

# Macro Prudential Research after The Crisis

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# Worshiping Interest Rates

- The public, the press, and the central banks of the world **focus almost exclusively on the riskless interest rate** as the determinant of **credit**.
- Output and employment too low: central banks should lower interest rates. Output too high: raise interest rates.
- Usually short run riskless interest rate.
- Radical departure that proves the point; forward guidance and quantitative easing in order to lock in future short run interest rates.

# Fear of Default

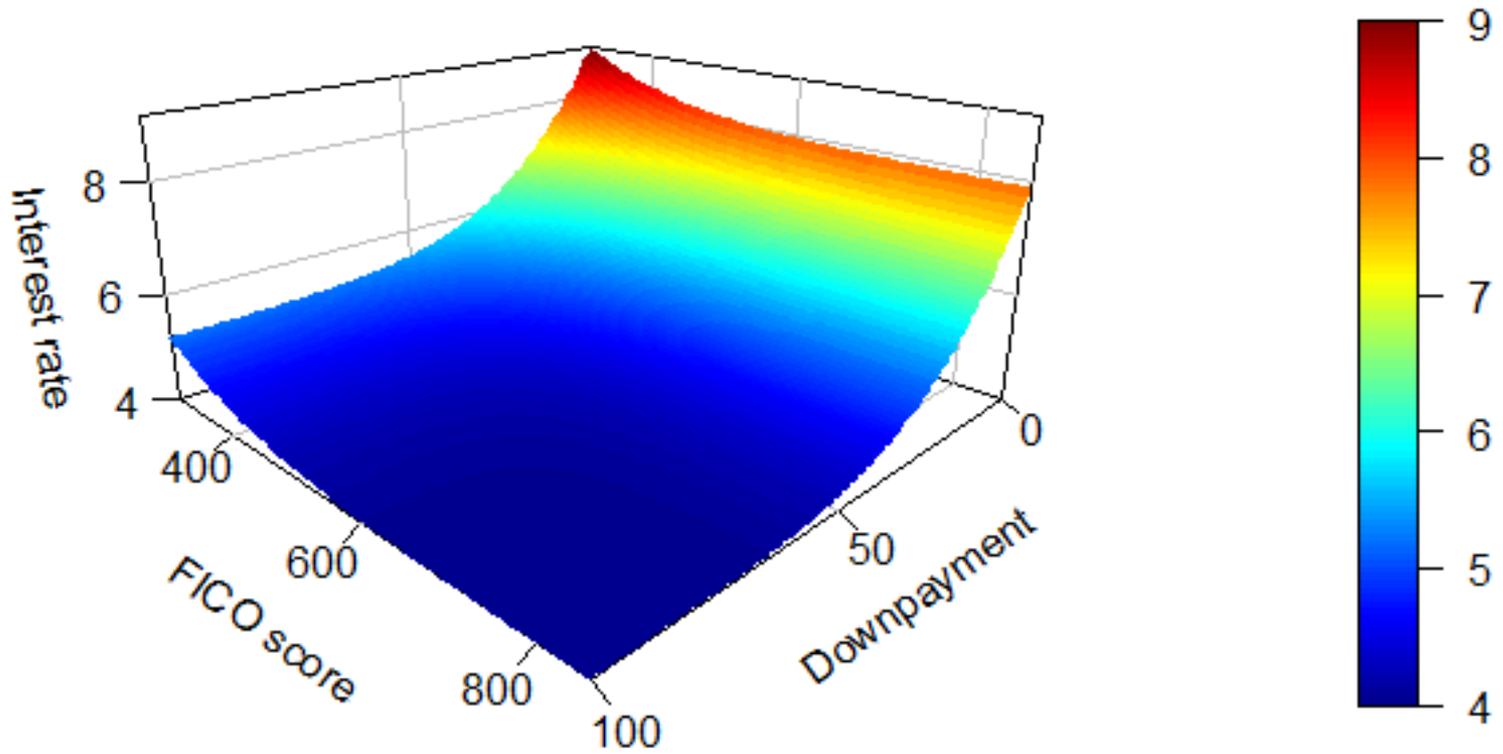
- Default emerged from the crisis as one of the central problems in macro economics, and a central problem in macro prudential policy.
- Before the crisis, the possibility and consequences of default were almost entirely missing from macro economics.
- The rational fear of default is often more important than the default.

# Old Fashioned Default Models, if one could find them in macro

- Understood default as a change in the payoffs of a loan.
- Observed that loans with different anticipated payoffs would trade at different interest rates.
- Concluded that a riskier world would lead to bigger losses per dollar promised and higher interest rates.

