T / (1+r)^T$$

- Absent points and whether or not amortization is full, r is the loan's IRR <u>if all payments are made</u>, i.e. the APR or YTM

Yield vs. return

- Yield (APR)is the lender's IRR if **and only if** all payments are made as planned
- In practice, borrowers default, fail to make payments on time, refinance or prepay when interest rates are low,…
- Causes transaction costs, and capital losses
- IRR<APR
- Riskier borrowers should pay more
- But paying more makes default more likely…
- Fixed point problem, which may or may not have a solution: market exclusion

Underwriting and default

- A slow-build up of equity means that any value shock becomes more likely to push loans underwater…
- Making borrowers one shock away from defaulting…
- At a time when shocks become ever more frequent
- => Mother of all foreclosure crisis
- Corbae and Quintin (2010) find that high-leverage (alone!) can account for half of the current crisis

Part IV: The role of recourse

Recourse clause

- **Exculpatory Clause**: removes the borrower from responsibility for the debt, giving the lender "no recourse" beyond taking possession of the collateral which secures the loan

- Absent this clause, lender can pursue a *deficiency judgment* in most states and go after the owner's other eligible assets, or the eligible assets of any guarantor

Default

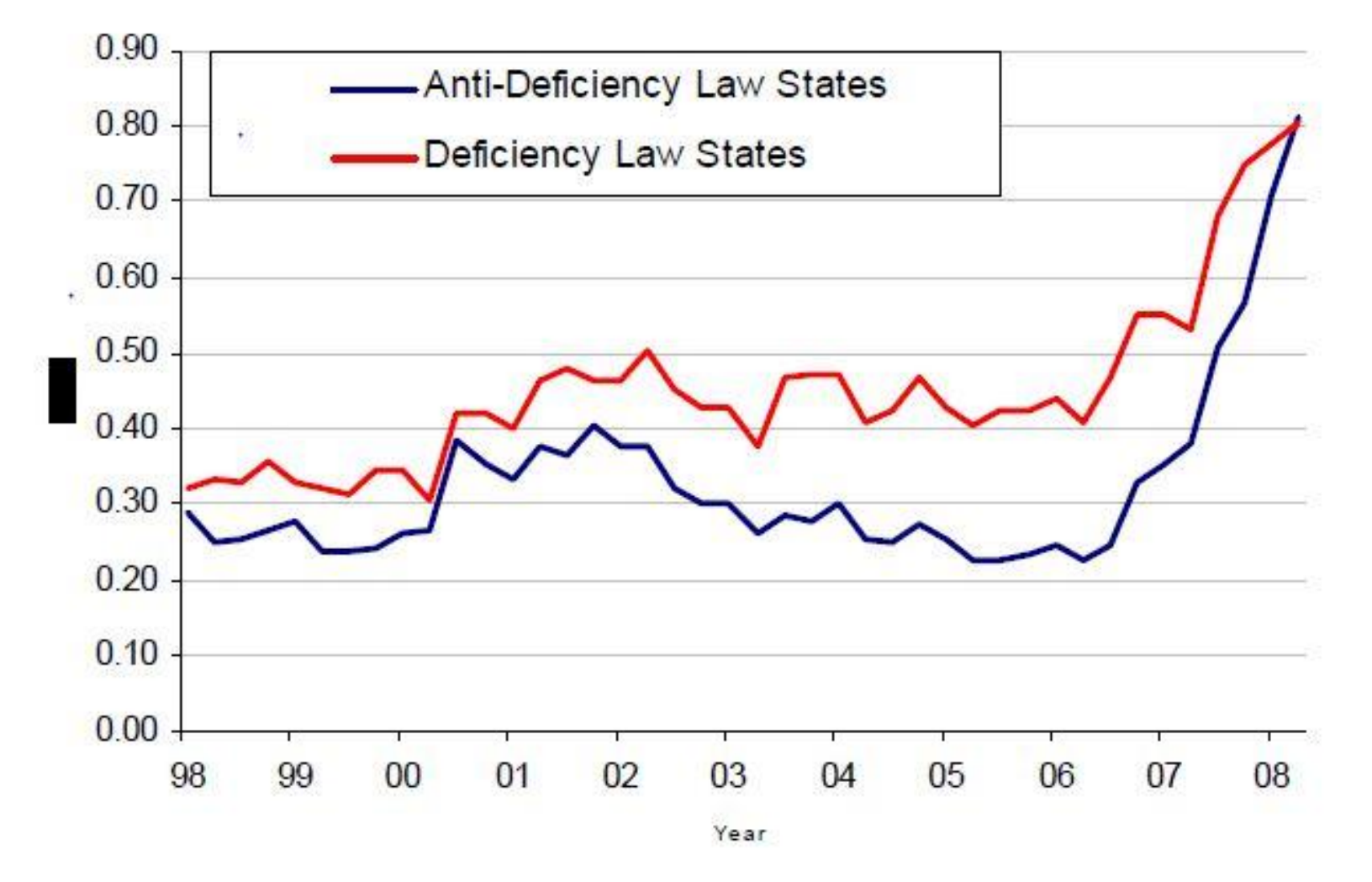
- When default occurs, lenders first pursue non-litigious actions:
  1. Grace period, with penalties
  2. Loan modification / workout (rare)
  3. Short sale
  4. Deed in lieu of foreclosure ("amicable" property transfer to lender)
  5. Loan transfer to a "White Knight"

