

Risky Borrowers or Risky Mortgages: Disaggregating Effects Using Propensity Score Models

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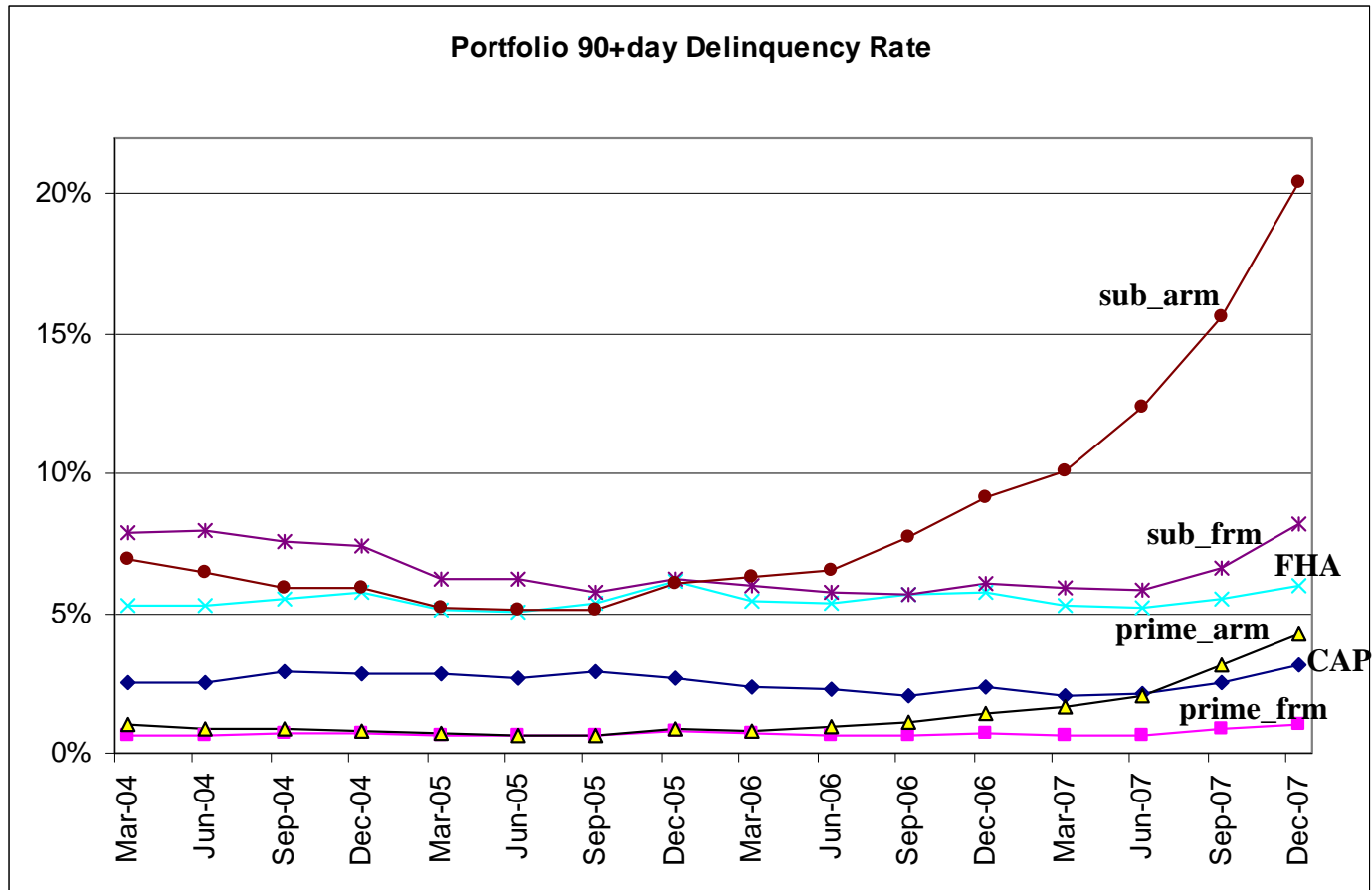




Who are serving LMI borrowers with marginal qualification

- **FHA loans** are designed to allow household with relatively low downpayment and high debt ratios to purchase moderately price housing. But they have a loan limit, larger upfront costs, not many choices of loan products and terms.
- To meet the **CRA goals** and **affordable lending goals**, secondary market institutions and mortgage originators have developed various affordable lending programs for low-income borrowers to support low-income lending and lending in underserved areas.
- **Subprime loans** for borrowers with impaired credit history, or low-doc or no-doc borrowers, low-down or no-down borrowers or borrowers with high debt ratios.