# Default and Credit Terms

- However, lenders worried about default do not simply raise interest rates. They change other terms of the contract.
- For example, they ask for collateral (lower LTV), or high credit ratings, or proof of high wealth per dollar borrowed or high income per dollar borrowed (low DTI).
- Credit is described not by a number but by a surface.



Credit Surface

# Credit Terms and Credit Tightness

- As FICO gets close to perfect, and collateral gets huge, the credit surface will become flat, and the required interest rate will approach the riskless rate.
- Two credit surfaces can have the same riskless interest rate, but reflect entirely different credit environments, if surfaces not flat.
- Credit tightness does not mean just a high (riskless) interest rate. Tightness might be measured by steepness of credit surface (not absolute height). Analogous to spreads. Or another measure mentioned shortly.

# Mapping the Credit Surface

- The credit surface is the most important representation of credit conditions in the economy.
- Yet it is very difficult to find more than bits and pieces of it.
- The central banks of the world should be mapping it out and publishing it periodically.
- And they should be forecasting it.
- And I think they should be managing all of it, not just riskless interest rates!

# Mapping Realized Credit or Flow of Funds

- Realized credit trades are points on the credit surface.
- Can count the volume or number of loans at each point on the credit surface to see credit picture of economy.
- Could also label it with type of borrower.
- This is flow of funds data, but even that is not so easily accessible.

# Significance of Tight Credit

- Many people who would want to borrow more at the riskless interest rate if default meant death, are unable to get bigger loans without putting up more collateral or getting a better credit rating.

# Liquidity Value and Collateral Value

- Hence marginal utility of loan differs from price.
- **Liquidity value** = price willing to pay for loan – price of loan  $> 0$
- **Liquidity wedge** = price willing to pay for loan / price of loan  $> 1$
- measures of tightness of credit markets
- But that implies
- **collateral value** = price willing to pay for asset that can be collateral – payoff value of the dividends of the asset  $> 0$
- Also willing to pay (bribe) for higher credit rating

# Bubbles

- The necessity of collateral to guarantee promises would appear to reduce investment and the value of goods people must borrow to buy.
- But it may be the reverse. The scarcity of collateral can raise its price above the Arrow Debreu price causing a bubble and overinvestment.

# Credit Surface Equilibrium

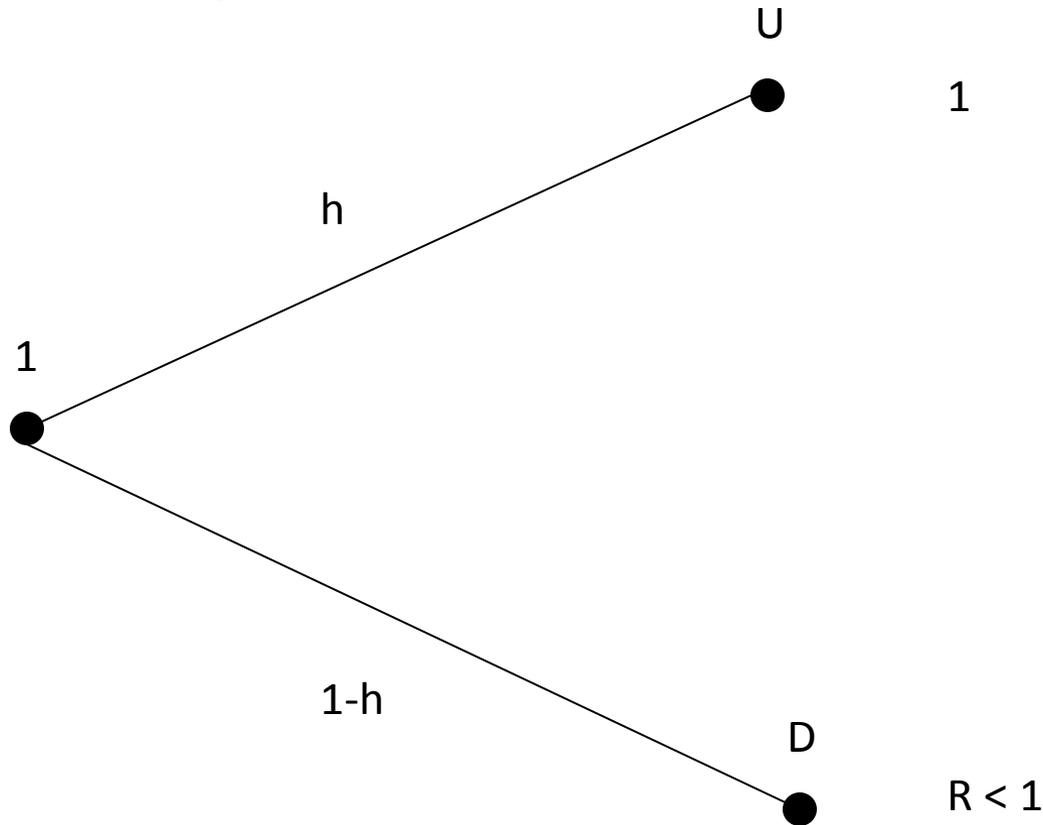
- Driven not just by impatience and productivity and growth, as is the case with credit models without uncertainty, but also by the perception of default losses.
- Greater fear of default implies a tighter credit market, not just higher interest rates.
- Key idea: Perception of greater losses does not move credit surface up in parallel, but tilts the credit surface to reduce the expected equilibrium defaults.
- Paradoxically, a safer world can create generate more equilibrium defaults.

