Your House or Your Credit Card, Which Would You Choose?

Personal Delinquency Tradeoffs and Precautionary Liquidity Motives

Ethan Cohen-Cole*
University of Maryland - College Park

Jonathan Morse
Federal Reserve Bank of Boston

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Abstract

This paper finds strong evidence that many individuals choose to pay credit card bills even at the cost of mortgage delinquencies and foreclosures. While the popular press and some recent literature have suggested that this choice may emerge from steep declines in housing prices, we find evidence that individual-level liquidity concerns are at least as important in the decision. That is, choosing credit cards over housing suggests a precautionary liquidity preference.

By linking the mortgage delinquency decisions to individual-level credit conditions, we are able to assess the compound impact of reductions in housing prices and retrenchment in the credit markets. Indeed, we find the availability of cash-equivalent credit to be a key component of the default decision. We find that a one standard deviation reduction in housing price changes elicits a change in the predicted probability of mortgage default that is similar in both direction and magnitude to a one standard deviation reduction in available credit (the values are -14.9% and -13.1% respectively). Availability of consumer credit appears important not only as a means of payment, but also as an insurance mechanism for individuals and a shock absorber for the economy as a whole. Our findings our consistent with consumer finance literature that finds individuals have a preference for preserving liquidity - even at significant cost.

*Ethan Cohen-Cole: Robert H Smith School of Business. 4420 Van Munching Hall, University of Maryland, College Park, MD 20742. email: ecohencole@gmail.com. (301) 541-7227. Jonathan Morse: 600 Atlantic Avenue, Boston MA. email: jonathan.morse@bos.frb.org. The authors are grateful for helpful comments and suggestions from Ezra Becker and Judit Montoriol-Garriga. The views expressed in this paper are those of the authors and do not necessarily reflect those of the Federal Reserve Bank of Boston or the Federal Reserve System.

For years, the conventional wisdom in the consumer finance industry has been that a consumer will pay their mortgage bill long after they have gone delinquent on other financial obligations. This paper finds strong evidence that many individuals in fact make the opposite choice, paying credit card bills even at the cost of mortgage delinquencies and foreclosures. While the popular press and some recent literature have suggested that this choice may emerge from steep declines in housing prices, we find evidence here that individual-level liquidity concerns are at least as important in the decision. That is, the fact that choosing credit cards over housing leads to a slightly higher revolving credit line than the opposite choice suggests a precautionary liquidity preference. Indeed, the decision appears particularly suprising as the difference in liquidity is quite small; implying a very strong liquidity need (see Telyukova, 2009).

The fact that housing loans come with collateral not only makes these decisions particularly surprising, but also had led to the general perception that mortgages were a much safer lending option than credit cards. In the past couple of years; however, the decline in housing prices has called into question consumer preference for paying mortgages before other obligations. Indeed, Guiso *et al.*, (2009) find that 26% of all individuals who default on their mortgage are capable of paying their mortgage. The topic of strategic default has become ever more salient in the current environment, with a growing body of work to support it (see for example Foote *et al.*, 2008). This literature, in general, considers if housing price declines are a sufficient condition for agents to engage in strategic default behavior.

Our extension to this line of work is the evaluation of liquidity concerns. While many of the individuals in our dataset may be *able* to pay their mortgage, ala Guiso *et al.* (2009), we examine a particular subset of individuals that allows us insight into *why* they choose not to. Indeed, as in the Guiso *et al.* (2009) case, many of these individuals have faced large housing price declines, making mortgage payments less attractive. Our dataset and approach allows us to marry this information with specifics on individual liquidity position. We find that liquidity concerns are at least as important as housing prices in the default decision.

Our approach examines the decision of individuals who have an *option* to default on only one of two types of credit, their mortgages or their revolving credit.[1] Because we are able to identify individuals who have undergone a mild economic shock as well as isolate the delinquency decision, we can answer one of the questions at the core of the debate about the initiation and spread of the current financial crisis: is the default decision motivated by housing prices concerns? This question is of notable relevance in the current environment, because we have seen both a dramatic changes in housing prices as well as a significant reduction in the availability of consumer credit. The retrenchment in consumer credit issuance has happened

[1]We use the terms revolving credit and credit cards interchangeably throughout the paper. Credit cards comprise the vast majority of consumer revolving credit.

for a variety of reasons and is beyond the scope of the paper. Nonetheless a pattern has emerged indicating that protecting consumer credit lines may be an increasingly important factor in delinquency decisions. An example from December 2008, USA Today profiled a woman who missed a single payment and lost well over half her credit line.[2]

By linking the mortgage delinquency decisions to individual-level credit conditions, we are able to assess the compound impact of reductions in housing prices and retrenchment in the credit markets. Indeed, we find the availability of cash-equivalent credit to be a key component of the default decision. When considering mean-behavior we find that a one standard deviation reduction in housing price changes elicits a change in the predicted probability of mortgage default that is similar in both direction and magnitude to a one standard deviation reduction in available credit (respectively -14.9% and -13.1%). An important implication of our primary finding is the importance of a properly functioning credit market. In our interpretation, availability of consumer credit in the current economy is not only important as a means of payment, but also as an insurance mechanism for individuals and a shock absorber for the economy as a whole. Our findings are consistent with consumer finance literature that finds individuals have a preference for preserving liquidity - even at significant cost (see Dey (2009), Agarwal *et al.* (2009) , etc.).

We evaluate the decisions of individuals in 2006 and 2007 under moderate financial stress, those that have faced shocks sufficiently large to warrant missing payments on either revolving credit or mortgages, but not both. When consumers reach a point of financial distress, they must choose how to manage financial obligations that exceed current resources. It is crucial to understand this group of individuals over this particular time period not only because they compose a growing segment of the population, but, more importantly, they are in the unique position of being able to influence both their economic outcome as well as that of individuals around them (Cohen-Cole and Duygan-Bump (2008) finds social networking effects in a number of consumer credit markets). Further, understanding these tradeoffs may be informative as to decision processes of the remainder of the population.

This paper will quantify the mechanisms that contribute to individuals' decisions to default on certain credit obligations but not others. In effect, we will evaluate which source of credit or collateralized assets individuals seek to protect in the face of financial stress. Do individuals facing hardship protect their homes at the expense of their credit cards or vice versa? We seek to understand which individuals do so, why they do so, and what impact these decisions have on the economy.

Our results indicate an increasing propensity to defer mortgage payments in order to protect credit cards (see Table I). Our primary result is that individuals facing higher liquidity constraints are more likely to

[2]Kathy Chu, "Changing credit card terms squeeze consumers," *USA Today*, December 15, 2008.

protect their credit cards. We infer from this that individuals wish to ensure future access to lines of credit to cover regular costs of living. Indeed, Transunion has found evidence that "consumers... have become more conscientious in protecting those credit instruments still available to them and are making every effort to pay their credit card bills on time."[3] Moreover, this tradeoff is particularly noticeable in areas that experienced high housing price growth and subsequent declines. In Florida, Nevada and California, consumers' desire to protect revolving credit has been increasing at a much greater rate than elsewhere in the country. This is consistent with Wall Street Journal reports that cardholders in these same states, or in distressed construction or finance industries, face increased scrutiny.[4] The percent of individuals that chose this option increased 331% between June 2006 and December 2007 in these states versus 97% in the remainder of the country.

