
Foreclosure's Wake

The Credit Experiences of Individuals Following Foreclosure

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The views expressed are those of the authors and do not necessarily represent those of the Federal Reserve Board or its staff.

Research Focus

- Foreclosures lower credit scores and consequently reduce future access to credit
- Very little is known about the size of these declines or how long they last
- We examine the impact that foreclosure has on credit scores and how long it takes individuals to recover
 - Also examine how individuals perform on their credit obligations before and after foreclosure

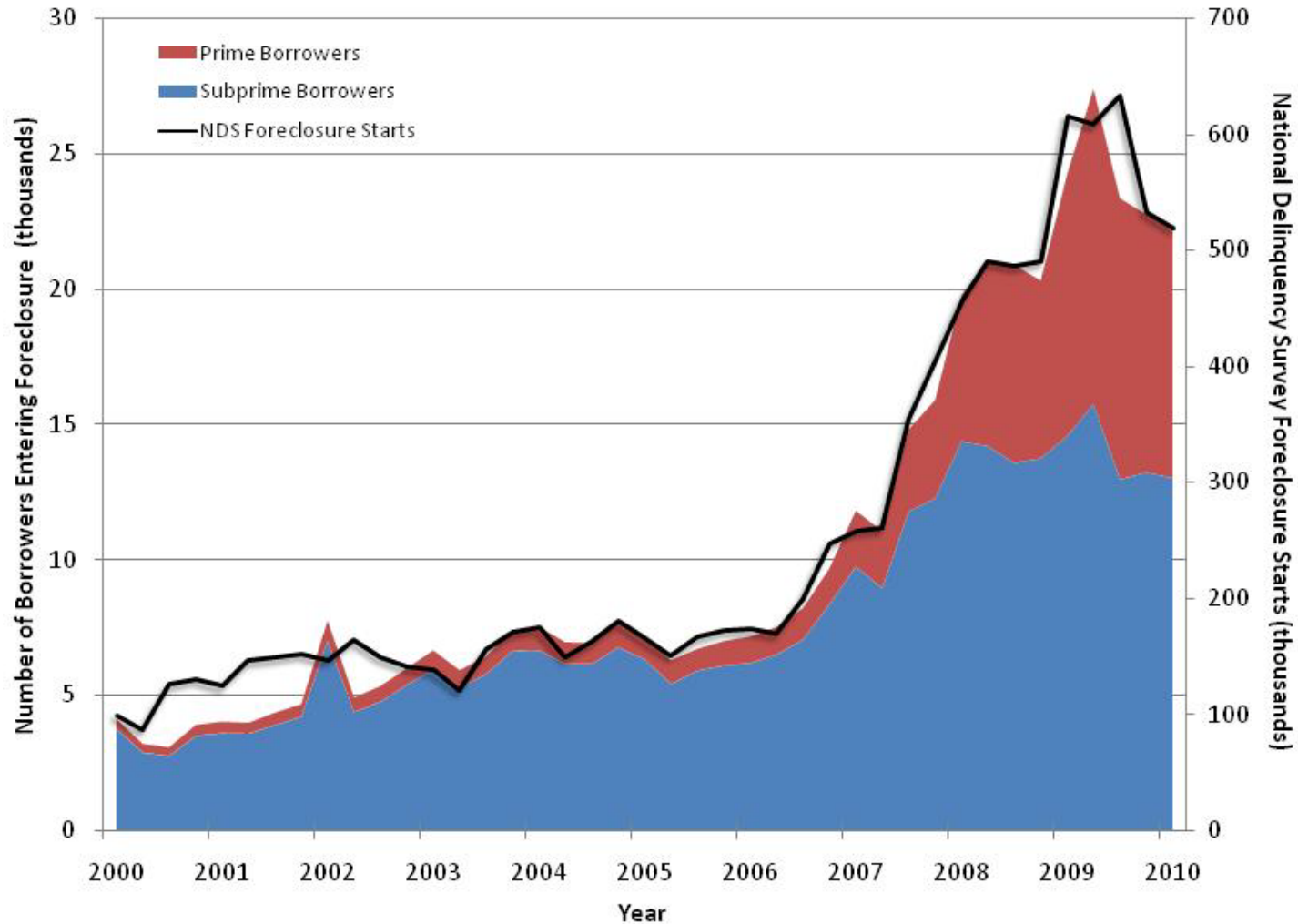
Literature Review

- Lower neighborhood property values
 - Harding, Rosenblatt, & Yao (2009); Immergluck & Smith (2006b); Lin, Rosenblatt, & Yao (2009); Leonard & Murdoch (2009); Mikelbank (2008); Schuetz, Been, & Ellen (2008); Rogers & Winter (2009)
- Increase violent crime rates
 - Immergluck & Smith (2006a)
- Impose substantial costs on local governments
 - Apgar, Duda, and Gorey (2005)

Data – Foreclosure Sample

- Anonymous credit records from Equifax
 - Observed quarterly from 1999Q1 – 2010Q1
- 345,360 individuals whose mortgage entered foreclosure during 2000-2009
- Definitions:
 - “Foreclosure Period” – quarter in which mortgage enters foreclosure
 - “Pre-delinquency Period” – quarter before foreclosure when record last free of mortgage delinquency

