



# Stress Testing Residential Mortgage Portfolios

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# Four issues we were asked to address:

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1. “Seeking Robustness”: A quixotic quest?
2. Example 1: Loan Mods
3. Example 2: Second liens
4. Example 3: Payment shocks



# Seeking Robustness



# “Seeking Robustness”: Some preliminary considerations

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- *Must define*: Stability over specifications? Minimize MSE, Out-of-sample error? Upside/downside error equivalent? Cross-sectional or time series? All time periods equivalent “crisis” vs. “normal”?
- *What is the objective function*: Minimize no. or \$ below reg. capital? (Any relevance to no. or \$ above? All sizes, regions, assets, time periods the same?)
- *What is the right benchmark scenario*: “Worst” case?, Specific VAR?, Same over time?, How relevant over different policy/economic eras?
- *What drivers are most important*? The same across all sectors?

# The ideal model to “Seeking robustness” in the residential mortgage market

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- Universally available data (macro/micro economic conditions, loan type & terms, borrower, property, lender, etc. etc.) down to individual loan level
- Complete structural model for sectors, perfectly integrated into portfolio model
- Perfect incorporation of policy & other “control” variables with perfect foresight of future changes and consideration of asymmetric information, “gaming,” option environment, moral hazard and fraud
- Unfortunately not available, but better in residential mortgage market than in some sectors

# Specific advantages of residential mortgage market in Seeking Robustness

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- Loan level terms and payment histories (Loan Performance, GSE's, FHA, etc.)
- Many borrower, property, lender, servicer, etc. characteristics
- Relatively simple capital structures
- Much improved house price data, even at local level
- We understand much about factors driving borrower payment behavior (payment, prepayment, delinquency and default)

# ...But there are disadvantages too for proper stress testing of the residential mortgage market

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Our models often do not sufficiently...

- Take into account the condition of the lender, borrower behavioral variations, asymmetric information, moral hazard, the importance of embedded options encouraging “strategic” behavior, certain borrower characteristics, the existence of “fundamental asset” (i.e., house) values, or policy regime shifts
- Recognize and formally treat the multi-dimensional choice behavior facing borrowers, lenders, servicers, appraisers, etc. (e.g., payments, modifications, fraud “for money” and “for house”)
- Take into account the timing and magnitude of costs associated with delinquency, default, foreclosure loan modification, etc. (e.g., see *The Costs of Mortgage Loan Foreclosures: Case Studies of Six Savings & Loan Associations* (FHLBB, 1977))



# ...Nor do they

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- Do a good job of revealing and taking proper account of the degree of correlation with other market sectors (and its change over time)
- Help us to understand what drives the volatility and correlations among house prices over time at the metropolitan, regional, or local levels or among different price sectors or unit types or under different capital market conditions
- Help us to understand what drives a “bubble” mentality or behavior among borrowers (e.g., the run-up in prices in late-2003 when the GSE’s withdrew and were replaced in dramatic fashion by subprime, pay-option-ARM’s, alt-A, etc.)



# Finally (and most importantly), they do not yet...

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- Identify a sound measure of “fundamental” house price levels locally or nationally, which would permit development of a commonly accepted “Green-Yellow-Red” bubble early-warning system
- My experience involving much of the recent litigation representing the fallout from the financial crisis is that virtually none of the lenders, ratings agencies, monoline or mortgage insurers, or analysts ran scenarios that embedded expectations of 40% house price declines within any scenario tested. Had they done so, their models would have predicted default rates of the same order of magnitude of what actually occurred. (THIS SUGGESTS EVERYTHING ELSE MAY HAVE BEEN SECOND ORDER)



# Example 1: Loan Mods



# A primer on loan modifications (mods)

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- Have been with us for many years, as “workouts”
- Traditionally involved borrowers who faced either cash flow or financial insolvency (often both)
- A workout traditionally involved an extended term, then possibly accrual of interest, then possibly reduced rate, rarely a write-down of principal
- Have taken on a new life recently because of volume and impact (political and economic)

# The “new world” of loan mods

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- Created by Federal and state/local policy initiatives (e.g., HAMP, HARP), litigation challenging “robo-signing,” other alleged improprieties in underwriting/ servicing
- Intent to encourage continued ownership of unit, with costs usually disproportionately borne by lender or servicers, sometimes by government
- New variants such as equity sharing being proposed, but primarily increased pressure for principal forgiveness
- Feds cannot simply purchase and take the hit (as in 1933 with the HOLC) for political and economic reasons

# “Optimal” modification

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- Interior solution: Pareto in sense both borrower and lender made better off than extremes of foreclosure or forgiveness, but does not necessarily imply total costs minimized
- Mod initiative taken either because economically rational or because of policy pressure or mandate. This is what makes it hard to predict incidence of mods.