Our empirical strategy follows three steps. To start, as we wish to isolate the impact of a moderate shock on financial decisionmaking, we sub-divide our sample to capture individuals that, ex-post, have met this criterion. We do so as follows. To ensure that we capture only individuals that have experienced a 'new' shock, we begin with individuals that had no delinqeuncies until the beginning of our sample in June 2006. Then, to isolate the decision between housing and credit card delinquency, we focus only on home owners with at least one credit card. Finally, we focus on the individuals that have had a delinquency on on either their mortgage or their revolving debt, *but not both*. We highlight this group as these individuals have some ability to direct their financial resources, providing us the ability to evaluate their decision processes.

Our second step is to evaluate the decision itself. We evaluate the binary choice between defaulting on type 1 (mortgage) or type 2 (revolving) debt. In addition to controlling for a wide range of potential influences, we test two factors that could impact this decision. As suggested above, the two factors are housing price changes and individual access to liquidity prior to the shock. We define our measures for each in greater length below. Broadly, we find an important role for each. Individuals in areas with large housing price declines respond to that incentive by choosing to protect credit cards more often than in other areas. This is consistent with the story that individuals default as their mortgages rise above 100 percent loan to value ratio. As well, it appears that there has been some change in these tradeoffs over time. As prices have fallen, an increasing fraction of consumers appear to prefer liquidity to guaranteed housing. A model of consumer optimization would suggest that this implies either a great level of financial distress or low housing prices. To make these tradeoffs, which are costly, consumers have apparently reached a level of stress that requires immediate liquidity for daily needs and/or very, very low expectations of future housing price appreciation.

[3] http://newsroom.transunion.com/index.php?s=43&item=516. Downloaded April 15, 2009.

[4] Robin Sidel, "Card Issuers Get Personal To Check Credit," *The Wall Street Journal,* June 19, 2008.

Importantly, we find that access to liquidity is a significant determinant in the decision. Lower cash-equivalent credit is associated with a higher probability of paying a credit card bill in place of a mortgage. Our inference from this finding is that individuals under financial stress choose to pay a credit card in order to maintain access to liquid credit to cover daily living expenses. This is consistent with individuals, particularly in low to moderate income ranges, being credit constrained. To the extent that these constraints are binding for common expenses, individuals appear to have a preference for liquidity over housing.

Finally, we briefly illustrate the potential for spillovers to the remainder of the economy. The mechanism for this is straightforward and comes from existing literature on the impact of foreclosures on surrounding home values.[5] To quantify the magnitude of the choices to default on mortgages rather than credit cards, we estimate a two-step regression as follows. Our objects of interest are local area average delinquency rates on mortgages, a reasonable measure of the generalized level of distress in mortgage markets. We wish to understand how the binary choice above (mortgage vs revolving) at an individual level impacts the wider average. To evaluate the pass through from individual liquidity concerns to aggregate distress, our first stage uses the liquidity we introduced above.

We will structure the paper as follows. In the section that follows, we will provide some stylized facts that characterize the tradeoffs that we are discussing. Section 3 provides a summary of the relevant literature and Section 4 our econometric methodology. We continue in Section 5 to describe our data. Section 6 provides results and sensitivity tests and Section 7 concludes.

II Stylized Facts

We provide some initial information here to motivate our study. Using panel data on 2.2 million individuals from 2006 and 2007, described in more detail below, we can assess the probability that individuals choose one type of delinquency over another. To begin, we isolate the approximately 350,000 individuals that have a mortgage and some type of revolving credit in both June 2006 and December 2007. Then, we subdivide the sample into individuals that were delinquent on one of these credit products in each time period. A summary of the facts presented here is available in Appendix T1.

Fact 1: A large fraction of individuals choose delinquency on mortgages or credit cards, but not both.

Fact 2: A large fraction of these individuals choose delinquency on mortgages while continuing payment on credit cards.

Of the sample of individuals that have a mortgage in 2006 and 2007, 9,290 have had some type of credit

[5] A survey of this literature is available in Lee (2008) and in a Center for Responsible Lending report (2008).

card delinquencies in the sample time period. However, 8,339 have had some type of mortgage delinquency. Given that there is imperfect overlap in these groups, a substantial fraction of individuals are choosing to become delinquent on housing but not on their credit cards. Indeed, a full 6,187 of the 8,339 (or about 74%) had this profile. The converse is also true. Of the 9,290 that choose credit card delinquency, 7,138 (about 77%) did so without any late mortgage payments (see Table I).

These statistics are remarkable for two reasons. One, a large fraction of consumers are making choices about which debt to cover when faced with economic hardship. Our current models of distress (principally bankruptcy studies) regard overall economic condition alone, or speak to strategic run-up of unsecured debt prior to bankruptcy. The small scale of the average delinquency ($<$\$1000) and the number of individuals in the sample suggest that the observations are not pre-bankruptcy behavior. Indeed, an insignificant fraction of individuals that are delinquent in 2006 become bankrupt by 2007.

Fact 3: As delinquency rates have risen overall, the proportion choosing mortgage delinquency over credit cards has risen.

It is well known that economic conditions deteriorated between June 2006 and December 2007 (and more since that point). During that time, delinquency and default rates increased for most groups of individuals. For the purposes here, the notable change was the difference between credit card and mortgage delinquencies. Individuals that were mortgage delinquent but not credit card delinquent increased 127% during the 18 month period. Individuals that were credit card delinquent but not mortgage rose 18%.

Fact 4: Areas with large housing price declines show stronger patterns of credit card protection

Panel B of Table I shows the same statistics as above, divided into two groups of states. Looking at consumer decisions in three states that have been marked with high housing price increases (and then declines) shows a huge increase in mortgage delinquency rates without corresponding increases in credit card delinquency. In fact, these increased by 331% during the 18 month time period.

The core econometric methodology below will evaluate only those individuals that were current in June 2006 and became delinquent on one type in 2007.

III Literature

The growing and increasingly important literature on consumer financial decision making has not yet, to the authors' knowledge, tackled the question of delinquency priority, or its effects on the economy. In addition to the work, cited above, on the spillover effects of foreclosures and the decision to default on a mortgage in isolation, the closest antecedents are the literatures on consumer bankruptcy decisions and non-traditional

lending.

Consumer bankruptcy emerges out of the same patterns of financial distress that, in generally smaller amounts, lead to the delinquency tradeoffs discussed in this project. Indeed, there has been a large rise in bankruptcies over the last few decades. The literature to date on bankruptcy partitions the reasons for bankruptcy into two types.[6] The first considers increases in idiosyncratic uncertainty due to changing labor earnings volatility or decreases in medical insurance coverage (Barron *et al.*, 2000 and Warren and Warren Tyagi, 2003). This category also captures the demographic scenario that argues that the passing of the baby-boomers through the prime bankruptcy ages and changing family structure have increased the number of risky households (Sullivan *et al.* 2000). Another study (Cohen-Cole, 2009) finds that risk has been increasing across the spectrum of households and the bankruptcy decision is indeed a function of this exposure.