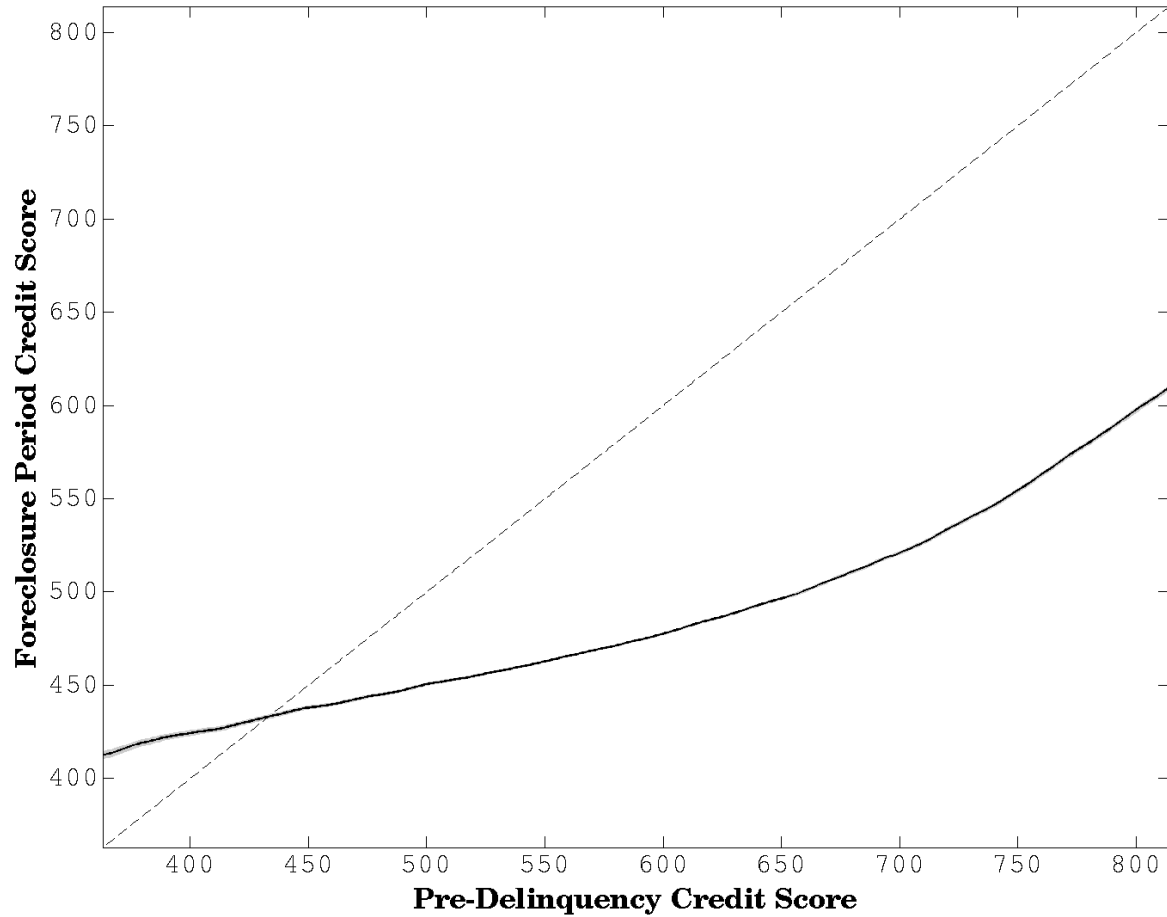
Foreclosure Starts by Quarter



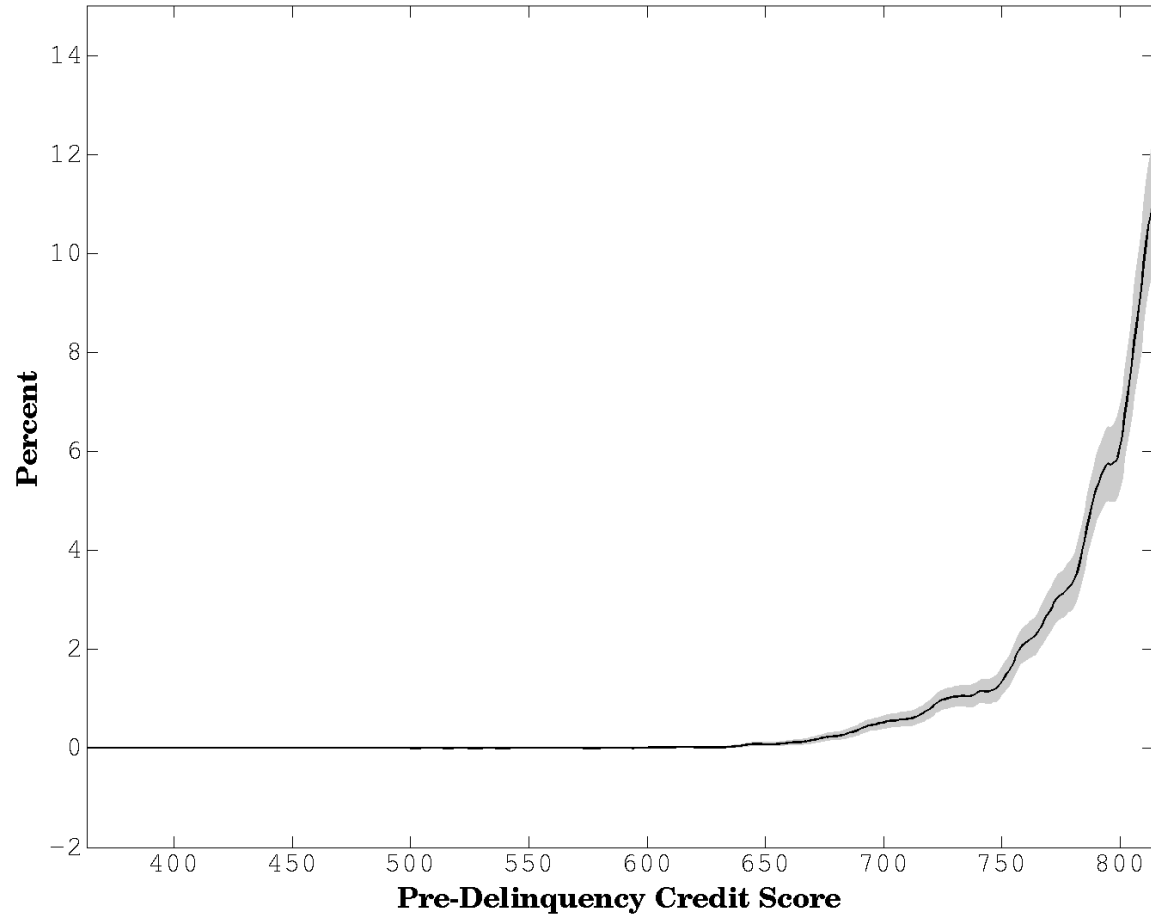
Credit Score Declines Accompanying Foreclosure

- Little is known about the size of declines
 - Models are proprietary
- FICO information suggests scores fall
 - 85 points for borrower with score of 680
 - 160 points for borrower with score of 780
- Simulated score changes based on adding foreclosure in isolation

Score Changes Around Foreclosure



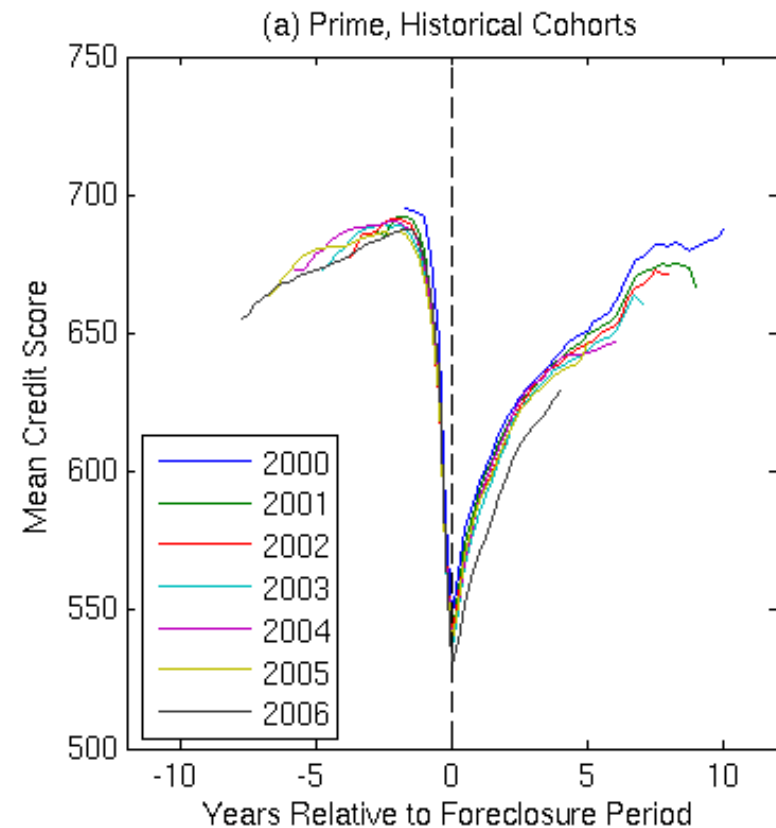
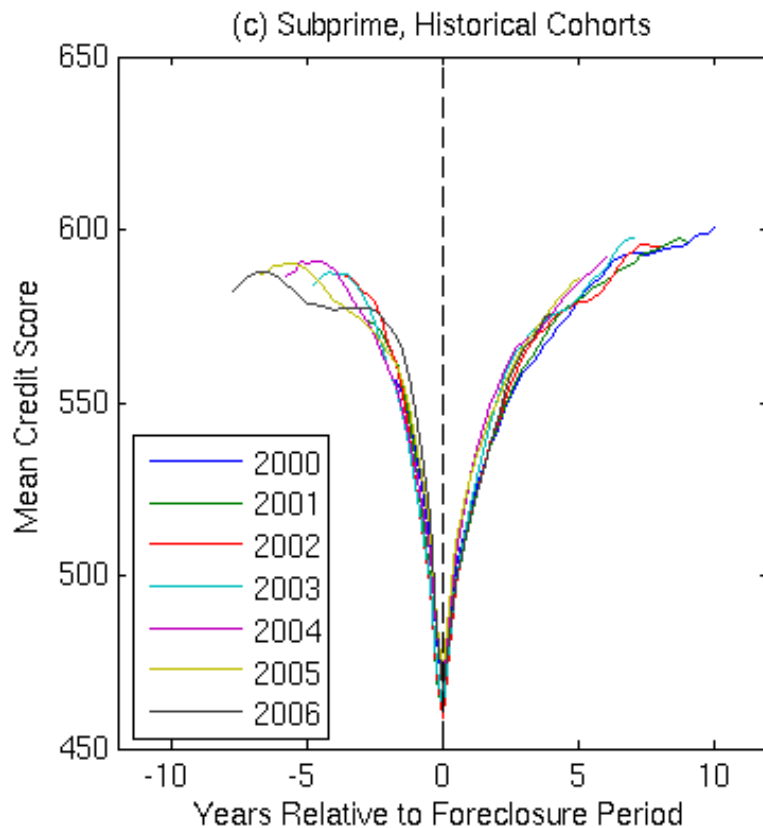
Share With Prime Credit Scores in Foreclosure Period



