

Foreclosure's Wake: The Credit Experiences of Individuals Following Foreclosure

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Abstract: While a substantial literature has examined the causes of mortgage foreclosure, there has been relatively little work on the consequences of foreclosure for the borrowers themselves. Using a large sample of anonymous credit bureau records, observed quarterly from 1999Q1 through 2010Q1, we examine the credit experiences of almost 350,000 borrowers before and after their mortgage foreclosure. Our analysis documents the substantial declines in credit scores that accompany foreclosure and examines the length of time it takes individuals to return their credit scores to pre-delinquency levels. The results suggest that, particularly for prime borrowers, credit score recovery comes slowly, if at all. This appears to be driven by persistently higher levels of delinquency on consumer credit (such as auto and credit card loans) in the years that follow foreclosure. Our results also indicate that the experiences of individuals whose mortgages entered foreclosure from 2007 to 2009 have followed a similar path to borrowers foreclosed earlier in the decade, though post-foreclosure delinquency rates for the recently foreclosed have been higher and, consequently, credit score recovery appears to be taking longer.

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I. Introduction

The recent surge in mortgage foreclosures has prompted several policy initiatives aimed at modifying delinquent mortgages and helping borrowers remain in their homes. These initiatives have been informed by a voluminous literature that has identified economic shocks to mortgage holders as being a central cause of mortgage delinquency. These shocks, which can include among other things, job loss, divorce, or a sharp decline in the value of the property backing the mortgage, may leave borrowers unable or unwilling to pay their mortgage and consequently lead to default and possibly foreclosure.

Despite the substantial literature on the economic shocks that lead to foreclosure, very little is known about whether these shocks have effects on the borrowers that persist beyond the resulting foreclosure. One area in which there may be persistent effects is in future access to credit. Mortgage delinquencies reduce credit scores, which makes obtaining new credit both more difficult and more expensive. This suggests that, regardless of the nature of the economic shock, access to credit will be diminished for a time after the foreclosure. However, if the shock is sufficiently transitory, there is reason to believe that this restricted access will be relatively short lived, as credit scoring models tend to discount older delinquencies. As a result, the restricted access to credit may be of short duration, with financially responsible borrowers returning to their pre-delinquency credit scores only short time after undergoing hardship.

However, there are also reasons to believe that the economic shocks that lead to foreclosure may have effects that persist for a longer period of time and that the foreclosure itself may contribute to their persistence. The greater difficulty that individuals face in accessing new credit after a mortgage delinquency, including the higher costs for the credit they obtain, may make it harder for individuals to weather future shocks, thereby making subsequent delinquencies more likely and reducing an individual's ability to restore a credit score to its pre-

delinquency level. Foreclosures may also erode a borrower's ability to withstand future shocks by destroying existing wealth or taking away a wealth-building asset. For such reasons, foreclosures may leave in their wake effects that linger long after the foreclosure has concluded.

This paper examines the credit experiences of borrowers before and after foreclosure using a large panel of anonymous individual credit records, observed quarterly from 1999 through the first quarter of 2010. Our emphasis is on understanding how access to credit, as reflected in individual credit scores, is affected by foreclosure and whether these effects persist over time. As part of this analysis we also examine the performance of individuals on credit obligations, including non-mortgage credit, around the time of their foreclosure and in the years that follow.

The results of our analysis suggest that the credit scores of mortgage borrowers entering foreclosure decline to subprime levels, regardless of their score level before their delinquency, and remain depressed for several years after foreclosure. Persistently lower credit scores appear to derive less from the presence of the mortgage delinquency on the individual's credit record (which remains for seven years following the delinquency) and more to the elevated delinquency rates that foreclosed individuals experience on all types of consumer credit in subsequent years. These post-foreclosure effects are particularly pronounced for borrowers who had prime-quality credit scores prior to their mortgage delinquency.

Our analysis also has sobering implications for the current foreclosure crisis. Our results show that the share of foreclosures that involve borrowers with prime credit scores is substantially higher than it has been in previous years. The post-foreclosure credit experiences of these borrowers appear to be following a pattern that is consistent with what was observed for similar borrowers in earlier years, though the data for borrowers entering foreclosure since 2006 show that their post-foreclosure delinquency rates have been notably higher than the historical

experience and consequently, their credit scores have been recovering more slowly. Based on the historical experience, the thousands of borrowers who are currently being foreclosed (or whom have been recently foreclosed) will likely experience higher levels of credit delinquency and a reduced ability to access credit for several years into the future.

The plan of the paper is as follows. The next section describes the existing literature on mortgage foreclosure, highlighting the implications for post-foreclosure credit experiences. The following section discusses the data used in this study and presents summary statistics about foreclosures during the time period we study. Section 4 discusses how credit scores decline as mortgages enter foreclosure and how they evolve in the years that follow. The performance of foreclosed borrowers on all credit obligations is then discussed in section 5. The last section presents concluding thoughts and provides suggestions for additional research.

II. Literature Review

The literature on the aftereffects of mortgage foreclosure has focused on the negative externalities that result for the neighborhood in which a foreclosed property is located.¹ Most of these studies have examined how a foreclosure affects the sale prices of nearby homes. These studies have generally found that proximity to a foreclosed home lowers a property's sale price (Harding, Rosenblatt, and Yao, 2009; Immergluck and Smith, 2006b; Lin, Rosenblatt, and Yao, 2009; Leonard and Murdoch, 2009; Mikelbank, 2008; Schuetz, Been, and Ellen, 2008; Rogers and Winter, 2009). Mortgage foreclosures have also been found to increase violent crime rates (Immergluck and Smith, 2006a) and to impose substantial costs on local governments (Apgar, Duda, and Gorey, 2005). None of these studies, nor any other study we are aware of, examines the impact that foreclosure has on the borrowers themselves.

¹ In addition to generating negative externalities, foreclosures may eliminate the positive externalities that are associated with homeownership. See Dietz and Haurin (2003) and Haurin, Dietz, and Weinberg (2003) for a discussion of these positive externalities.

A substantial literature, however, has attempted to examine the factors that contribute to foreclosure and to mortgage delinquency more generally.² These studies have traditionally viewed a mortgage as an options contract in which the borrower can “put” the mortgage back to the lender if the investment does not pan out or “call” the mortgage by prepaying the loan if interest rates fall (Kau, Keenan, and Kim, 1994). Under this theory, borrowers whose house value depreciates so that it is worth less than the loan (less any associated transactions costs associated with default) make a strategic decision to walk away from the property and “strategically” default on the mortgage.

Consistent with this “option theory,” several studies have found that negative equity is associated with higher foreclosure rates (Foote, Gerardi, and Willen, 2008; Bhutta, Dokko, and Shan, 2010; Bajari, Chu, and Park, 2008). However, at least as early as Foster and Van Order (1984, 1985), these studies have also generally found negative home equity to be a poor predictor of foreclosure. Many individuals with negative equity do not default and, perhaps more puzzling, some portion of individuals who go through foreclosure have equity in the property.

Because of these puzzles, some, including Vandell (1995) and Elmer and Selig (1999), have argued for the importance of “trigger events” in helping to explain mortgage default. Trigger event theory argues that foreclosures arise as a consequence of unforeseen borrower stress, such as job loss, divorce, or an adverse health event, that renders borrowers insolvent. Particularly when combined with negative housing equity, which eliminates two alternative exits from a loan (selling the property or refinancing into a more affordable mortgage), this insolvency results in a foreclosure. However, as shown by Elmer and Seelig (1999), borrower insolvency by itself can result in foreclosure, so negative equity is neither sufficient nor necessary.

² For a review of this literature, see Department of Housing and Urban Development (2010).

The empirical evidence for the importance of trigger events has been mixed. While several studies have found factors related to trigger events (such as income) to be related to foreclosures, studies have generally found negative equity to be a more important predictor (Capozza, Kazarian, and Thomson, 1997). As several authors have suggested, the primacy of house prices may be a reflection of having better data on an individual's equity position in a property than information about their solvency level, which has generally been estimated by the use of aggregated measures such as county-level unemployment rates. In addition, it is possible that house price depreciation may be partly caused by mortgage delinquencies that may both decrease the demand and increase the supply of single-family housing.

While these two explanations offer very different perspectives on what drives foreclosures, the post-foreclosure experiences of individuals in both cases may be similar in many regards. Both strategic defaulters and insolvent borrowers will experience substantial declines in their credit scores as a result of the foreclosure and will face reduced access to credit as a result. Similarly, in both cases, borrowers will lose any equity in the property that they had accumulated or would have accumulated in the future had they remained in the house.

Despite these similarities, however, there are reasons to expect that borrowers who default because of a trigger event will fare worse following a foreclosure than those who engage in strategic default. First, whatever economic shock led the borrower to be unable to make their payments may continue after the foreclosure. This could result in higher delinquency rates following the foreclosure that would inhibit a borrower's recovery. The trigger event may also have caused delinquencies on loans besides the mortgage, whereas delinquencies on other credit obligations would be less likely for a strategic defaulter. This would lead to a larger initial decline in credit score following the foreclosure that may make it more difficult for a borrower to recover.

III. Data

The data used in this study come from a large random sample of individual credit records drawn at the end of each quarter from Equifax, one of the three national credit bureaus. The same individuals are selected each quarter, allowing us to track their credit experiences over time, though the identities of these individuals remain anonymous.³ These data cover the time period from the first quarter of 1999 through the first quarter of 2010.

The information provided by the bureau includes aggregated summary measures on the credit accounts that each individual maintains. For example, we know the number of auto loans each person has, the total balances owed on these accounts, and the delinquency status of these loans. Account-level information is available for mortgage loans, but not for other types of credit. The data also include the credit bureau's proprietary credit score that, while not a FICO score, uses a similar numeric scale.

We observe the credit records of over 11.7 million individuals contiguously from the first period they appear in the data through the first quarter of 2010. Most records are observed for the entire period covered by our sample, but for borrowers whose first credit experiences occurred at some point after the first quarter of 1999, we observe their credit records from when they entered the bureau data onwards.⁴

From this population, we construct a "foreclosure sample" comprised of 345,360 individuals whose mortgage entered foreclosure between 2000 and 2009.⁵ To be included in this

³ The data include a unique sequence number that allows us to track individual credit experiences over time without any personal identifying information. All of the individuals in our sample remain anonymous.

⁴ We exclude from the sample those records that are not observed contiguously. Most of the credit records that are excluded for this reason involve records that appear for a short time (less than one year) and then disappear. We believe these are predominantly "fragmented" files; that is, they are records that exist to hold information on accounts that cannot be uniquely linked to an existing individual's credit record. Fragmented files will disappear when they are successfully linked to another record.

⁵ We also can identify records with new foreclosures during 1999Q2-1999Q4 and 2010Q1. We exclude these individuals from our foreclosure sample because of a lack of pre-delinquency information for people in the earlier period and a lack of post-foreclosure experience for those entering foreclosure in 2010. We cannot identify

sample, an individual's credit record must show no evidence of foreclosure before 2000 and must indicate a severe mortgage delinquency during the quarter in which the foreclosure record first appeared (the "foreclosure period").⁶ For this population, we identify the credit score from the quarter prior to the foreclosure period in which the individual's credit record was last free of any mortgage delinquencies (the "pre-delinquency score") and use this score to characterize each individual's pre-mortgage-delinquency creditworthiness in univariate analyses. Borrowers with credit scores of 660 or above are denoted as "prime" and those individuals with scores below this level are "subprime." Most of our analysis is conducted using individuals in the foreclosure sample exclusively.

For comparison purposes, we construct two additional samples that are used in our statistical estimations. The first is a "derogatory sample" that is comprised of 107,339 individuals who experienced a major mortgage delinquency (120 days past due or worse) between 2000 and 2009, but who do not appear to have entered foreclosure. To ensure that individuals in this sample do not include those whose loans will enter foreclosure, we include only those individuals whose credit record indicates that at a later date they were no longer delinquent on a mortgage. This will arise when mortgages return to a current state, are charged off by the lender, or are paid off by the borrower. For this population, we denote the quarter in which their mortgages first became 90 or more days past due as the "derogatory period."

The second comparison sample is the "nonderogatory sample." In constructing this sample, we identify over 5 million individuals with a mortgage during our sample period whose credit records contain no indication of foreclosure activity and who are not in our derogatory sample. We then draw a 1-in-25 sample from this population that comprises our nonderogatory

individuals entering foreclosure in 1999Q1 because without data from earlier periods we cannot determine if a foreclosure record was new that quarter or had been reported in a previous quarter.

⁶ We require evidence of a severe mortgage delinquency during the quarter to ensure that we have accurately captured the timing of the foreclosure.

sample. Sampling is necessary to keep the number of observations used in estimations to reasonable levels.⁷ In these estimations, weights are used to account for the different sampling rate for this population. The derogatory and nonderogatory samples are used in estimations where a control group for the foreclosure sample is appropriate.