The second category is the role of the changes in the credit market environment that have made bankruptcy more attractive or expanded credit to a broader set of households, including higher-risk ones (see Dick and Lehnert, 2009, for a recent example). This second set of explanations includes the story that credit market innovations (such as the development and spread of credit scoring) facilitated the increase in credit granted to households by reducing the transaction costs of lending (Athreya 2004). But it also includes the possibility that the personal costs incurred by defaulters have fallen substantially, either as a result of improved bankruptcy filing procedures, the learning by households from each other as to how to navigate the bankruptcy process, or a decrease in social stigma associated with default.[7]

Non-traditional lending research is potentially useful as well for an understanding of delinquency tradeoffs as users of payday lending and similar fringe products are often in situations of financial distress or unable to access traditional markets. This literature does not provide a direct analysis of tradeoffs between types of delinquency, but does offer some perspective on why individuals may choose to use payday loans. A summary of this literature is available in Skiba and Tobacman (2008). The same authors find in a prior paper that the use of payday loans is explained by a combination of consumer shocks and very high discount rates (Skiba and Tobacman, 2005). Agarwal *et al.* (2009) find evidence that consumers will even open payday credit lines before using all available consumer credit. The implication, for delinquency tradeoffs, is strategic consumers that find themselves in a financial stress situation, may resort to protecting their credit cards rather than their houses.

On a related topic, Cole *et al.* (2008) provide some detailed evidence of spending patterns of credit con-

[6] See White (2007) for an excellent review.

[7] See Cohen-Cole and Duygan-Bump (2008) for more on social effects and bankruptcy.

strained households. While they do not directly address delinquency, they find strong patterns of spending choices that vary according to the severity of credit constraints.

This paper seeks to contribute to the outstanding literature by providing both an empirical analysis of financial decision making in periods of financial distress prior to or in place of bankruptcy. This involves individual-level delinquency tradeoffs. Importantly, it will also assess spillovers from current housing market stress into financial decisions and vice-versa. As many individuals move to protect personal liquidity at the expense of their home payment, there can be changes in aggregate housing values.

IV Econometric Methodology

Our goal, as discussed, is to highlight the decision making amongst individuals facing moderate financial distress. This is a particularly salient question because these individuals face a peculiar tradeoff - one that has potential economic spillovers. Neither those facing extreme distress nor those under little distress must choose between paying a household mortgage or paying credit card debt.

Our goal is to understand the decisions made by individuals that face mild economic shocks, those large enough to force a delinquency of some type, but insufficiently large to push the individual out of traditional credit altogether or into bankruptcy. Since we lack direct information on shocks faced by individuals, we isolate a particular type of financial distress by subdividing our sample and taking advantage of the panel structure of our data. That is, we isolate the shocks by looking at individuals that meet our criterion for the ex-post response to the shock and infer the presence of some economic shock. We corroborate our method by identifying that the locations in which these individuals live faced a combination of a disproportionate share of localized shocks and increased sensitivity to these shocks in the form of lower income, etc. That is, we estimate

$$facedshock_i = \alpha + \beta_1 Y_j + \beta_2 X_i + \varepsilon_i \tag{1}$$

where the variable $facedshock_i$ is in indicator for those individuals who had no delinquencies as of June 2006 and a sixty day delinquency on one type of credit in December 2007. Through most of our analysis, we will use a probit specification. We use the notation in equation 1 above for simplicity of presentation. We include a range of individual and local level covariates, labeled X_i and Y_j respectively. We remove individuals from the sample that had multiple delinquencies as well as those that had any delinquency in 2006. This structure allows us to isolate the correlates of the individuals that faced this particular type of shock. In principle the type and magnitude of the shocks will be heterogeneous, but the outcome of the shocks homogeneous. That is, a wealthy individual may need to be hit with a series of large shocks or a

poor individual with one minor shock to reach this economic condition. However, this is a useful tool in that it allows us to evaluate a highly heterogeneous population in terms of wealth, income, race, education, etc. but nonetheless evaluate a common set of decisions.

Once we've defined our population and shocks, we can move to evaluating the decision itself. We do so as follows. We define a variable, $CC \prec MT$, which uses the preference relation, $\prec$, to indicate that an individual chooses a revolving credit delinquency instead of a mortgage one. Thus, a revolving credit delinquency is coded as a 1. We can then estimate

$$CC \prec MT = \alpha + \beta_1 Y_j + \beta_2 X_i + \beta_3 price_j + \beta_4 liquidity_i + \varepsilon_i \tag{2}$$

where $price_j$ is some local measure of housing prices and $liquidity_i$ is an individual level measure of credit available to the individual at the beginning of our sample, before the delinquency in question. Our baseline measure is the amount of unused revolving credit available to the individual in June 2006. This ex-ante measure is useful because it provides an unbiased measure of the economic condition of the individual prior to the onset of financial distress. The principal and key assumption here is that individuals do not obtain more credit with the plan of becoming delinquent. Given that we have excluded individuals who went bankrupt before our first sample date from the sample as well as those who are unwilling or unable to pay all of their debt, we see little reason to believe why an individual would increase available credit lines with the plan to avoid payment on one of them.

So why would an individual choose one type of delinquency over another? There are various possibilities. Perhaps the penalty in terms of credit score, and thus future access to credit, differs across types of credit? In fact, we find there to be little evidence of this. To illustrate, we calculate a counterfactual penalty for each type of delinquency. We do so as follows:

First, using the sample of individuals that did not have any delinquency in either 2006 or 2007, we estimate the following model for the credit score in 2007 using observables in 2006:

$$CS\_2007_i = \beta_1 CS\_2006_i + \beta_2 X\_2006_i + u_i \tag{3}$$

where i is defined for all individuals and where $X\_2006 = \{age_i, income_i, race_i, etc.\}$, and CS_2007 and CS_2006 are the credit scores in 2007 and 2006 respectively.

Using model 3, we predict the credit score in 2007 for the sample of i individuals that have either mortgage or revolving credit delinquencies. This is the counterfactual: estimated credit score that an individual would have in 2007 if they had not been delinquent, conditional on their observable characteristics in 2006.

$$\widehat{CS\_2007}_j = \widehat{\beta}_1 CS\_2006_j + \widehat{\beta}_2 X\_2006_j$$

where $\widehat{CS}\_2007_j$ is the predicted score in 2007 for individuals that have either type of delinquency in 2007.