# Collateral Equilibrium and Volatility

- Most interesting and important credit term is collateral. Collateral equilibrium is special case where the only term considered is collateral or leverage.
- Source of risk in collateral equilibrium is volatility of asset values.
- Can see in collateral equilibrium that as volatility goes up, credit markets tighten (leverage goes down, liquidity wedge goes up).

Geanakoplos 2003  
Fostel-Geanakoplos 2013

Asset Payoff



**Binomial No Default Theorem:** If binomial tree and agents get no utility from holding collateral, (like with REPO) then no default in equilibrium. Only non-contingent promise traded is  $(R,R)$ . Hence volatility up ( $1/R$  goes up) implies leverage down.

<sup>15</sup> (If utility from holding collateral, like housing, then can have default in equilibrium.)

More Leverage →  
Higher Asset Prices

Low Leverage →  
Lower Asset Prices

- Leverage gives optimists more buying power.
- Relies on no short sales.

# Marginal Buyer Theory of Price



Natural buyers = Optimists  
Marginal buyer

Public = Pessimists

If no short selling. That's why CDS became important.

# Leverage Cycle

- Long period of Low Volatility
- Leverage goes up because of low volatility and gradual innovation
- Optimists acquire more and more of assets
- Asset prices go up
- Debt goes up for two reasons.
- Sets stage for crash

# Leverage Cycle Crashes



Price falls more than any agent thinks it ought to because marginal buyer changes

Even worse if CDS suddenly appears

# Why can there be too much Leverage in a world of rational agents?

- More leverage raises asset prices at first by enabling natural buyers to purchase more, but reduces them later because natural buyers are so far in debt.
- Constraining leverage thus changes prices and can redistribute wealth to provide more insurance.
- Underwater borrowers do not fix their houses; limiting leverage will raise prices in crisis and reduce number of underwater homeowners.

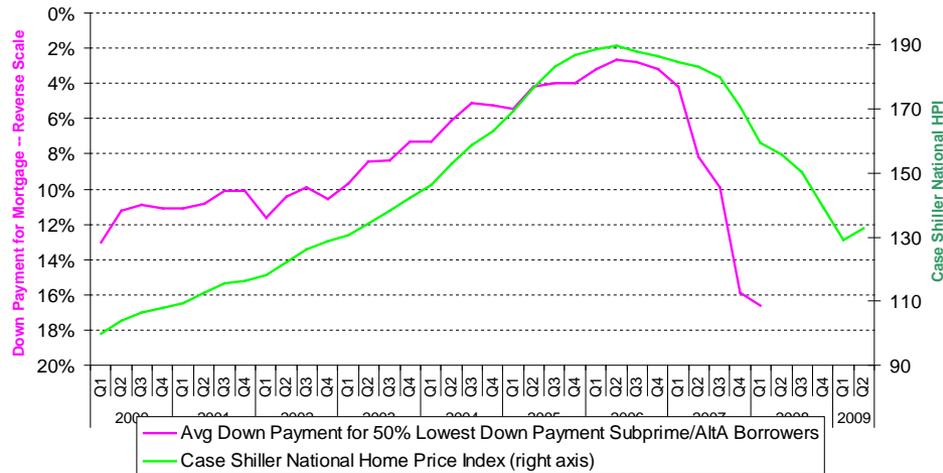
# Credit Cycle big contribution

- Credit cycle literature (Bernanke, Gertler, Gilchrist, Kiyotaki Moore, Holmstrom-Tirole) emphasizes diminution in investment and prices because people are limited in how much they can borrow to spend on goods by need to post collateral, or put own skin in the game.
- Credit cycle emphasizes multiplier-accelerator: higher asset-collateral values means (at fixed LTV) higher loans which means more investment which means more activity and higher asset values.