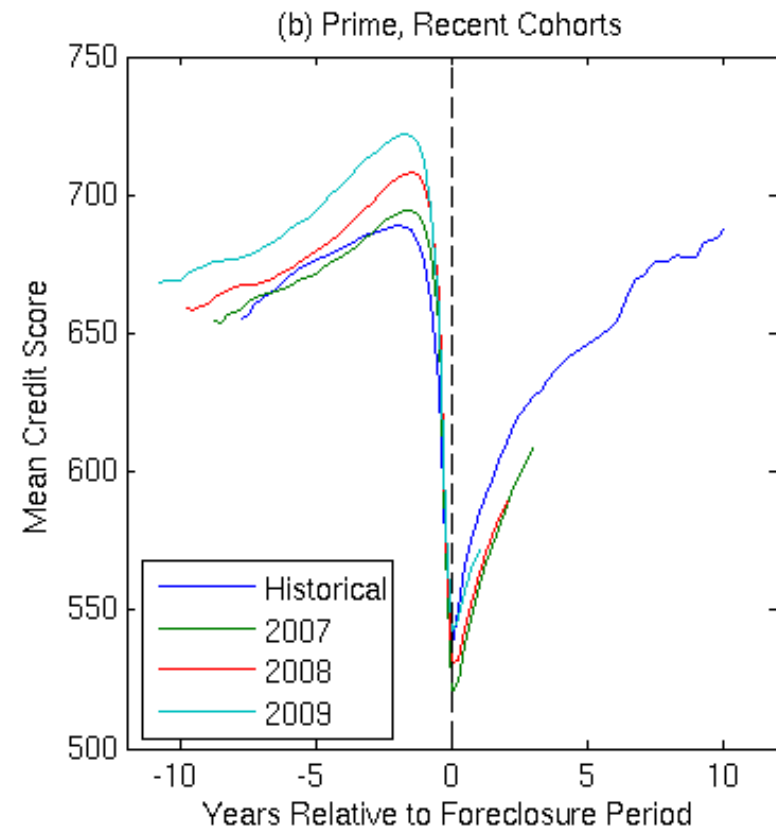
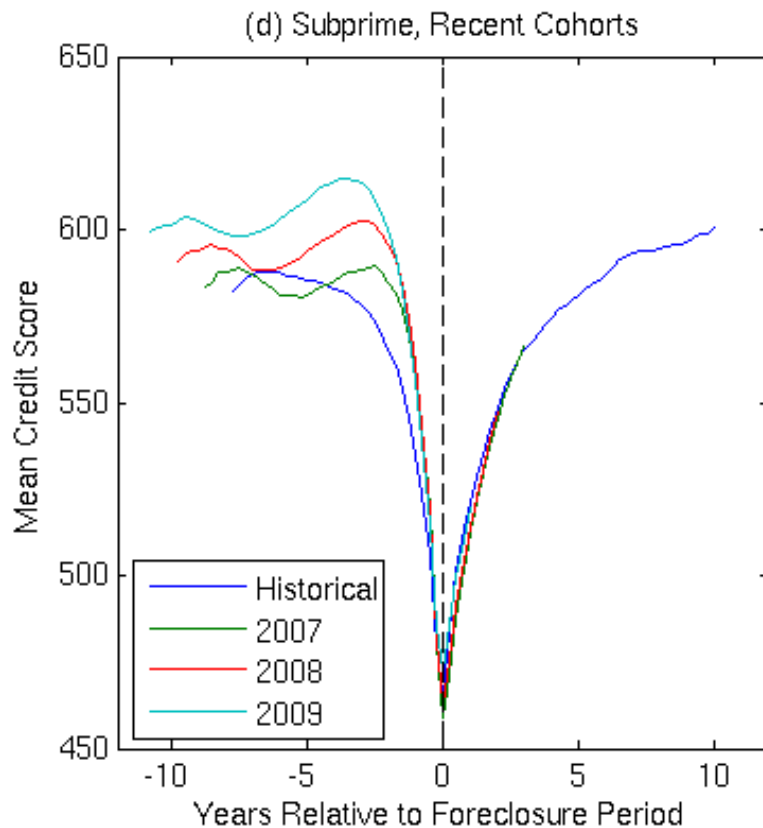
Credit Score Recovery

- Lower credit scores accompanying foreclosure will reduce access to credit
- How long do these reductions last? Possibly not long:
 - FICO suggests scores may recover after 2 years
 - VantageScore simulations indicate recovery may take as few as 9 months
 - Information about foreclosure removed from credit record after 7 years

Mean Credit Scores, Historical Cohorts



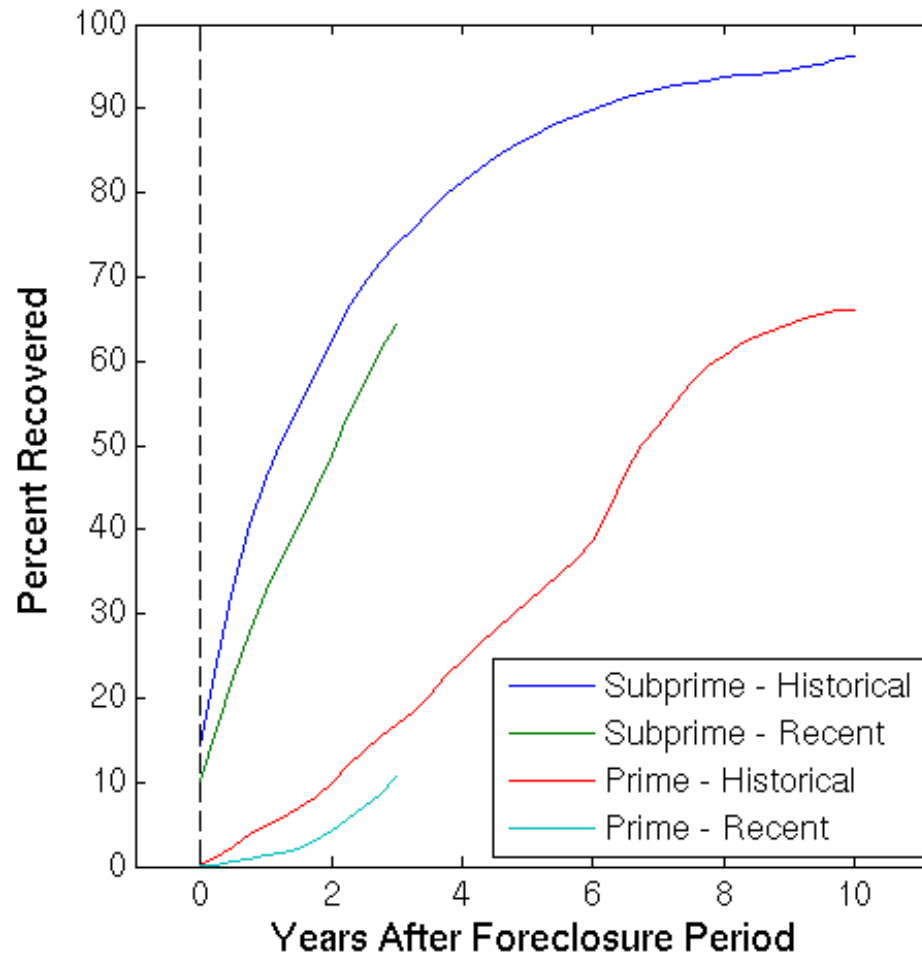
Mean Credit Scores, Recent Cohorts



A More Focused Definition

- A credit score “recovers” when it returns to its pre-delinquency level
- Once a credit score returns to its pre-delinquency level, it is assumed to remain recovered in all subsequent periods

Share with Recovered Credit Score



Multivariate Analysis

- Add two additional populations as control groups
 - Derogatory sample: People with major mortgage delinquency (120 days past due or worse) but no foreclosure
 - 4,992,634 observations
 - Non-derogatory population: Mortgage holders with no evidence of a major mortgage delinquency
 - 1-in-25 sample
 - 8,478,837 observations
- Estimations use weights to account for sampling

Multivariate Analysis

- Credit scores recovering more slowly for recent cohorts
 - Recent cohorts have higher credit scores (even within prime/subprime categorization)
 - Economic conditions may be less favorable to recovery
- Paper employs multivariate analysis
 - Uses county-level data from Quarterly Census of Employment and Wages
 - Sample of individuals with mortgages who did not enter foreclosure
- Multivariate results consistent with figures shown here

Summary Statistics

<u>Variable Name</u>	<u>Full Sample¹</u>	<u>Non-Derogatory Sample</u>	<u>Foreclosure Sample</u>	<u>Derogatory Sample</u>
<i>Credit Scores</i>				
Initial Score	694	702	608	599
Pre-delinquency score	595	N.A.	597	590
Contemporaneous score	713	725	589	594
<i>Dates (Number of quarters since 1999Q1)</i>				
Initial period	0.8	0.8	1.4	0.8
Foreclosure period	29.9	N.A.	29.9	N.A.
Pre-delinquency period	25.4	N.A.	26.4	22.4
Derogatory period	23.8	N.A.	N.A.	23.8
<i>Economic Conditions</i>				
Unemployment rate	5.1	5.1	5.2	5.3
Average weekly wage	729.7	729.8	735.9	709.4
<i>Timelag Variables</i>				
TSINCEFIRST	22.1	22.1	21.8	22.1
<i>Credit Performance</i>				
DELALL	0.095	0.068	0.411	0.366
DELCC	0.065	0.048	0.291	0.281
DELAUTO	0.028	0.017	0.131	0.102
Number of Observations	27,852,407	8,478,837	14,380,936	4,992,634