Next, we estimate the delinquency penalty, conditional on delinquency type, for individuals that were delinquent in 2007 by subtracting the estimated credit score in (2) from the actual observed credit score in 2007.

$$PenaltyCC_j = CS\_2007_j - \widehat{CS}\_2007_j \quad | \quad i \text{ was CC delinquent \& not mortgage delinquent in 2007}$$

and

$$PenaltyMT_j = CS\_2007_j - \widehat{CS}\_2007_j \quad | \quad i \text{ was mortgage delinquent \& not CC delinquent in 2007}$$

Table III shows the two penalties and should make clear that there is little distinction between the two types of credit. We further use this counter-factual methodology to explore the unutilized credit and revolving credit limit penalties associated with the delinquency decision. As is clear from Table III, choosing delinquency in the mortgage account preserves unutilized cash equivalent credit by a far greater amount than revolving delinquency. This result is even more astounding when considered in terms of the stronger cash equivalent credit limit penalty for mortgage delinquents. Indeed, the cash equivalent credit limit penalty is 88% *greater* for mortgage delinquents than for revolving credit delinquents; however the unutilized cash equivalent balance penalty is 26% *less* for mortgage delinquents than for revolving credit delinquents.

Rather, we believe that individuals choose the type of delinquency based on two factors: one, the economic value of the underlying asset, the house and two, the consumption value of consumer credit in relieving the individual budget constraint.

In our results section, we provide a range of sensitivity tests that tests the set of correlates we choose, our definition of shocks and population subsets, and our choice of dependent variable.

V Data

This paper draws primarily on a very large proprietary data set provided under contract by Transunion, one of the three large US credit agencies. The data are drawn from stratified random samples of individuals and include information from personal credit reports. In particular, the file includes individual date of birth, a variety of account and credit quality information such as the number of open accounts, defaulted accounts, current and past delinquencies, amount of past due balances, credit lines, credit balances, etc. The information spans all credit lines, from mortgages, bank cards, installment loans to department store accounts. Transunion also provides a summary measure of default risk (a generic credit score). As is customary,

account files have been purged of names, social security numbers, and addresses to ensure individual confidentiality. However, they do provide geo-coding information that allows us to match these personal credit history files with information from the US Census; again, in a manner in which confidentiality is maintained.

One of the benefits of the credit database used here is that it includes a measure of credit risk. For each individual, Transunion includes a proprietary credit score. Credit scores in general are inverse ordinal rankings of risk. That is, an individual with a credit score of 200 is viewed to have higher risk of default than an individual of score 201. Furthermore, most credit scoring systems currently in use are based on a logarithmic scale, meaning the difference in risk between 200 and 201 may or may not be equal to the change from 201 to 202. As in Gross and Souleles (2002) and Cohen-Cole and Duygan-Bump (2008), this paper uses the score as a control for changes in the risk composition of borrowers, together with account information on credit lines, balances, and utilization rates. The data were drawn from credit reports from the middle of 2006 and the end of December 2007. It is comprised of a very large repeated cross-section with about 27 million individuals, as well as a smaller short panel of about 2.2 million individuals. Twenty seven million individuals amount to an approximate 1 in 10 draw of all individuals with a credit history. The very large size of the dataset is useful in particular in helping to understand the heterogeneity present in the data while maintaining explanatory power.

For this paper, we draw on detailed information on borrower delinquency and utilization patterns. Transunion includes information on sixty day delinquency patterns for each type of credit. We exploit this variable's ability to distinguish between individuals who faced a shock and those who casually miss payments to identify distressed individuals. Thus we categorize an individual that has a balance that is at least sixty-days past due to be delinquent in the respective credit type. In terms of utilization, we compute an individual's unutilized revolving credit from their revolving credit limit and their current revolving credit balance. Given the availability of geo-coding information for the individuals, one can compute *local* delinquency rates.

The Transunion data also have a number of advantages for our study. First, these data allow us to look at various features of borrowing and delinquency behavior without concern for measurement error. Second, there are many individuals who meet our narrow set of conditions (not delinquent in 2006 and delinquent on only one type in 2007). Our key disadvantage is that we have no direct information on household income or employment status. This led to our choice of a subsample which isolates the individuals who faced some type of financial shocks.

Census Data and Other Information

Together with the credit information, the paper uses an individual's geo-coded census block address from

the Transunion data and links a wide variety of information on location characteristics. In particular, because there is no individual-level data on variables such as income and education, the paper relies on the following variables to control for local economic and demographic conditions. For demographic controls (education, race, and marital status), the paper uses data from the US 2000 Census national summary files and merges information at the neighborhood level (defined as a 1 mile radius). The paper uses data on median household incomes and poverty rates from the US 2000 Census and the 2005 and 2006 American Community Surveys at the county level. One can also match information from the Current Population Survey and Local Area Unemployment Statistics of the BLS on health insurance coverage (at the state level) and unemployment rates (at the county level), respectively, for the corresponding years. Finally, to capture the house price dynamics we take quarterly price data from the Office of Federal Housing Enterprise Oversight at the state level. The key advantage here is that one can link information at a more granular level (in most cases) than the state-level information. By using this degree of granularity, one can control a degree of the heterogeneity in economic shocks faced in the US economy.

When all this information has been merged a certain number of individuals get dropped due to missing data, for example on credit scores. Once these and other similar missing observations are removed, the paper has about 12 million observations for 2006 and a similar number of observations for 2007; with a panel of about 350,000.[8] Appendix T1 presents some summary statistics.

VI Delinquency Tradeoffs

The Revolving vs Mortgage decision

As explained above, our core methodological approach is to isolate the population of interest and illustrate the primary factors impacting their decision. We begin with a description of our primary results. Table IV shows the results of a probit regression of the binary variable $(CC \prec MT)$ on a range of individual financial controls, local demographic information and local economic indicators. The table reports marginal effects at the mean. As well, the specification includes our variables of interest, housing price changes and availability of credit. We measure housing prices changes over two time periods: 2000-2007 and 2006-2007. The two allow us to capture differential response to long run price trends and short term shocks. Recall that our data sample extends from June 2006 to December 2007, so the price changes are those that occurred

[8]Missing credit information comes from gaps in the original data. Missing information from the demographic files is due to discrepancies between the geo-codes from the credit bureau and the census. When a geo-code from the credit bureau lay more than a mile from the closest census block group centroid from the census, the data point is excluded. One can also match these remaining points by associating the individual with the closest centroid and run the risk of connecting the individual with an incorrect neighborhood. Nonetheless, the key coefficients on a regression using this methodology are substantively unchanged from the baselines below.

relatively early in the crisis.

Our dependent variable equals 1 if an individual was not delinquent in June 2006 and became delinquent on at least on of her credit cards in December 2007, but not on her mortgage and equals 0 if the same individual was delinquent on her mortgage in 2007 and not any of her credit cards. Column 1 of Table IV shows that both housing price trends are positively correlated with the dependent variable. The intuition is straightforward, during a time period of rising housing prices, when faced with a delinquency choice; individuals choose to defer payment on their credit cards rather than the increasing value asset. As well, our measure of liquidity, current available revolving credit liquidity, is positive signed as well. As liquidity increases, individuals default on their credit cards in place of their mortgage. When faced with lower liquidity, individuals appear to choose mortgage delinquency in order to protect the available remaining credit on their credit cards. Since credit cards are largely a cash substitute, this serves as a potential buffer against economic shocks. Indeed, a one standard deviation increase in available credit leads to a 12% increase in the probability that a distressed individual will choose revolving credit delinquency over mortgage delinquency.[9] Columns 2-4 repeat the exercise using alternate functional specification. Column 2 is a fixed effect, by county, probit. Column 3 and 4 are OLS and OLS with fixed effects by county respectively. As should be apparent, there is little variation in results as we alter functional form.