While the pre-delinquency credit characteristics of individuals in the foreclosure and derogatory samples can easily be identified and compared, the non-derogatory population does not have an equivalent reference period. To facilitate comparisons among all three samples, we focus on the first period in the data in which we observe a credit score for an individual, the “initial period,” and refer to the credit score from this quarter as an individual’s “initial score.” We use this score to characterize the pre-delinquency creditworthiness of borrowers in multivariate analyses.

The data supplied by the credit bureau are supplemented by data on economic conditions from the Quarterly Census of Employment and Wages (QCEW), produced by the Bureau of Labor Statistics. The QCEW provides one of the few measures of economic activity at the county level that is released in a sufficiently timely manner to cover most of the period of our sample. These data include information on the unemployment rate and on the average weekly wage in each county. At the time this dataset was compiled, the QCEW data was available through the fourth quarter of 2009, so multivariate analyses that use the QCEW data do not include information from 2010Q1.

A complete listing of the variables used in this study and their mean values for all three samples and for the combined sample are presented in table 1. The unit of observation used in

⁷ Since each individual can generate as many as 45 observations (one for each quarter between 1999 and 2010Q1), using all of the observations would have resulted in a dataset with over 200 million observations.

calculating these means, and in the estimations in this paper, is the individual-quarter, such that each individual may generate as many as 45 observations.

Beyond the means reported in table 1, these data show a substantial increase in foreclosure activity during the time period covered by our sample. The stacked areas in figure 1 show the number of borrowers in our sample whose mortgage entered foreclosure in each quarter from 2000Q1 through 2010Q1. While foreclosure activity appears to have increased steadily over the entire sample period, the increase has been particularly pronounced beginning as early as the middle of 2006. Much of this increase (particularly from 2007 onwards) has involved borrowers who had prime pre-delinquency credit scores. This suggests that the borrowers whose mortgages entered foreclosure after 2006 were more numerous and, at least prior to their mortgage entering delinquency, higher credit quality.

Comparing the foreclosure rates in the credit bureau data with rates from other sources is complicated by the unit of observation. While most sources of data report the number of *loans* entering foreclosure, the bureau data provide a count of the number of *borrowers* whose mortgage enters foreclosure. Loans that are jointly held by more than one borrower will be reflected in the credit record of each account holder, and consequently, will be over-represented in the bureau data. Since jointly held loans generally have lower delinquency rates, rates calculated using bureau data will be consistently lower than account-based delinquency rates. Nevertheless, when the number of borrowers entering foreclosure from the bureau data in this sample is compared to the number of loans entering foreclosure from the Mortgage Bankers' Association's *National Delinquency Survey*, both sources of data show a very similar time trend of foreclosure activity, as shown by a comparison of the black line and the stacked shaded area in figure 1.

IV. Credit Score Transitions

One immediate effect of mortgage foreclosure (or more generally of the mortgage delinquencies that precede them) is a reduction in credit score. Because the equations that generate these scores are not publically available, very little is known about the magnitude of the declines. The limited information made available by Fair Isaac suggests that FICO scores fall by about 85 points for a hypothetical borrower with a pre-delinquency score of 680 or 160 points for a borrower with an initial score of 780 (Christie, 2010). These declines are calculated based on simulated events in which a foreclosure occurs in isolation with no other accounts becoming delinquent.

Since foreclosures may be triggered by events that result in delinquencies on other types of credit (*e.g.*, credit cards) simulated declines may understate the actual declines that borrowers experience as their mortgages enter foreclosure. To gauge the magnitude of the experienced score declines, we compare pre-delinquency credit scores with foreclosure-period credit scores for the individuals in our foreclosure sample.

Figure 2 shows foreclosure-period credit scores as a function of pre-delinquency credit scores. Except at the very lowest credit score levels, credit scores declined substantially leading up to the foreclosure. Individuals with higher pre-delinquency credit scores experienced larger declines. The magnitudes of these declines, as expected, are larger than those reported for the FICO score, likely reflecting delinquencies on other accounts and changes in other risk factors such as utilization rates.⁸

An important consequence of the score declines shown in figure 2 is that foreclosed borrowers see their credit scores fall to subprime levels, regardless of their pre-delinquency

⁸ For a borrower with a 680 score, we find that scores decline on average by about 170 points (compared to the 85 points reported by Fair Isaac) and for a borrower with a 780 score the decline would be closer to 200 points (compared to 160 points). These comparisons are complicated, however, by the fact that the analysis documented in this paper does not use a FICO score.

score. As shown in figure 3, very few borrowers have a prime-quality credit score (660 or above) once their mortgage enters foreclosure. Even those borrowers who had the highest pre-delinquency scores are overwhelmingly subprime as their mortgage enters foreclosure.

Credit Score Recovery

The information about a foreclosure and the other delinquencies that occur at the same time will remain on a borrower's credit record for 7 years. So a foreclosure itself could conceivably have a direct effect that persists for that long; however, because the recency of delinquency is generally an important factor in credit scoring models, the negative effects of these events should diminish rapidly. According to Fair Isaac, FICO scores can recover in as little as two years if individuals pay their bills on time and limit their use of credit.⁹ In addition, simulations using the VantageScore indicate that a person can return his credit score to its pre-delinquency level in as few as 9 months, by bringing delinquent accounts to current status (VantageScore, 2010). Credit score recovery, therefore, may occur years before the information on the foreclosure is removed from a credit record.

This suggests that, if the economic shocks that led to the foreclosure are sufficiently transitory, a borrower's credit score may return to its pre-delinquency level after only a couple of years. Longer recovery times might then serve as an indication that the foreclosure itself was followed by additional difficulty.

The four panels of figure 4 show average credit scores in the years before and after foreclosure for individuals in the foreclosure sample. The sample is subdivided according to whether the borrower had a prime or subprime credit score (top and bottom panels, respectively) and according to the year in which their mortgage entered foreclosure. The two left panels show the seven "historical" cohorts (2000 to 2006) and the right panels show the three "recent" cohorts

⁹ See <http://www.myfico.com/crediteducation/questions/Foreclosure-FICO-Score-Affect.aspx>, last visited July 8, 2010.

(2007 to 2009). These figures show that credit scores bottom out in the foreclosure period and then begin to immediately rebound, with the pace of recovery appearing to be slower and less complete for prime borrowers. While these patterns are evident for all cohorts, the recent cohorts generally have higher pre-foreclosure scores and lower post-foreclosure scores than the historical cohorts.

A clearer picture of the time it takes an individual's credit score to recover is provided in figure 5. We compare a borrower's credit score in each post-foreclosure quarter to his pre-delinquency score. When the score returns to, or exceeds, its pre-delinquency level, his score is considered to have recovered in that period. Once a score has recovered, it is considered to be recovered in all subsequent periods regardless of whether the score remains above its pre-delinquency level.¹⁰ For most subprime borrowers, credit scores recover to their pre-delinquency levels within a few years of the foreclosure period. Over 60 percent of subprime borrowers in the historical cohorts saw their credit scores recover within two years of the quarter in which their mortgage entered foreclosure. After eight years, about 94 percent of subprime borrowers recover.

As was suggested by the mean score changes, credit score recovery for prime borrowers is much slower. After two years, only 10 percent of prime borrowers have returned their credit scores to their pre-delinquency levels. The pace of recovery increases sharply at around six years after the foreclosure period, which is approximately the time we would expect information

¹⁰ An alternative definition of "recovery" (at least for prime borrowers) might be when a person's credit score returns to prime levels (i.e., above 660). This definition, however, ignores that expected delinquency rates decline as scores increase, even through the prime ranges (Board of Governors, 2007), and as a result, with risk-based pricing, borrowers can expect to pay higher costs for credit than they would have had they maintained their pre-delinquency scores. Additionally, credit scores may be noisy measures of borrower creditworthiness (both across time and across scores calculated from the three national credit bureaus) such that borrowers with lower prime scores will be more likely to find themselves below the prime-score cutoff on any given day than they would have had they had the (higher) prime credit scores prior to their mortgage delinquency. For these reasons, we believe that borrowers whose scores return to prime levels, but remain below their pre-delinquency levels, have not completely recovered.

about the mortgage foreclosure to be removed from borrowers' credit records.¹¹ But even after the delinquency information has been expunged, recovery appears to be incomplete for many prime borrowers. One-third of prime borrowers in our sample do not see their credit scores return to their pre-delinquency levels. This is true even for those borrowers whom we observe 10 years after their mortgage entered foreclosure.

While we observe a shorter post-foreclosure period for individuals in the recent cohorts, the patterns in figures 4 and 5 suggest that these borrowers are having a more difficult time returning their credit scores to their pre-delinquency levels. For both prime and subprime recent cohorts, the pace of recovery has been consistently slower than was observed for borrowers in the historical cohorts. We would expect this pattern for two reasons. First, the pre-delinquency scores of borrowers in the recent cohorts are higher than in the historical cohorts and higher credit scores appear to recover more slowly. Second, macroeconomic conditions in the post-foreclosure period for borrowers in the recent cohorts may have been less favorable to score recovery than the conditions faced by borrowers in the historical cohorts.

To examine the extent that differences in the path of credit scores over time may be affected by the economic environment, we estimate equations that control, to the extent possible, for economic conditions. These estimations also use the derogatory and non-derogatory samples to help identify the effects of time and economic conditions.

Using S and F to denote an individual's initial and foreclosure periods, respectively, we model individual's credit score in quarter t as

$$Score_t = \alpha + g(Score_S, t - S) + X_t\beta + f(F, t) + \varepsilon_t \quad (1)$$

¹¹ Under the Fair Credit Reported Act (FCRA), delinquency information, including information about foreclosures, must be removed from an individual's credit record after seven years from the date of first delinquency. As a result, foreclosure information should be removed in fewer than 7 years after foreclosure.

where α is a county-specific fixed effect, $g()$ is a function representing the expected path of credit scores over time, X_t includes county-level economic effects (i.e., the unemployment rate), $f()$ captures deviations experienced by individuals around the time of their foreclosure, and ε_t captures unobserved effects. The function $g(\text{Score}_s, t-S)$ is formalized in our estimations as a linear combination of each individual's initial score, Score_s , and a linear spline (with yearly breakpoints) of time elapsed since the first period, $t-S$.

The effects of foreclosure on the path of credit scores are captured by the function $f(F, t)$. We model this function using an annual cohort fixed effect and a series of dummy variables representing each quarter relative to the foreclosure period. Specifically, it's parameterized as

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

where δ^F is the annual cohort effect, i indexes the quarters relative to an individual's foreclosure period and $I(\cdot)$ is an indicator function that equals one if the condition is true and zero otherwise, and R is the set of quarters in the recent cohorts. The effects for quarters more than 2 years prior to the foreclosure period are normalized to zero. We include a recent cohort deviation, γ_i^R , which allows us to test whether the experiences of recently foreclosed borrowers have been identical to those of borrowers in earlier years. Quarterly effects for 7 or more years after foreclosure are consolidated into a single effect, γ_{28} , which captures the long term effects on score. Since we do not observe 7 years of post-foreclosure experience for borrowers in the recent cohorts, there is no recent cohort deviation for this long-term effect.

The foreclosure effects captured by $f(F, t)$ represent deviations from the expected path of credit scores over time. Because the expected path of credit scores may be very different for individuals with substantially different initial scores, and to reduce the sample sizes used in

estimation, we estimate equation (1) using four subsamples based on each individual's initial score.

The results of these estimations, which are shown in table 2, are largely as expected. Within each subsample, a higher initial credit score is positively associated with subsequent scores. The average weekly wage in a county is also positively and significantly related to score changes, with larger effects for subprime individuals. County-level unemployment rates are also generally negatively associated with score changes, though not to a statistically significant extent, for borrowers with scores below 760. For individuals with initial scores of 760 or above, unemployment rates have a positive and highly significant effect, which we believe represents the tendency this population to reduce their use of credit in times of economic distress, which results in higher scores.

The pattern of credit scores around the time of foreclosure is similar to that observed in the univariate figures. Credit scores decline in the two years leading up to a foreclosure and begin to recover immediately after the foreclosure period. Scores, however, remain persistently and significantly depressed in the years that follow. Even after seven years after the foreclosure period, credit scores are 50 to 75 points below where they would have been otherwise.

These estimates suggest that, while credit scores *can* recover after a short period of time, in practice they do not. Instead, foreclosures appear to be followed by persistently lower credit scores that likely reduce borrower access to credit for many years. Since these effects continue beyond the point at which the information about the foreclosure is removed from each person's file, these declines cannot be explained by the foreclosure itself and instead must derive from other factors.