Model

$$Score_t = \alpha + g(Score_s, t - S) + X_t\beta + f(F, t) + \varepsilon_t$$

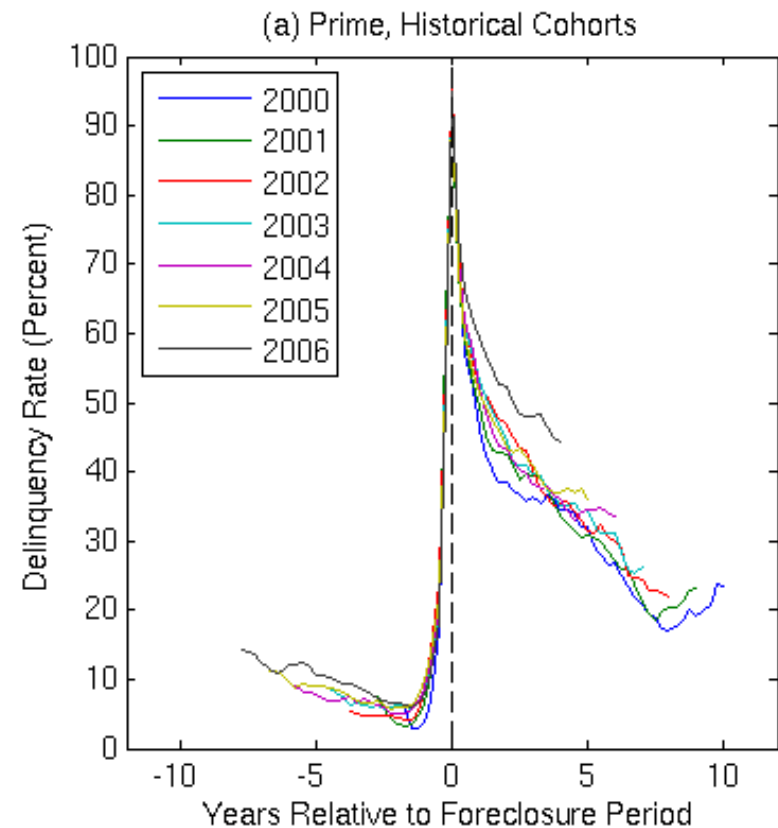
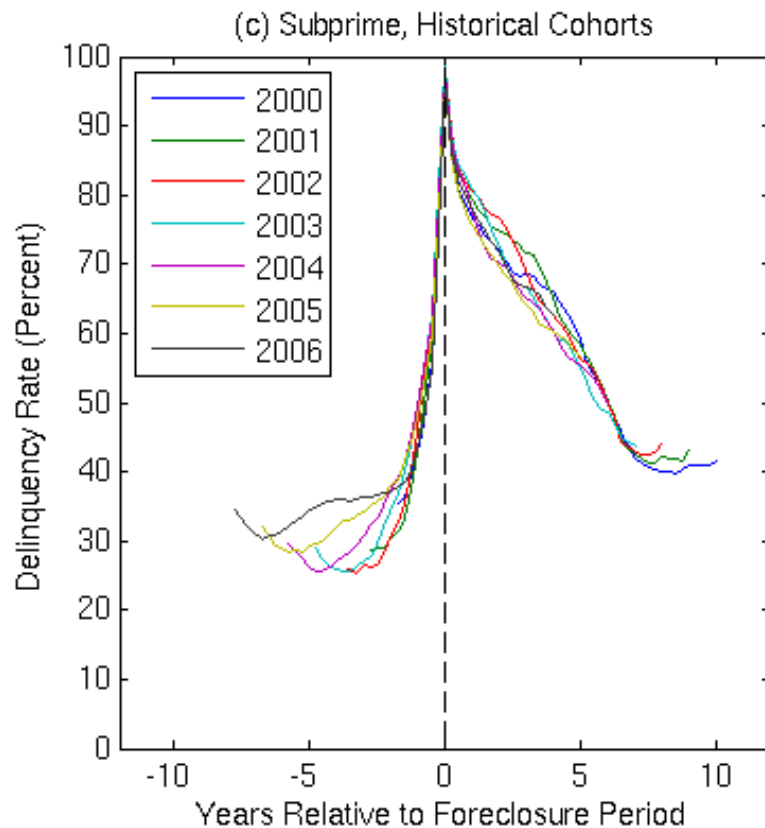
$$f(F, t) \equiv \delta^F + \sum_{i=-8}^{27} I(i = t - F)(\gamma_i + I(F \in R)\gamma_i^R) + I(t - F \geq 28)\gamma_{28}$$

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	SCORE		SCORE		SCORE		SCORE	
	(1)		(2)		(3)		(4)	
Initial Score	0.535***		0.769***		0.771***		0.255***	
Average Weekly Wage	1.915**		19.680***		29.102***		27.491***	
Unemployment Rate	0.146***		-0.051		-0.035		-0.014	
<hr/>								
<i>Time Relative To Foreclosure</i>		Recent Cohort		Recent Cohort		Recent Cohort		Recent Cohort
<i>(Indicator variables):</i>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>
2 years before	-35.665***	11.558***	-32.927***	14.325***	-23.476***	10.500***	-16.346***	5.380***
1 year before	-79.226***	28.261***	-76.548***	29.853***	-59.107***	15.059***	-43.492***	1.105*
Foreclosure period	-206.840***	0.377	-185.184***	-5.246***	-144.338***	-23.404***	-110.548***	-29.968***
1 year after	-151.156***	-14.218***	-129.970***	-17.788***	-94.567***	-30.403***	-68.853***	-29.669***
2 years after	-124.875***	-9.639***	-104.689***	-9.734***	-74.441***	-17.126***	-53.898***	-15.914***
3 years after	-109.942***		-90.819***		-63.660***		-46.830***	
4 years after	-104.561***		-84.061***		-60.270***		-45.430***	
5 years after	-101.352***		-80.792***		-58.752***		-46.168***	
6 years after	-94.385***		-76.914***		-57.748***		-46.985***	
7 or more years after	-76.223***		-67.628***		-57.604***		-52.076***	
<hr/>								
Number of Observations	2,982,431		7,223,032		9,664,551		5,531,026	
R-squared	0.154		0.256		0.242		0.250	

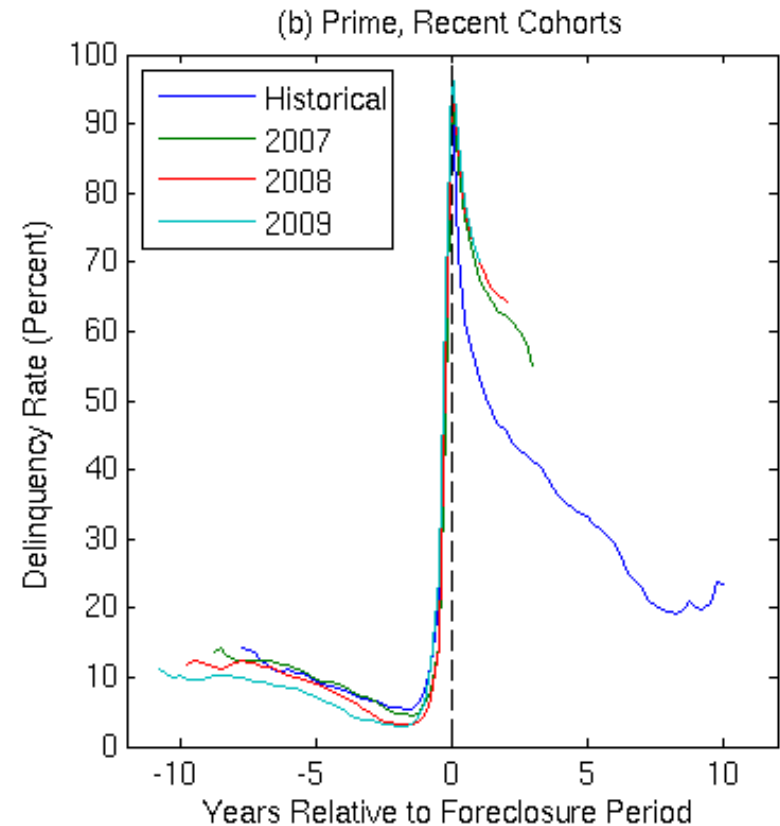
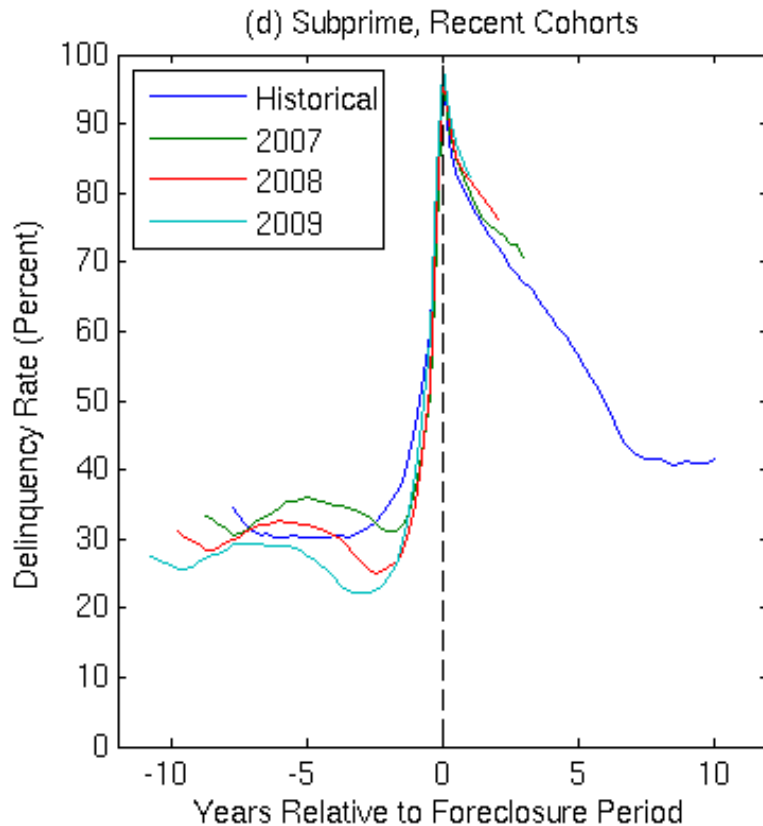
Why Are Scores Persistently Low?