Performance of Different Loan Products



Source: Mortgage Bankers Association and Self-Help. 90+day delinquencies include loans in different foreclosure stages. N=44,973 for the CAP portfolio.



High default rate of subprime mortgages:

Risky borrowers? or Risky products?

- It may be true that borrowers holding subprime loans are riskier
 - Borrowers holding subprime loans are generally weaker across key underwriting criteria: collateral (down payment), credit history (credit score), and repayment capacity (debt ratios).
- Some features and loan terms that are more prevalent among subprime products
 - prepayment penalties and balloon payments (Quercia, Stegman, and Davis, 2007; Danis and Pennington-Cross, 2005)
 - adjustable rate (Calhoun and Deng, 2002)
 - hybrid ARMs (Ambrose, LaCour-Little, and Huszar, 2005; Pennington-Cross and Ho, 2006)
- It is difficult to isolate the impact of loan features unless we are comparing borrowers with similar risk characteristics. This study compares the relative risk of loan products in a special lending program and a sample of subprime loans from a proprietary dataset.

Data (I)

McDash Analytics

- Loan level info about 15 residential mortgage servicers;
- Tracking over 20 million active loans on a monthly basis
- Good coverage on conventional prime loans and FHA market
- Modest coverage in the subprime market

Definition of subprime loans

- B&C loans
- High-cost ARMs (arm margin greater than 300 basis points)

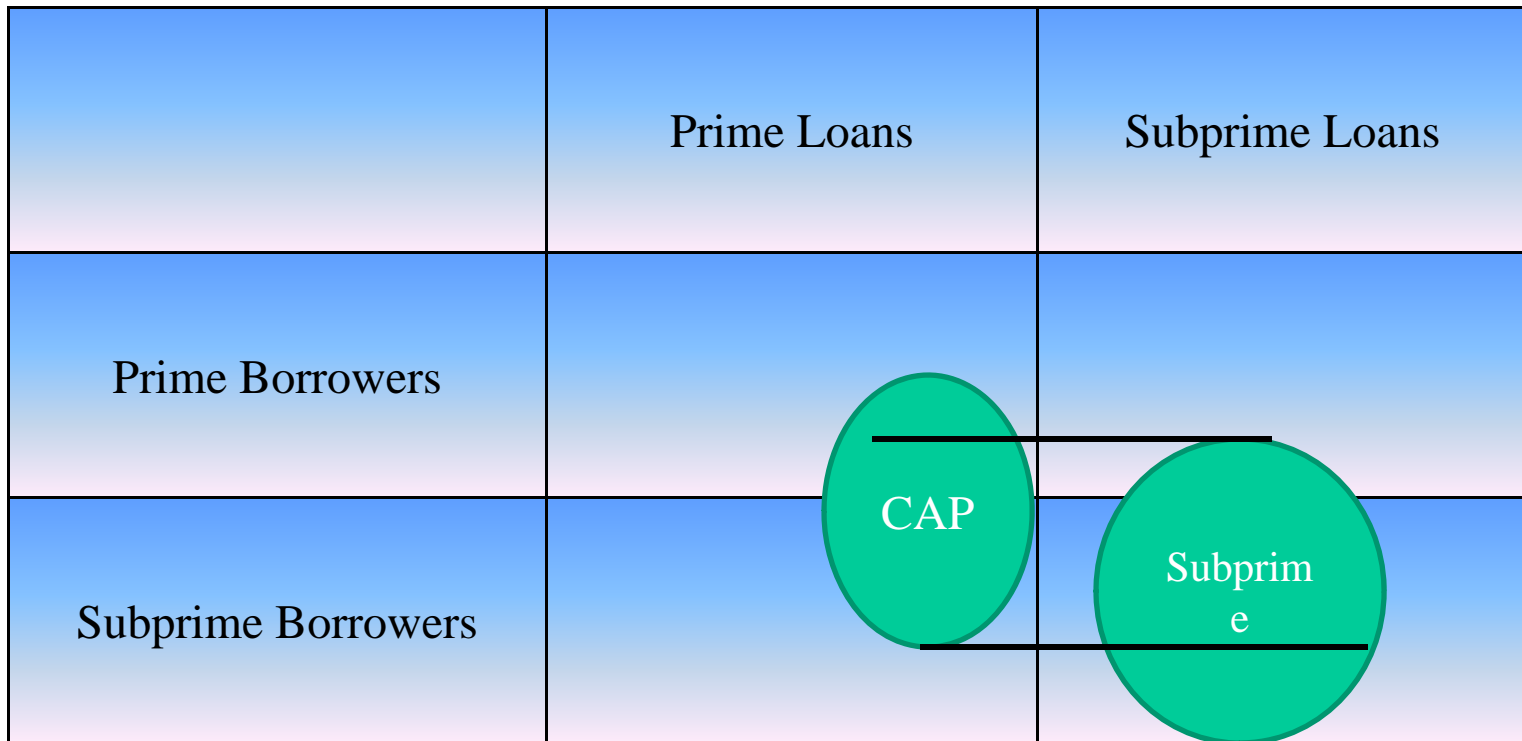
Data (II)

