

# Underwriting Standards, Loan Products, and Loan Performance: What Have We learned?

Marsha Courchane, Charles River Associates

Len Kiefer, Freddie Mac

Peter Zorn, Freddie Mac

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# Overview

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- Background:
  - Post-crisis legislative and regulatory changes to the mortgage market have encouraged conservative lending standards in their efforts to prevent another collapse.
  - Market dynamics (on both the supply and demand side) have also led to very low risk origination books over the past 4 - 5 years.
  - The result is that little mortgage credit is flowing to low-income borrowers with lower FICO scores and smaller down payments (“targeted borrowers”).
- Goal:
  - Assess whether the rich loan performance experience of the previous decade provides sufficient data to allow updated statistically-based automated underwriting systems (“AUS”) to responsibly extend credit to targeted borrowers.
  - Explore the policy implications of our analysis

# Existing literature

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- There have been many studies of the mortgage crisis, but only a few are directly relevant to our analysis.
  - Amromin, Gene and Anna L. Paulson, 2009, “Comparing Patterns of Delinquency among Prime and Subprime Mortgages.”
  - Courchane, Marsha J. and Peter M. Zorn, 2012, “The Differential Access and Pricing of Home Mortgages: 2004–2009.”
  - Pennington-Cross, A. and G. Ho, 2010, “The Termination of Subprime Hybrid and Fixed Rate Mortgages.”
  - Quercia, Roberto G., Lei Ding, and Carolina Reid, 2012, “Balancing Risk and Access: Underwriting Standards for Qualified Residential Mortgages.”
- Implications for our analysis:
  - Important to treat separately prime, subprime and government markets.
  - May be possible to extend credit responsibly to targeted borrowers.

# Our approach

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- Assess the impact of applying updated AUS to targeted borrowers.
  1. Estimate a model of loan performance.
  2. Use the estimated model to develop AUS scorecards.
  3. Set cutpoints to demarcate the marginal (responsible) risk tolerances.
  4. Run targeted borrowers through the AUS scorecards to determine the percentage of the population that meet responsible risk tolerances.
- Draw policy implications throughout our analysis.

# Our data

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- CoreLogic is the main source for our data.
  - Includes loan level data on originations between 1999 and 2009.
  - Reasonably rich borrower and mortgage term characteristics.
  - Records performance of the loans.
- We append additional post-origination information.
  - House price appreciation (from Freddie Mac's internal price indices).
  - Unemployment rates (from Bureau of Labor Statistics).
  - Mortgage interest rates (from Freddie Mac's PMMS rate).
- We use HMDA to create post-sampling weights.
  - CoreLogic is a convenience, but not a representative, sample.
  - We hope that HMDA weights result in more accurate inferences to the loan origination population.

# *Step 1: Estimation*

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- Statistically-based AUS systems develop their scorecards from empirically derived relationships between underwriting variables and loan performance.
- We limit our empirical analysis to first-lien, owner-occupied, purchase-money mortgages.
- We run our estimations separately for prime, subprime and government loans to account for the separate dynamics of these markets.
- Our estimations predict the probability of going 90-days or more delinquent (“D90”) in the first 3 years after origination.
  - D90 is a common performance measure for industry scorecards.

# Estimation specification

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- The explanatory variables in our estimations include variables known to underwriters at origination, as well as variables that can only be known post-origination.
  - Factors such as the changes in house prices after loan origination significantly affect performance.
  - It is important to include all such key determinants of loan performance in our estimations.
  - Excluding these variables would run the risk of omitted variable bias if the underwriting variables observed at origination are correlated with post-origination variables (which they often are).
- We estimate our models using logistic regression.
  - Probability(D90 in 3 years) =  
F(origination variables, post-origination variables, error term).

# Explanatory variables in our estimations

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- Underwriting variables known at origination:
  - FICO score
  - Debt-to-income (“DTI”) ratio – (although not available for subprime loans)
  - Loan-to-value (“LTV”) ratio
  - Loan amount
  - Documentation type (full, low, missing)
  - Channel (retail, wholesale, other)
  - Owner-occupancy (Y/N)
  - Product type (ARM, balloon, FRM-15, FRM-30, FRM-other, hybrid)
  - Condo flag (Y/N)

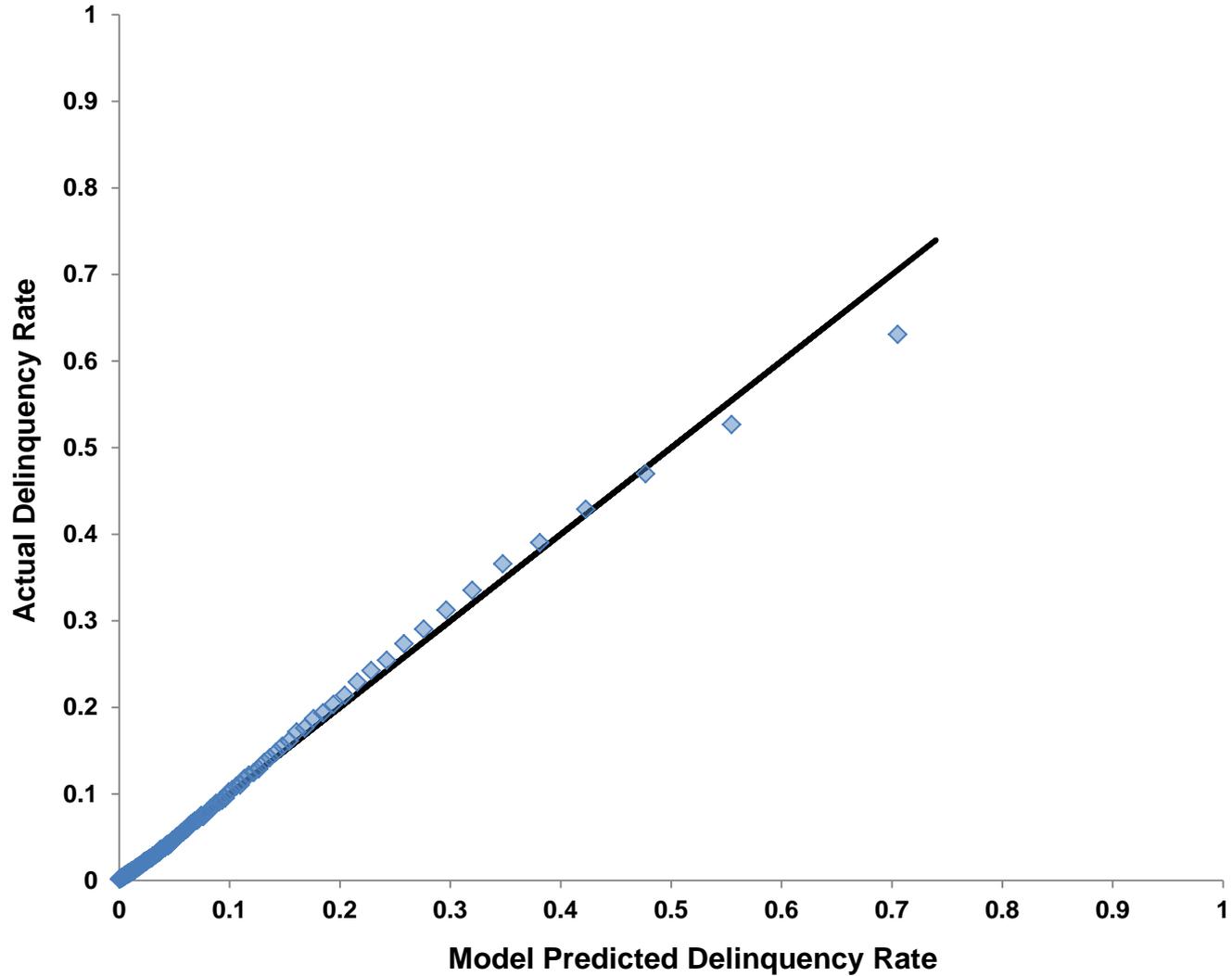
# Explanatory variables in estimation (con't)