- Reason is unknown
- Cannot be directly attributed to foreclosure after 7 years
- Most likely candidate explanation is payment delinquency
 - Generally most important explanatory variables in credit bureau based models
- Look at share of borrowers who are 90 days past due or worse

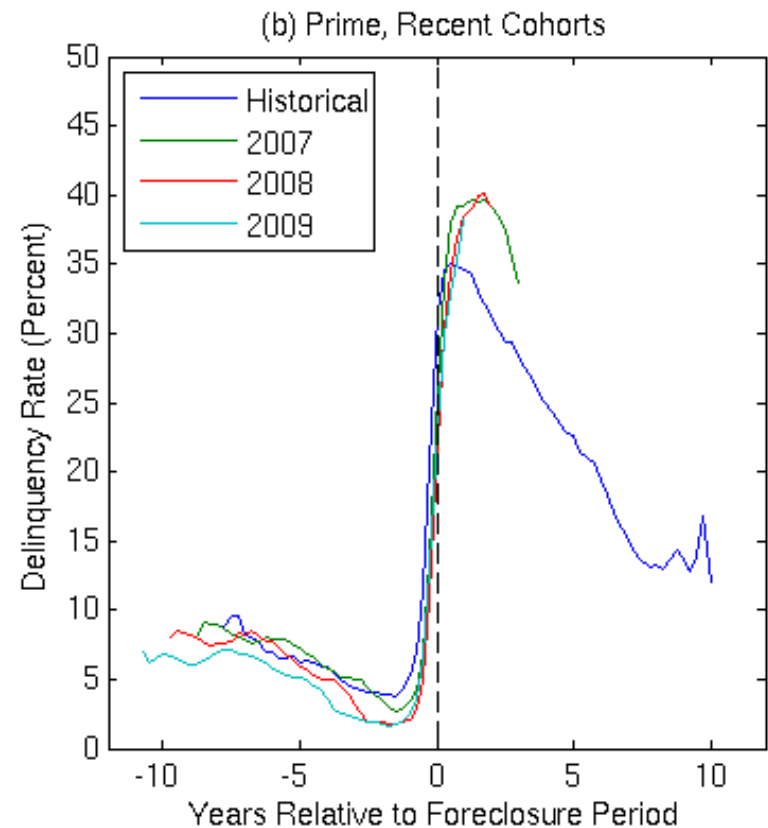
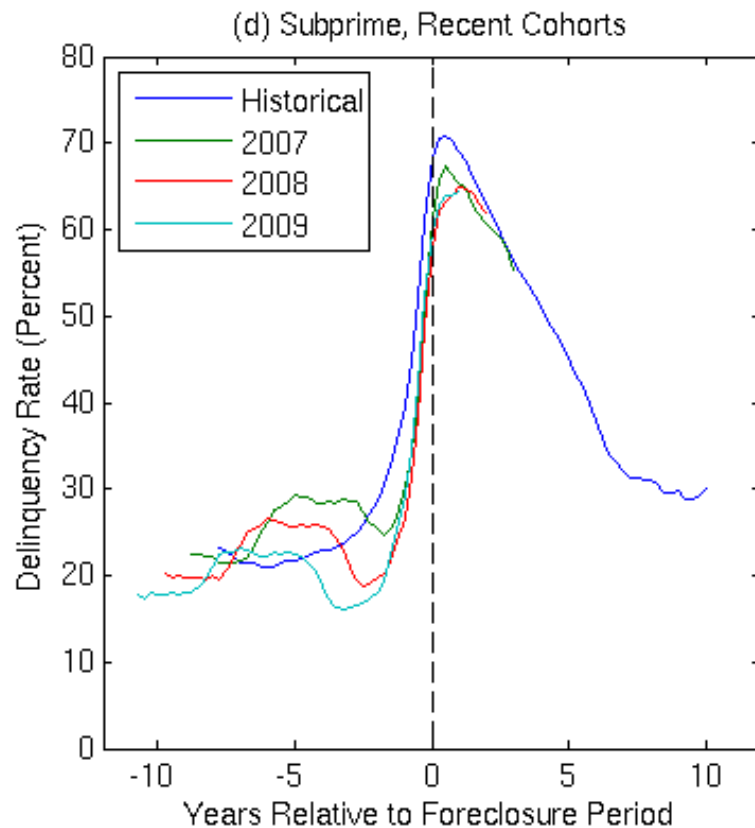
Delinquency Rate on All Credit, Historical Cohorts



Delinquency Rate on All Credit, Recent Cohorts



Credit Card Delinquency Rates



Auto Loan Delinquency Rates

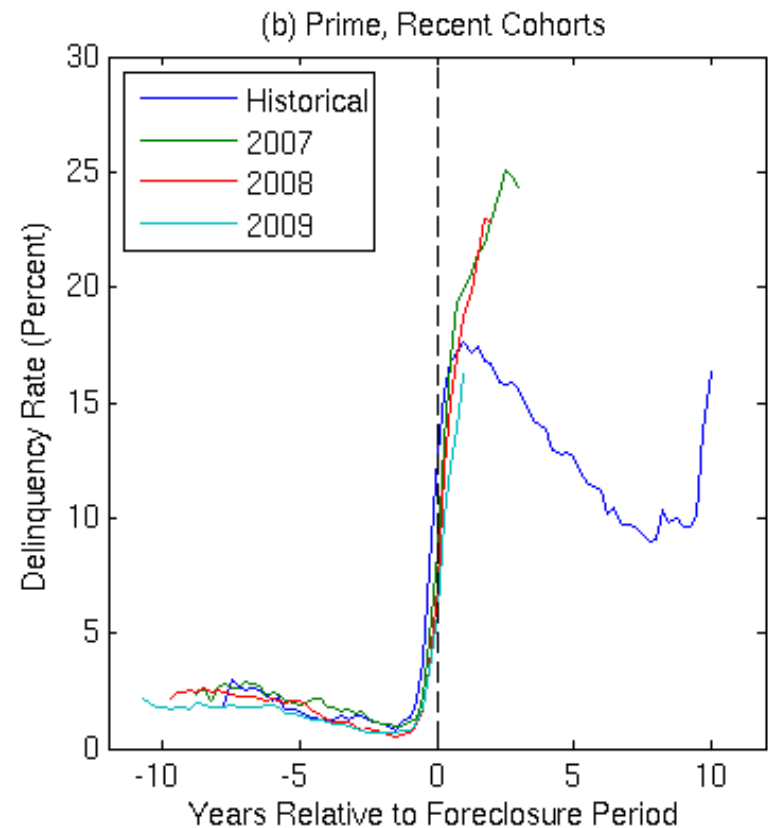
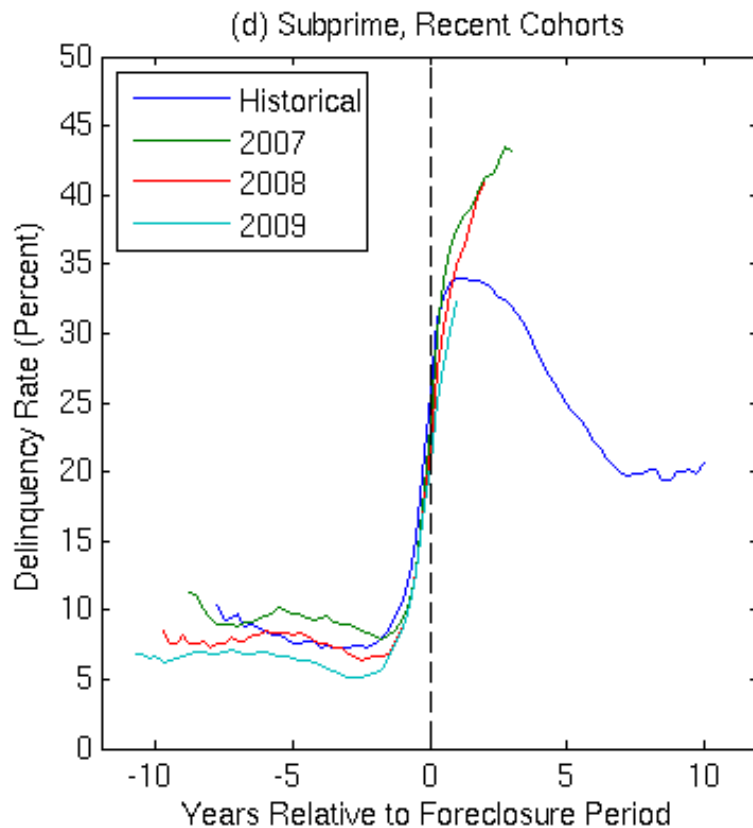