- When that does not work, lenders turn to legal/litigious actions
  1. Warning shots: notice of intent, sue for specific performance, …
  2. Foreclosure: forced sale

Deficiency judgments

- In some states, on some contracts and by law, borrower's liability is limited to collateral, even without an explicit exculpatory clause
- In most states, lender can pursue a deficiency judgment when foreclosure proceeds fall short of borrower's total obligations
- Requires a judicial sale
- Court determines "fair value" of asset, lender can sue for difference between remaining obligation and fair value
- In principle, recourse should deter default
- In practice, conventional wisdom is that lenders seldom pursue deficiency judgments because they are money-losing propositions

Foreclosure rates by deficiency regime



- Source: Garriga and Schlagenhauf, 2009

Deficiency and default

- States where deficiency judgments are allowed do not seem to have systematically lower foreclosure rates
- Could be due to differences in the composition of the pool of borrowers, and differences in business conditions
- Research into the residual effect of deficiency status yields mixed results
- Perhaps this is not surprising:
  1. Expected returns to deficiency judgments are small
  2. Even if deficiency does deter default, lenders would set tougher standards in anti-deficiency states (selection)

More punishment, less default?

- The effect of punishment on average default rates are fundamentally ambiguous
- However (if credible and under plausible conditions) punishment does lower the likelihood that a particular borrower will default
- There is little doubt, in fact, that toughening punishment must eventually cause default rates to fall
- See France vs. the US (as argued by Feldstein, 2011)

Part IV: The role of securitization

An amazing technology

- Basic idea:
  1. Pool a large number of mortgages
  2. Sell the pool as a security, or use the pool as collateral for one or more debt instruments (bonds)
- Purpose:
  1. Allow more investors to invest in real estate debt instruments
  2. Make that investment more liquid
  3. Pool/fine-tune risk

A machine to generate AAA paper

- Why did securitization take off after 2000?
- Among other things because AAA paper became scarce largely due to the global saving glut (US paper hogs)
- AAA paper lubricates many key markets, the repo market in particular
- Where to find it? There is, after all, only so many blue chip issuers
- Answer: CMOs
- Housing boom created endless supply of mortgages, only trick is to somehow issue safe bonds backed by unsafe assets
- Sounds crazy, but it "works": no AAA tranche of any CMO deal has defaulted to date (many have been downgraded, but none have formally defaulted)

The subordination theorem(s)

Theorem I: Risk-free debt can be written against a pool *if and only if* the worst-case scenario CF realization from the pool is strictly positive

Proof: Let A be the lowest possible CF realization associated with the pool. Make the quantity of debt small enough that the promise is A or less.