V. Performance on Credit Obligations

The persistence of low credit scores beyond the point at which information about a foreclosure is removed from a credit record suggests that the post-foreclosure behavior of individuals may be different after foreclosure. Performance on credit obligations is generally the most important component in credit scoring models and, therefore, it is the most likely cause of the observed score differences.¹² To examine this possibility, we examine how delinquency rates change for borrowers around the time their mortgage enters foreclosure.

The four panels of figure 6 show the share of prime (top panels) and subprime (bottom panels) borrowers who were 90 or more days past due on one or more of their credit obligations in the quarters around the foreclosure period for each of the 10 foreclosure cohorts. While delinquency rates are substantially higher for subprime borrowers, the general patterns over time are similar for both borrower types. Delinquency rates spike to around 100 percent in the foreclosure period, primarily reflecting the mortgage delinquency itself, and then decline subsequently.¹³ However, even several years after the foreclosure period, delinquency rates remain above the levels observed prior to the foreclosure period. This is particularly true for prime borrowers, for whom delinquency rates remain substantially higher. For example, while approximately 10 percent of borrowers with prime pre-delinquency credit scores were delinquent on a credit obligation five years before the foreclosure period, the delinquency rate eight to ten years after the foreclosure was about twice this level.

¹² Payment history comprises 35 percent of the FICO score and 32 percent of the VantageScore making it the most important group of credit characteristics comprising each model. For more information, see Fair Isaac (2009) and http://www.vantagescore.com/about/vantagescore_model/ (last visited July 13, 2010).

¹³ Delinquency rates in the foreclosure period do not increase exactly to 100 percent. This is because the delinquency data record the status of an account at the end of the quarter. It is possible for an individual to have a new foreclosure record without being delinquent in the foreclosure period, provided that the mortgage that enters foreclosure is reported as having been closed prior to the end of the quarter in which the new foreclosure record is first reported.

This finding offers a potential explanation for the persistence of lower credit scores after foreclosure. The lower scores may reflect higher delinquency rates on credit in the years after foreclosure. This change in behavior appears to impact performance on all types of credit. Figures 7 and 8 show the share of credit card borrowers and auto loan borrowers who were delinquent on one or more of these accounts, respectively. For both loan products, delinquency rates increase substantially around the foreclosure period and peak shortly thereafter. While the share of borrowers with a delinquency on these products subsequently decline, they remain above the levels observed in the years before the foreclosure period.

To examine the extent to which these changes in delinquency rates can be attributed to changes in the macro- or regional economic environment, we estimate logit models of borrower delinquency. The dependent variable in these models takes on a value of 1 if a borrower was 90 or more days past due on a credit obligation at the end of the quarter, or zero if they were current or less than 90 days delinquent on all of their accounts. The right-hand-side variables are specified in the same manner that we used for estimations of credit score changes (equation (1)). We also use the same four subsamples based upon borrowers' initial credit scores.

The results of these estimations for delinquency on all credit obligations are shown in table 3. As expected, these results indicate that, within each of the subsamples, a higher initial credit score is associated with lower delinquency rates. Additionally, the average weekly wage in the county is negatively associated with delinquency and the unemployment rate is positively associated with delinquency.

Patterns of delinquency around the foreclosure period are consistent with the univariate results. Delinquency peaks in the foreclosure period and declines thereafter. However, in the following years, the delinquency rate remains above the levels observed more than two years prior to the foreclosure (which, as with the credit score migration estimations, are normalized to

zero and used as a base period). Similar patterns are observed from delinquency rate estimations for credit card and auto loan borrowers (tables 4 and 5).

These estimations provide somewhat inconsistent pictures of how the performance of the recent cohorts on their credit obligations compares to the historical experience. Overall delinquency rates (on all credit) for the recent cohorts appear to increase more slowly approaching the foreclosure period than the historical experience, but appear to reach higher levels in the quarters following foreclosure. For credit cards, the patterns are similar though the differences in the years after foreclosure are only significant for subprime borrowers. In contrast, auto loan delinquency rates for borrowers in the recent cohorts appear to be lower for these borrowers both before and after the foreclosure period.

Individual-Based Delinquency Rates

One potential criticism of the delinquency rates used in this section is that they are calculated for borrowers; that is, they show the share of individuals with a particular type of credit who are 90 or more days past due on at least one of these obligations. Using credit cards as an example, individuals without a credit card are not included in the numerator or denominator of the credit card delinquency rates. To the extent that less creditworthy individuals are more likely to be excluded from credit markets following foreclosure, the increase in delinquency rates that we observe should underestimate the true change in behavior. However, it is also possible that more creditworthy individuals, who would have been less likely to go delinquent, disproportionately tend to avoid the market for these credit products after foreclosure. In this case, the estimated change in delinquency would be an overstatement and could primarily reflect a changing composition of the individuals who borrow after foreclosure.

To test whether this is the case, we also examine the share of *individuals* with a delinquent account around the foreclosure period. This share of individuals is similar to the

delinquency rates we showed earlier, except that those individuals without credit are treated like individuals who obtained credit and were not delinquent. These shares are shown for credit cards and auto loans in the four panels of figure 9. While these shares are lower than the borrower-based rates by construction, they continue to show a pattern in which borrowers are more likely to be delinquent on all types of consumer credit after foreclosure. If we use a similar definition of delinquent in our logit estimations, as shown in table 6, the results are also consistent with our earlier results. Therefore, our results do not appear to be driven by a changing composition of borrowers in the years following foreclosure.

Flawless Payment Histories

The higher post-foreclosure delinquencies that we attribute to a change in borrower behavior might represent a more subtle shift. Borrowers who have previously gone delinquent periodically prior to foreclosure, may simply go delinquent in the post-foreclosure period with greater frequency. As a result, the change that we observe in the data may not reflect a break with past patterns as much as a gradual change.

To examine this possibility we isolate a specific portion of our foreclosure sample that meet two criteria. First, they must have no evidence on their credit record of having been delinquent on a credit account more than six months prior to the foreclosure period. Second, they must have exhibited at least three years (12 quarters) of on-time payment performance, meaning they must have had accounts open for at least that long. Individuals who meet these two criteria have a demonstrated history of being able to make on-time payments and handle credit over a prolonged period of time.

Despite this history of on-time payments, these individuals experience delinquency patterns that are similar to others in the foreclosure sample (figure 10, panel (a)). By construction, none of the individuals in this subsample have any delinquencies more than 2

quarters before their foreclosure period. In the foreclose period, approximately 100 percent of these individuals are delinquent on a credit obligation and though delinquencies fall off thereafter, they remain at elevated levels throughout the eight years of post-foreclosure experience that we observed. On credit cards, auto loans, and other non-mortgage credit obligations (panels (b)-(d)), delinquencies spike around the foreclosure period and peak shortly after. Delinquencies then decline steadily, but remain well elevated above the pre-delinquency levels. Patterns for other types of credit, which are not shown in the figures, reveal similar patterns for these borrowers.

The patterns observed for this subsample suggest that the changes we observe between the pre- and post-foreclosure time periods represent a substantial break with past patterns and not a gradual decline of marginal borrowers. These individuals had demonstrated a history of timely payments prior to their foreclosure and exhibit substantially worse payment performance in the years that follow. The behavior of these borrowers appears to have substantively changed around the time their mortgages entered foreclosure.

Mortgage Derogatory without Foreclosure

It is difficult to determine to what extent (if any) the effects documented in this paper are the result of the foreclosure process itself or other causes. However, we can compare the credit experiences of borrowers who went through foreclosure with those of borrowers in our derogatory sample, who experienced major derogatory episodes on their mortgages, but who do not appear to have gone through the foreclosure process.

To do this we estimate a logit model of borrower delinquency that includes a separate function that captures the effects of a major mortgage derogatory on the delinquency rate of borrowers on credit obligations. This function is identical to the function estimation for the foreclosure effect, though it is calculated relative to the derogatory period defined earlier. The

results of this estimation are provided in table 7, where the coefficients on the derogatory effect are expressed as deviations from the foreclosure effect.

These results suggest that borrowers who experience a major mortgage delinquency, but who do not appear to have started the foreclosure process also experience persistent effects. However, these effects appear to be milder than those observed for the foreclosure population, as shown by the negative coefficients on the derogatory sample deviation. This difference is statistically significant for all four credit score groups.

We cannot, however, necessarily attribute this difference to the foreclosure process itself. Borrowers who experience a major derogatory on their mortgage but not foreclosure may have experienced less severe shocks and, as a result, been able to avoid foreclosure. As such, this difference may reflect a selection, and not a treatment, effect. Regardless of the reason, however, borrowers who go through foreclosure appear to experience significantly worse aftereffects than other distressed mortgage borrowers.

Recent Experience and Strategic Default

The relatively poor performance of the recent cohorts of borrowers, both in terms of delinquency and credit score recovery, is somewhat unexpected. While some of this may be attributable to a less-favorable economic environment or higher initial credit scores of these borrowers, the results persist even when we control for these factors.

One reason why this finding is surprising is the attention that has been paid in the literature and in news stories about the role of strategic default in recent foreclosures. For example, Guiso, Sapienza, and Zingales (2009) estimate that 26 percent of existing mortgage defaults involve borrowers who are strategically defaulting. As discussed earlier, we would expect the post-foreclosure experiences of these borrowers to be less severe than that of

borrowers who default as a result of trigger events or hardship. If the recent cohorts of borrowers include a larger share of strategic defaulters, we would expect post-foreclosure credit experiences of the recently foreclosed to be better than the historical patterns.

Since the patterns of likely strategic defaulters may be obscured by the post-foreclosure experience of other foreclosed borrowers, we attempt to better isolate those borrowers that were most likely to be engaging in strategic default. Since the credit bureau data do not provide any information about the value of the property used to secure the mortgage, it is difficult to identify those individuals whose mortgages were underwater. Nevertheless, using the Federal Housing Finance Administration's (FHFA's) quarterly house price index, we calculate the percentage decline in house prices between the quarter in which the mortgage was originated and the quarter in which it entered foreclosure. Those individuals for whom the house price index decline was at least 20 percent are identified as "price decline" cohort. We estimate logit models, similar to those estimated earlier, that include an additional foreclosure effect deviation for the individuals in this group.

The results of this estimation are shown in table 8. As in the previous tables, the coefficients on the foreclosure effects for the recent cohorts are shown as deviations from the patterns of the historical cohorts. The coefficients for the price decline cohort are expressed as deviations from the patterns of the recent cohorts. Therefore, a coefficient of zero on a foreclosure effect for the price decline cohort would indicate that their experience in that quarter was identical to the recent cohort. Instead, the estimated coefficients for the price decline cohort appear to be amplified values of the coefficients for the recent cohorts, both in terms of being lower in the pre-foreclosure periods and higher in the post-foreclosure periods. This suggests the post foreclosure delinquency rates of the individuals in the price decline cohorts have not only

been higher than the historical cohorts, they have been higher than other borrowers in the recent cohorts that do not appear to have confronted house price declines that were as severe.

The reasons for this result are not clear. Perhaps these individuals had a larger share of their wealth tied up in their homes, so when house prices declined they were less able to cope with post-foreclosure shocks. Alternatively, our methodology for identifying likely strategic defaulters may be inadequate or the number of strategic defaulters may be fewer than is commonly believed. Unfortunately, the credit bureau data do not provide sufficient information to determine whether this, or any other explanation, is accurate. However, these results do suggest that the post-foreclosure experience of borrowers who have experienced large price declines is consistent with what is observed for other foreclosed borrowers.

VI. Conclusions

The recent foreclosure crisis has drawn a lot of policy and research attention to the causes of mortgage foreclosures and to responses designed to mitigate these problems. The paper contributes to the literature on foreclosures by examining the consequences that foreclosure may have for borrowers in terms of their future access to credit.

Our analysis, which is based on a large anonymous sample of credit bureau records, examines the credit experiences of individuals in the wake of foreclosure. We find that credit scores decline into the subprime range as a borrower's mortgage enters foreclosure. While scores begin to recover almost immediately, for borrowers who had prime-level credit scores prior to their mortgage delinquency, the recovery takes many years, if it comes at all. The lack of recovery appears to reflect a change in borrower behavior following foreclosure in which the borrower exhibits greater levels of delinquency on all types of consumer credit in subsequent years.

With the data available, we are unable to identify the reasons for this change in behavior. Nevertheless, there are at least three possible explanations for the patterns that we observe. First, the foreclosure process may alter a borrower's financial circumstances in a manner that makes future delinquencies more likely. Mortgage delinquency and foreclosure lower borrower credit scores, thereby reducing access to credit or increasing the costs of access. The foreclosure may also destroy wealth or deprive borrowers of a wealth-building asset, thereby reducing their ability to weather the trigger events that are associated with delinquency. In this case, the change in borrower circumstances that can explain future elevated delinquency levels is a direct effect of the foreclosure.