# Conditions encouraging mod under economic rationality

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- Costs of foreclosure high to both borrower and lender (judicial foreclosure state with long redemption period and high negative equity, extended lack of access to credit and renting expensive, and strong behavioral aversion to “strategic” default)
- Lender has unquestioned legal right to foreclose but limited ability to take full write-down on balance sheet immediately
- Borrower has sufficient cash flow to make slightly reduced payments
- Negative equity is not high
- Extending term, perhaps slight lowering of rate effectively is “extend and pretend” and rent-to-own

# When is mod irrational?

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- Lender's costs upon foreclosure are minimal and bearable from a capital adequacy standpoint, while borrower's costs are not high (rents low, little restriction of future credit needs, no perceived "stigma")
- Borrower has serious cash flow solvency problem
- Negative equity is high
- May result in friendly foreclosure, possibly short sale
- HAMP, HARP and other federal programs incorporate this calculus, but have resulted in many fewer modifications than anticipated



# Predicting mods and assessing their impact

- Involves working off default model: Given event of default (or in some cases threat of default or other pressure), allocate to possible outcomes: bring current, loan mod (type), short sale, friendly foreclosure, foreclosure, etc. [note: endogeneity of default and mod is possible, cf. Mayer]
- Multinomial logit using proportional (non-proportional?) hazards methodology for multiple choices a la, Deng and Quigley. Structural models may prove superior. Explanatory variables similar to those above.
- **ONE IMPORTANT NOTE:** Two conditions are present:
  1. Incentive to “game” one’s intents
  2. Significant option value to waiting; Will the Feds be coming in with a better deal?

# Predicting mods and assessing their impact (continued)

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- Requires estimation of both timing and costs of modification. Uncertainty in costs (including optionality as above) reduces mod incidence
- Requires also estimation of re-default in the future. Depends on either imperfect design originally, or changed conditions since (credit events, policies/programs, house price declines). **IMPORTANT:** Re-default could also be implicitly intended, as both borrower and lender were “buying time”

# What about mods motivated by policy mandates or pressures?

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- Not necessarily economically rational from the standpoint of Pareto or cost minimizing outcomes (in fact, probably not). But could relate to “fairness,” as determined by one-off evaluations
- Difficult to predict unless we incorporate mod program initiatives endogenously into model
- Conditional costs and cost allocations can still be estimated, however, and incorporated into models



# Example 2: Second Liens



# A primer on second liens

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- Recorded after first, take secondary position in claims from default
- Have been around for a long time; more recent innovations have been home equity loans (HEL), home equity lines of credit (HELOC), “silent” seconds, and “piggybacks”
- Higher loss expectations in event of default and create higher default risk by their presence

# The modeling problem with second liens

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- Borrower decides when to default (strategically?)
- Lender(s) decide how to respond: foreclose, modify, or forbear
- Same factors affecting borrower and lender(s)' decisions as for first lien alone, but with some twists:
  - Borrower decides which loan to default on: 1<sup>st</sup> or 2<sup>nd</sup>
  - Lenders' have to decide optimal response depending upon whether their loan is current or in default

# The solution to the default and resolution decisions for second liens

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- If negative equity is  $< L2$ , borrower will default on L2. L2 lender will foreclose or mod depending on costs of foreclosure, loss given default, security of lien. Added cost of taking out L1. Borrower could strategically default.
- If negative equity is  $> L2$ , lender on L1 is exposed to loss, L2 has loss recovery of zero. Borrower will default on L2 and possibly L1. Lender L2 will forbear, leaving lender L1 to foreclose or seek mod.
- Depends also on expectations of future property values & interest rates (optionality)
- Depends also on borrower's strategic default proclivity, lender's capital cushion, adverse selection, moral hazard, possible fraud
- The bottom line: Is complex. Interesting theoretical model building and empirical exercise



# The special problems with HELOCs, silent seconds, piggybacks

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- HELOCs typically have fixed term without full amortization, could be called, implying balloon risk
- Silent seconds obtained/recorded after first, and first lienholder unaware. Default risk enhanced. Could be used fraudulently to inflate sales price and create a 100% first.
- Piggybacks provided by first lienholder up to 100% CLTV (or more). Cheaper than mortgage insurance and overcomes down payment deficiency
- Each have their own unique, complex risk modeling challenges.



# Example 3: Payment shocks



# What are “payment shocks” and why are they problematic?

- Sudden increase in installment payments caused by end of “teaser rate” or “interest-only (IO)” period for subprime, pay option ARM’s, HELOC’s, others
- Can cause delinquencies, perhaps increase default risk if equity position marginal and little cash liquidity
- Usually a minor problem for IO for long-term, fully amortizable loans, since amortization is low in first years
- But teaser-rate shock can be significant, especially if market rates rise (for ARM’s) or contract rate significantly higher than teaser (e.g., 1% → 8%). Even greater problem if underwritten at 1%
- HELOCs special problem (discussed above) is that it is IO until maturity => a huge shock (balloon)
- Each require their own unique default model specifications and estimations