- Community Advantage Program (CAP)
 - Partnership between Self-Help, Fannie Mae, Ford Foundation, and a group of lenders.
 - Started in 1998, over 50,000 loans
 - Secondary market outlet for CRA-type loans
 - Prime mortgage products serving borrowers with
 - Low- to moderate- income
 - Weak credit history and/or low down-payments
 - A sample of 9,221 CAP loans originated during 2003-2006

Methodology: Propensity Score Match

- In the first phase, PSM method summarizes all of the background (covariate) information about taking out a subprime into a scalar which is called propensity score.
- Then in the second phase, subprime loans are matched to CAP loans based on the estimated propensity scores and the resultant sample usually is a subset of the original sample.
- In the last step, regression models can be applied to the matched group to compare performance of subprime and CAP loans.
- Advantages of PSM: it summarizes multidimensional covariates into a one-dimensional score; it provides an adjustment for selection bias to help support strong inferences about program effects using observational data.

Propensity Score Match: focusing on borrowers with similar risk characteristics but holding different products: CAP or subprime

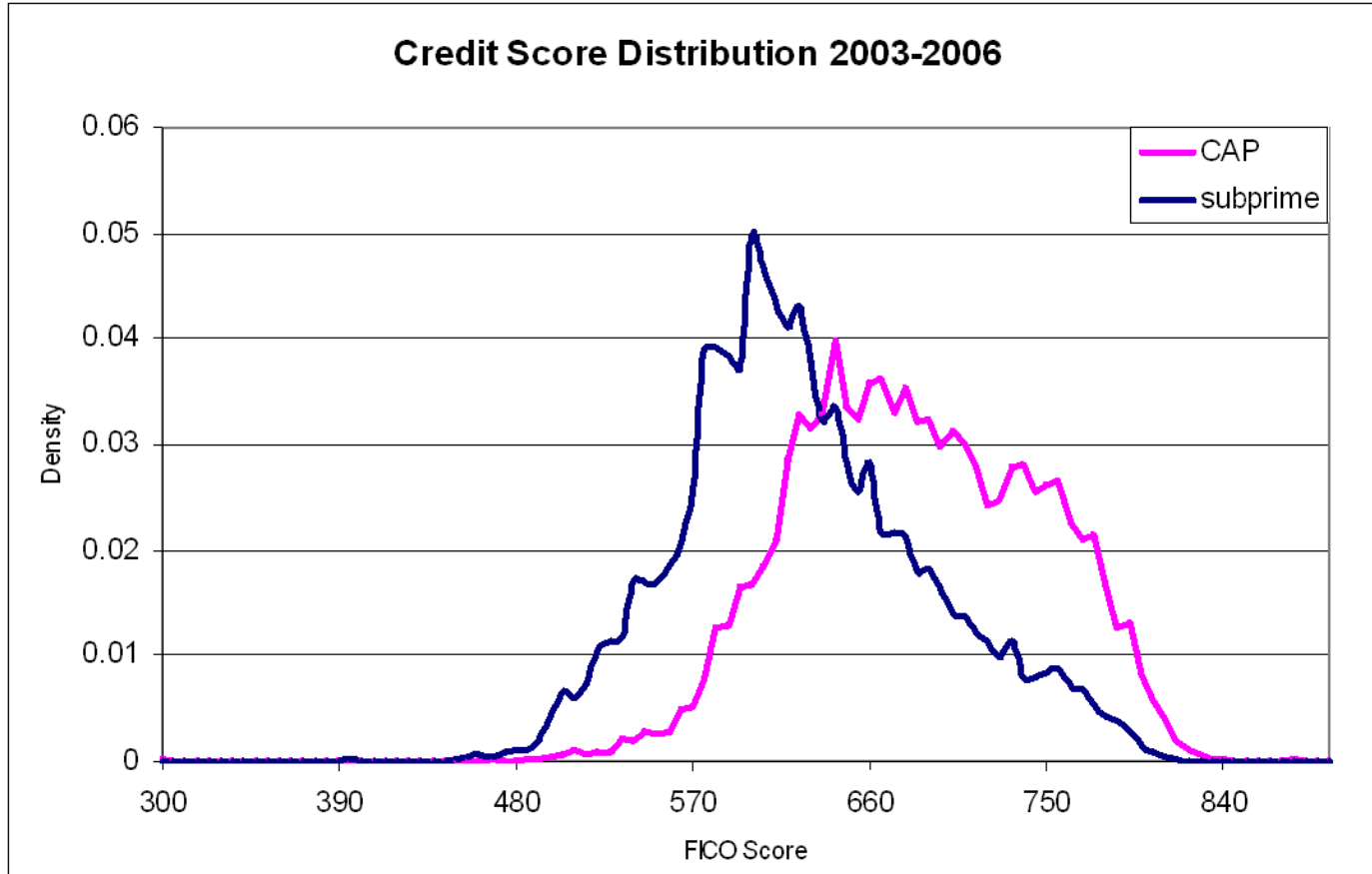


This following characteristics are same/similar:

	CAP	Subprime
Lien status	first-lien	first-lien
Loan purpose	home purchase	home purchase
Occupancy status	owner occupied	owner occupied
Loan amount	conforming	conforming
Property type	single-family	single-family
Loan term	30-year	30-year
Documentation	full/alternative doc	full/alternative doc
Geography	CAP	in zip codes with CAP
N (2003-2006)	9,221	48,808

However, underwriting criteria and some loan characteristics are different:

	CAP	Subprime
Credit score	686	629
DTI Underwriting	40.0%	42.9%
LTV	96.5%	83.1%
ARM	-	90.3%
Broker originated	-	69.9%
Prepayment penalty	-	53.7%
Note-Rate	6.66%	7.96%
N (2003-2006)	9,221	48,808



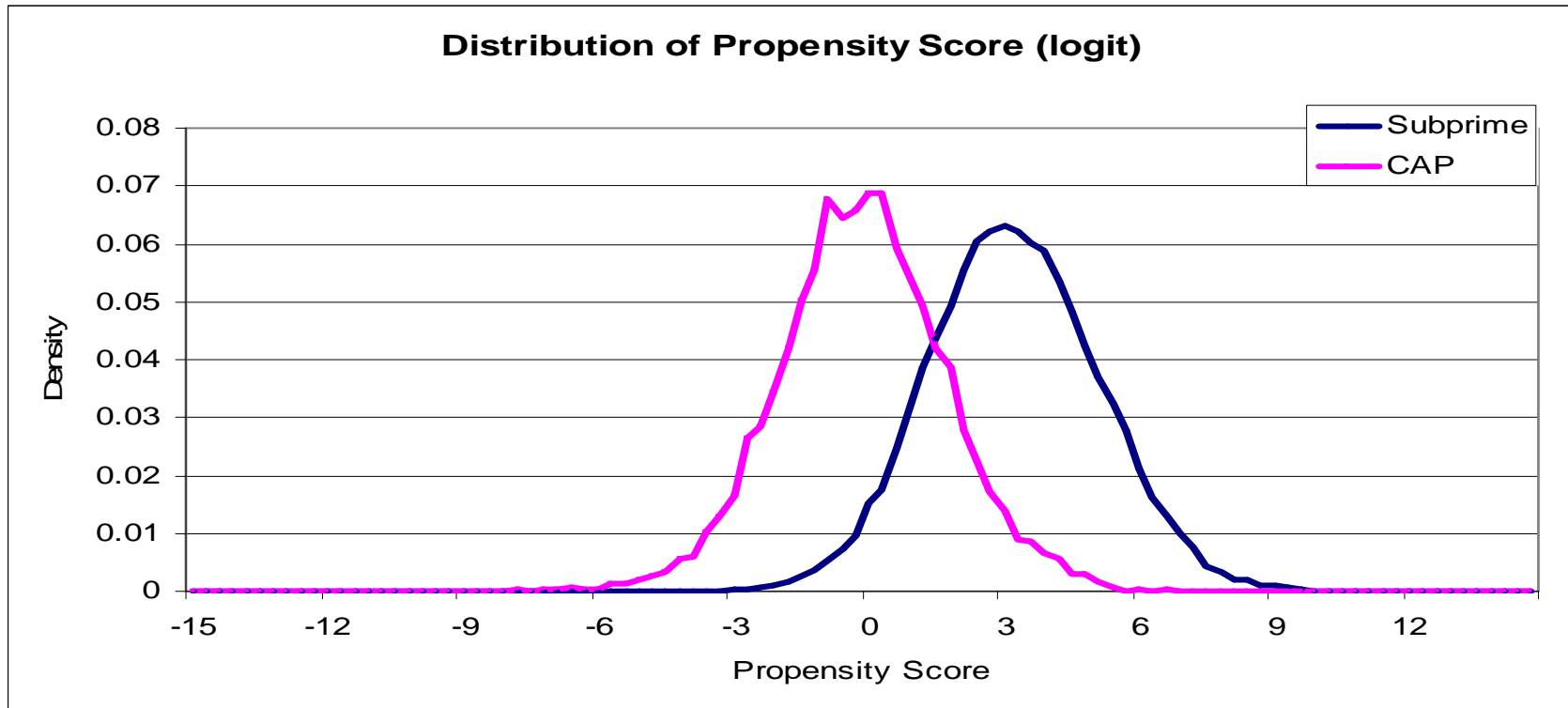
Explanatory variables to predict propensity of taking out subprime