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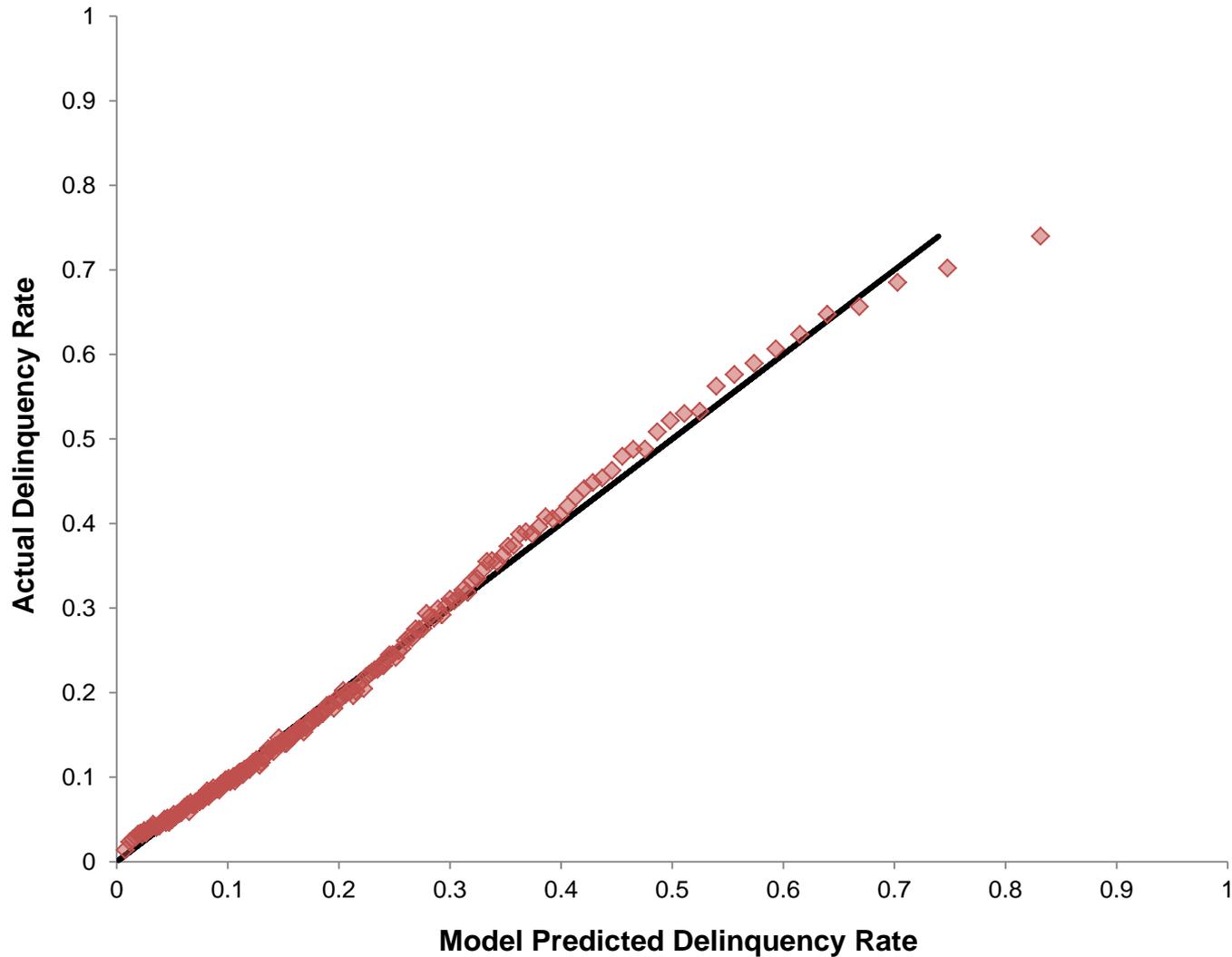
- Variables observed only after origination:
  - Future house price growth
  - Future unemployment rates
  - Future interest rates
- Variable interactions included in the model:
  - FICO score and LTV ratio
  - Loan amount and LTV ratio
  - FRM and LTV ratio
  - House price growth and LTV ratio
  - FICO score and loan amount