Table 3: Logit Estimation Results of Borrower Delinquency on All Types of Credit

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	All Credit Delinquency		All Credit Delinquency		All Credit Delinquency		All Credit Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.019***		-0.018***		-0.014***		-0.006***	
Average Weekly Wage	-0.125		-0.393***		-0.398***		-0.368***	
Unemployment Rate	0.005		0.019***		0.018***		0.018***	
<hr/>								
<i>Foreclosure Effects</i>		Recent Cohort		Recent Cohort		Recent Cohort		Recent Cohort
<i>(Indicator variables):</i>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>	<u>All Cohorts</u>	<u>Deviation</u>
2 years before	0.623***	-0.258***	0.418***	-0.283***	0.228***	-0.262***	0.044***	-0.251***
1 year before	1.424***	-0.317***	1.090***	-0.374***	0.781***	-0.298***	0.421***	-0.208***
Foreclosure period	6.058***	0.460***	5.591***	0.602***	5.011***	0.505***	4.277***	0.322***
1 year after	2.953***	0.667***	2.735***	0.470***	2.387***	0.401***	1.855***	0.322***
2 years after	2.435***	0.539***	2.309***	0.327***	2.075***	0.223***	1.654***	0.150***
3 years after	2.162***		2.003***		1.844***		1.522***	
4 years after	1.939***		1.740***		1.669***		1.388***	
5 years after	1.596***		1.451***		1.487***		1.249***	
6 years after	1.161***		1.121***		1.227***		1.071***	
7 or more years after	0.391**		0.503***		0.858***		0.888***	
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Number of Observations	2,939,015		7,024,594		9,124,529		5,085,261	
Pseudo R-squared	0.127		0.150		0.105		0.076	

Table 4: Logit Estimations of Borrower Delinquency on Credit Cards

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	Credit Card Delinquency		Credit Card Delinquency		Credit Card Delinquency		Credit Card Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.019***		-0.018***		-0.014***		-0.006***	
Average Weekly Wage	-0.051		-0.443***		-0.508***		-0.490***	
Unemployment Rate	0.004		0.018***		0.017***		0.019***	
<hr/>								
<i>Foreclosure Effects</i>								
<i>(Indicator variables):</i>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>
2 years before	0.681***	-0.321***	0.378***	-0.277***	0.221***	-0.293***	0.109***	-0.349***
1 year before	1.285***	-0.289**	1.059***	-0.426***	0.755***	-0.355***	0.488***	-0.342***
Foreclosure period	2.699***	-0.268**	2.496***	-0.389***	2.025***	-0.220***	1.460***	-0.075***
1 year after	2.498***	0.040	2.338***	0.040	2.107***	0.072***	1.620***	0.079**
2 years after	2.135***	0.033	2.011***	0.019	1.869***	0.098***	1.463***	0.072*
3 years after	1.783***		1.719***		1.633***		1.304***	
4 years after	1.607***		1.438***		1.466***		1.202***	
5 years after	1.188***		1.167***		1.292***		1.072***	
6 years after	0.794***		0.832***		1.012***		0.921***	
7 or more years after	0.220		0.319***		0.685***		0.814***	
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Number of Observations	2,741,471		6,125,883		7,004,536		3,532,992	
Pseudo R-squared	0.098		0.116		0.079		0.053	

Table 5: Logit Estimations of Borrower Delinquency on Auto Loans

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	Auto Loan Delinquency		Auto Loan Delinquency		Auto Loan Delinquency		Auto Loan Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.013***		-0.016***		-0.012***		-0.003***	
Average Weekly Wage	-0.795*		-0.669***		-0.577***		-0.454***	
Unemployment Rate	0.050*		0.012		0.026***		0.029***	
<i>Foreclosure Effects</i>								
<i>(Indicator variables):</i>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>
2 years before	0.078	-0.082	0.258***	-0.438***	0.082***	-0.276***	-0.094***	-0.192***
1 year before	1.247***	-0.914***	0.727***	-0.566***	0.494***	-0.415***	0.188***	-0.320***
Foreclosure period	2.557***	-0.685*	2.094***	-0.732***	1.655***	-0.555***	1.056***	-0.352***
1 year after	2.400***	-0.027	2.285***	-0.222**	1.985***	-0.286***	1.497***	-0.242***
2 years after	2.303***	-0.077	2.085***	-0.088	1.894***	-0.159***	1.497***	-0.127**
3 years after	1.981***		1.841***		1.724***		1.439***	
4 years after	1.730***		1.495***		1.537***		1.323***	
5 years after	1.523***		1.223***		1.346***		1.173***	
6 years after	1.203***		0.994***		1.158***		1.033***	
7 or more years after	0.503		0.538***		0.892***		0.928***	
Number of Observations	852,111		2,936,420		4,243,301		2,371,708	
Pseudo R-squared	0.098		0.132		0.097		0.051	

Individual-Based Delinquency Rates

- Delinquency rates on previous slides have been borrower based
 - Individuals without credit in period t are excluded
- Possible that increase in delinquency reflects high-quality borrowers abstaining for credit use
- Instead look at share of individuals who are delinquent
 - Treat people without credit like people with credit who are not delinquent