Theorem II: Debt with less than a probability p of default can be written against a pool *if and only if* the CF realization is strictly positive with probability 1-p

Proof: Let A be such that P(CF>A) > 1-p. Make the quantity of debt small enough that the promise is A or less.

How about them CDOs and CDO^{2}s?

- Junior tranches of MBS are often pooled into new deals, often out of necessity (*investors won't pay much for stand-alone B tranches*)
- If combining these tranches raises the lower bounds on overall cash-flows, more AAA paper can be produced with the right level of credit support
- The problem: getting the level of credit support right
- Top tranches of many CDO deals defaulted, which means that people overestimated the ability of pooling to dissipate systematic risk

The game investment banks play

- If you get the following trivial point, you understand securitization better than most people who say they understand securitization

- Given a pool of assets, investment banks choose a feasible security scheme E to write against a given pool of assets to solve:

$$\text{Max } MV(E) - C(E)$$

where MV(E) is the market value of scheme E given investors' willingness to pay for various type of assets while C(E) is the cost of issuing that combination of securities and funding the assets

- After 2000, the scope of securitization widened markedly to include riskier pools of assets because the willingness to pay for top tranches made deals profitable that weren't before

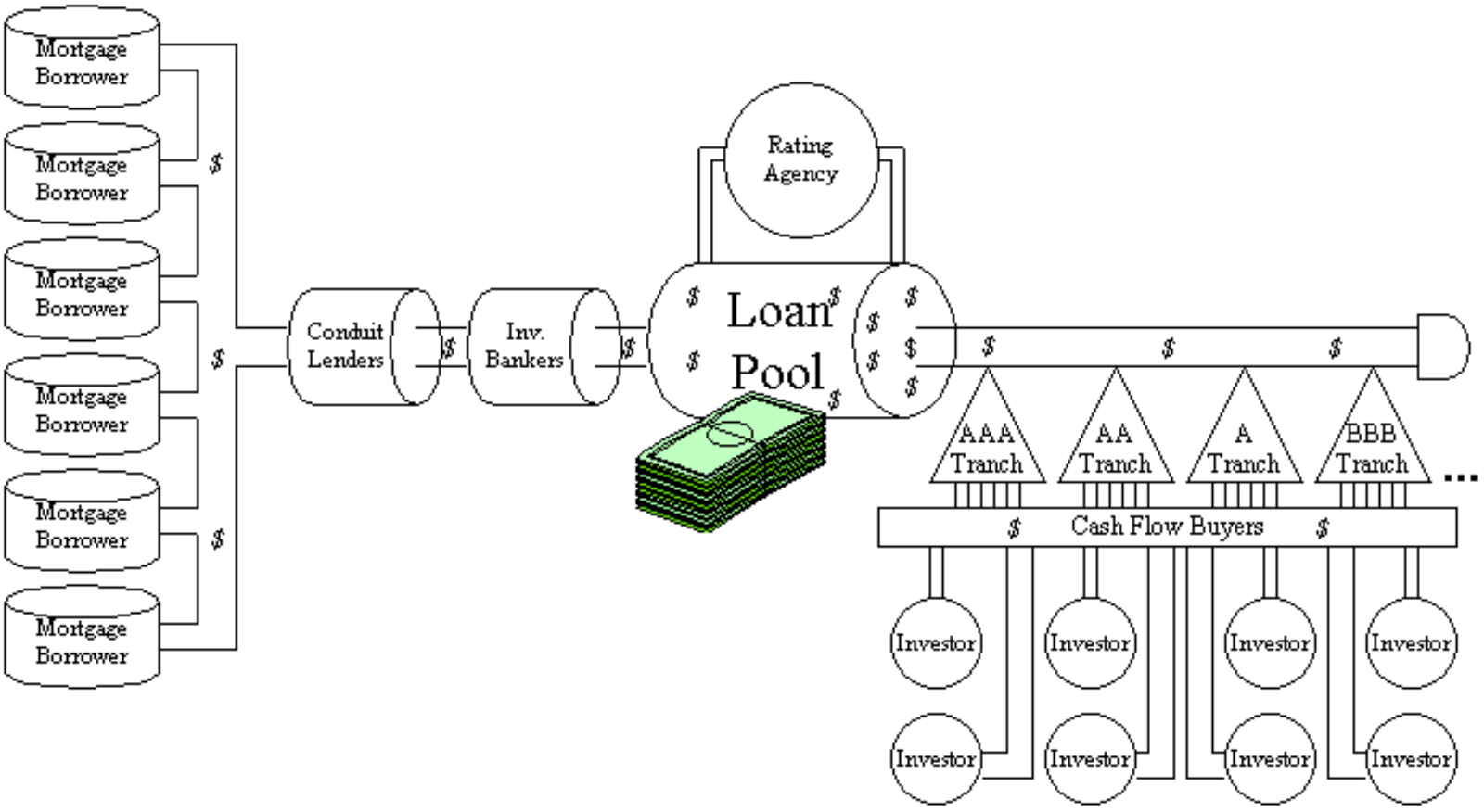
Mortgage securitization: a short history