# Model fit—Prime

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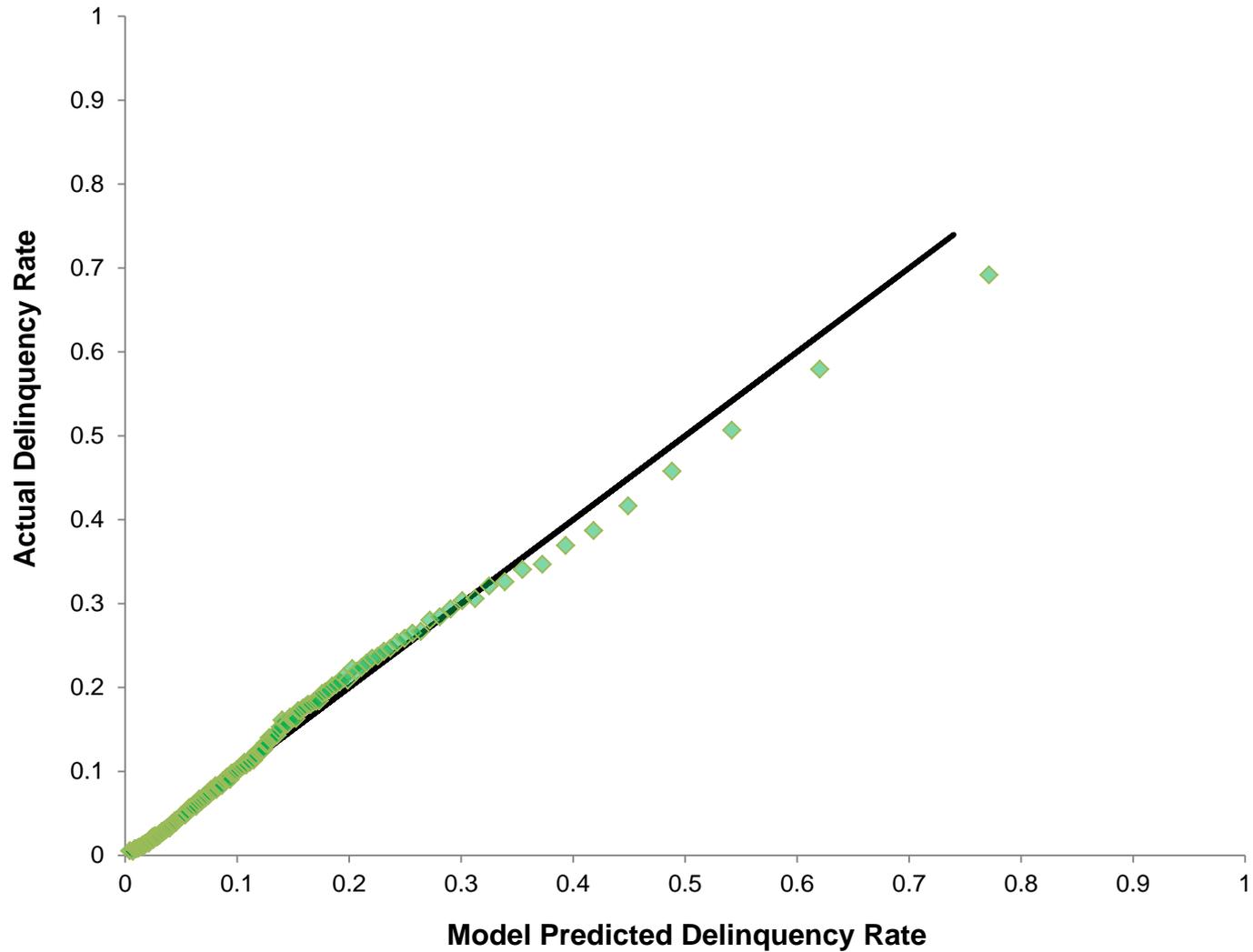


# Model fit—Subprime



# Model fit—Government

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# Estimation comments and caveats

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- Our estimations differ from typical scorecard estimations in several ways.
  - Less detailed credit information—likely reduces our fit.
  - Estimated on same data to which the scorecard is applied, rather than to earlier historical observations—likely increases our fit.
  - On net we believe (hope) our fit is representative of industry scorecards.
- Our model ignores some theoretical concerns.
  - Competing risks (when borrowers prepay they cannot default)
  - Endogeneity of market segment, product type, and LTV ratio.
  - While these are typically ignored in real-world AUS, doing so could create biased relationships in our scorecards.
- Our simple structure restricts possible policy experiments.
  - Our policy experiments must assume that targeted borrowers do not change their observed market segment, product, and LTV.

## *Step 2: Scorecard construction*

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- Statistically-based AUS scorecards assess the riskiness of loans using empirically derived relationships.
- Our empirical estimations predict loan riskiness using variables known at origination, as well as variables known only after origination.
- Because AUS scorecards assess risk at origination, the values of post-origination variables are unknown and must, somehow, be taken into account.
- We develop two separate types of scorecards to handle the challenge of the unknown values of post-origination variables:
  - “Through-the-Cycle” scorecards.
  - “Perfect Forecast” scorecards.

# Through-the-Cycle scorecards

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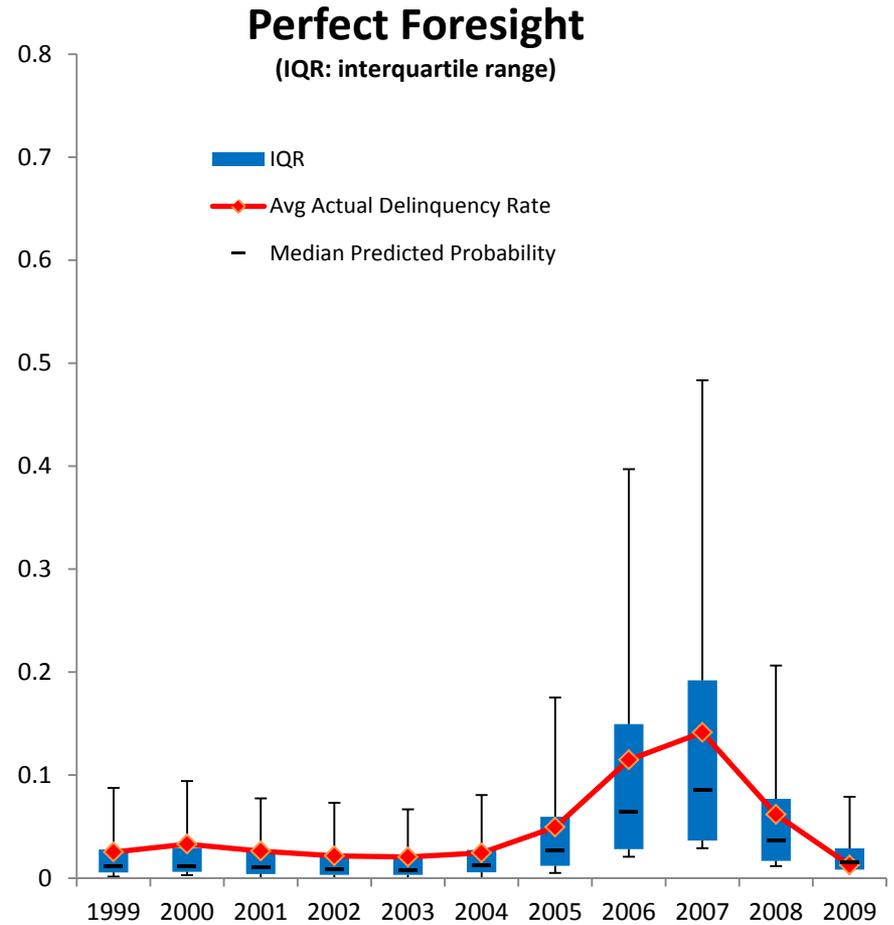
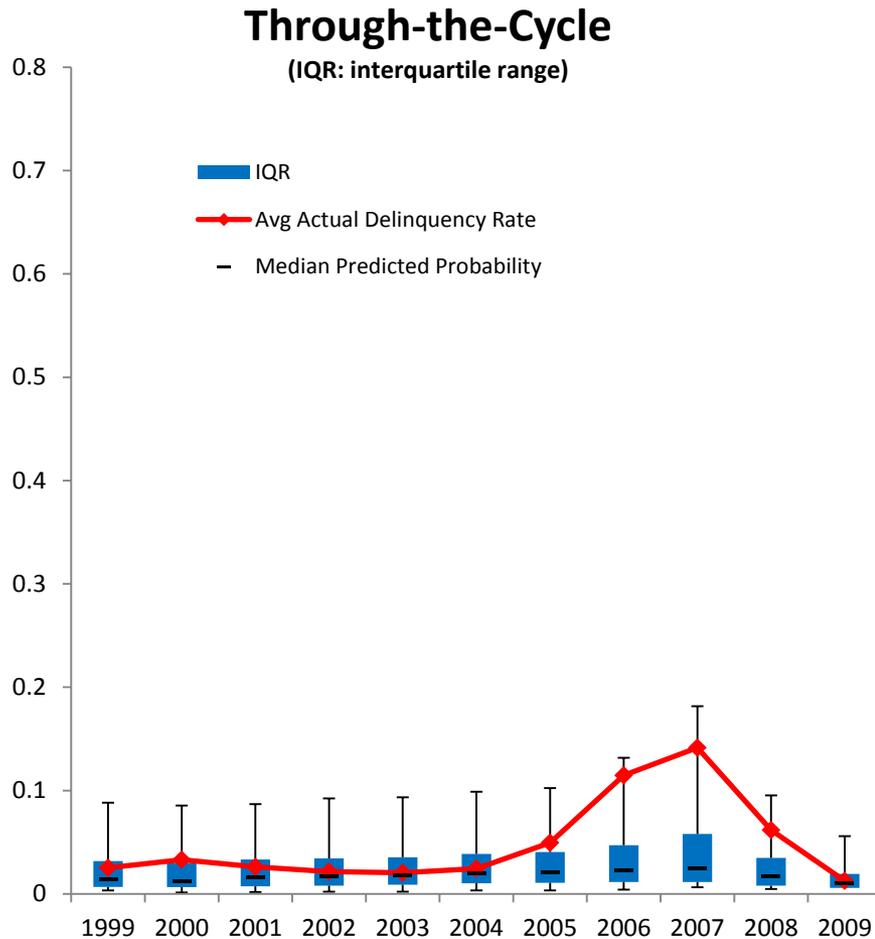
- Treat post-origination variables as controls.
  - Do not attempt to forecast future values, but instead set them to constant, unchanging levels.
  - We set future values at levels that approximate long-run equilibrium—annual house price appreciation of 2%, unemployment rate of 6%, and assume no change in interest rates after origination.
- Inherently counter-cyclical.
  - “Conservative” assessments of risk during credit expansions temper growth; “optimistic” assessments of risk during credit contractions stimulate growth. For example, if house prices are rising, but assumed to be fixed at 2%, will not account for reduced risk of rising house prices.
- Result in challenging business implications.
  - Forego any attempt to accurately predict loans’ future performance.
  - Sacrifice low-risk lending and market share during expansions, expand high-risk lending and market share during contractions.