# Credit Cycle vs Leverage Cycle

- Credit cycle literature missed collateral value and bubbles and overproduction.
- Missed dramatic changes in leverage which create dramatic changes in asset prices, in both boom (over-leverage) and bust (de-leverage) phase.

### Housing Leverage Cycle Margins Offered (Down Payments Required) and Housing Prices

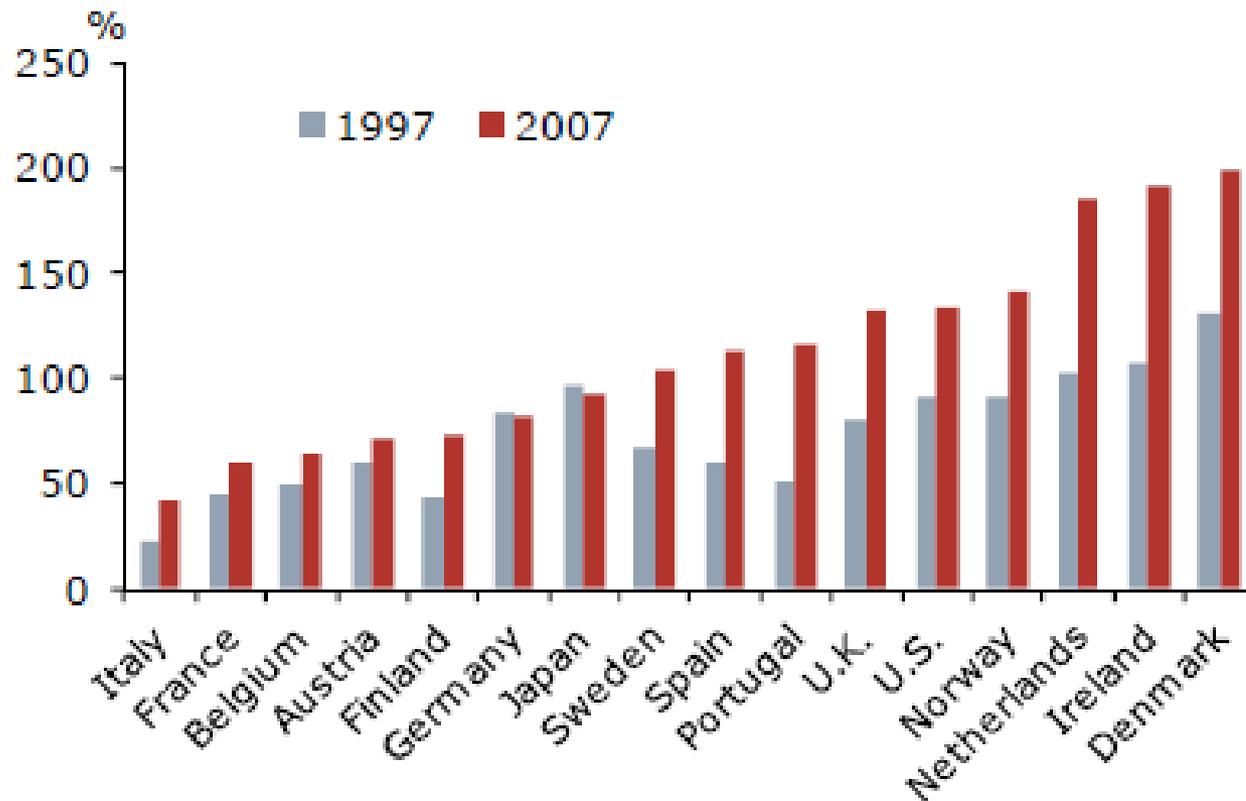


Observe that the Down Payment axis has been reversed, because lower down payment requirements are correlated with higher home prices.

Note: For every AltA or Subprime first loan originated from Q1 2000 to Q1 2008, down payment percentage was calculated as appraised value (or sale price if available) minus total mortgage debt, divided by appraised value. For each quarter, the down payment percentages were ranked from highest to lowest, and the average of the bottom half of the list is shown in the diagram. This number is an indicator of down payment required: clearly many homeowners put down more than they had to, and that is why the top half is dropped from the average. A 13% down payment in Q1 2000 corresponds to leverage of about 7.7, and 2.7% down payment in Q2 2006 corresponds to leverage of about 37.