Individual-Based Delinquency

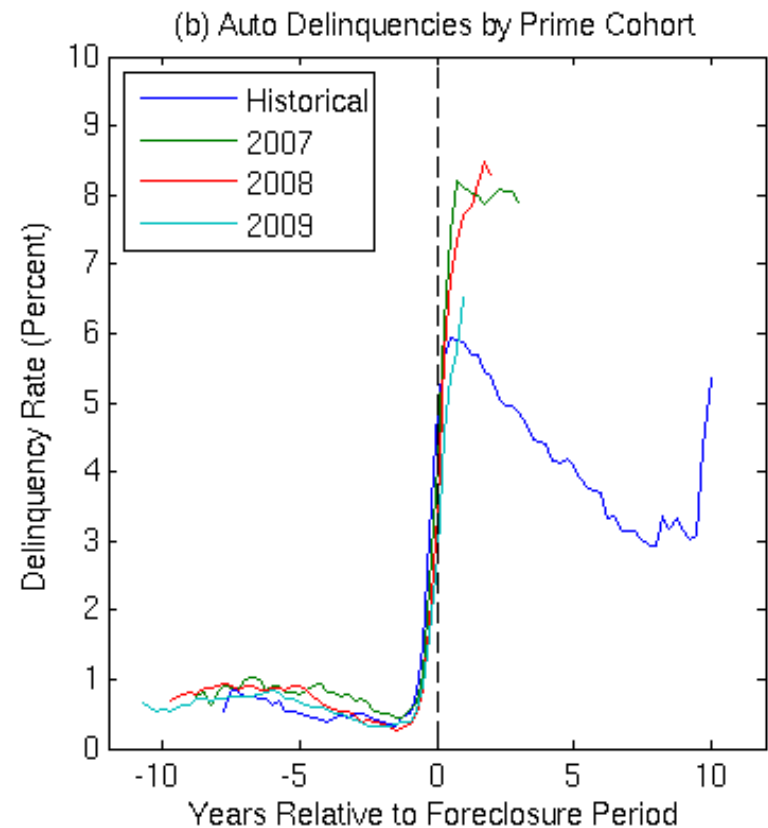
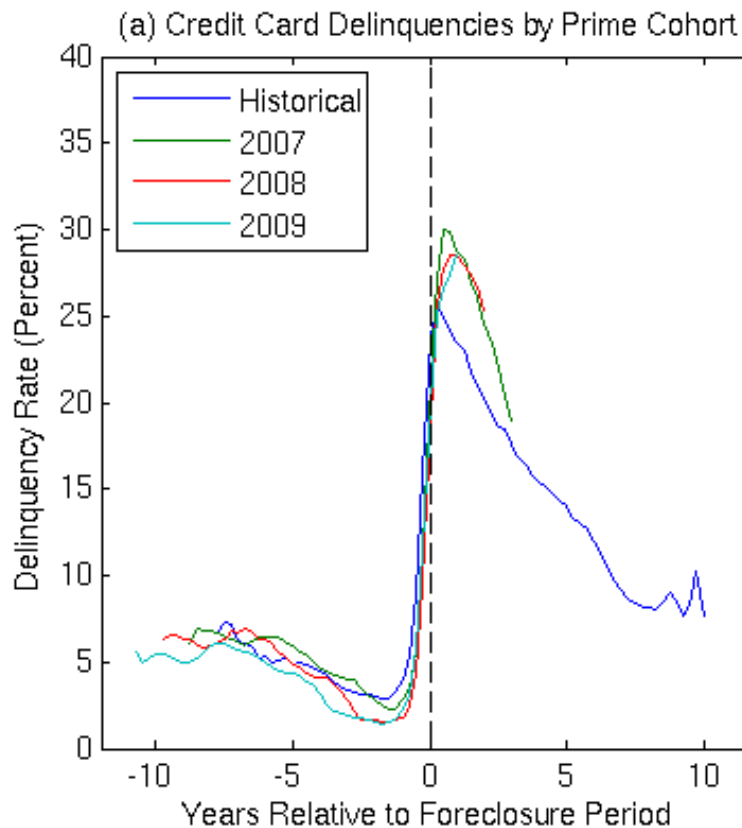


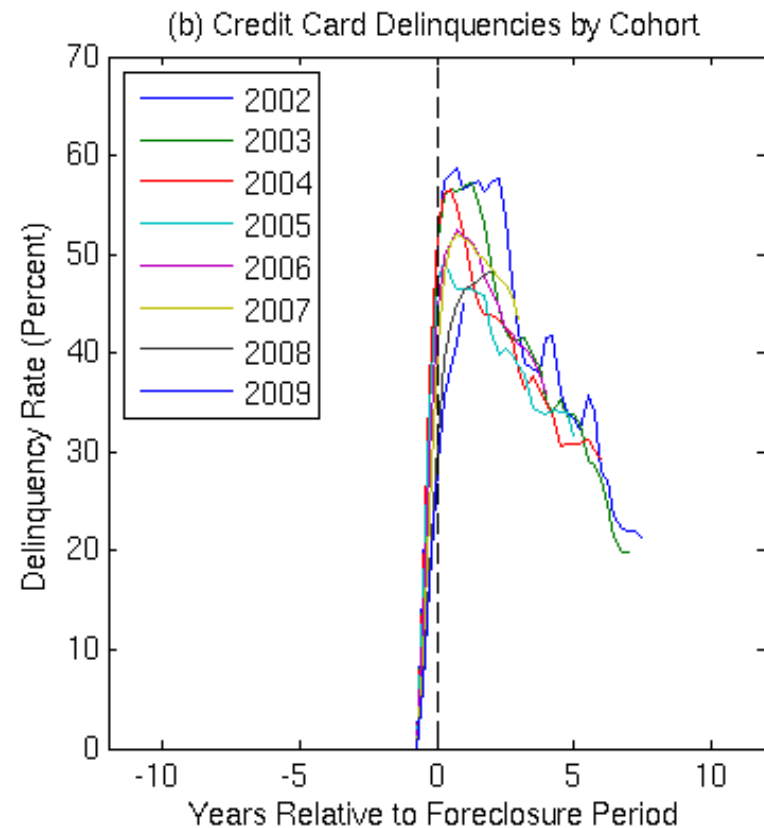
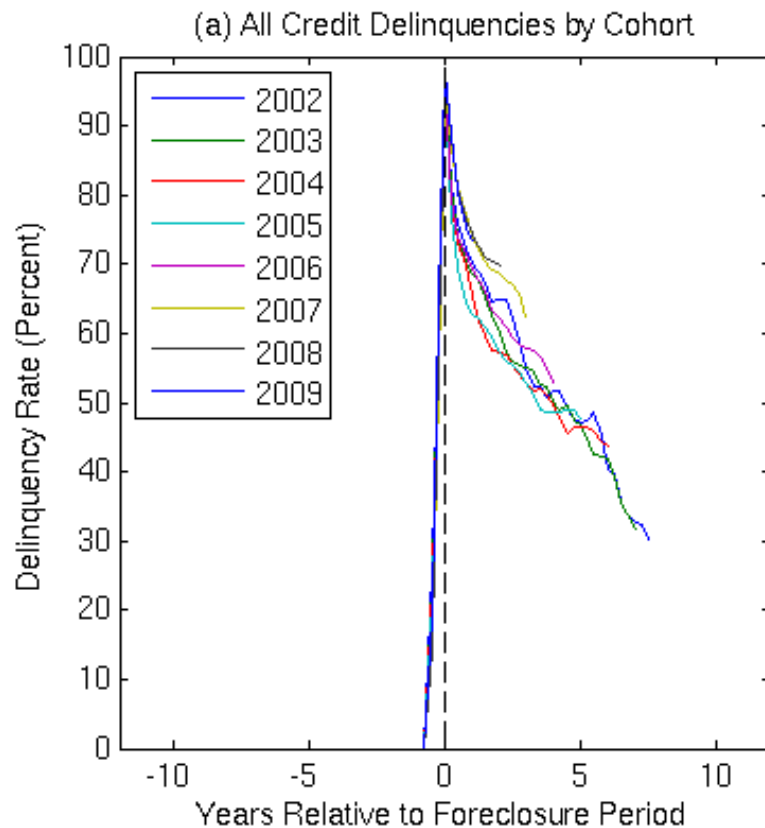
Table 6: Logit Estimations of Individual Delinquency on All Types of Credit

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	All Credit Delinquency		All Credit Delinquency		All Credit Delinquency		All Credit Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.019***		-0.018***		-0.013***		-0.006***	
Average Weekly Wage	-0.118		-0.382***		-0.371***		-0.337***	
Unemployment Rate	0.005		0.018***		0.016***		0.015***	
<i>Foreclosure Effects</i>								
<i>(Indicator variables):</i>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>	<u>All Cohorts</u>	<u>Recent Cohort Deviation</u>
2 years before	0.628***	-0.244***	0.422***	-0.262***	0.251***	-0.241***	0.107***	-0.220***
1 year before	1.428***	-0.294***	1.096***	-0.345***	0.816***	-0.271***	0.513***	-0.167***
Foreclosure period	5.921***	0.593***	5.444***	0.681***	4.770***	0.611***	3.971***	0.525***
1 year after	2.806***	0.715***	2.534***	0.525***	2.117***	0.478***	1.595***	0.424***
2 years after	2.258***	0.526***	2.060***	0.308***	1.745***	0.217***	1.335***	0.182***
3 years after	1.942***		1.718***		1.486***		1.178***	
4 years after	1.685***		1.451***		1.309***		1.042***	
5 years after	1.356***		1.158***		1.119***		0.907***	
6 years after	0.927***		0.808***		0.848***		0.726***	
7 or more years after	0.146		0.179***		0.475***		0.551***	
Number of Observations	3,021,315		7,296,537		9,762,133		5,598,902	
Pseudo R-squared	0.124		0.145		0.097		0.068	

Flawless Payment Sample

- Increase in delinquency may reflect gradual change where borrowers just becoming delinquent more frequently
- Identify subset of the populations with a flawless payment history before foreclosure
 - No evidence of missed payments more than 6 months before foreclosure period
 - At least 3 years (12 quarters) of payments made