- **Underwriting variables** directly affect credit risk, and therefore affect mortgage choice/assignment since higher credit risk is hypothesized to be associated with a greater probability of taking out a subprime mortgage: FICO score; DTI; LTV.
- We used the average FICO score for mortgages originated in the preceding year in the zip code as a proxy of **local credit risk**.
- Educational distribution is included as a proxy of residents' **financial knowledge/literacy**.
- Herfindahl- Hirschman Index (“HHI”) is constructed to measure the extent of **market competition** in the market (the sum of squared market shares of lenders in a zip code).
- Share of minority is included to consider the local **demographics**.
- Quarterly calendar dummy variables.

Results of the logistic regressions

	2003		2004		2005		2006	
	Model1 Coef.	Model2 Coef.	Model1 Coef.	Model2 Coef.	Model1 Coef.	Model2 Coef.	Model1 Coef.	Model2 Coef.
ltv90		-0.227		-0.299*		-1.319*		-1.557*
ltv97		-1.884*		-1.190*		-3.146*		-2.615*
ltv100		-5.442*		-4.294*		-5.369*		-6.388*
dti36	-1.191*	-1.012*	-1.242*	-0.723*	-1.138*	-0.697*	-1.024*	-0.842*
dti42	-1.230*	-0.741*	-1.476*	-0.869*	-1.306*	-0.768*	-1.332*	-1.161*
dti100	0.172	0.185*	0.005	0.582*	-0.445*	0.526*	-1.118*	-0.696*
cred580	4.646*	4.492*	3.986*	3.269*	4.183*	3.287*	2.408*	2.283*
cred620	2.081*	1.945*	2.278*	2.152*	2.966*	2.711*	1.801*	2.787*
cred660	1.465*	1.623*	1.148*	1.278*	1.575*	1.471*	1.205*	1.707*
cred720	0.854*	1.021*	0.560*	0.719*	0.693*	0.692*	0.586*	0.917*
loan_amt	0.012*	0.012*	0.013*	0.014*	0.011*	0.011*	0.010*	0.011*
qtr1	0.006	-0.094	-0.549*	-1.140*	0.665*	1.259*	1.104*	1.315*
qtr2	-0.059	-0.246*	-0.045	-0.240*	0.427*	1.048*	0.919*	1.034*
qtr3	-0.588*	-0.427*	0.088	-0.145	-0.077	0.214*	0.642*	0.573*
HHI	-14.843*	-10.598*	-18.798*	-17.662*	-20.794*	-13.509*	-23.402*	-15.688*
area credit								
score	-0.004*	-0.033*	-0.004*	-0.020*	-0.001	-0.012*	0.002	-0.005
pctmin	-0.006*	-0.029*	0.005*	-0.006*	0.017*	0.009*	0.014*	0.008*
pct_high	-0.122*	-0.109*	-0.076*	-0.036*	-0.046*	-0.016*	-0.127*	-0.120*
pct_somecoll	0.061*	0.066*	0.048*	0.047*	0.058*	0.041*	0.018*	0.012
pct_coll	-0.081*	-0.063*	-0.066*	-0.044*	-0.055*	-0.032*	-0.086*	-0.076*
_cons	6.013*	27.522*	5.496*	17.437*	0.968	10.569*	4.130*	11.742*
	N=7,434		N=21,376		N=16,966			N=12,253