A second possible explanation is that the foreclosure may have been the result of some trigger event that itself has lingering effects on a borrower's ability to make timely payments on credit obligations. For example, a mortgage borrower may experience an adverse medical event that results in higher medical costs or reduces her ability to earn income for a period that continues beyond the foreclosure. This could lead to a higher level of credit delinquency and a lower credit score going forward. Other trigger events, such as job loss or divorce, may produce similar effects. In this case, the change in the behavior of borrowers after foreclosure is the result of changed financial circumstances that arise from an income or expense shock (a trigger event). Therefore, these changes in borrower behavior are the result of changed financial circumstances that do not arise from the foreclosure, but rather from the event that triggered the foreclosure.

The final possibility is that the changes we observe are independent of borrowers' financial circumstances and, instead, represent changes in borrower preferences. Going through a foreclosure may lower the "stigma" that the borrower internalizes from the delinquency. Alternatively, having a low credit score may reduce the incentive for making on-time payments.

As a result, borrowers may perceive lower costs of delinquency in the future. Unlike the previous two explanations, this possibility focuses on a change in borrower behavior that is internal to the borrower.

These possible explanations are not mutually exclusive, and each may play a role in explaining subsequent changes in borrower behavior. With the data that we have available, we are unable to directly test whether each of these play a role or, if so, the contribution that each makes to the post-foreclosure patterns that we observe. Nevertheless, the success of policy interventions designed to reduce these effects will depend critically on the extent to which each of these explanations is driving the change in behavior.

One widely used policy solution aimed at reducing foreclosure is mortgage modification. Private banks and the federal government, through the Home Affordable Modification Program (HAMP) and other initiatives have created pathways for distressed borrowers to modify their mortgages as an alternative to foreclosure. Preliminary evidence indicates that redefault rates following loan modifications have been high. A recently released report predicts that the redefault rate from the HAMP program is likely to be 65 to 75 percent. Private firms' modification programs have not fared much better. Haughwout, Okah, and Tracy (2009) find that for subprime mortgages with private modifications in which payments were meaningfully reduced, redefault rates reached 57 percent during the first year. The results in this paper are consistent with the high redefault rates observed on modified mortgages.

If the post-foreclosure change in behavior that we observe can be attributed to changes in a borrower's circumstances that directly result from the mortgage delinquency, then one might expect successful loan modifications to reduce these effects. As additional data on loan modifications become available, research may be able to better determine how much of the change that we observe can be attributed to the mortgage delinquency itself. However, it should

be noted that many loan modification programs only modify seriously delinquent loans. As a result, the damage to the credit scores of the borrowers is already done and, to the extent that damage this may contribute to the persistence of the post-foreclosure effects that we observe, modification may not alleviate these effects.

References

- Apgar, William C., Mark Duda, and Rochelle Nawrocki Gorey**, 2005, "The Municipal Cost of Foreclosures: A Chicago Case Study," Homeownership Preservation Foundation Housing Finance Policy Research Paper No. 2005-1.
- Ambrose, Brent W., and Charles A Capone, Jr., and Yongheng Deng**, 2001, "Optimal Put Exercise: An Empirical Examination of Conditions for Mortgage Foreclosure," *Journal of Real Estate Finance and Economics*, 23(2): 213-34.
- Bajari, Patrick, Sean Chu, and Minjung Park**, 2008, "An Empirical Model of Subprime Mortgage Default from 2000 to 2007," NBER Working Paper No. 14625.
- Bhutta, Neil, Jane Dokko, and Hui Shan**, 2010, "The Depth of Negative Equity and Mortgage Default Decisions," FEDS Working Paper No. 2010-35.
- Capozza, Dennis R., Dick Kazarian, and Thomas A. Thompson**, 1997, "Mortgage Default in Local Markets," *Real Estate Economics*, 25(4): 631-655.
- Christie, Les**, 2010, "How Foreclosure Impacts Your Credit Score," *CNNMoney.com*, April 10. Available at http://money.cnn.com/2010/04/22/real_estate/foreclosure_credit_score/index.htm (last visited July 2, 1010).
- Dietz, Robert D. and Donald R. Haurin**, 2003, "The Social and Private Micro-level Consequences of Homeownership," *Journal of Urban Economics*, 54(3): 401-50.
- Elmer, Peter J. and Steven A. Seelig**, 1999, "Insolvency, Trigger Events, and Consumer Risk Posture in the Theory of Single-Family Mortgage Default," *Journal of Housing Research*, 10(1): 1-25.
- Fair Isaac Corporation**, 2009, *Understanding Your FICO Score*. Available at http://www.myfico.com/Downloads/Files/myFICO_UYFS_Booklet.pdf (last visited July 13, 2010).
- Foote, Christopher, Kristopher Gerardi, and Paul Willen**, 2008, "Negative Equity and Foreclosure: Theory and Evidence," *Journal of Urban Economics*, 64(2) pp. 234-245.
- Guiso, Luigi, Paola Sapienza, and Luigi Zingales**, 2009, "Moral and Social Constraints to Strategic Defaults on Mortgages," National Bureau of Economic Research Working Paper No. 15145.
- Hagerty, James R.**, 2010, "High Default Rate Seen for Modified Mortgages." *The Wall Street Journal*. June 16.
- Harding, John P., Eric Rosenblatt, and Vincent W. Yao**, 2009, "The Contagion Effect of Foreclosed Properties," *Journal of Urban Economics*, 66(3) pp. 164-78.
- Haughwout, Andrew, Ebiere Okah, and Joseph Tracy**, 2009, "Second Chances: Subprime Mortgage Modification and Re-Default." Federal Reserve Bank of New York Staff Report #417.
- Haurin, Donald R., Robert D. Dietz, and Bruce A. Weinberg**, 2003, "The Impact of Neighborhood Homeownership Rates: A Review of the Theoretical and Empirical Literature," *Journal of Housing Research*, 13(2): 119-151.
- Immergluck, Dan, and Geoff Smith**, 2006a, "The Impact of Single-family Mortgage Foreclosures on Neighborhood Crime," *Housing Studies*, 21(6): 851-66.
- Immergluck, Dan, and Geoff Smith**, 2006b, "The External Costs of Foreclosure: The Impact of Single-Family Mortgage Foreclosures on Property Values," *Housing Policy Debate*, 17(1): 57-79.
- Kau, James B., Donald C. Keenan, and Taewon Kim**, 1994, "Default Probabilities for Mortgages," *Journal of Urban Economics*, 35(3): 278-96.

- Leonard, Tammy, and James C. Murdoch**, 2009, "The Neighborhood Effects of Foreclosure," *Journal of Geographical Systems*, 11(4): 317-32.
- Lin, Zhengu, Eric Rosenblatt, and Vincent W. Yao**, 2009, "Spillover Effects of Foreclosures on Neighborhood Property Values," *Journal of Real Estate Finance and Economics*, 38: 387-407.
- Mikelbank, Brian A.**, 2008, "Spatial Analysis of the Impact of Vacant, Abandoned, and Foreclosed Properties" Federal Reserve Bank of Cleveland Office of Community Affairs Paper.
- Rogers, William and William Winter**, 2009, "The Impact of Foreclosures on Neighboring Housing Sales," *Journal of Real Estate Research*, 31(4): 455-79.
- Schuetz, Jenny, Vicki E. Been, and Ingrid Gould Ellen**, 2008, "Neighborhood Effects of Concentrated Mortgage Foreclosures," *Journal of Housing and Economics*, December, 17(4): 306-319.
- U.S. Department of Housing and Urban Development**, 2010, *Report to the Congress on the Root Causes of the Foreclosure Crisis*. January.
- Vandell, Kerry D.**, 1995, "How Ruthless is Mortgage Default: A Review of Synthesis of the Evidence," *Journal of Housing Research*, 6(2): 245-64.
- VantageScore**, 2010, "Impact on Consumer VantageScore Credit Scores Due to Various Mortgage Loan Restructuring Options," white paper. Available at http://www.vantagescore.com/docs/loan_restructuring_options.pdf, last visited July 9, 2010.

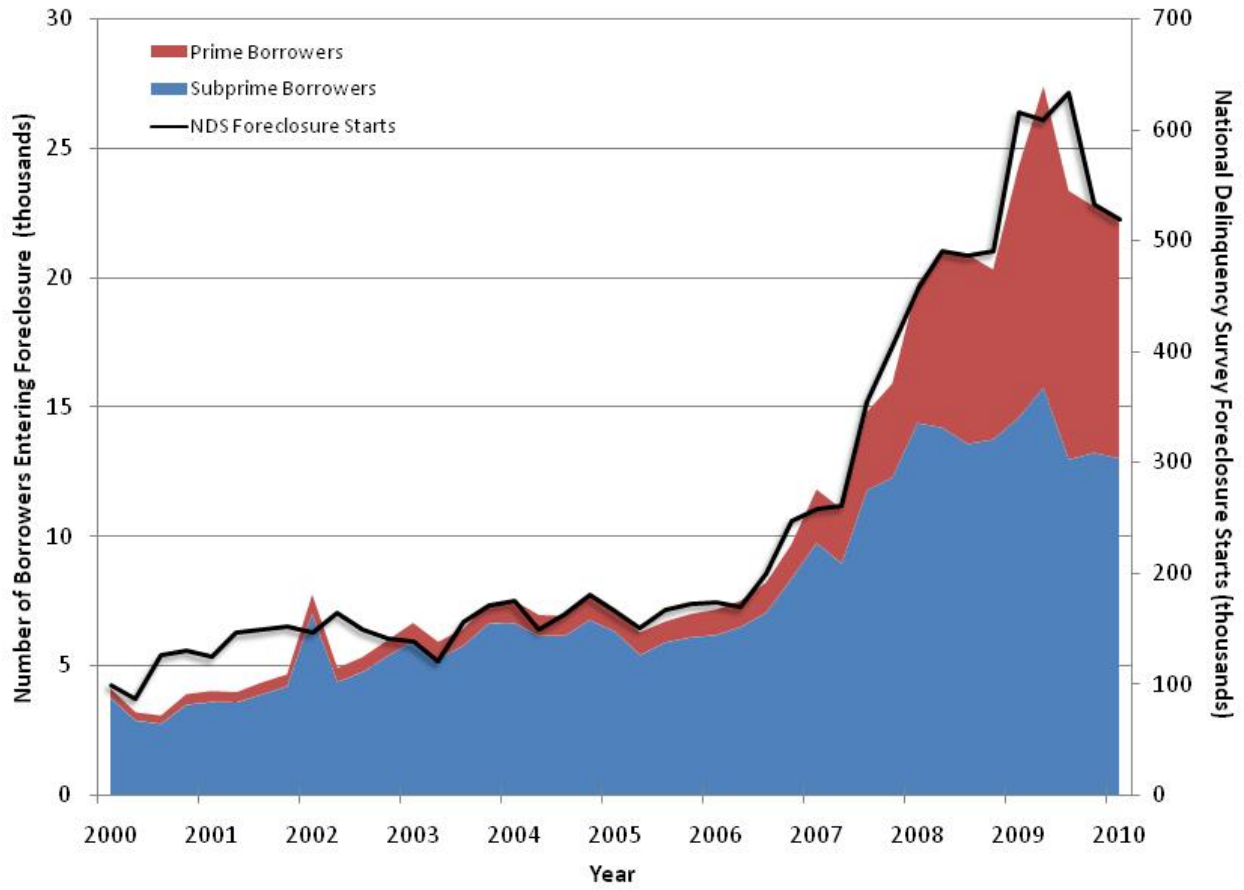


Figure 1: Foreclosure Starts by Quarter, 2000Q1 - 2010Q1

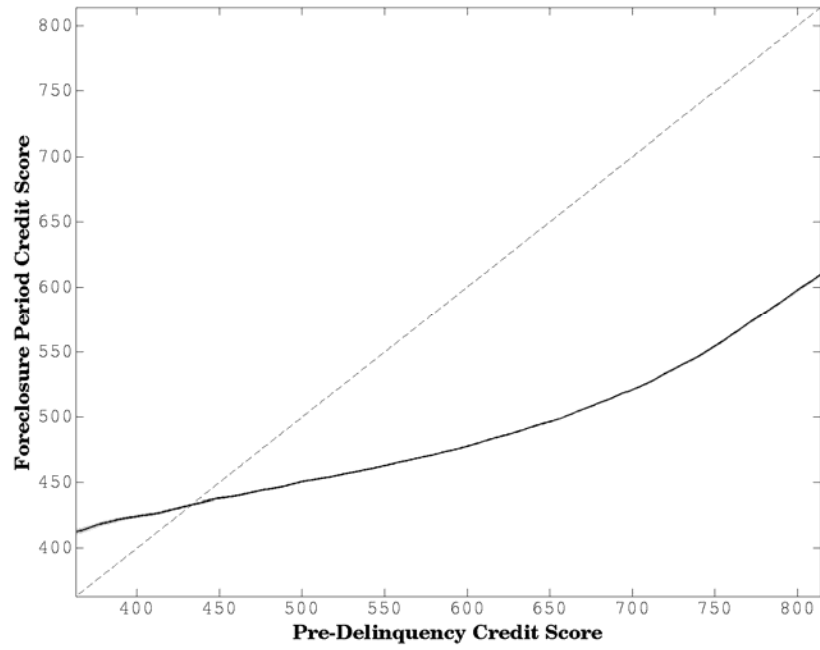


Figure 2: Foreclosure Period Credit Scores by Pre-Delinquency Credit Score, with 95% Confidence Interval