Delinquency for Flawless Payment Sample



Recent Cohorts and Strategic Default

- Recent cohorts following similar pattern to historical cohorts, though post-foreclosure experience somewhat worse
 - Robust to controlling for credit score and economic conditions (unemployment)
- Somewhat surprising given the attention given to strategic default in recent foreclosures

Strategic Defaulters

- Difficult to identify strategic defaulters in credit bureau data
 - No information about LTVs
- Instead, we isolate subset of population that is more likely to contain strategic defaulters
 - Calculate decline in FHFA HPI between quarter in which mortgage opened and foreclosure period
 - “Price decline” cohort – individuals for whom HPI decline was at least 20 percent

Price Decline Cohort

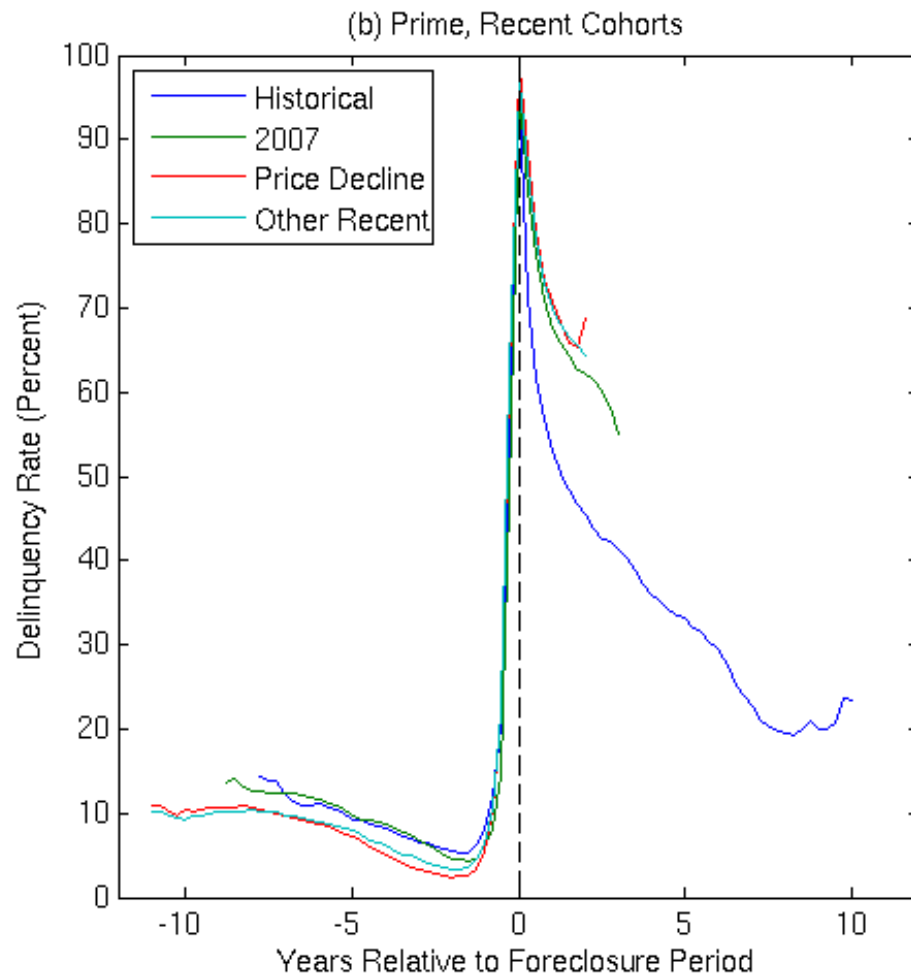


Table 8: Logit Estimations of Borrower Delinquency on All Types of Credit with Price Decline Cohorts

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	All Credit Delinquency		All Credit Delinquency		All Credit Delinquency		All Credit Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.019***		-0.018***		-0.014***		-0.006***	
Average Weekly Wage	-0.124		-0.390***		-0.394***		-0.364***	
Unemployment Rate	0.006		0.020***		0.019***		0.018***	
<hr/>								
<i>Time Relative To Foreclosure</i>								
<i>(Indicator variables):</i>								
	<u>Recent Cohort</u>	<u>Price Decline</u>	<u>Recent Cohort</u>	<u>Price Decline</u>	<u>Recent Cohort</u>	<u>Price Decline</u>	<u>Recent Cohort</u>	<u>Price Decline</u>
	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>	<u>Deviation</u>
2 years before	-0.192**	-0.383***	-0.203***	-0.460***	-0.185***	-0.520***	-0.190***	-0.512***
18 months before	-0.191*	-0.417***	-0.258***	-0.417***	-0.213***	-0.441***	-0.194***	-0.429***
1 year before	-0.252**	-0.347***	-0.318***	-0.276***	-0.260***	-0.221***	-0.178***	-0.239***
6 months before	-0.141	0.162	-0.280***	0.069*	-0.153***	0.077***	-0.026	0.011
Foreclosure period	0.166	1.300***	0.336***	1.241***	0.266***	1.523***	0.157***	1.470***
6 months after	0.731***	0.390***	0.528***	0.508***	0.449***	0.524***	0.345***	0.564***
1 year after	0.621***	0.341*	0.412***	0.460***	0.353***	0.445***	0.290***	0.376***
18 months after	0.626***	0.411	0.378***	0.348***	0.308***	0.361***	0.231***	0.442***
2 years after	0.516***		0.321***	-0.353	0.226***	-0.367	0.156***	-1.262**
<hr/>								
Number of Observations	2,939,015		2,939,015		9,124,529		5,085,261	
Pseudo R-squared	0.127		0.150		0.105		0.076	

Comparison with Major Derogatory Population

- Performance of foreclosure population can be compared to performance of major derogatory population
- Not intended to measure “treatment effect” of foreclosure
 - Could help rule out foreclosure treatment effect if two groups exhibit similar performance

Table 7: Logit Estimations of Borrower Delinquency on All Types of Credit with Derogatory Effect

Initial Score Range:	760 and over		660 to 759		560 to 659		Below 560	
Dependent Variable:	All Credit Delinquency		All Credit Delinquency		All Credit Delinquency		All Credit Delinquency	
	(1)		(2)		(3)		(4)	
Initial Score	-0.018***		-0.018***		-0.013***		-0.006***	
Average Weekly Wage	-0.122		-0.390***		-0.395***		-0.370***	
Unemployment Rate	0.006		0.019***		0.018***		0.017***	
<hr/>								
<i>Foreclosure/Derogatory Effects</i>		Derog		Derog		Derog		Derog
<i>(Indicator variables):</i>	All Cohorts	Sample	All Cohorts	Sample	All Cohorts	Sample	All Cohorts	Sample
		Deviation		Deviation		Deviation		Deviation
2 years before	0.629***	-0.004	0.425***	-0.072**	0.240***	-0.027*	0.057***	0.080***
1 year before	1.433***	-0.383***	1.100***	-0.302***	0.798***	-0.193***	0.442***	-0.037*
Foreclosure or Derogatory period	6.065***	-2.221***	5.593***	-2.066***	5.027***	-1.823***	4.305***	-1.599***
1 year after	2.964***	-1.011***	2.747***	-1.002***	2.414***	-0.867***	1.891***	-0.685***
2 years after	2.450***	-0.862***	2.325***	-0.891***	2.110***	-0.791***	1.699***	-0.645***
3 years after	2.179***	-0.811***	2.025***	-0.806***	1.887***	-0.725***	1.575***	-0.599***
4 years after	1.959***	-0.836***	1.766***	-0.744***	1.718***	-0.657***	1.449***	-0.505***
5 years after	1.619***	-0.852***	1.481***	-0.623***	1.544***	-0.569***	1.318***	-0.405***
6 years after	1.187***	-0.499***	1.155***	-0.558***	1.292***	-0.469***	1.149***	-0.327***
7 or more years after	0.422***	-0.334	0.546***	-0.398***	0.936***	-0.326***	0.984***	-0.212***
<hr/>								
Number of Observations	2,939,015		7,024,594		9,124,529		5,085,261	
Pseudo R-squared	0.142		0.167		0.118		0.085	

Conclusions

- Credit scores decline into subprime ranges as mortgage enters foreclosure
- Credit score recovery takes many years, if it comes at all
- Lack of recovery appears to reflect changes in borrower behavior in the form of higher delinquency

Limitations

- Cannot identify the reasons for this change in behavior
- Three candidate sources
 - Foreclosure may alter borrowers' financial circumstances in manner that makes future delinquencies more likely
 - Lower credit scores or destroyed wealth
 - Event that triggered foreclosure may have persistent effects that alter borrowers' financial circumstances
 - Borrower preferences may change after foreclosure
 - Lower stigma associated with delinquency

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