Creating the "Off-Prime" Loan

We bought more house than we could afford
A normal income shock incited a tipping point, and a crisis

Theory

Not responsible for causing the mortgage crisis

- Adjustable rate mortgages (interest rates stayed low)
- High Loan-To-Value (LTV) ratios (FHA+ business as usual)
- Immigrants (longer-term), gender or race
- Negative equity (has happened before w/out a crisis)
- Central bank keeping interest rates low for a long period (overbuilding, yes)
- Mortgage Backed Securities (MBS) or any other financial instrument

Responsible for causing the mortgage crisis

- Government-sanctioned rating agencies marking bonds as AAA (Wall Street overleveraging)
- Loan-to-Income (LTI) ratios above 3.5 (black swan? maybe not)
  › Basically, people bought too much house to (manage and) absorb normal income shocks
  › Financial markets created unemployment creating personal budget constraints creating defaults
  › Market/Economy/Unemployment quickly turning around (slowly) supports affordability crisis
- Option ARMS - teaser rates, Alt-A, interest only, deferred principal payment (some pain)

Student loans the next disruption on deck (P/E ratios in 2001, housing in 2008)
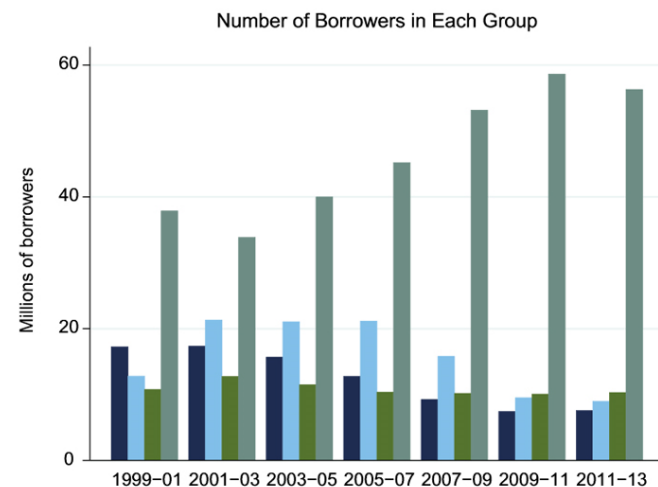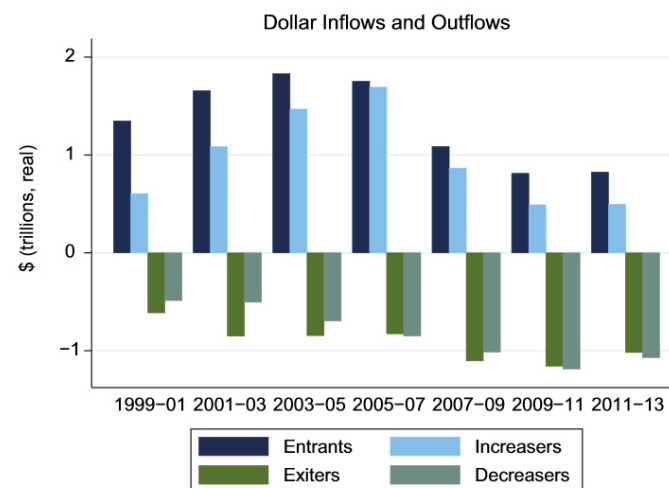
Mortgage Debt Flows

Household mortgage debt

- From 1999-07, mortgage debt doubled to $11 trillion
  - › More than all U.S. government debt
  - › 30% of nonfinancial sector debt
- From 2008-13, mortgage debt declined by $2 trillion
  - › Larger and longer running decline than any since 1945

Swings in stock of debt

- Surge (and bust) had less to do with first-time home buyers and more with real estate investors (speculators)
- Tightened credit standards have severely limited debt growth in recent years
- Total inflows from 2011-13 significantly lower than even 1999-01 (pre-boom)

Takeaways

- Those who **already** own homes are still unwinding debt
- Credit has to loosen to bring in **first-time home buyers**
- Investors, not first-time buyers, contributed more to crisis
- Few are increasing debt loads (e.g. refinancing)

Dollar Inflows and Outflows

Legend: Entrants, Increasers, Exiters, Decreasers

Number of Borrowers in Each Group

Importance of Loan to Income (LTI)

Why did more ARMS fail during crisis? Rates were staying low?