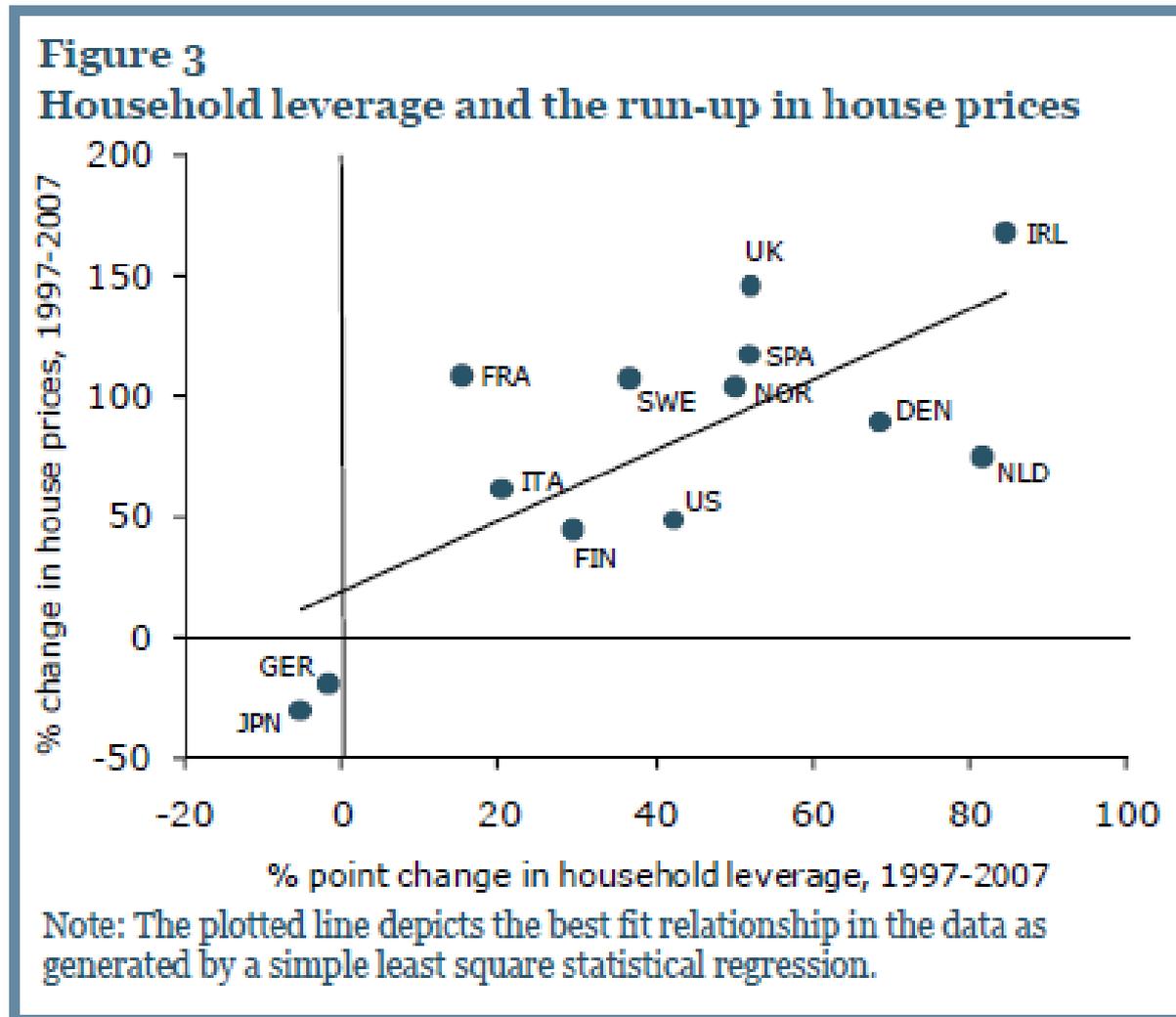
Note Subprime/AltA Issuance Stopped in Q1 2008.