# Perfect Foresight scorecards

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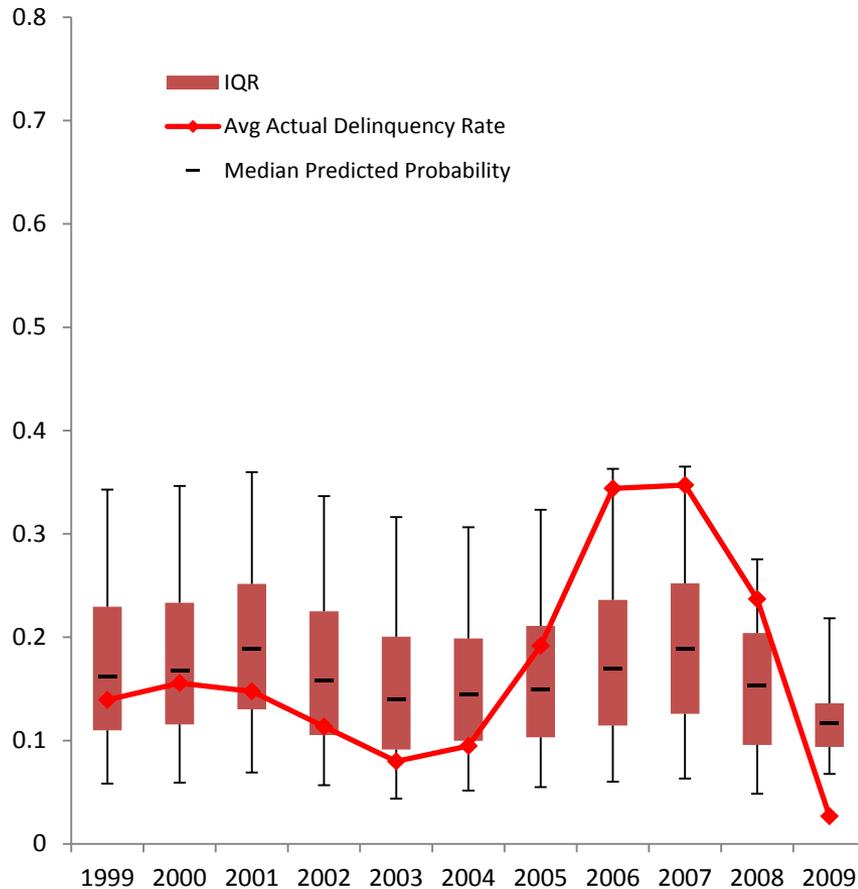
- Perfectly predict future values of post-origination variables.
  - Scorecards are simply the predictions of the estimated models.
- Inherently pro-cyclical
  - “Optimistic” assessments of risk during credit expansions encourage growth, “conservative” assessments of risk during credit contractions temper growth. For example, recognize rising house prices so expand lending while if falling, reduce lending (positive derivative).
  - However, scorecards perfectly predict turning points, so pro-cyclicality occurs primarily during early parts of the cycle. (In reality, this would not occur.)
- Accurately predict loans’ future performance, resulting in opportunistic business models.
  - Expand market share through low-risk lending during expansions, sacrifice market share by foregoing high-risk lending during contractions.