- Some explained by teaser rates and deferred principle repayment
- Main reason is LTI changes pre-crisis – personal income shocks had material impact
  - › Striking increase in LTI from 3.3 during 80s/90s to as high as 4.5 by 2005
  - › United States not alone – these same trends identified around the world
  - › Low payments (artificially) prevented Mortgage-To-Income (MTI) from increasing
  - › LTV stayed steady and bears little responsibility

LTI triggered defaults

- Reduced mortgage affordability
- Negative equity only an aftershock

Use LTI as an important underwriting factor

- Income shocks require LTI buffering
  - › Allow for temporary budget constraints (unemployment, health, etc)
  - › Can write financial instrument around MTI (lower payments), but not LTI (both are fixed)
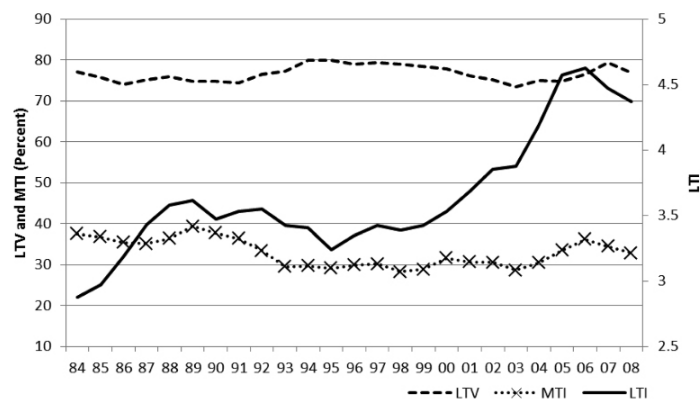
Wall Street and Credit Ratings

Wall Street needed more mortgages to be written

- Collateralized debt obligations
  - Collateral is your house, debt is what you owe, and obligation is your promise to pay
  - Bonds and insurance (credit default swaps) were issued on these CDOs (trusts)
  - Not all bonds alike – tranches allowed holder to manage risk (get paid first = lower rate)
- Wall Street was running out of prime borrowers, but demand high for mortgages
  - Initially went subprime – houses never going down, so <640 FICO risk willing to take
  - Could get above the loan approval thresholds with ARMs (passed risk to pool anyway)
  - When ran out of threshold buyers, got creative and artificially created threshold buyers

Wall Street had pools of good and bad loans, which not ideal, should be fine

- Credit agencies marked most pools as AAA, allowing Wall Street to overleverage
  - Government relied on credit agency for accuracy when setting required cash reserves
  - Even BBB tranches, when spun off into a CDO, were re-tranched and marked AAA
  - CDOs were created that bet on CDOs (synthetic) and again were marked AAA

How Wall Street Fell Apart

Mortgage lending practices <u>not</u> the reason Wall Street failed

- Exotic loans (even criminality) and subprime were not enough to tank the economy
  - › There will always be bad loans and foreclosures and unscrupulous lending practices
  - › Some believe exotic loans, e.g. bait and switch interest rates, for defaults to blame (contributed)

Classic run on the bank

- We bought more house than we could afford! (in more ways than just the loan payment)
  - › Wall Street demand for mortgages (and low interest rates) led to oversupply, which led to softening
  - › Mortgages starting failing because of normal income shocks (owners maxed out in all areas)
  - › Vicious cycle – more failed, more oversupply, more softening, more negative equity, more failed
- Investors started unwinding investments and moving to cash
  - › Nervous investors wanted to go to cash positions – Wall Street didn't have enough cash
  - › Can't meet your obligations (Bear and Lehman), then you will need to file for bankruptcy
  - › If Bear and Lehman can risk bankruptcy, what about Goldman, JPMorgan, etc? (intertwined)
  - › All investors started making calls to exit investments and go to cash positions
  - › Government had to step in and provide the cash for these investors (Wall Street overleveraged)
  - › Why wasn't Wall Street properly capitalized? Greed? Maybe. Credit agencies. Definitely!