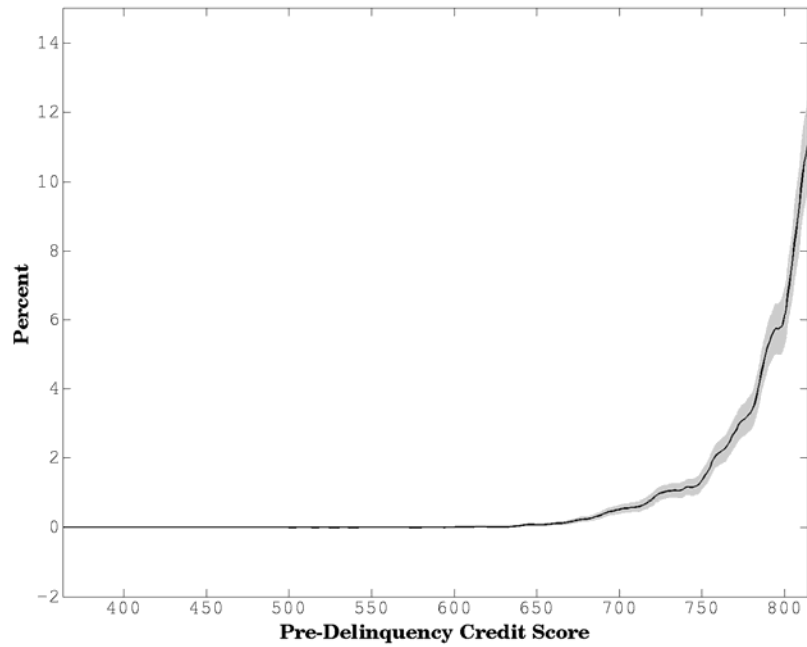


Figure 3: Share of Individuals with Prime Foreclosure Period Credit Scores by Pre-Delinquency Score, with 95% Confidence Interval

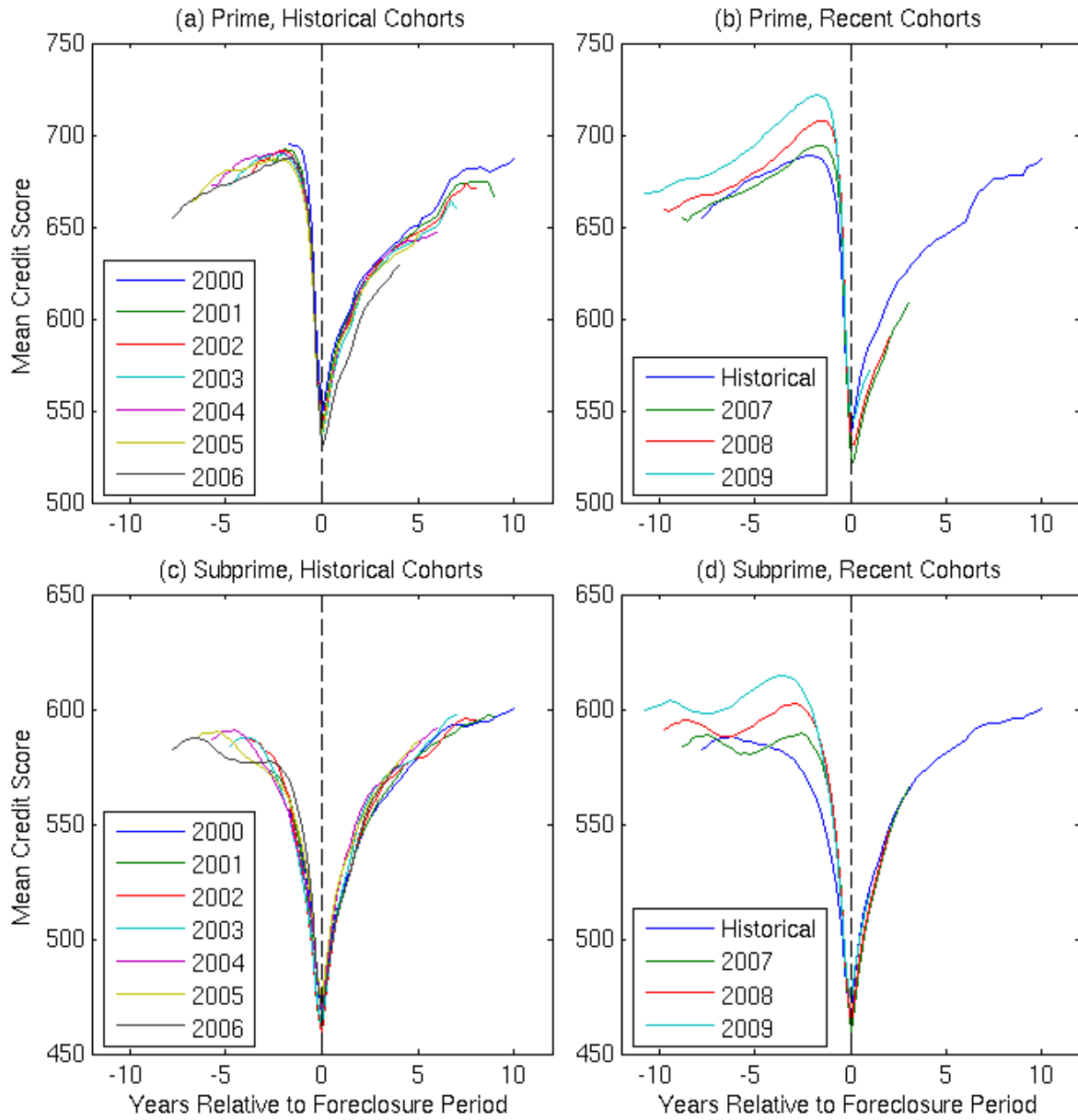


Figure 4: Mean Credit Scores Before and After Foreclosure by Cohort

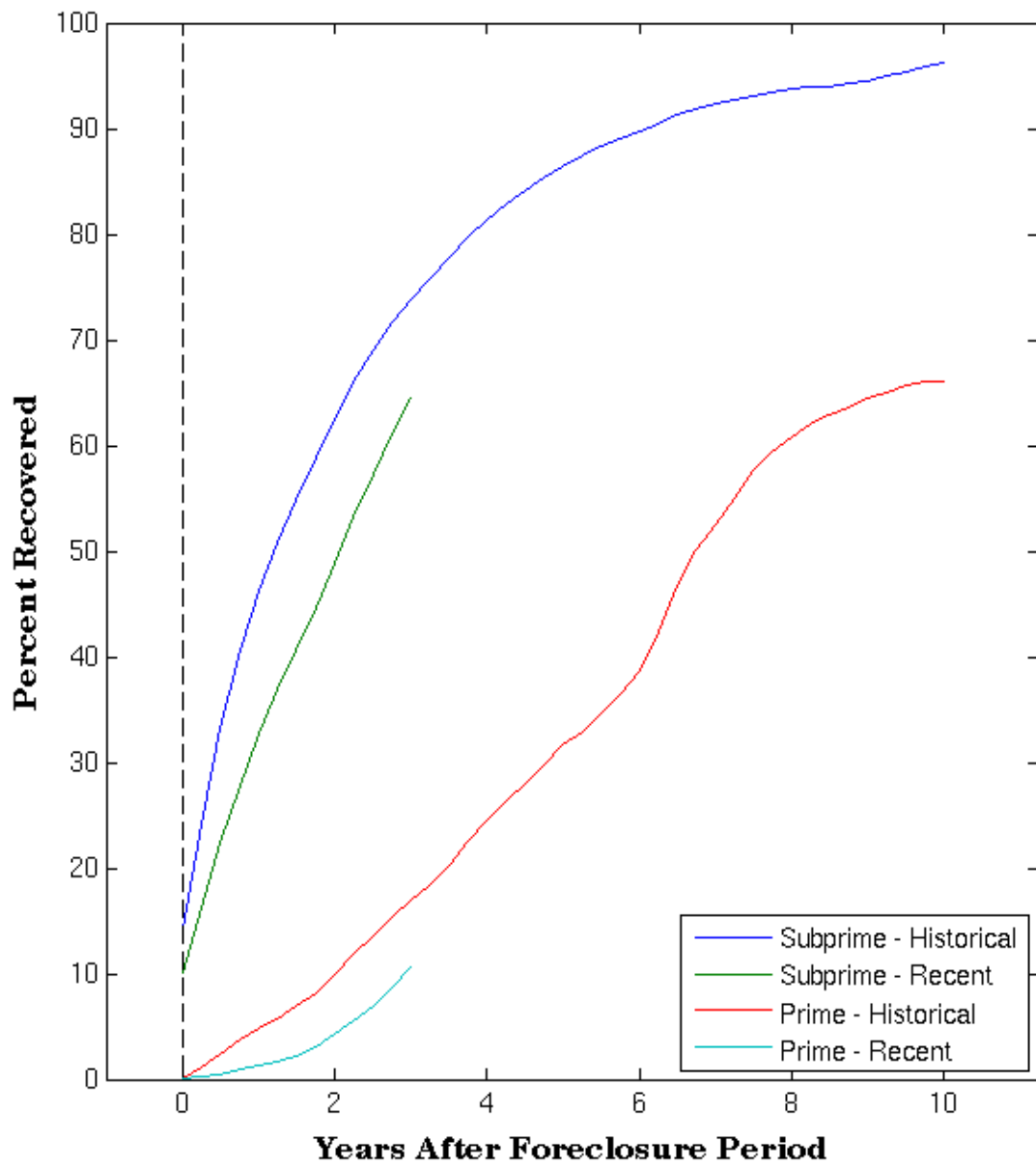


Figure 5: Share of Borrowers whose Credit Score has Recovered After Foreclosure

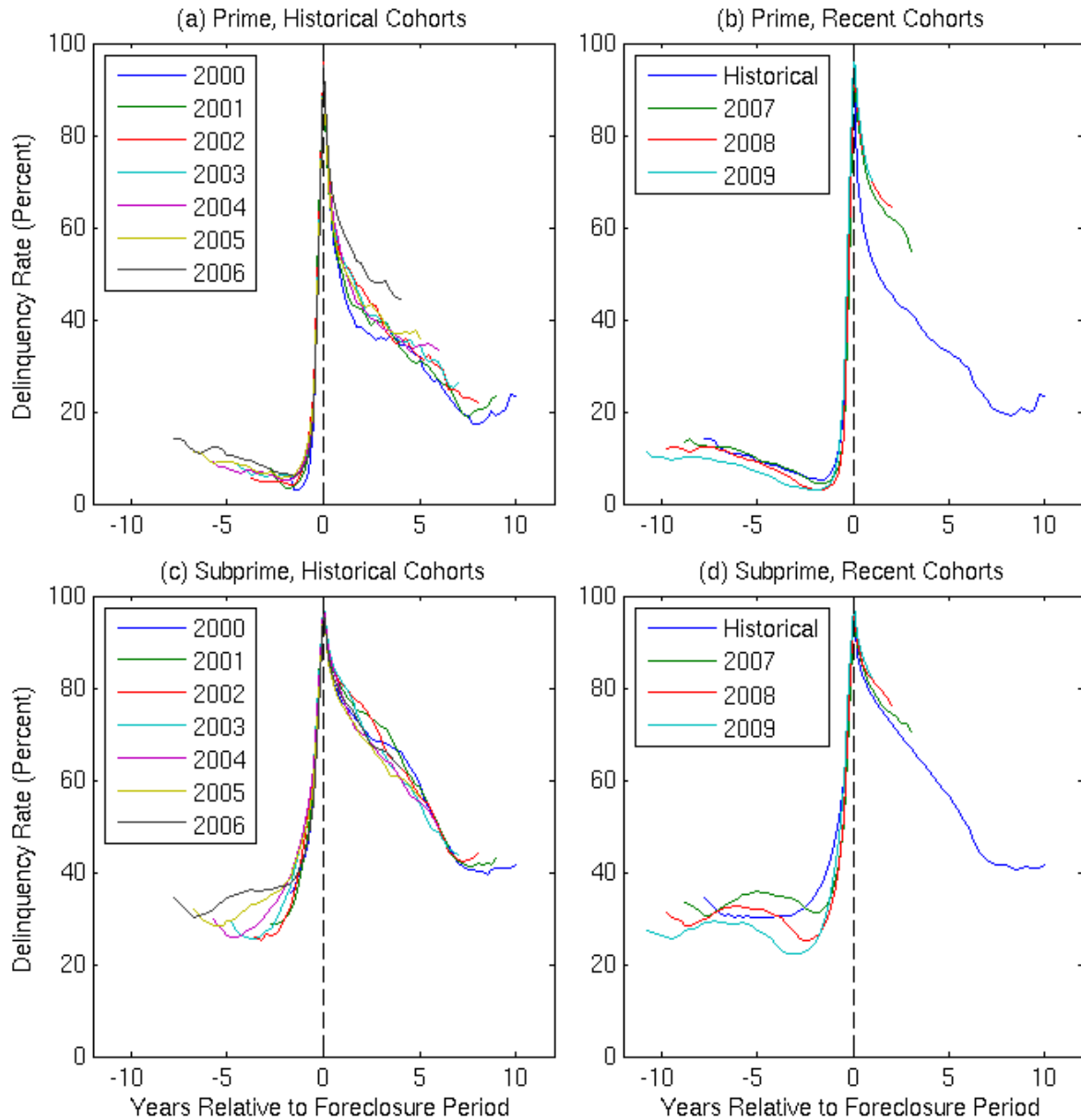


Figure 6: Share of Borrowers who were 90 or More Days Past Due on a Credit Obligation, by Foreclosure Cohort