# Prime scorecards

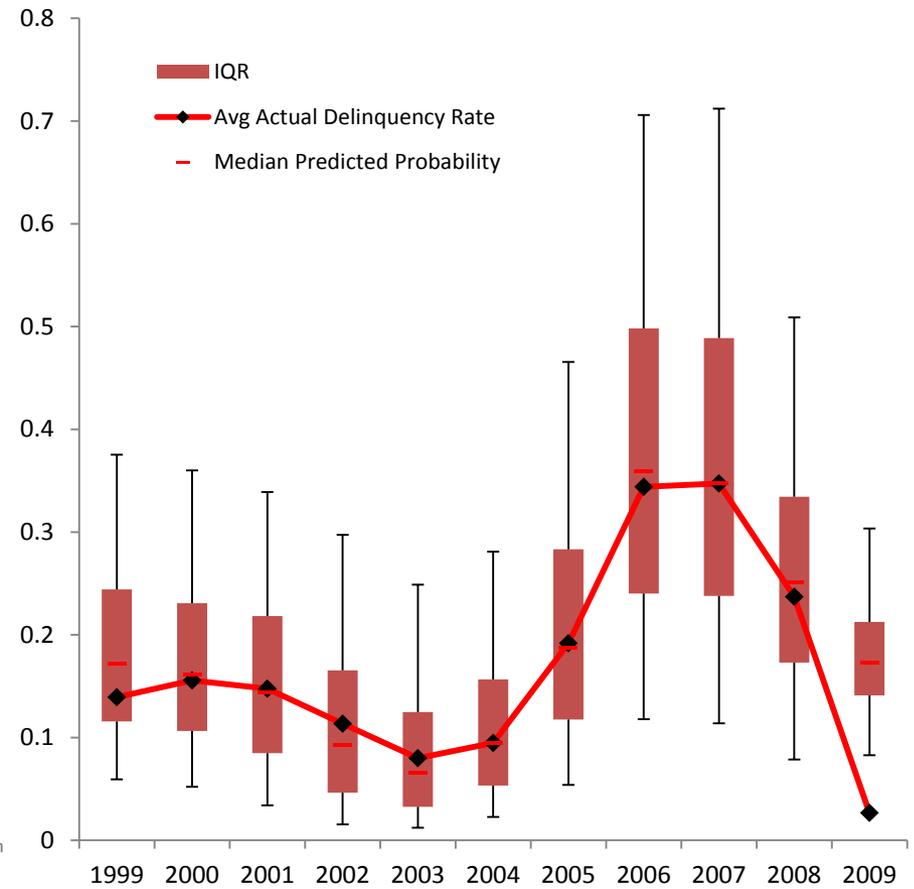


# Subprime scorecards

## Through-the-Cycle

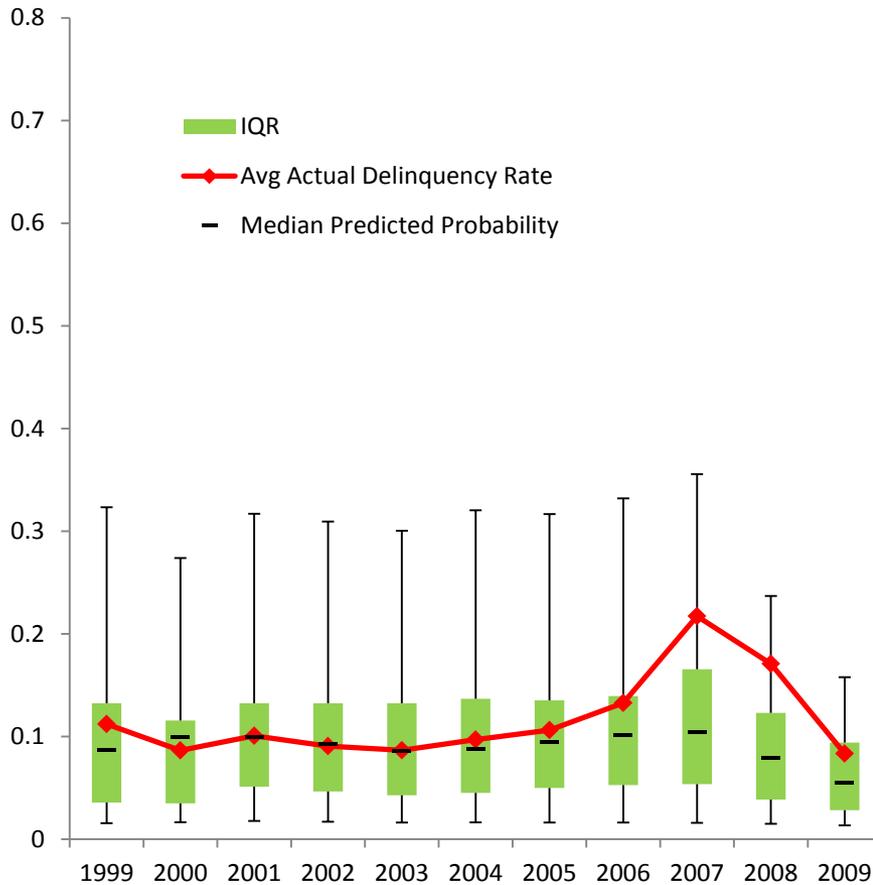


## Perfect Foresight

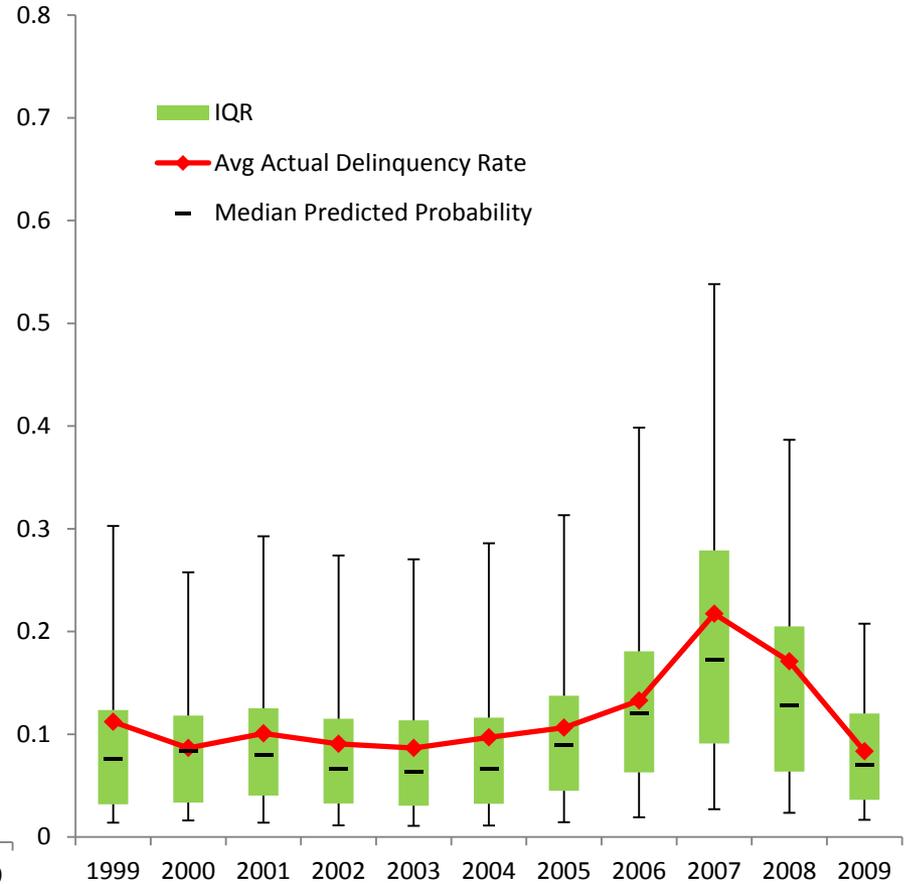


# Government scorecards

## Through-the-Cycle



## Perfect Foresight



# Scorecard comments and caveats

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- The two types of scorecards address different and competing public policy concerns.
  - The counter-cyclical nature of the through-the-cycle scorecards addresses macroeconomic stability.
  - The accuracy of the perfect foresight scorecards addresses concerns over prudent lending and taxpayer liability.
  - Recent legislation and regulation seem more concerned with the latter.
- Perfect forecasting is an unreasonable expectation.
  - It is very difficult to predict turning points—few forecasters predicted the timing of the recent downturn.