Results of the propensity score match



	N of the new sample		
	CAP Original Sample	CAP	Subprime
Match	9,221	6,160	6,160

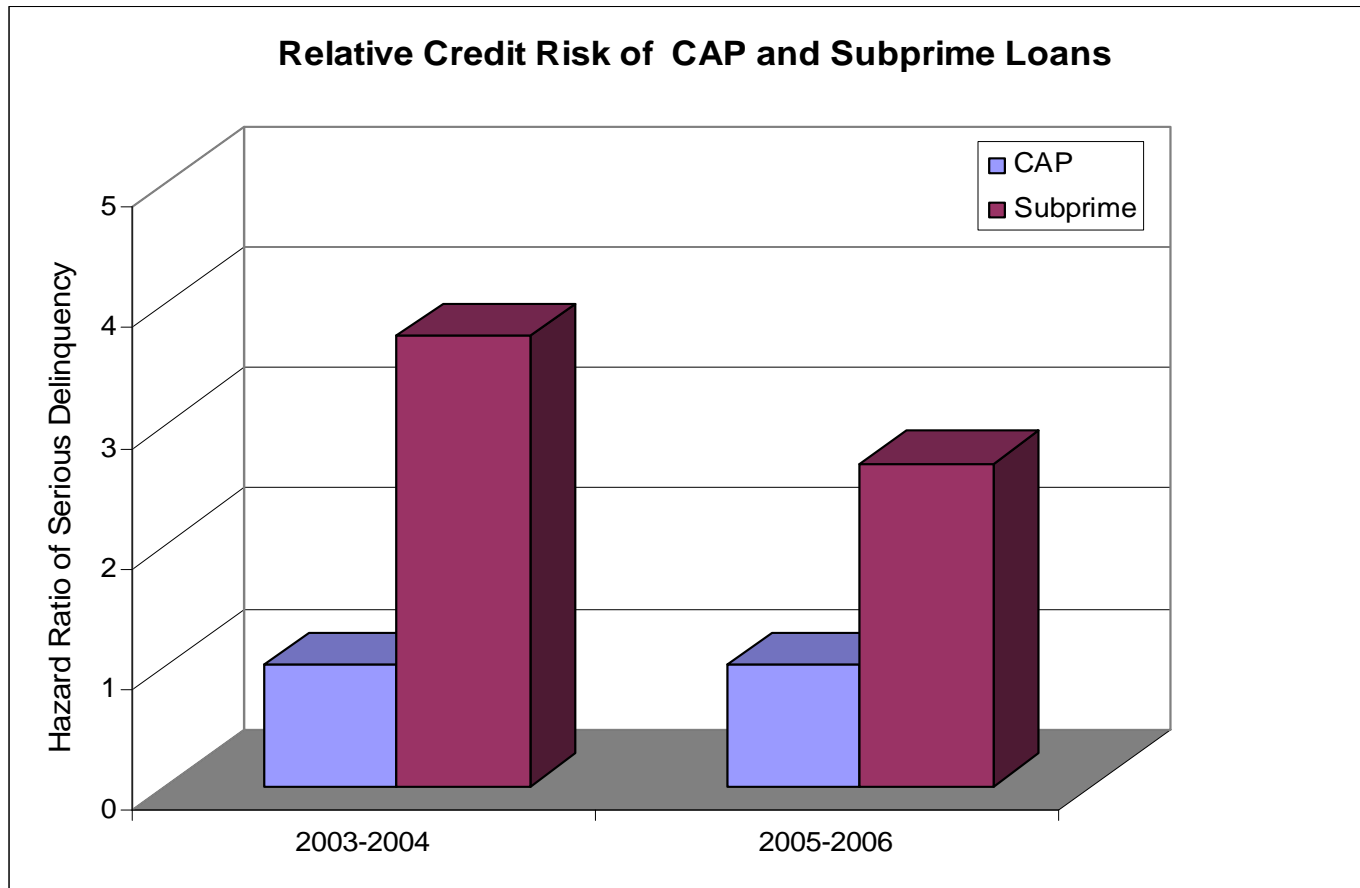


Performance of the matched sample (proportional hazard model for the first 90-day Delinquency)

_t	2003-2004 Sample				2005-2006 Sample			
	Haz. Ratio	P>z	Haz. Ratio	P>z	Haz. Ratio	P>z	Haz. Ratio	P>z
dti<28	-	-	-	-	-	-	-	-
dti 28-36	1.441	0.011	1.434	0.012	0.871	0.268	0.887	0.339
dti 36-42	1.513	0.003	1.490	0.005	1.023	0.848	1.033	0.786
dti>42	1.228	0.151	1.370	0.028	0.867	0.223	0.927	0.520
cscore<580	9.426	0.000	8.324	0.000	3.671	0.000	3.762	0.000
cscore 580-620	6.333	0.000	5.846	0.000	2.835	0.000	2.980	0.000
cscore 620-660	4.437	0.000	4.030	0.000	2.363	0.000	2.353	0.000
cscore 660-720	2.017	0.000	1.860	0.000	1.472	0.003	1.451	0.005
cscore >=720	-	-	-	-	-	-	-	-
Ltv<80	-	-	-	-	-	-	-	-
Ltv80-90	1.059	0.636	1.109	0.395	1.365	0.004	1.451	0.000
Ltv90-97	1.197	0.179	1.426	0.009	1.478	0.000	1.688	0.000
Ltv>=97	1.993	0.000	2.380	0.000	1.252	0.056	1.706	0.000
Loan_amt	0.997	0.007	0.998	0.022	1.001	0.405	1.002	0.048
area credit score	0.989	0.000	0.990	0.000	0.985	0.000	0.987	0.000
y2003 (y2005)	0.869	0.098	0.824	0.025	0.536	0.000	0.511	0.000
area house price appre	0.927	0.000	0.932	0.000	0.952	0.008	0.942	0.001
area unemployment rate	1.182	0.007	1.185	0.007	1.096	0.073	1.069	0.196
subprime	3.732	0.000	-	-	2.676	0.000	-	-
sub_arm			2.061	0.000			1.750	0.000
sub_arm&ppp			1.470	0.361			1.620	0.000
sub_bro			5.006	0.000			3.067	0.000
sub_bro&ppp			4.795	0.000			3.445	0.000
sub_bro&arm			4.735	0.000			4.842	0.000
sub_bro&arm&ppp			5.044	0.000			5.071	0.000
CAP			-	-			-	-
N	6,434				5,886			