Functional Form

A potential difficulty with augmented valuation models (AVM) is that individuals may have different liquidity needs due to local conditions, prior obligations, differences in preferences, and more. While there is little ability to identify the level of liquidity need by individual, we modify our measure to capture a location specific measure of income differences. Our robustness check here, also contained in Table IV, is a measure of income-adjusted cash-equivalent credit availability. To calculate this, we divide the available cash-equivalent credit by local median income. We then supplement this measure with two other measures of income-adjustment credit. The first is mortgage balance divided by local median income and the second revolving credit limit divided by local median income. The first of these is useful to capture differences in housing finance by location. We replace the credit availability variable in Columns 1-4 with these measures in Column 5. We can observe that higher mortgage financing leads to more mortgage defaults. As well, higher available credit per dollar of income leads to more credit defaults, even controlling for total credit lines. Again, we see this as evidence of choosing mortgage default when faced with credit constraints. The

[9] Further, we compute the change in probabilities which result from adjustments to the short term and long term housing price changes. For an increase in the long term housing prices by one standard deviation we report an increase in the probability that a moderately distressed individual will choose revolving delinquency over mortgage delinquency by 4.6%, for short term price changes the change is an increase of 14.3%.

magnitudes are similar: the probability that an individual, faced with a mild shock, will choose mortgage delinquency over revolving credit delinquency is 0.492 and for the alternate specification the probability is 0.487.

We also evaluate the impact of nonlinearities on the delinquency decision. To do so, we look at the combination of our two types of factors, price changes and liquidity constraints. We interact the credit availability variable with price changes and repeat the specification variations from Table IV. We find that the interaction of liquidity concerns and price changes indeed lead to a greater probability of choosing to protect credit cards over mortgages. That is, even in a situation where both price declines and liquidity constraints are of concern, individuals continue to choose access to cash-like liquidity over paying their mortgage. Indeed, the number suggest that a 10% decline in housing prices and a 25% fall in credit access suggests an increased probability of choosing credit cards (going delinquent on a mortgage account) of 30%.

Regional Economic Distress

Another potential concern is that the results are a function of localized regional distress. While we include two forms of housing price trends, a recent and a longer-term one, potential state or region-specific level shocks such as declining industries or particularly large spillovers from housing to other sectors may lead to different delinquency decisions. Specifically, we highlighted the importance of three particular states that saw large drops in housing prices and the apparent magnified impact, in those states, on changes in the delinquency decision. In this regard we saw that the distressed housing markets of Arizona, California, and Florida exhibit a dramatic increase in mortgage-only delinquents in our sample. In Table V we give further support to this finding. Table V shows the results from the baseline regression delineated into two samples - the distressed markets (the ten worst markets in terms of housing price changes between 2006 and 2007) and non-distressed markets. Each of these regressions exhibit the same general trend as the baseline model, increasing revolving credit delinquency in housing price changes and unutilized revolving credit. However, the magnitude of each of these coefficients reaffirms the story above. These results make it apparent that the short term price fluctuations are decidedly more important in the distressed market. In the distressed markets, the magnitude of short term housing prices is significant and roughly twice the size of the (not-significant) coefficient for the non-distressed market. It then follows that the weight of the other variables of interest are both decidedly less important in the distressed market - indeed we report the unutilized credit coefficient only that is three-fourths of the non-distressed market and the long term price fluctuations as insignificant.

Credit Constraints (score and age)

The dearth of liquidity and its impact on delinquency decisions may be particularly salient for those that would have a higher chance of being credit constrained. This would include those with worse credit and the young. We look at each here.

Beginning with age, we hypothesize that life-cycle patterns have a significant impact on the ex-ante credit constraints and thus, this group should show an increased need for liquidity. Table VI reports the age dependent results of our baseline regression. Unsurprisingly, for individuals under thirty the liquidity effect of delinquency is stronger than at any other age. It is precisely these individuals that have lower disposable income, lower savings, and lower available credit than at any point later in life. The preservation of available revolving credit in order to meet short term obligations is thus intuitive and supported by the data. This effect carries over into short term housing price fluctuations as well where they are more apt to default on mortgages than their elder counterparts. On average, these younger individuals have less equity in their homes than the older population; a result of larger down-payments and greater repayment of the principal by elder individuals. Perhaps more surprising is that the relevant coefficients for the middle age group, a group not traditionally associated with binding credit constraints, are also highly significant and of large magnitude.

The magnitude for these individuals reflect the same liquidity preservation seen earlier, however the smaller coefficient on the short term price fluctuations reflect the increased housing services that are derived from home ownership for middle aged individuals. This too is in line with our priors, middle aged individuals, whose homes represent the aggregation of important life decisions, are more apt to protect their mortgages than their younger counterparts. Finally, among the oldest group in our sub-sample we see only a weak relationship between the delinquency decision and credit availability and no relationship between the delinquency decision and housing prices.

Table VII shows a decomposition of our primary results by credit score. Belying the notion that only poor credit individuals would encounter these types of situations; the results are largely consistent across the credit spectrum. Each of the three categories show positive and significant coefficient on the recent housing price change, with the largest effect arising for those with the best credit scores. The coefficients on the available credit variable are also unsurprising. As credit quality falls, available credit becomes increasingly important; the coefficient for the low credit quality is more than three times as large as the coefficient for the high credit quality individuals. Those with poor credit have a particularly large incentive to defend their source of credit, particularly when faced with a financial shock.

VII Economic Spillovers

This section addresses the economic spillovers component of the paper. Our broad finding is that the individual decision to choose to protect consumer credit instead of housing has a negative externality. In particular, it leads directly to higher foreclosures from those individuals. It also leads, indirectly, to increased local delinquencies. We attribute the latter effect to the spillover of foreclosure on local housing prices. Of course, since we showed that falling housing prices is correlated with increased delinquency (Table III), we call attention to the feedback effect between particular individual choices and accelerating declines in prices and delinquency.

This section will show two phenomena. The first is a simple correlation between liquidity constraints and local delinquency rates. This is supportive of the spillover concept. The second is a relationship between individual level choices for a particular form of credit and local delinquency rates. We will instrument the choice given potential endogeneity concerns.

Liquidity Constraints $\Rightarrow$ Local Delinquency

We illustrate the spillovers empirically in two stages. We begin with a simple OLS specification:

$$\Delta localDelinquency_j = \alpha + \beta_1 Y_j + \beta_2 X_i + \beta_3 price_j + \beta_4 liquidity_i + \varepsilon_i \quad (4)$$

where $\Delta localDelinquency_j$ calculated the change in delinquency rates between June 2006 and July 2007. The remaining variables are the same as specified above in equation 2. We highlight the results of this regression in Table VIII. After controlling for local demographic and economic shocks as well as individual level credit characteristics, we find a strong significant relationship between housing price declines and increases in delinquency (the negative coefficient on Short Term Housing Price Change). A one standard deviation decrease in short-run housing price changes is associated with an increased revolving delinquency rate of 43% and mortgage delinquency of 42%.