  - Real-world forecasting scorecards will likely be significantly less accurate and more pro-cyclical than our perfect foresight scorecards.

# Step 3: Cutpoints

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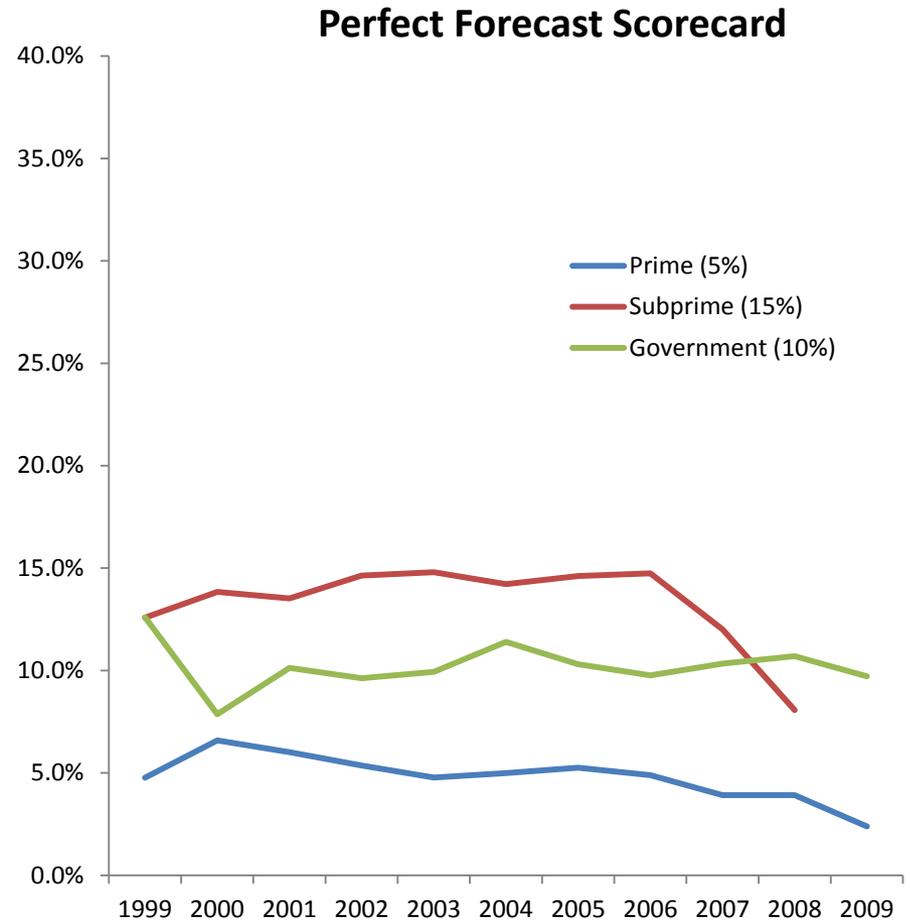
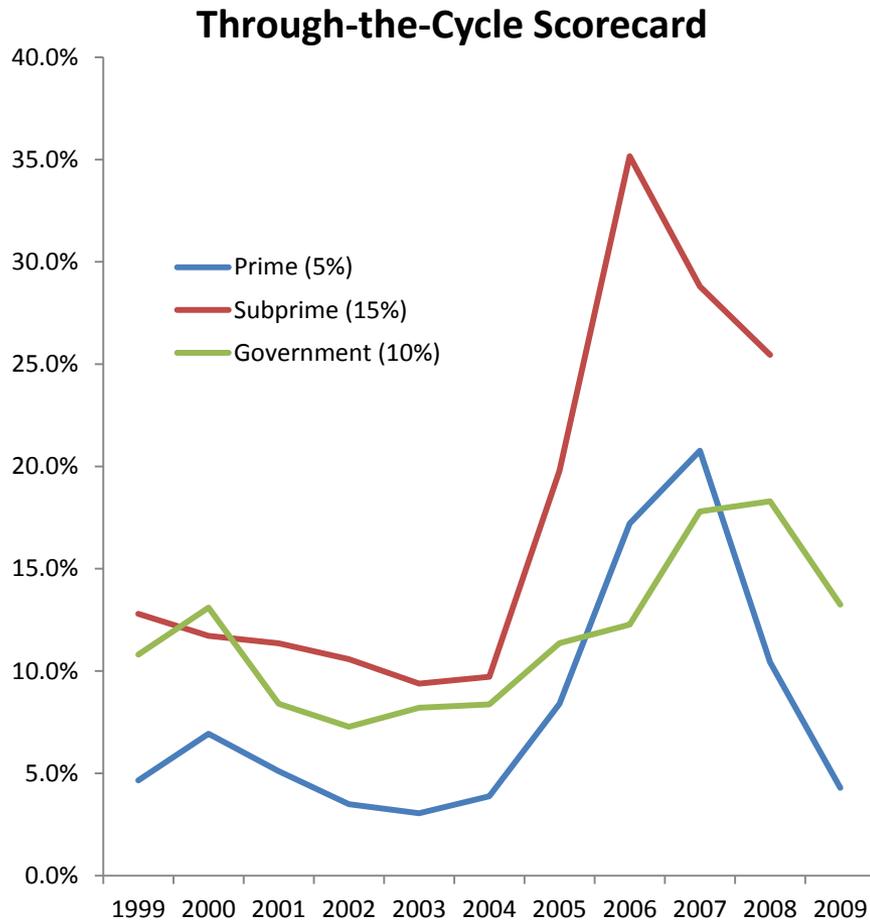
- Cutpoints determine the marginal acceptable risks.
  - Loans that score below the cutpoints are considered acceptable risk, and consistent with responsible lending.
  - Loans that score above the cutpoints are considered too risky.
- Cutpoint setting is a judgment call.
  - It is primarily based on business decisions about the risks that lenders feel comfortable taking and pricing.
  - It is directly influenced by regulatory and oversight constraints.
  - It is also indirectly influenced by broad market pressures and public policy considerations.
- Cutpoints are applied to scorecard scores at origination.
  - Scorecards (explicitly) vary in their predictive accuracy, so marginal accept performance will vary across scorecards for the same cutpoint.