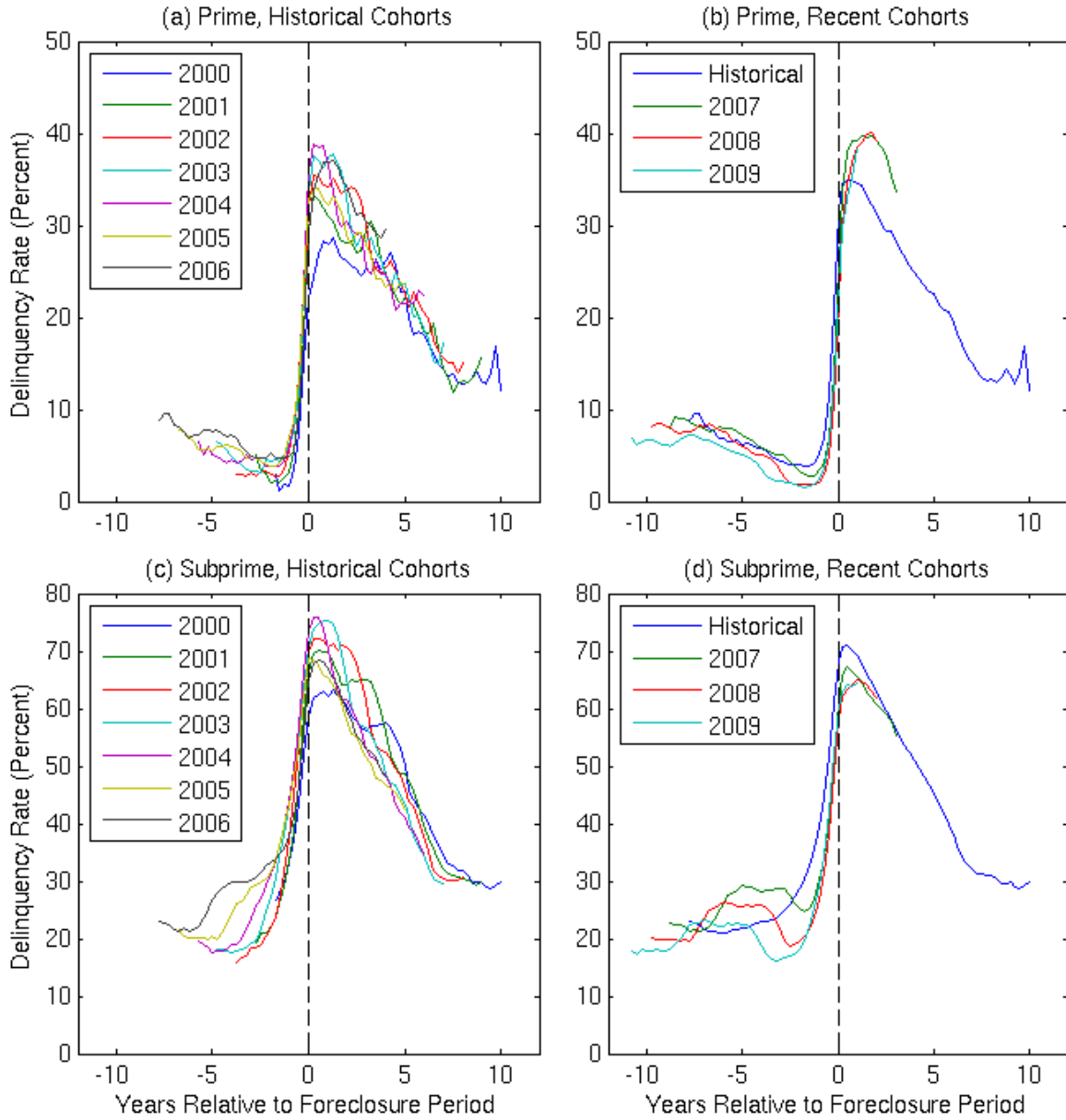


Figure 7: Share of Credit Card Borrowers 90 or More Days Past Due on at Least One Credit Card Account

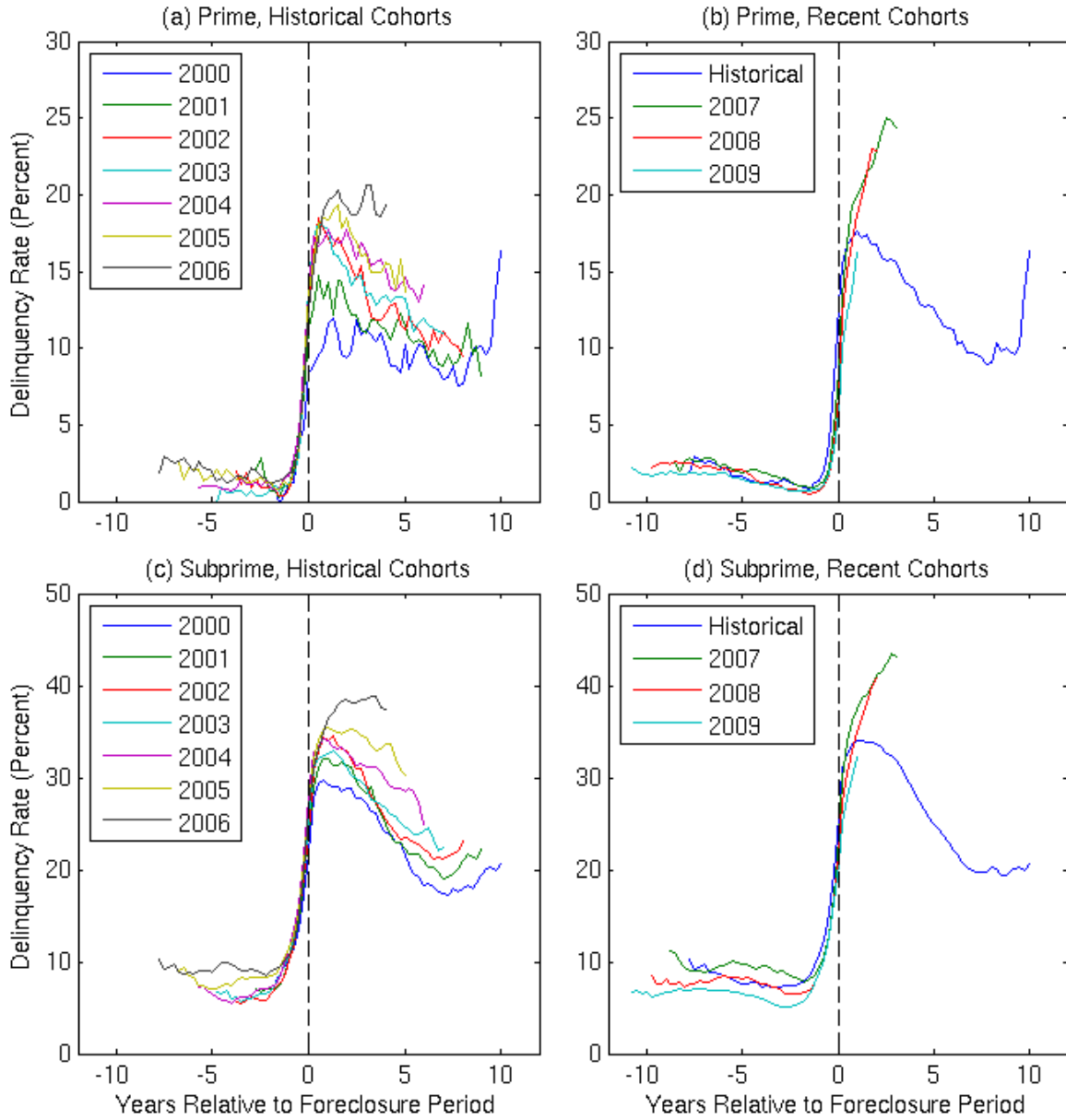


Figure 8: Share of Auto Loan Borrowers 90 or More Days Past Due on at Least One Auto Loan

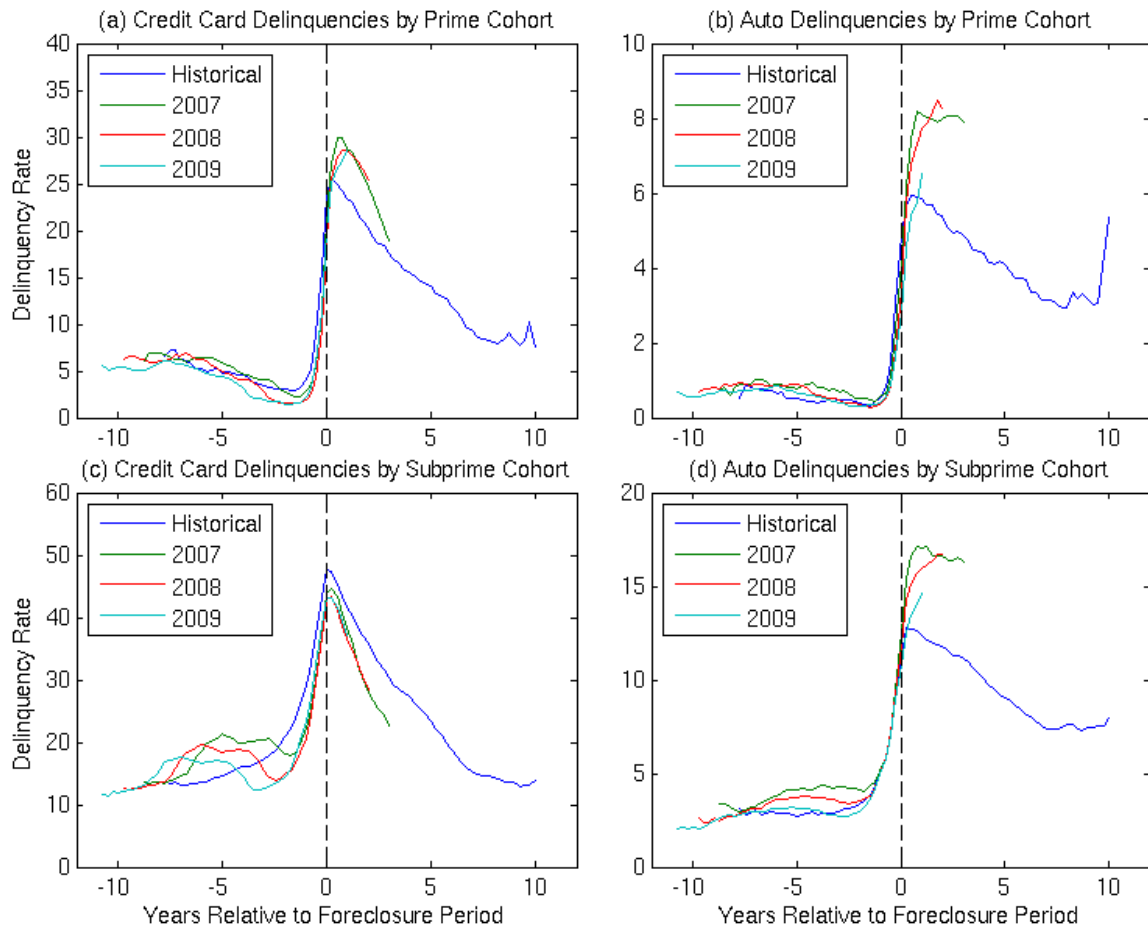


Figure 9: Share of Individuals with a Credit Card or Auto Loan Delinquency, by Score Level and Cohort