Mortgage-Backed Securities

Transparency in mortgage markets leads to increased volatility (counterintuitive)

- Lenders will change mortgage loan behavior in areas that experience income shocks
  - › (If) Lenders know geographic location of each mortgage and can react, will magnify impact
  - › Lenders will withdrawal credit from that region in anticipation of future shocks
  - › Opaque securitized instruments hide these localized shocks (tamp down impacts)
- Borrowers have to deal with unexpected income and real estate shocks at same time
  - › If local geography has an income shock and real estate transparent, double shock is coming

An opaque equilibrium, with insurance, allows for better long term returns

- Investors prefer bundled mortgages (opaque) to tranched mortgages (transparent)
- Insurers prefer to release coarse information to preserve liquidity in the market
  - › A perception of future liquidity creates current liquidity (i.e. opacity essential for liquidity)
  - › When the composition of a security is opaque, then all investors are symmetrically ignorant
- Informed investors willing to invest in riskier tranching (but how many really informed)

Government Involvement

Was government part of the pre-crisis problem?

- Federal housing mandates
  - › Community Reinvestment Act required reporting of lending to low-income households
  - › Fannie and Freddie were subject to percent-of-business goals for low income households

Post crisis programs

- Foreclosure interventions increased timelines from 16/11 (judicial/non-judicial) to 29/18 months
- 10% reduction in mortgage payment associated with 10-11% reduction in default propensity
- Modifications mitigate lender carrying costs, borrower moving, future credit and social costs
- Once again, LTI front and center in driving whether renegotiation and modification available

Has credit actually become too tight?

- Balance expanding credit availability while protecting taxpayers from another crisis
- FHA has kept LTV fairly steady, but credit score needed for loan climbed significantly
- Tighter credit runs counter to restarting the housing market (and ignores social costs)

Impact of Immigrant-Native Differences

Immigrant status

- Between 1970 & 2010, percent of U.S residents born in another country increased from 4.8% to 12.5%
  - Some of the increase due to reduction in native-born birth rates
- Will account for almost 2/3rds of growth between 1995 and 2050
- Immigrant ownership rate increased from 46.5% in 1995 to 53.3% in 2006
  - Did not play heightened role in financial crisis, although reported by media
- More likely to be delinquent than native-borns (after controlling for other factors)
  - Not due to disproportionally living in areas more prone to price volatility
  - Living in gateway cities is not correlated to higher delinquency rates
  - Time in host country a factor – those here <20 years have higher rates than native-borns
  - There may be evidence that where immigrants originate from may be a factor
  - No evidence that 2nd generation more likely to be delinquent than 3rd+ generations

Gender and Race

Gender has no effect on the decision to deny a mortgage (post housing crisis)

- Low income women more likely to get a mortgage than low income men
- White females (+Asians) have an advantage getting a mortgage
  - › 1.30x more likely than Black women - Black women 1.6x more likely to get denied
  - › 1.17x more likely than Hispanic women – Hispanic women 1.3x more likely to get denied
- There is a similar race pattern between White, Asian, Black and Hispanic men

Within race, gender has no effect, except in two areas

- White men have a higher fallout rate than white women
- Asian men have a lower denial rate than Asian women

The mortgage pie has a smaller diameter

- Origination rates up (7-8%), denial rates are down (by 4%) and fallout rates down (4%)
- Tight mortgage lending restrictions have decreased opportunities for <u>all</u> applicants

Takeaway: Gender not a factor, race is still a significant factor

Does Homeownership Impact Labor Markets?