- The US government wanted liquid secondary markets for mortgages after the great depression: FNMA (1938), GNMA (1968), FHLMC (1970)
- Ginnie issues first pass-through in 1968
- Bank of America issues first private label pass-through in 1977
- Solomon Brothers and First Boston create the CMO concept in 1983

Securitization process

1. Mortgages are originated
2. Sold to and pooled by investment banker
3. Pool is used to create one or several securities:
    i. Mortgage-backed bonds (MBBs)
    ii. Mortgage pass-through securities (MPTSs)
    iii. Mortgage pay-through bonds (MPTBs)
    iv. Collateralized Mortgage Obligations (CMOs)

CMBS Securitization Process



More CMBS language

- Once pooled, mortgages are usually transferred to a trust
- *Real Estate Mortgage Investment Conduit* (REMIC) are untaxed, pass-through entities that:
  1. Hold a fixed pool of mortgages
  2. Distribute payments to investors
- *Pooling and servicing agreement (PSA):* specifies how loans will be serviced, and how proceeds and losses are to be distributed to investors
- *Servicers (Primary, Master, Special):* administer the loans

Basic example

- Consider a pool of 1,000 identical FRMs with initial balance $75,000 (each), contract rate 11%, and yearly payments
- If all goes according to the plan, $12,735,107 in P&I will be collected each year on these mortgages until maturity
- This pool can be securitized in at least 4 fundamental ways, I'll discuss the two most common ones

Mortgage pass-through security (MPTS)

- Mortgage originator pools mortgages and sells equity (ownership) rights to investors
- All cash flows net of fees are "passed through" to investors
- No overcollateralization necessary

Basic example of an agency MPTS

- Take same pool as before
- Investors purchase certificates (equity shares) in the $75M pool and receive payments in proportion to their initial investment
- 0.5% goes to GSE, 10.5% is passed through, along with the principal

Collateralized Mortgage Obligations (CMOs)

- CMOs are debt instruments issued using a pool of mortgages as collateral, with the pass-through features of MPTBs
- *Ex Uno Plures*: several classes of securities are issued against the same pool of mortgage, ordered by priority
- Each class of security is called a *tranche* (slice)
- Each tranche has its own risk characteristics, and can be sold to investors with different objectives
- Completes the market: new sources of fairly safe fixed income instruments
- Sum of PV of the pieces > PV(Pool)

CMOs: example 1

- Back to our $75M pool of FRMs
- 3 tranches:
  1. A: 9.25% rate, $27M face value
  2. B: 10% rate, $15M face value
  3. Z: 11% rate, $30M face value
- Payments available for reduction of principal of A and B: Principal payments from pool + Interest Payments on Z
- Go to A first, then B
- Once A and B are retired, Z gets paid

What is the fuss about securitization?

- Can reduce incentives for originators to do their homework
- Obfuscates risk
- Securitizers dictate what products are offered, for better or for worse
- Not particularly compelling, if you ask me…
- Much more compelling (heck, undeniable): higher demand for AAA made deals profitable that were not profitable before