Liquidity Constraints $\Rightarrow$ Preference for Consumer Credit $\Rightarrow$ Local Delinquency

In this section, we extend the results from Table IV, in which we showed a link from liquidity constraints to the preference for consumer credit. We show that this choice for consumer credit leads to local spillovers in the form of increased delinquency. We use two variants of a similar model, designed to capture slightly different effects. In each we use a measure designed to capture the choice to protect a particular form of credit.

The first version specifies the model:

$$\Delta localDelinquency_j = \alpha + \beta_1 Y_j + \beta_3 price_j + \beta_4 (CC \prec MT)_i + \varepsilon_i \quad (5)$$

$$(CC \prec MT)_i = \alpha + \beta_1 Y_j + \beta_2 X_i + \beta_3 price_j + \beta_4 liquidity_i + \varepsilon_i \quad (6)$$

where the first stage is identical to equation 2, above. Results from this specification are available in Table VIII, Columns 5 and 6. The latter of these two columns shows the impact on local mortgage delinquency rates. The negative coefficient shows that more individual choosing to protect credit cards leads to higher mortgage delinquency rates in the community. Recall that the $CC \prec MT$ that is the dependent variable in the first stage is equal to 1 if individuals choose to default on their credit cards, but not their mortgages. Thus lower predicted values (negative coefficient) indicate defaults on mortgages. This increases local mortgage delinquency rates.

The opposite is true for local credit card delinquency rates. More protection of credit cards leads to decreases in local revolving delinquency.

As should be apparent from equation 5 above, we instrument $CC \prec MT$ with the set of individual level credit characteristics, including the availability of credit. Our exclusion is thus that spillovers must take place through the price mechanism of foreclosures.

Because this first version limits our sample to the group of individuals studied in Table IV, we expand the sample by relaxing the assumption that we need to focus on individuals that had no delinquencies in 2006 and a single type in 2007. We now use two first stage regressions, one each for mortgage and revolving delinquency:

$$\Delta localDelinquency_j = \alpha + \beta_1 Y_j + \beta_3 price_j + \beta_4 lateRE_i + \beta_4 lateMT_i + \varepsilon_i \quad (7)$$

$$LateRE_i = \alpha + \beta_1 Y_j + \beta_2 X_i + \beta_3 price_j + \beta_4 liquidity_i + \varepsilon_i \quad (8)$$

$$LateMT_i = \alpha + \beta_1 Y_j + \beta_2 X_i + \beta_3 price_j + \beta_4 liquidity_i + \varepsilon_i \quad (9)$$

The two late variables are indicator variables for each of the 60 day delinquency measures. These two first stage regressions have the same specification as Columns 2 and 3 from Table II. We now include the full spectrum of individuals that became late on each form of credit. The advantage is the vastly increased sample size. The disadvantage is that we no longer can isolate the precise choice of an individual between revolving credit and mortgages; instead, we have a disaggregation of the factor influencing each choice in the absence of the other form of credit. Nonetheless, the conclusions are largely consistent. Increases

in delinquencies on mortgages are positively associated with increases in local delinquency rates for both mortgages and credit cards. The opposite effect is true for revolving debt.

Notice the distinction in results between this specification and the first structural form. The responsiveness of revolving debt delinquency at the community level appears to have the opposite sign as a function of individual credit card delinquencies. We interpret this as being driven by the large number of individuals that have both mortgage and revolving delinquency. Our first structural model included only individuals that chose a particular type of delinquency. Regardless, the impact on mortgage delinquencies is robust to specification.

VIII Conclusion

This paper has found evidence on the drivers of individual delinquency decisions. In particular, our study extends existing literature by focusing on the decisions of individuals who, under moderate financial stress, consider the tradeoff between delinquency in their mortgage and their revolving credit accounts. In this regard our study contributes to the field in two important ways; first we identify a subset of the population - those who face moderate financial shocks - that to our knowledge has not been the focus of existing studies. This subset of the population comprises of a larger percentage of individuals than does the subset that we identify as severe stress individuals (delinquency in two, as opposed to one, accounts). Second, our examination of the delinquency decision finds strong evidence that individual liquidity considerations and local housing prices are significant and robust predictors of the delinquency decision for individuals under moderate stress. Our results, that individuals may choose to preserve liquidity by defaulting on their mortgages, counters the conventional wisdom that individuals protect their homes at all costs.

Our analysis then examines this effect in the broader context of regional variations in delinquency rates. This extension is important, not only from a political economy perspective but also as a important qualification of the emerging literature which documents individuals decisions to default on their mortgages as a function of their debt to equity ratio on their homes. Our evidence indeed confirms that housing prices play an important role in determining mortgage delinquencies; indeed it is one of two factors that we determine to be of particular relevance. Future research will include an analysis of supplemental data on individual mortgage balances and local housing price information to address this question explicitly.

The contributions of this study to the consumer finance literature are important, yet there remain important extensions to this paper that would add clarity our thesis. Specifically, with more complete panel data we could examine the precise timing of the delinquency decisions and determine the spillovers with more

accuracy. This would allow more detailed analysis of particular prices and values at which the housing price changes and cash equivalent credit become key factors in the delinquency decision. Finally, examining our results in light of local economic shocks would isolate the response to various shock type and allow a more complete understanding of the feedback from individual decisions to the local economy.

Nonetheless the policy implications of the study are clear. One, mortgage affordability, in the context of a complete view of household finances, is indeed an important determinant of an individual's decision to repay it. Two, consumer credit is an important consumption smoothing tool both at the individual and economy wide levels. Three, home prices matter for default decisions in conjunction with other factors. Though for distinct reasons, we agree with the Foote *et al.*, (2009) conclusion that ameliorating the impact of individual level idiosyncratic shocks such as job loss is crucial. We also think that loan modification for *both* mortgage and consumer credit would be appropriate.

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TABLE I: DELINQUENCY CHOICE

Panel A:

	Revolving Credit Delinquency	Mortgage Delinquency
Count	9,290	8,339
No Delinquency of Other Type	7,138 (77%)	6,187 (74%)
Change June 2006 - December 2007	18%	127%

Panel B:

	Revolving Credit Delinquency	Mortgage Delinquency
Change June 2006 - December 2007 (Nevada, California, Florida)	60%	331%
Change June 2006 - December 2007 (All Other States)	12%	97%

Notes: Data is drawn from credit reports for 2.2 million individuals in June 2006 and December 2007. The number show those individuals that have a house and a mortgage in each of the two time periods. Delinquency is defined as 60 day delinquency at the time of the credit report. The percentage increases in both panels refer to the increase in single delinquency (e.g. mortgage delinquency and no revolving delinquency or vice versa) type between the two time periods for the sample denoted in the row header.