# Setting cutpoints

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- There is no single “correct” cutpoint, so we provide a menu.
  - Cutpoints set the maximum acceptable risk in terms of the scorecards’ assessment of D90 in the first three years after origination.
  - We provide analyses for cutpoints for D90 rates of 5%, 10%, 15% and 20% for the prime, subprime and government markets.
  - This spans a reasonable set of responsible cutpoints.
- To simplify presentations we also pick a single, representative cutpoint for each market.
  - Based on performance of 1999-2001 originations at the 90<sup>th</sup> percentile.
  - Prime underwriting was relatively standardized— set cutpoint at 5%.
  - Subprime underwriting appears less standardized—conservatively set cutpoint at 15%.
  - Government underwriting also appears less standardized—conservatively set cutpoint at 10%.

# Actual D90 rates at representative cutpoints



# Cutpoint comments and caveats

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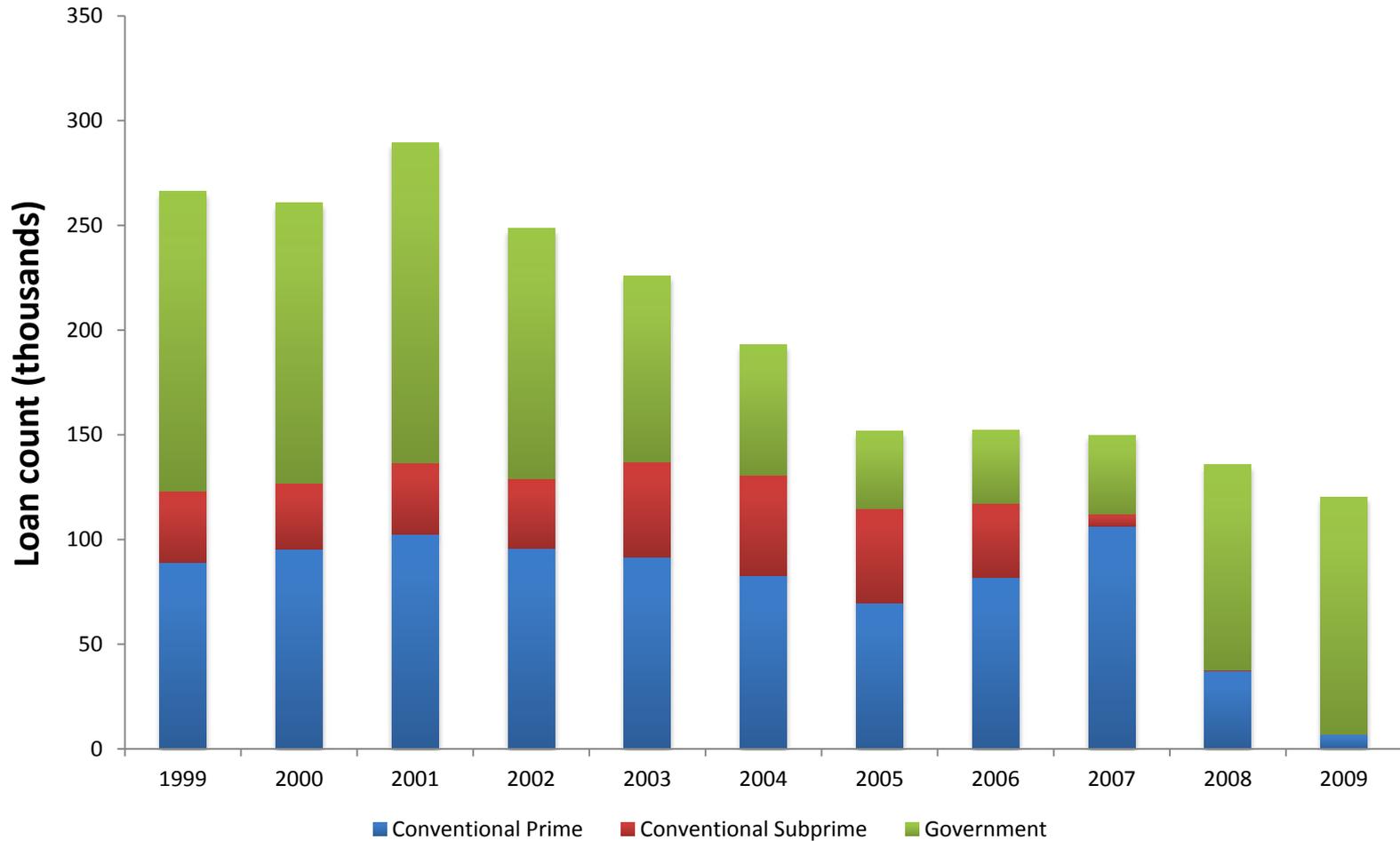
- Cutpoints are only one potential method for limiting risk.
  - Mechanical (computer-coded) scorecard overrides can be used to limit identified risks, or to account for risks that are inadequately modeled.
  - Loans or products can be made “ineligible”/unacceptable because of their perceived risks (e.g., low documentation loans or layered risk loans) or because they are viewed as predatory (e.g., loans with excessive prepayment penalties).
  - Pricing can affect both the risk accepted and its profitability.
  - We do not incorporate these alternative options in our analyses.
- Cutpoints need not, and likely will not, be held constant over time.
  - They likely will be loosened in periods where risks are considered low.
  - They likely will be tightened in periods where risks are considered high.