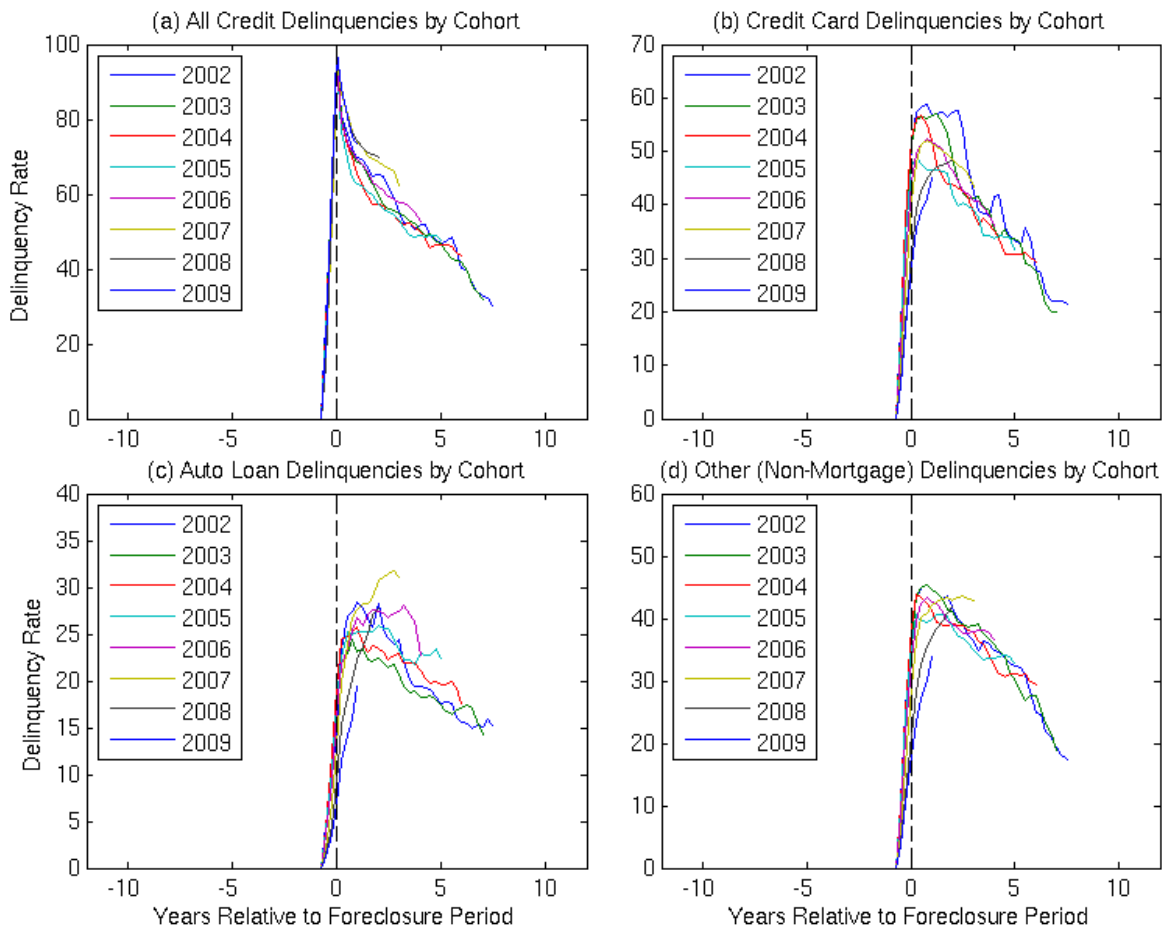


Figure 10: Share of Borrowers in Flawless Payment Sample That Are Delinquent, by Cohort

Table 1: Variable Definitions and Summary Statistics

<u>Variable Name</u>	<u>Description</u>	<u>Full Sample¹</u>	<u>Non-Derogatory Sample</u>	<u>Foreclosure Sample</u>	<u>Derogatory Sample</u>
<i>Credit Scores</i>					
Initial Score	Initial credit score observed for this individual	694	702	608	599
Pre-delinquency score	Credit Score in quarter before foreclosure or mortgage derogatory when record was last free of mortgage delinquency	595	N.A.	597	590
Contemporaneous score	Credit score in period <i>t</i>	713	725	589	594
<i>Dates (Number of quarters since 1999Q1)</i>					
Initial period	Quarter in which initial score observed	0.8	0.8	1.4	0.8
Foreclosure period	Quarter in which mortgage entered foreclosure	29.9	N.A.	29.9	N.A.
Pre-delinquency period	Quarter before foreclosure or mortgage derogatory when record was last free of mortgage delinquency	25.4	N.A.	26.4	22.4
Derogatory period	Quarter in which mortgage became 120 or more days past due for Derogatory Sample	23.8	N.A.	N.A.	23.8
<i>Economic Conditions</i>					
Unemployment rate	County-level, quarterly unemployment rate from QCEW	5.1	5.1	5.2	5.3
Average weekly wage	Average weekly wage, reported quarterly by county from QCEW	729.7	729.8	735.9	709.4
<i>Timelag Variables</i>					
TSINCEFIRST	Number of quarters between initial period and period <i>t</i>	22.1	22.1	21.8	22.1
<i>Credit Performance</i>					
DELALL	Delinquent indicator (90 days past due or worse) for all credit types	0.095	0.068	0.411	0.366
DELCC	Delinquent indicator for credit cards	0.065	0.048	0.291	0.281
DELAUTO	Delinquent indicator for auto loans	0.028	0.017	0.131	0.102
Number of Observations		27,852,407	8,478,837	14,380,936	4,992,634

N.A. = Not applicable.

¹ Means for the full sample are weighted to account for sampling of non-derogatory population.

Table 2: Credit Score Migration Estimations

Initial Score Range: Dependent Variable:	760 and over SCORE (1)	660 to 759 SCORE (2)	560 to 659 SCORE (3)	Below 560 SCORE (4)				
Initial Score	0.535*** (0.006)	0.769*** (0.005)	0.771*** (0.008)	0.255*** (0.007)				
Average Weekly Wage	1.915** (0.861)	19.680*** (1.190)	29.102*** (2.043)	27.491*** (4.014)				
Unemployment Rate	0.146*** (0.038)	-0.051 (0.047)	-0.035 (0.068)	-0.014 (0.114)				
<i>Time Relative To Foreclosure (Indicator variables):</i>	All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation
2 years before	-35.665*** (1.317)	11.558*** (1.482)	-32.927*** (0.456)	14.325*** (0.546)	-23.476*** (0.298)	10.500*** (0.397)	-16.346*** (0.365)	5.380*** (0.537)
1 year before	-79.226*** (1.827)	28.261*** (2.073)	-76.548*** (0.613)	29.853*** (0.734)	-59.107*** (0.386)	15.059*** (0.512)	-43.492*** (0.462)	1.105* (0.665)
Foreclosure period	-206.840*** (1.647)	0.377 (1.859)	-185.184*** (0.582)	-5.246*** (0.692)	-144.338*** (0.395)	-23.404*** (0.511)	-110.548*** (0.501)	-29.968*** (0.671)
1 year after	-151.156*** (1.597)	-14.218*** (2.030)	-129.970*** (0.572)	-17.788*** (0.763)	-94.567*** (0.407)	-30.403*** (0.566)	-68.853*** (0.555)	-29.669*** (0.757)
2 years after	-124.875*** (1.519)	-9.639*** (2.524)	-104.689*** (0.553)	-9.734*** (0.922)	-74.441*** (0.421)	-17.126*** (0.663)	-53.898*** (0.611)	-15.914*** (0.886)
3 years after	-109.942*** (1.493)		-90.819*** (0.550)		-63.660*** (0.440)		-46.830*** (0.668)	
4 years after	-104.561*** (1.586)		-84.061*** (0.585)		-60.270*** (0.485)		-45.430*** (0.750)	
5 years after	-101.352*** (1.751)		-80.792*** (0.647)		-58.752*** (0.538)		-46.168*** (0.842)	
6 years after	-94.385*** (2.016)		-76.914*** (0.760)		-57.748*** (0.614)		-46.985*** (0.952)	
7 or more years after	-76.223*** (3.078)		-67.628*** (1.070)		-57.604*** (0.798)		-52.076*** (1.155)	
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	

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

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

Initial Score Range: Dependent Variable:	760 and over All Credit Delinquency (1)	660 to 759 All Credit Delinquency (2)	560 to 659 All Credit Delinquency (3)	Below 560 All Credit Delinquency (4)					
Initial Score	-0.019*** (0.002)	-0.018*** (0.000)	-0.014*** (0.000)	-0.006*** (0.000)					
Average Weekly Wage	-0.125 (0.122)	-0.393*** (0.054)	-0.398*** (0.039)	-0.368*** (0.052)					
Unemployment Rate	0.005 (0.010)	0.019*** (0.004)	0.018*** (0.003)	0.018*** (0.004)					
<i>Foreclosure Effects (Indicator variables):</i>	<hr/>		<hr/>		<hr/>		<hr/>		
		All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation	All Cohorts	Recent Cohort Deviation
	2 years before	0.623*** (0.078)	-0.258*** (0.092)	0.418*** (0.020)	-0.283*** (0.025)	0.228*** (0.011)	-0.262*** (0.014)	0.044*** (0.012)	-0.251*** (0.018)
	1 year before	1.424*** (0.088)	-0.317*** (0.102)	1.090*** (0.023)	-0.374*** (0.028)	0.781*** (0.013)	-0.298*** (0.016)	0.421*** (0.014)	-0.208*** (0.020)
	Foreclosure period	6.058*** (0.126)	0.460*** (0.148)	5.591*** (0.044)	0.602*** (0.055)	5.011*** (0.029)	0.505*** (0.039)	4.277*** (0.037)	0.322*** (0.051)
	1 year after	2.953*** (0.098)	0.667*** (0.118)	2.735*** (0.029)	0.470*** (0.036)	2.387*** (0.017)	0.401*** (0.023)	1.855*** (0.020)	0.322*** (0.028)
	2 years after	2.435*** (0.100)	0.539*** (0.134)	2.309*** (0.030)	0.327*** (0.042)	2.075*** (0.017)	0.223*** (0.027)	1.654*** (0.021)	0.150*** (0.034)
	3 years after	2.162*** (0.102)		2.003*** (0.031)		1.844*** (0.018)		1.522*** (0.022)	
	4 years after	1.939*** (0.106)		1.740*** (0.033)		1.669*** (0.020)		1.388*** (0.024)	
	5 years after	1.596*** (0.113)		1.451*** (0.035)		1.487*** (0.021)		1.249*** (0.026)	
	6 years after	1.161*** (0.125)		1.121*** (0.039)		1.227*** (0.024)		1.071*** (0.029)	
	7 or more years after	0.391** (0.160)		0.503*** (0.049)		0.858*** (0.028)		0.888*** (0.034)	
	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		

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

Table 4: Logit Estimations of Borrower Delinquency on Credit Cards

Initial Score Range: Dependent Variable:	760 and over Credit Card Delinquency (1)	660 to 759 Credit Card Delinquency (2)	560 to 659 Credit Card Delinquency (3)	Below 560 Credit Card Delinquency (4)					
Initial Score	-0.019*** (0.002)	-0.018*** (0.000)	-0.014*** (0.000)	-0.006*** (0.000)					
Average Weekly Wage	-0.051 (0.151)	-0.443*** (0.064)	-0.508*** (0.047)	-0.490*** (0.062)					
Unemployment Rate	0.004 (0.012)	0.018*** (0.005)	0.017*** (0.003)	0.019*** (0.004)					
<i>Foreclosure Effects</i> <i>(Indicator variables):</i>		Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation				
	2 years before	0.681*** (0.090)	-0.321*** (0.107)	0.378*** (0.024)	-0.277*** (0.030)	0.221*** (0.013)	-0.293*** (0.017)	0.109*** (0.014)	-0.349*** (0.021)
	1 year before	1.285*** (0.104)	-0.289** (0.121)	1.059*** (0.028)	-0.426*** (0.033)	0.755*** (0.015)	-0.355*** (0.020)	0.488*** (0.017)	-0.342*** (0.024)
	Foreclosure period	2.699*** (0.108)	-0.268** (0.123)	2.496*** (0.031)	-0.389*** (0.036)	2.025*** (0.018)	-0.220*** (0.022)	1.460*** (0.020)	-0.075*** (0.027)
	1 year after	2.498*** (0.113)	0.040 (0.133)	2.338*** (0.033)	0.040 (0.041)	2.107*** (0.020)	0.072*** (0.026)	1.620*** (0.023)	0.079** (0.033)
	2 years after	2.135*** (0.117)	0.033 (0.151)	2.011*** (0.035)	0.019 (0.049)	1.869*** (0.021)	0.098*** (0.033)	1.463*** (0.025)	0.072* (0.043)
	3 years after	1.783*** (0.122)		1.719*** (0.037)		1.633*** (0.022)		1.304*** (0.027)	
	4 years after	1.607*** (0.127)		1.438*** (0.040)		1.466*** (0.024)		1.202*** (0.029)	
	5 years after	1.188*** (0.138)		1.167*** (0.043)		1.292*** (0.027)		1.072*** (0.032)	
	6 years after	0.794*** (0.157)		0.832*** (0.049)		1.012*** (0.030)		0.921*** (0.036)	
	7 or more years after	0.220 (0.203)		0.319*** (0.061)		0.685*** (0.036)		0.814*** (0.042)	
	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	