Wall Street overleverage caused illiquidity caused main street cash holding caused unemployment caused personal budget constraints caused defaults

- Everything else was more than likely a side effect or secondary contributor (e.g. neg. equity)
- Could not handle a temporary "shock" to personal income (LTI too high)

Residential mobility

- Unemployed homeowners less inclined to change residential location to find a job
  - › Relocation (moving costs) cost-prohibitive at a time of budget constraint
- Homeowners more risk adverse
  - › Likely to take a lower paying local job (another impact on LTI)
  - › Will accept longer commutes to stay in the home
  - › Ownership can drive increased incentives (intensity) for successful job search
- Long unemployment durations imply risk of selling home or foreclosure
- Highly leveraged owners feel additional pressure during job search

Takeaway: Homeowners stay put, intensify job search and settle for less (LTI impact)

Reverse Mortgages

Reverse mortgages may be a necessity

- Baby boomers not saving for retirement
  - › 41% of Americans aged 55-64 have no retirement savings account
  - › For those who do, the median account balance is only $103,000
  - › EBRI reports that 44% will fall short of needed retirement income
- Baby boomers do own homes
  - › Homeownerships rate for those 55-64 is 74 percent
  - › Homeowners 62 and older hold combined $3.84 trillion in equity

But lot's of complaints – process still maturing

- Lenders refuse to lower interest rates & children having a hard time being added to loan
- Mortgage only in name of older borrower, spouse facing foreclosure
- Loan servicing issues
  - › Heirs having a hard time paying off the loan, companies unresponsive
  - › Problems with appraisal process, inflated home price, lengthy delays, etc…
  - › Servicers not keeping accurate records
- Property tax and homeowners insurance non-payment forcing foreclosures

Need More Accurate Credit Models

Default prediction is the real goal of lending ("probability of default" models)

- Does creditworthiness only come in two categories? Good and bad
  › Lower FICO = higher cost is outdated, instead manage to affordability (w/shock buffers)
  › Mortgage lending should move from a transactional business to a consultative business
  › New credit models should advise applicants on top 10-20 houses they should consider
- Probability of delinquency (arrears) models in addition to default models
  › Modeling more than repayment behavior – i.e. credit score used only at time of origination
  › Regional economic conditions and borrower economic potential may be just as important

Predict which features are more correlated to default

- LTI, loan age and high LTV can all predict default (but not linearly)
- Population drift may also affect credit models (e.g. Detroit)
- Use long-term mortgage holders (single home) to understand behavior and tune models
- Small improvements in mortgage default prediction can have <u>large</u> revenue impacts

Current credit model work focuses more on unsecured debt (e.g. credit cards)

- There needs to be an effort to better understand secured debt (consumer) behavior

Machine Learning as a Better Predictor

Decision tree and random forest models will outperform logistic regression

- Models that allow for certain features to carry more weight may be ideal (predictive power)

Feature extraction critical

- Features can be binary (yes/no), categorical or continuous (numerical)
  - › Some features only observed at time of loan origination (e.g. marital status)
  - › Other features may be historical (e.g. employment history)
  - › Some features may be forecasts (economic outlook for specific region)
- Features with missing data will likely be set to unknown (not inferred)
  - › In some cases, nearest neighbor (kNN) algorithm will be used
- Features can number in the hundreds
  - › Examples include: LTI, loan age, LTV, loan count, regional unemployment, interest rate, loan purpose, property type, borrower location, gender, marital status, borrower count, etc…
- Off-application data may be very important (e.g. prospects for area, unemployment rate)
  - › For example, high performing K-12 school districts may be creating artificial price run up

Challenges

- Large difference in the relative proportion of non-defaulters and defaulters

Recommendation

Lower credit score thresholds (56% of Americans have subprime scores)

- Lower credit scores should correlate to affordability thresholds (vs. just pricing the loan)
- Use machine learning to better predict mortgage default probability
  › Don't rely on regulators (even standards) - build own risk models and look beyond FICO
  › Flip mortgage lending upside down – proactive (help buyer find right home) from reactive (yes/no)
  › Merge finding a home (realtor) with underwriting business, advising client on what to buy
- Look outside the loan application for environmental factors
  › For example, do you underwrite low credit score mortgages in gateway cities?

Focus on first-time mortgages versus refinancing

- Current owners are still unwinding debt and less likely to add to debt (still in shock)
- Millennials maybe a larger generation than even the Baby Boomers (student debt)
- Explore peer-to-peer lending (intermediary connecting investors to home buyers)
  › Risk and pricing (machine) models will give investors risk levels that are manageable

Bring back alternative mortgage products (AMP)

- Keep higher underwriting standards for AMPs
- Focus AMPs on high growth, likely to appreciate, geographic regions