## *Step 4: Target population impact*

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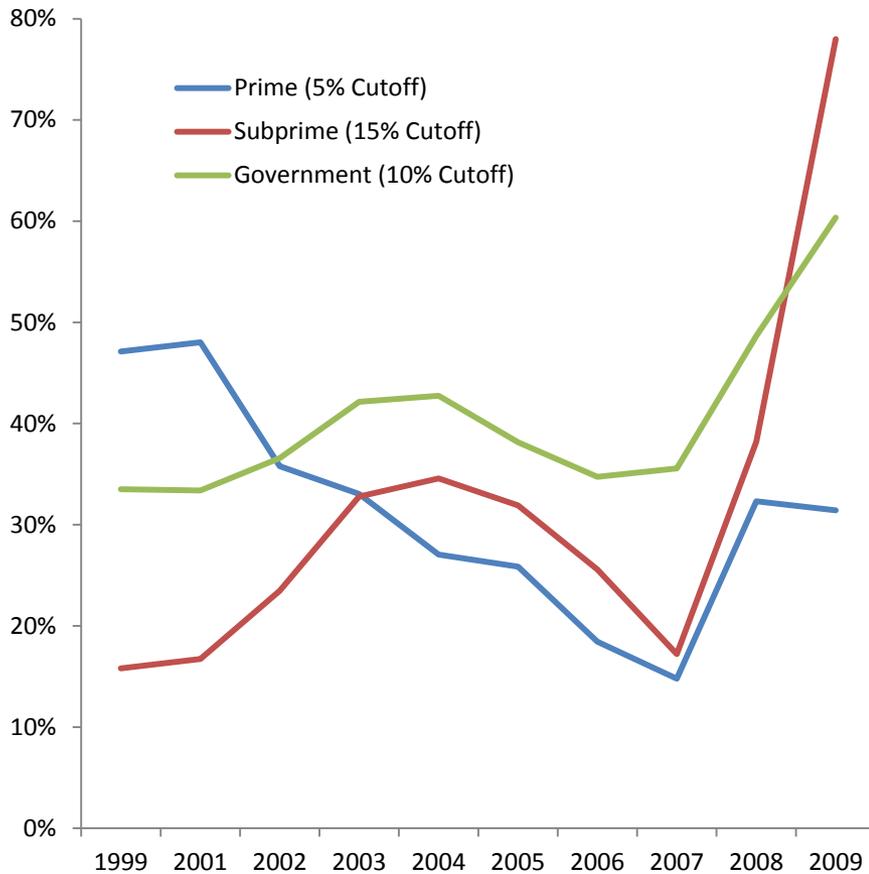
- Our final step is to apply the scorecards to the target population.
  - Loans to targeted borrowers that score below the cutpoints are considered acceptable risk.
  - We compare target borrower accept rates across markets and scorecards.
- The target population is defined as borrowers with:
  - LTV  $\geq$  90%, and
  - FICO scores  $\leq$  720, and
  - Loans in a low-income area (tract median income  $\leq$  80% of area median).
- The target population accounts for roughly 4% of all originations between 1999 and 2009.
  - This is a narrow definition of the target population, but it is representative of the group of borrowers upon whom public policy has focused.

# Target population distribution

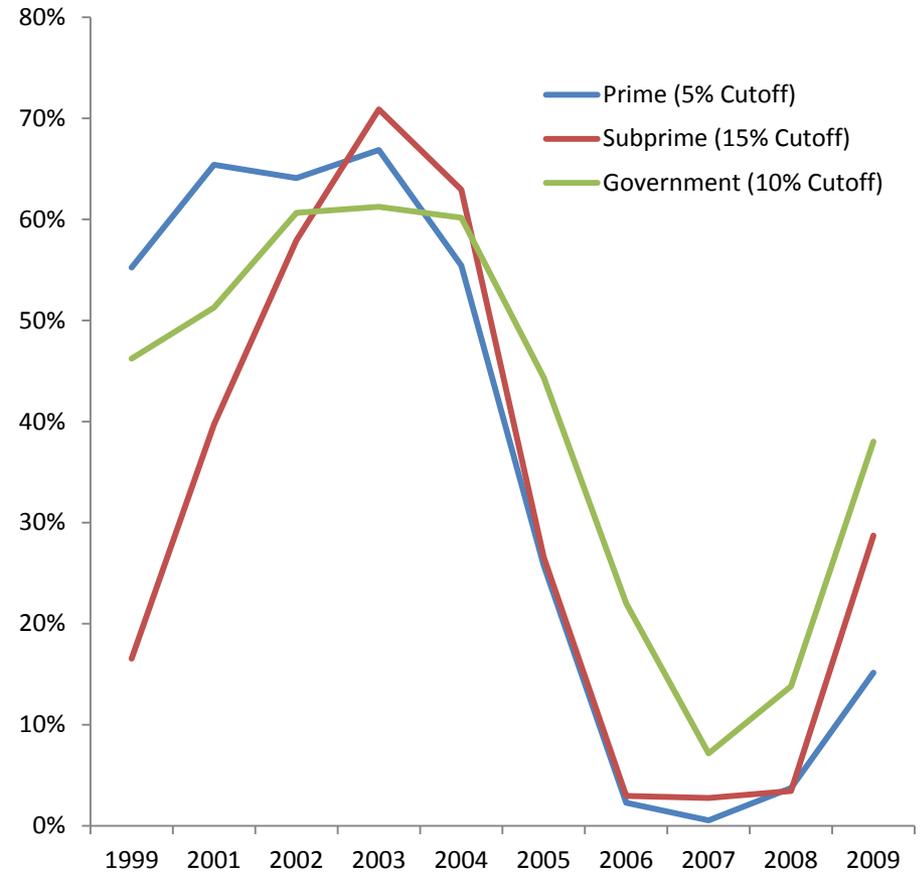


# Target population accept rates

## Through-the-Cycle Scorecard



## Perfect Foresight Scorecard



# Overall implications and conclusions

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- Automated underwriting seems to offer a responsible way to extend credit to targeted borrowers.
  - Roughly 35% of loans to targeted borrowers are acceptable risk under the Through-the-Cycle scorecard, and 40% under Perfect Foresight.
  - The Perfect Foresight scorecard differentially finds subprime loans acceptable risks, with 39% acceptable, relative to 26% for Through-the-Cycle.
- One-size-fits-all credit standards (cutpoints) should not be applied across markets.
  - Government and subprime lending aims at higher risk loans.
  - As a consequence, they will have to use higher (riskier) cutpoints to well serve targeted borrowers.

# Overall implications and conclusions (con't)

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- Traditional AUS could be enhanced to extend its reach.
  - Incorporating non-traditional data sources would extend its reach.
  - Further extensions likely require appropriately accounting for the value of other factors such as counseling and high-touch servicing.
- Access to credit for targeted borrowers is a function of both underwriting and pricing.
  - We look only at the former, the latter is equally important.
  - There are other underwriting considerations beyond those we consider (e.g., overrides, eligibility), which may mitigate our predicted impacts.
- We are unable to assess the impact of changing borrowers' market segment or product type.
  - Moving selected targeted borrowers to prime FRMs may be beneficial.

# Overall implications and conclusions (con't)

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- Creating a scorecard requires a policy tradeoff between concerns over macroeconomic stability and prudent lending/taxpayer liabilities.
  - Scorecards taking a constant viewpoint over time address stability; those incorporating forecasts address prudent lending.
  - Constant viewpoint scorecards create challenging business implications, and so likely require some government intervention.
  - Forecasting market trends has historically been difficult, so forecasting scorecards may (likely will) be both pro-cyclical and inaccurate.
  - Recent legislation and regulation appear overly restrictive in offering access to credit for targeted borrowers (e.g., few would qualify as either QM or QRM), while also favoring forecasting scorecards.