TABLE II: DELINQUENCY REGRESSION RESULTS

Dependent Variable	Faced Shock (2007)	Delinquent Mortgage Account (2007)	Delinquent Revolving Account (2007)
Medium Term Housing Price Change	-0.00208***	-0.00119***	-0.000436
	(0.000663)	(0.000311)	(0.000502)
Short Term Housing Price Change	-0.0787***	-0.0352***	-0.0139***
	(0.00477)	(0.00236)	(0.00362)
Available Cash Equivalent Credit (2006)	-1.42e-07***	-7.87e-08***	-4.44e-08***
	(6.25e-09)	(3.40e-09)	(4.34e-09)
individual controls	X	X	X
local demographic variables	X	X	X
local financial variables	X	X	X
Observations	351,366	350,217	350,217

Notes: The numbers reported are the marginal effects based on coefficients estimated using a probit model. See Appendix T1 for a detailed description of each of the variables. The dependent variable for the first column is an indicator variable which takes the value of 1 when an individual has a delinquency in either their mortgage or their revolving credit accounts. The dependent variable in the second column is an indicator variable which takes the value of 1 when an individual is mortgage delinquent. The dependent variable in the third column is an indicator variable which takes the value of 1 when an individual is revolving credit delinquent. The sample in all columns is limited to individuals who have only one delinquency or no delinquencies in 2007 and no delinquencies in 2006. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE III: DELINQUENCY PENALTIES

	Credit Score Penalty	Cash Equivalent Credit Limit Penalty	Un-Utilized Cash Equivalent Credit Penalty
Late Mortgage	-170	-18,700	-8,067
Late Revolving	-188	-9,950	-10,900
Number of Observations	7,975	7,975	7,975

Notes: The values reported pertain to individuals who were not delinquent in 2006, but became delinquent on either their revolving credit or mortgage debt between 2006 and 2007. The first column reports the average difference between forecast credit score, as described in the text, and actual credit score in points, the second column reports this difference for the cash equivalent credit limit, and the third column reports this difference for the un-utilized cash equivalent credit balance. Each statistic is reported for the delinquency type denoted in the row heading. All averages reported in the table exclude individuals who were delinquent in both revolving and mortgage accounts.

TABLE IV: BASELINE REGRESSIONS

Dependent Variable	Delinquency Decision	Fixed-Effect Probit	OLS	Fixed-Effect OLS	Alternate Definition	Fixed-Effect Alternate Definition
Medium Term Housing Price Change	0.0635**	0.0533*	0.0611**	0.0547**	0.111***	0.101***
	(0.0265)	(0.0294)	(0.0251)	(0.0265)	(0.0271)	(0.0307)
Short Term Housing Price Change	1.625***	1.584***	1.532***	1.506***	0.968***	0.936***
	(0.191)	(0.218)	(0.180)	(0.194)	(0.199)	(0.231)
Available Cash Equivalent Credit (2006)	2.95e-06***	2.99e-06***	2.58e-06***	2.59e-06***		
	(3.16e-07)	(3.19e-07)	(2.75e-07)	(2.75e-07)		
constant			-0.443***	-0.438***		
			(0.132)	(0.134)		
Income Adjusted Available Cash Equivalent Credit (2006)					0.100***	0.101***
					(0.0161)	(0.0163)
Income Adjusted Mortgage Balance (2006)					-0.0543***	-0.0559***
					(0.00316)	(0.00323)
Income Adjusted Revolving Credit Balance (2006)					0.153***	0.157***
					(0.0132)	(0.0134)
individual controls	X	X	X	X	X	X
local demographic variables	X	X	X	X	X	X
local financial variables	X	X	X	X	X	X
probit model	X	X			X	X
OLS model			X	X		
Fixed Effects (state-county)		X		X		X
Observations	7,975	7,975	7,975	7,975	7,963	7,963
R-squared			0.073			

Notes: The dependent variable in each column is an indicator variable representing individuals decision to go delinquent with revolving credit (1) or with mortgage credit (0) - individuals who went delinquent in neither and in both categories are omitted from the sample. The first column reports the marginal effects based on coefficients estimated using a probit model. The second column repeats this exercise using a fixed effects model where the panel variable is the state and county of residence. The third and fourth columns repeat the exercising using linear regression models. Column five and six offer a different definition for available credit - available credit as a function of local median income, additionally mortgage and revolving balances in terms of median income are also included in this specification. See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE IVa: BASELINE REGRESSIONS (MSA LEVEL HOUSING PRICES)

Dependent Variable	Delinquency Decision	Fixed-Effect Probit	OLS	Fixed-Effect OLS	Alternate Definition	Fixed-Effect Alternate Definition
Medium Term Housing Price Change (Local Prices)	0.108***	0.107***	0.0993***	0.0870***	0.168***	0.166***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)
Short Term Housing Price Change (Local Prices)	1.876***	1.866***	1.727***	1.604***	1.463***	1.448***
	(0.19)	(0.20)	(0.17)	(0.20)	(0.20)	(0.20)
Available Cash Equivalent Credit (2006)	0.00000289***	0.00000288***	0.00000254***	0.00000252***		
	(0.0000004)	(0.0000004)	(0.0000004)	(0.0000004)		
constant			-0.632***	-0.627***		
			(0.16)	(0.17)		
Income Adjusted Available Cash Equivalent Credit (2006)					0.0970***	0.0968***
					(0.02)	(0.02)
Income Adjusted Mortgage Balance (2006)					-0.0508***	-0.0510***
					(0.00)	(0.00)
Income Adjusted Revolving Credit Balance (2006)					0.142***	0.143***
					(0.02)	(0.02)
individual controls	X	X	X	X	X	X
local demographic variables	X	X	X	X	X	X
local financial variables	X	X	X	X	X	X
probit model	X	X			X	X
OLS model			X	X		
Fixed Effects (state-county)		X		X		X
Observations	4,959	4,959	4,959	4,959	4,953	4,953
R-squared			0.08			

Notes: The table is a replication of Table IV utilizing a different definition for short and medium term housing price change. In this specification the change in housing prices is calculated at the MSA level, as opposed to the state level. As data for MSA level housing prices is not available for all observations in our sample, the sample size in this specification is reduced to approximately 5,000 observations in each regression. The first column reports the marginal effects based on coefficients estimated using a probit model. The second column repeats this exercise using a fixed effects model where the panel variable is the state and county of residence. The third and fourth columns repeat the exercising using linear regression models. Column five and six offer a different definition for available credit - available credit as a function of local median income, additionally mortgage and revolving balances in terms of median income are also included in this specification. See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE V: DISTRESSED HOUSING MARKETS

Dependent Variable	**Distressed States**	**Non-Distressed States**
Medium Term Housing Price Change	0.0376	0.102**
	(0.0562)	(0.0399)
Short Term Housing Price Change	1.586***	0.833
	(0.547)	(0.568)
Available Cash Equivalent Credit (2006)	2.58e-06***	3.38e-06***
	(4.21e-07)	(4.73e-07)
individual controls	X	X
local demographic variables	X	X
local financial variables	X	X
Observations	3212	4763

Notes: The numbers reported are the marginal effects based on coefficients estimated using a probit model. The dependent variable in each column is an indicator representing individuals decision to go delinquent with revolving credit (1) or with mortgage credit (0) - individuals who went delinquent in neither and in both categories are omitted from the sample. The first column pertains to the ten most distressed states in our sample, as determined by the housing price change between 2006 and 2007. The second column pertains to the complementary group of states. See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE VI: AGE VARIATION