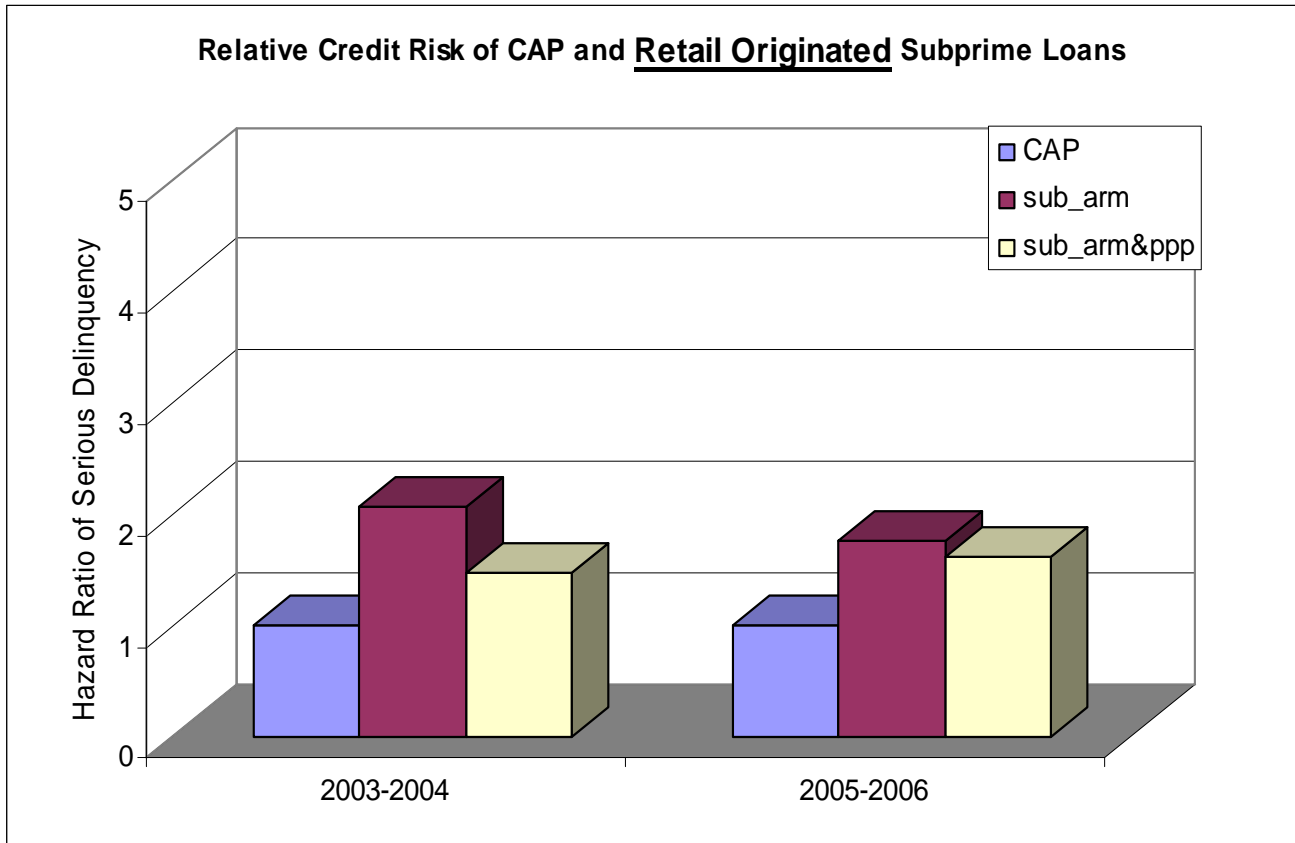


Results and Discussion (I)