**Figure 1**  
**Household leverage ratios: Debt to disposable income**

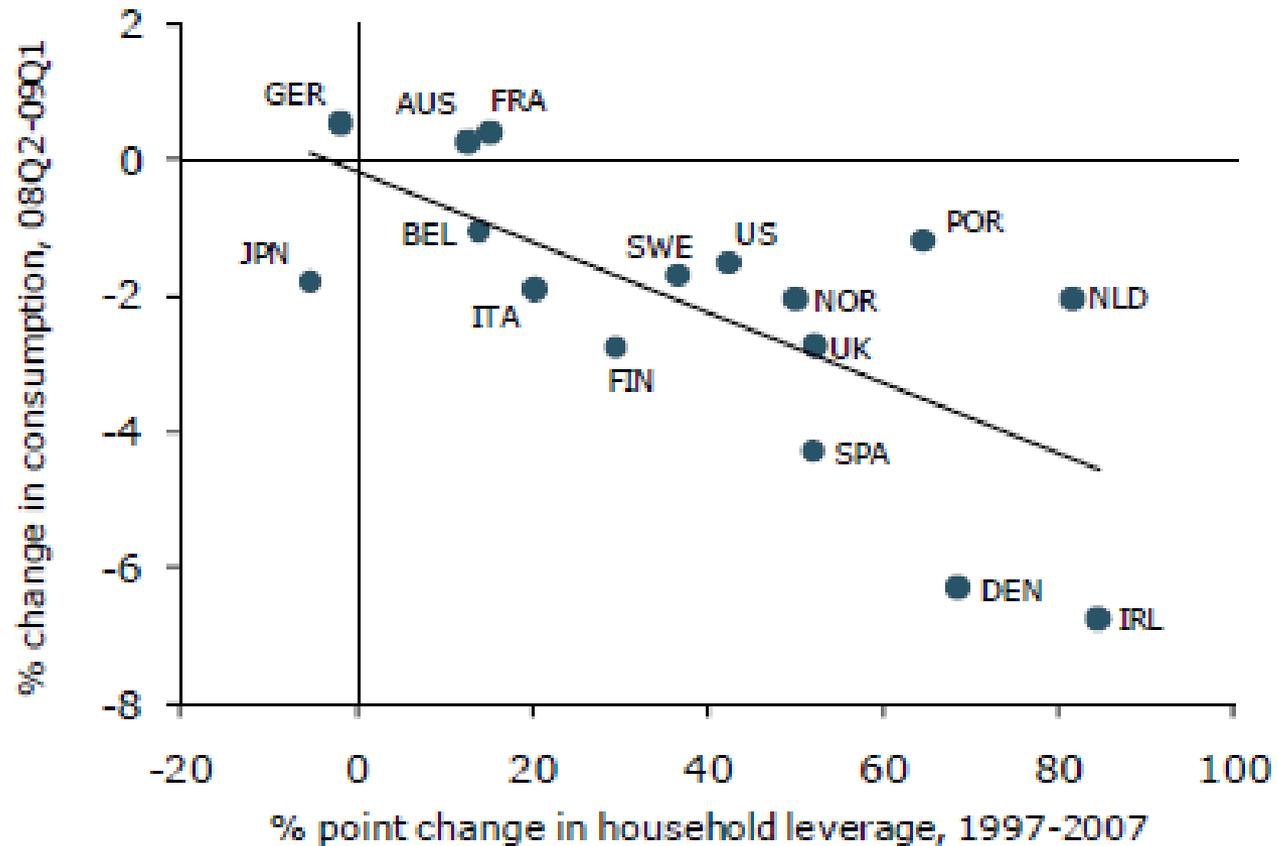


Note: The following countries use different data years: Japan 1997, 2006; Spain 2000, 2007; Ireland 2002, 2007.

Leverage is debt to equity in this San Francisco Fed study



**Figure 4**  
**Household leverage and the decline in consumption**



Note: The plotted line depicts the best fit relationship in the data as generated by a simple least square statistical regression.

# Subprime debt should have been written down

- Losses from foreclosure are horrible. Get on average 23% back on loan from foreclosing a subprime loan.
- Takes 18 months to 3 years nowadays to throw somebody out of his house.
- Mortgage not paid, taxes not paid, house not fixed, house often vandalized, realtor expenses etc.
- If write down principal on subprime loans, get more for lender and borrower!
- Example: \$160,000 loan, \$100,000 house. Could write down to \$80,000 or \$90,000.