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

Table 5: Logit Estimations of Borrower Delinquency on Auto Loans

Initial Score Range: Dependent Variable:	760 and over Auto Loan Delinquency (1)	660 to 759 Auto Loan Delinquency (2)	560 to 659 Auto Loan Delinquency (3)	Below 560 Auto Loan Delinquency (4)					
Initial Score	-0.013*** (0.005)	-0.016*** (0.001)	-0.012*** (0.001)	-0.003*** (0.000)					
Average Weekly Wage	-0.795* (0.429)	-0.669*** (0.137)	-0.577*** (0.088)	-0.454*** (0.100)					
Unemployment Rate	0.050* (0.028)	0.012 (0.009)	0.026*** (0.006)	0.029*** (0.006)					
<i>Foreclosure Effects (Indicator variables):</i>		Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation				
		All Cohorts	All Cohorts	All Cohorts	All Cohorts				
	2 years before	0.078 (0.283)	-0.082 (0.327)	0.258*** (0.071)	-0.438*** (0.083)	0.082*** (0.031)	-0.276*** (0.039)	-0.094*** (0.025)	-0.192*** (0.039)
	1 year before	1.247*** (0.306)	-0.914*** (0.349)	0.727*** (0.074)	-0.566*** (0.087)	0.494*** (0.035)	-0.415*** (0.042)	0.188*** (0.030)	-0.320*** (0.041)
	Foreclosure period	2.557*** (0.313)	-0.685* (0.350)	2.094*** (0.075)	-0.732*** (0.085)	1.655*** (0.037)	-0.555*** (0.042)	1.056*** (0.033)	-0.352*** (0.041)
	1 year after	2.400*** (0.321)	-0.027 (0.370)	2.285*** (0.080)	-0.222** (0.091)	1.985*** (0.041)	-0.286*** (0.046)	1.497*** (0.038)	-0.242*** (0.044)
	2 years after	2.303*** (0.335)	-0.077 (0.411)	2.085*** (0.085)	-0.088 (0.101)	1.894*** (0.044)	-0.159*** (0.052)	1.497*** (0.042)	-0.127** (0.052)
	3 years after	1.981*** (0.343)		1.841*** (0.089)		1.724*** (0.047)		1.439*** (0.046)	
	4 years after	1.730*** (0.348)		1.495*** (0.096)		1.537*** (0.052)		1.323*** (0.052)	
	5 years after	1.523*** (0.364)		1.223*** (0.104)		1.346*** (0.057)		1.173*** (0.058)	
	6 years after	1.203*** (0.389)		0.994*** (0.114)		1.158*** (0.063)		1.033*** (0.064)	
	7 or more years after	0.503 (0.463)		0.538*** (0.134)		0.892*** (0.073)		0.928*** (0.074)	
	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		

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

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

Initial Score Range: Dependent Variable:	760 and over All Credit Delinquency (1)	660 to 759 All Credit Delinquency (2)	560 to 659 All Credit Delinquency (3)	Below 560 All Credit Delinquency (4)					
Initial Score	-0.019*** (0.001)	-0.018*** (0.000)	-0.013*** (0.000)	-0.006*** (0.000)					
Average Weekly Wage	-0.118 (0.122)	-0.382*** (0.053)	-0.371*** (0.038)	-0.337*** (0.049)					
Unemployment Rate	0.005 (0.010)	0.018*** (0.004)	0.016*** (0.003)	0.015*** (0.003)					
<i>Foreclosure Effects (Indicator variables):</i>	<hr/>		<hr/>		<hr/>		<hr/>		
		Recent Cohort Deviation		Recent Cohort Deviation		Recent Cohort Deviation		Recent Cohort Deviation	
		All Cohorts	All Cohorts	All Cohorts	All Cohorts	All Cohorts	All Cohorts	All Cohorts	
	2 years before	0.628*** (0.078)	-0.244*** (0.092)	0.422*** (0.020)	-0.262*** (0.025)	0.251*** (0.010)	-0.241*** (0.014)	0.107*** (0.011)	-0.220*** (0.017)
	1 year before	1.428*** (0.088)	-0.294*** (0.102)	1.096*** (0.023)	-0.345*** (0.028)	0.816*** (0.012)	-0.271*** (0.016)	0.513*** (0.014)	-0.167*** (0.019)
	Foreclosure period	5.921*** (0.122)	0.593*** (0.145)	5.444*** (0.042)	0.681*** (0.053)	4.770*** (0.026)	0.611*** (0.035)	3.971*** (0.031)	0.525*** (0.044)
	1 year after	2.806*** (0.097)	0.715*** (0.117)	2.534*** (0.028)	0.525*** (0.036)	2.117*** (0.016)	0.478*** (0.021)	1.595*** (0.018)	0.424*** (0.026)
	2 years after	2.258*** (0.100)	0.526*** (0.132)	2.060*** (0.029)	0.308*** (0.041)	1.745*** (0.017)	0.217*** (0.025)	1.335*** (0.020)	0.182*** (0.030)
	3 years after	1.942*** (0.102)		1.718*** (0.030)		1.486*** (0.017)		1.178*** (0.021)	
	4 years after	1.685*** (0.105)		1.451*** (0.032)		1.309*** (0.019)		1.042*** (0.023)	
	5 years after	1.356*** (0.113)		1.158*** (0.035)		1.119*** (0.021)		0.907*** (0.025)	
	6 years after	0.927*** (0.124)		0.808*** (0.039)		0.848*** (0.023)		0.726*** (0.028)	
	7 or more years after	0.146 (0.159)		0.179*** (0.048)		0.475*** (0.028)		0.551*** (0.033)	
	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		

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

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

Initial Score Range: Dependent Variable:	760 and over All Credit Delinquency (1)	660 to 759 All Credit Delinquency (2)	560 to 659 All Credit Delinquency (3)	Below 560 All Credit Delinquency (4)					
Initial Score	-0.018*** (0.002)	-0.018*** (0.000)	-0.013*** (0.000)	-0.006*** (0.000)					
Average Weekly Wage	-0.122 (0.124)	-0.390*** (0.055)	-0.395*** (0.040)	-0.370*** (0.053)					
Unemployment Rate	0.006 (0.010)	0.019*** (0.004)	0.018*** (0.003)	0.017*** (0.004)					
<i>Foreclosure/Derogatory Effects (Indicator variables):</i>	<hr/>		<hr/>		<hr/>		<hr/>		
		All Cohorts	Derog Sample Deviation	All Cohorts	Derog Sample Deviation	All Cohorts	Derog Sample Deviation	All Cohorts	Derog Sample Deviation
	2 years before	0.629*** (0.078)	-0.004 (0.107)	0.425*** (0.020)	-0.072** (0.028)	0.240*** (0.011)	-0.027* (0.015)	0.057*** (0.012)	0.080*** (0.018)
	1 year before	1.433*** (0.088)	-0.383*** (0.117)	1.100*** (0.023)	-0.302*** (0.031)	0.798*** (0.013)	-0.193*** (0.017)	0.442*** (0.015)	-0.037* (0.020)
	Foreclosure or Derogatory period	6.065*** (0.126)	-2.221*** (0.147)	5.593*** (0.044)	-2.066*** (0.049)	5.027*** (0.029)	-1.823*** (0.032)	4.305*** (0.037)	-1.599*** (0.042)
	1 year after	2.964*** (0.098)	-1.011*** (0.123)	2.747*** (0.029)	-1.002*** (0.035)	2.414*** (0.017)	-0.867*** (0.020)	1.891*** (0.021)	-0.685*** (0.023)
	2 years after	2.450*** (0.101)	-0.862*** (0.128)	2.325*** (0.030)	-0.891*** (0.035)	2.110*** (0.018)	-0.791*** (0.020)	1.699*** (0.022)	-0.645*** (0.023)
	3 years after	2.179*** (0.103)	-0.811*** (0.131)	2.025*** (0.031)	-0.806*** (0.036)	1.887*** (0.019)	-0.725*** (0.021)	1.575*** (0.023)	-0.599*** (0.023)
	4 years after	1.959*** (0.107)	-0.836*** (0.135)	1.766*** (0.034)	-0.744*** (0.038)	1.718*** (0.020)	-0.657*** (0.022)	1.449*** (0.026)	-0.505*** (0.024)
	5 years after	1.619*** (0.115)	-0.852*** (0.149)	1.481*** (0.036)	-0.623*** (0.041)	1.544*** (0.022)	-0.569*** (0.023)	1.318*** (0.028)	-0.405*** (0.025)
	6 years after	1.187*** (0.127)	-0.499*** (0.166)	1.155*** (0.040)	-0.558*** (0.048)	1.292*** (0.025)	-0.469*** (0.026)	1.149*** (0.031)	-0.327*** (0.028)
7 or more years after	0.422*** (0.162)	-0.334 (0.214)	0.546*** (0.050)	-0.398*** (0.062)	0.936*** (0.030)	-0.326*** (0.031)	0.984*** (0.037)	-0.212*** (0.030)	
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		

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.

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

Initial Score Range: Dependent Variable:	760 and over All Credit Delinquency (1)	660 to 759 All Credit Delinquency (2)	560 to 659 All Credit Delinquency (3)	Below 560 All Credit Delinquency (4)				
Initial Score	-0.019*** (0.002)	-0.018*** (0.000)	-0.014*** (0.000)	-0.006*** (0.000)				
Average Weekly Wage	-0.124 (0.122)	-0.390*** (0.054)	-0.394*** (0.039)	-0.364*** (0.052)				
Unemployment Rate	0.006 (0.010)	0.020*** (0.004)	0.019*** (0.003)	0.018*** (0.004)				
<i>Time Relative To Foreclosure (Indicator variables):</i>	Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation	Recent Cohort Deviation				
	Price Decline Deviation	Price Decline Deviation	Price Decline Deviation	Price Decline Deviation				
2 years before	-0.192** (0.094)	-0.383*** (0.122)	-0.203*** (0.025)	-0.460*** (0.037)	-0.185*** (0.015)	-0.520*** (0.026)	-0.190*** (0.018)	-0.512*** (0.036)
18 months before	-0.191* (0.102)	-0.417*** (0.126)	-0.258*** (0.027)	-0.417*** (0.038)	-0.213*** (0.016)	-0.441*** (0.026)	-0.194*** (0.020)	-0.429*** (0.036)
1 year before	-0.252** (0.104)	-0.347*** (0.129)	-0.318*** (0.029)	-0.276*** (0.037)	-0.260*** (0.017)	-0.221*** (0.025)	-0.178*** (0.020)	-0.239*** (0.034)
6 months before	-0.141 (0.106)	0.162 (0.118)	-0.280*** (0.030)	0.069* (0.035)	-0.153*** (0.018)	0.077*** (0.023)	-0.026 (0.021)	0.011 (0.033)
Foreclosure period	0.166 (0.152)	1.300*** (0.214)	0.336*** (0.057)	1.241*** (0.092)	0.266*** (0.039)	1.523*** (0.087)	0.157*** (0.052)	1.470*** (0.148)
6 months after	0.731*** (0.115)	0.390*** (0.134)	0.528*** (0.036)	0.508*** (0.046)	0.449*** (0.023)	0.524*** (0.034)	0.345*** (0.028)	0.564*** (0.053)
1 year after	0.621*** (0.120)	0.341* (0.174)	0.412*** (0.037)	0.460*** (0.060)	0.353*** (0.023)	0.445*** (0.042)	0.290*** (0.028)	0.376*** (0.065)
18 months after	0.626*** (0.124)	0.411 (0.275)	0.378*** (0.038)	0.348*** (0.092)	0.308*** (0.024)	0.361*** (0.071)	0.231*** (0.030)	0.442*** (0.120)
2 years after	0.516*** (0.135)		0.321*** (0.042)	-0.353 (0.563)	0.226*** (0.027)	-0.367 (0.410)	0.156*** (0.034)	-1.262** (0.496)
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				

Note: Standard errors are in parentheses. *, **, and *** denote statistical significance at the 10, 5, and 1 percent levels. Standard errors are robust to heteroskedasticity and clustered by individual. Estimations also include a linear spline for time since the initial period and county, time (quarter), and foreclosure cohort fixed effects. A complete set of estimation results is available from the author upon request.