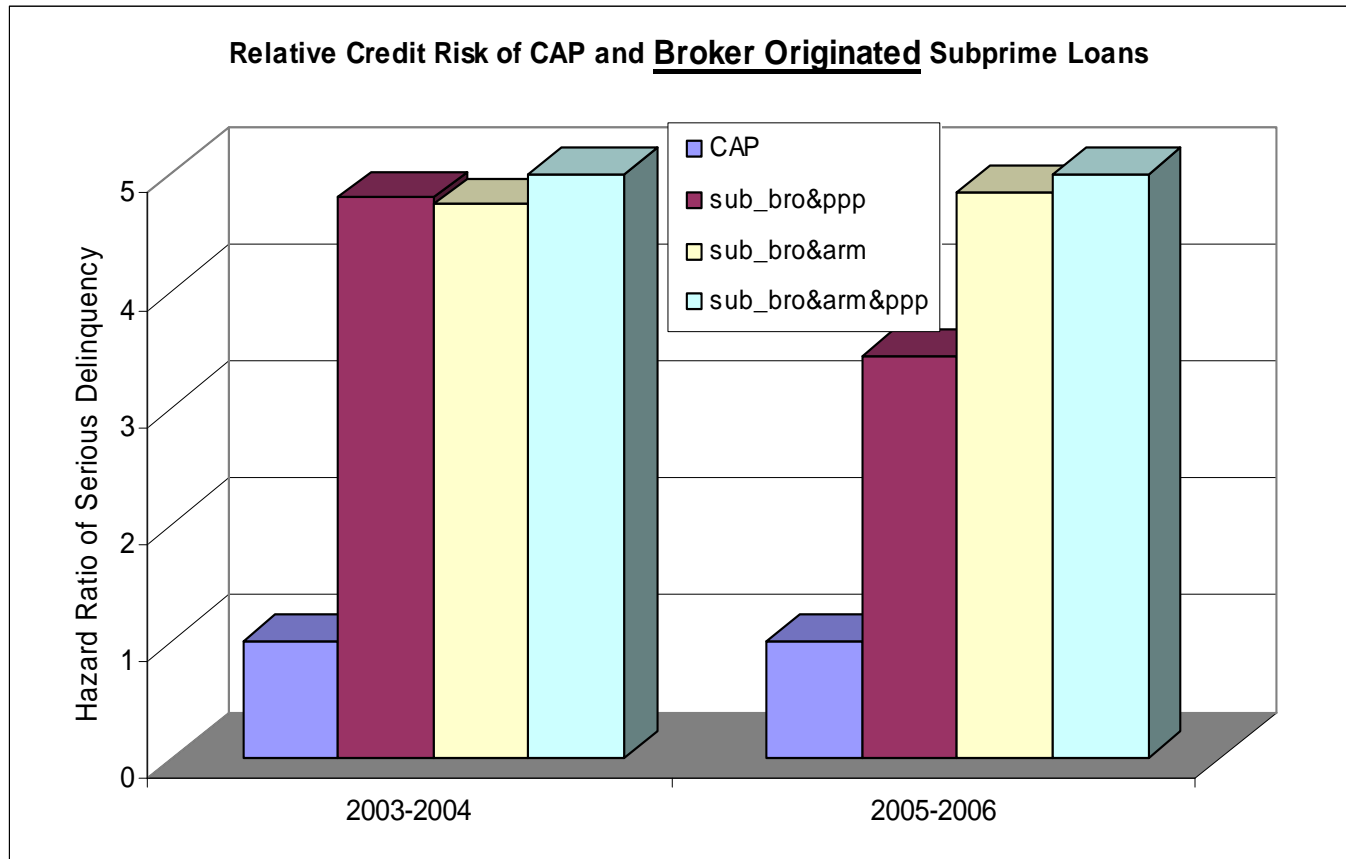


Results and Discussion (II)





Results and Discussion (III)





Results and Discussion (IV)

- The broker origination channel, the terms of adjustable rate, and prepayment penalty all increase the default risk of mortgages.
- Why broker originated subprime loans are more likely to default and more likely to prepay?
 - Subprime loans are much more complex than conventional fixed-rate prime mortgages. It is difficult for borrowers understand complicated loan features and terms and compare costs of different products.
 - Are broker originated subprime loans have significantly higher prices?
 - Are broker originated subprime loans more likely to have high-risk features?
 - Do broker originated subprime loans have looser underwriting standard?



Preliminary conclusions

- The higher default risk of subprime loans may not be attributed to credit risk only, instead it is significantly associated with characteristics of loans products and the origination channel in the subprime market.
- For borrowers with similar characteristics, the estimated default risk would be much lower if they take affordable loans with prime terms and conditions instead of subprime mortgages.