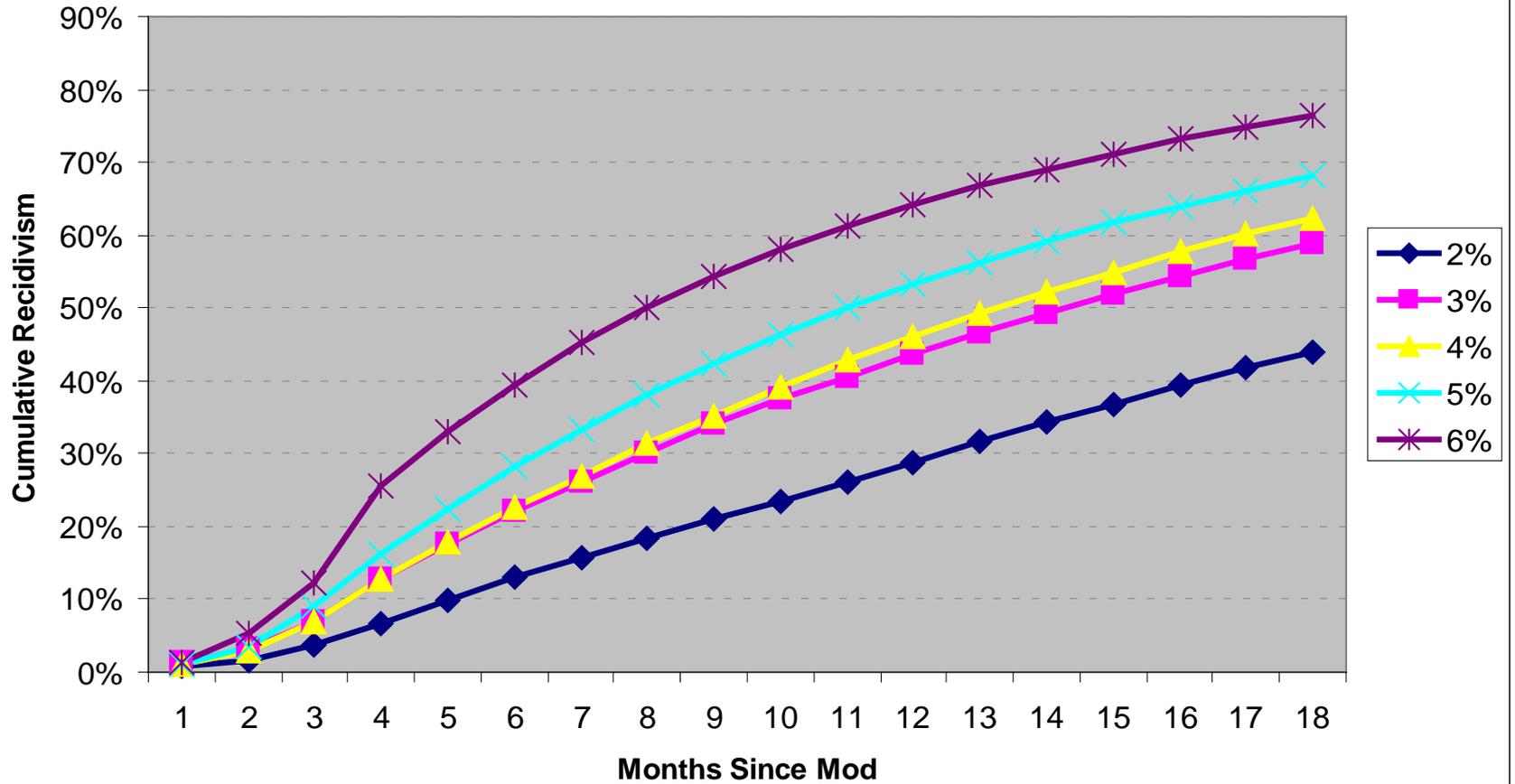
# Foreclosure Policy Mistakes

- Thought that temporarily writing down interest would make a big difference
- Thought could give small incentives to Servicers and Banks and they would make modifications

# Warned 5 Years Ago

- Geanakoplos-Koniak in October 2008 NY Times Op-Ed “Mortgage Justice is Blind” explained why Servicers would never do proper modifications. Advocated community bankers.
- NY Times Op-ed March 2009 “Principal Matters” advocated writing down principal as only solution.

### Subprime Cumulative Recidivism by Coupon and Months Since Mod



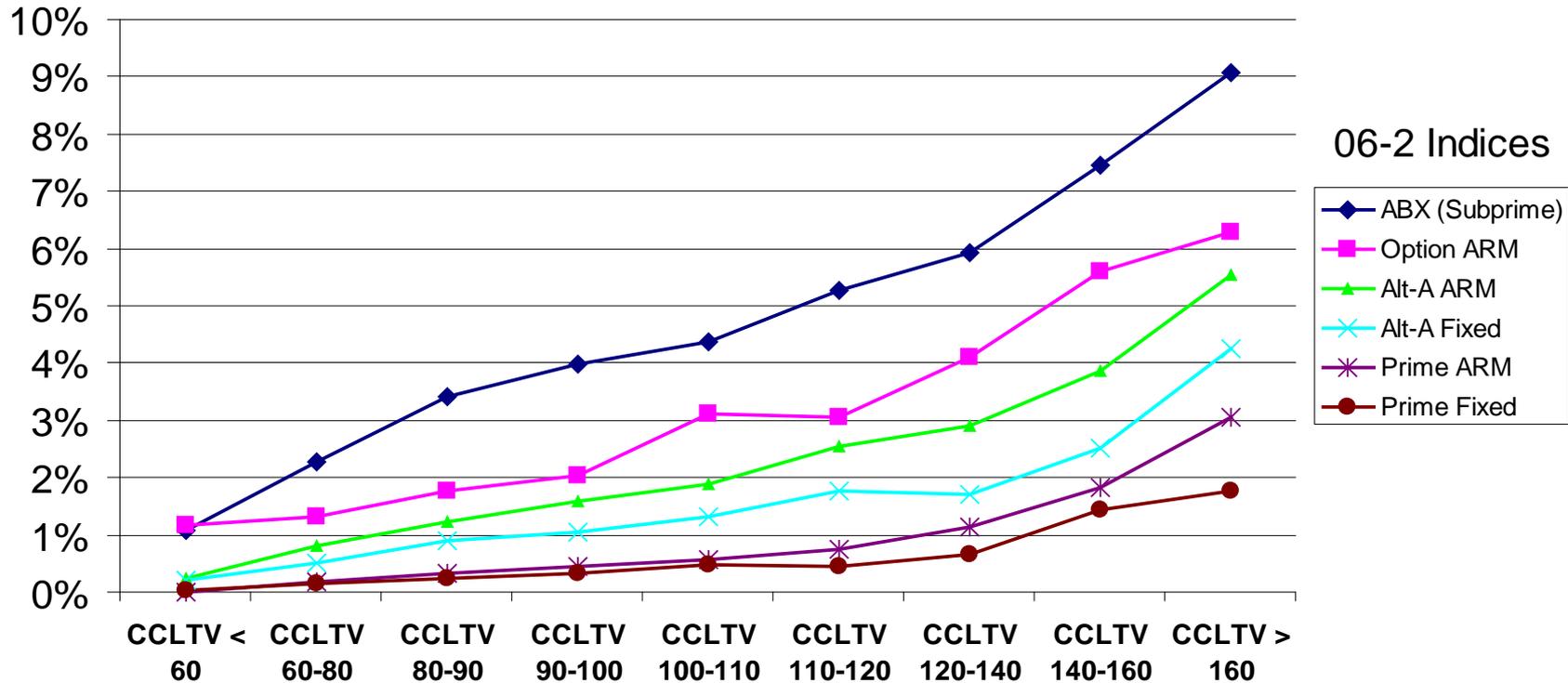
# Community Bankers

- Government could hire community bankers in each area.
- Loan information would be sent to them.
- Their job would be to modify loans to make as much money as possible for **lender**.

# Default, Punishment, Forgiveness

- Idea that defaulting is morally reprehensible.
- Or that forgiving loans would create moral hazard and encourage future default.
- And prevent lenders from lending.
- All wrong.

**Net Monthly Flow (Excluding Mods) from <60 days to >=60 days DQ**  
**6 Month Average as of Jan 09**



# European Leverage Cycle

- Household borrowing problem in many countries
- Banks overleveraged.
- But also sovereigns overleveraged. (Because of implicit guarantees being in Euro).
- Need forgiveness where it is impossible to repay debt.

# Collateral and Punishment

- Borrowers are incentivized to repay by penalties as well as collateral. Penalties can be jail, or reputational, or pangs of conscience.
- Different borrowers might view penalties differently.
- So how to preserve simplicity of perfect competition and anonymous markets?
- Pooling! See Dubey-Geanakoplos-Shubik 1988, 2005. Need to compute default rates of pool, not individuals.

# Collateral and Money

- Collateral equilibrium becomes more complicated. Difficult to incorporate simply into infinite horizon model.
- Becomes attractive to work with finite horizon models of money and collateral.
- But how can money have value in a finite horizon model?
- Answer: Inside and Outside money. See Dubey-Geanakoplos (1986).

# Where Research Must Turn

- Mapping the actual Credit Surface.
- Building models of the credit surface.
- Generating rules for managing leverage and other credit terms as well as interest rates.
- Integrating monetary equilibrium and collateral and punishment equilibrium.
- Answering when and how to forgive debt.