Dependent Variable	**<30**	**30-50**	**>50**
Medium Term Housing Price Change	0.0608	0.0678**	0.0514
	(0.0621)	(0.0303)	(0.0998)
Short Term Housing Price Change	2.208***	1.456***	0.904
	(0.433)	(0.220)	(0.738)
Available Cash Equivalent Credit (2006)	3.02e-06***	3.02e-06***	1.88e-06**
	(1.13e-06)	(3.54e-07)	(9.08e-07)
individual controls	X	X	X
local demographic variables	X	X	X
local financial variables	X	X	X
Observations	1,555	5,861	559

Notes: The numbers reported are the marginal effects based on coefficients estimated using a probit model. The dependent variable is an indicator representing individuals decision to go delinquent with revolving credit (1) or with mortgage credit (0) - individuals who went delinquent in neither and in both categories are omitted from the sample. The first column pertains to individuals between the ages of 18 and 30, the second column pertains to individuals between the ages of 30 and 50, and the last column pertains to individuals aged 50 and above. See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE VII: CREDIT SCORE GROUPS

Dependent Variable	Low Credit Score	Mid-Credit Score	High Credit Score
Medium Term Housing Price Change	0.110**	-0.00725	0.0967**
	(0.0449)	(0.0457)	(0.0473)
Short Term Housing Price Change	1.473***	1.367***	2.157***
	(0.331)	(0.329)	(0.336)
Available Cash Equivalent Credit (2006)	8.99e-06***	4.33e-06***	2.78e-06***
	(1.45e-06)	(7.35e-07)	(3.79e-07)
individual controls	X	X	X
local demographic variables	X	X	X
local financial variables	X	X	X
Observations	2,680	2,622	2,673

Notes: The numbers reported are the marginal effects based on coefficients estimated using a probit model. The dependent variable is an indicator representing individuals decision to go delinquent with revolving credit (1) or with mortgage credit (0) - individuals who went delinquent in neither and in both categories are omitted from the sample. The first column pertains to individuals with low credit scores (less than 495), the second column pertains to middle credit score individuals (between the credit scores of 495 and 596), and the last column pertains to high credit score individuals (above 596). See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE VIII: LOCAL DELINQUENCY RATES

	OLS		IV Regression: Indicator Variables		IV Regression: delRE	
Dependent Variable	**Change in Local Revolving Delinquency**	**Change in Local Mortgage Delinquency**	**Change in Local Revolving Delinquency (IVreg)**	**Change in Local Mortgage Delinquency (IVreg)**	**Change in Local Revolving Delinquency (Ivreg_sub)**	**Change in Local Mortgage Delinquency (IVreg)**
Medium Term Housing Price Change	0.00143***	-0.000172	0.00168***	0.000326	-0.00701*	-0.00821**
	(0.000340)	(0.000223)	(0.000387)	(0.000276)	(0.00372)	(0.00387)
Short Term Housing Price Change	-0.0465***	-0.0534***	-0.0416***	-0.0412***	-0.0493*	-0.0760***
	(0.00240)	(0.00157)	(0.00291)	(0.00207)	(0.0280)	(0.0291)
Available Cash Equivalent Credit (2006)	-5.24e-09***	-1.02e-08***				
	(1.99e-09)	(1.31e-09)				
Indicator of Delinquent Revolving Credit Account (2006)			-0.125***	-0.165***		
			(0.0278)	(0.0198)		
Indicator of Delinquent Mortgage Account (2006)			0.0853***	0.160***		
			(0.0198)	(0.0141)		
Delinquency Choice (1 - Revolving, 0 - Mortgage)					0.0644***	-0.0838***
					(0.00700)	(0.00728)
individual controls	X	X				
local demographic variables	X	X	X	X	X	X
local financial variables	X	X	X	X	X	X
OLS	X	X				
Instrumental Variable Regression			X	X	X	X
Observations	357,187	357,187	357,187	357,187	7,975	7,975

Notes: The dependent variable is the change in local delinquency rates between 2006 and 2007, for either revolving credit or mortgage credit. The first and second columns are OLS regressions which include all of the baseline controls, columns three and four are instrumental variable regressions which include a subset of the baseline controls and have as instruments the binary choices for delinquency in credit and mortgage accounts, and columns five and six are instrumental variable regressions which include a subset of the baseline controls and have as an instrument the binary choice of delinquency in either revolving or mortgage credit (based on the sample from the baseline regression). See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

TABLE IX: BASELINE - INTERACTION TERM

	Delinquency Decision	Fixed-Effect Probit	OLS	Fixed-Effect OLS	Alternate Definition	Fixed-Effect Alternate Definition
Dependent Variable						
Medium Term Housing Price Change	0.0629**	0.0524*	0.0607**	0.0538**	0.111***	0.100***
	(0.0265)	(0.0295)	(0.0251)	(0.0266)	(0.0271)	(0.0307)
Short Term Housing Price Change	1.517***	1.466***	1.472***	1.434***	0.841***	0.785***
	(0.208)	(0.233)	(0.194)	(0.208)	(0.215)	(0.247)
Available Cash Equivalent Credit (2006)	3.12e-06***	3.18e-06***	2.66e-06***	2.67e-06***		
	(3.43e-07)	(3.46e-07)	(2.90e-07)	(2.90e-07)		
avail0HOUSE	8.18e-06	9.09e-06	4.36e-06	4.98e-06	9.29e-06	1.12e-05*
	(6.13e-06)	(6.20e-06)	(5.29e-06)	(5.29e-06)	(6.06e-06)	(6.17e-06)
constant			-0.443***	-0.437***		
			(0.132)	(0.134)		
Income Adjusted Available Cash Equivalent Credit (2006)					0.108***	0.111***
					(0.0171)	(0.0173)
Income Adjusted Mortgage Balance (2006)					-0.0545***	-0.0562***
					(0.00316)	(0.00324)
Income Adjusted Revolving Credit Balance (2006)					0.153***	0.158***
					(0.0132)	(0.0134)
individual controls	X	X	X	X	X	X
local demographic variables	X	X	X	X	X	X
local financial variables	X	X	X	X	X	X
probit model	X	X			X	X
OLS model			X	X		
Fixed Effects (state-county)		X		X		X
Observations	7,975	7,975	7,975	7,975	7,963	7,963
R-squared			0.073			

Notes: The dependent variable in each column is an indicator variable representing individuals decision to go delinquent with revolving credit (1) or with mortgage credit (0) - individuals who went delinquent in neither and in both categories are omitted from the sample. The innovation of this table is the inclusion of an interaction term that is comprised of the available credit variable and the change in recent housing prices variable. The first column reports the marginal effects based on coefficients estimated using a probit model. The second column repeats this exercise using a fixed effects model where the panel variable is the state and county of residence. The third and fourth columns repeat the exercising using linear regression models. Column five and six offer a different definition for available credit - available credit as a function of local median income, additionally mortgage and revolving balances in terms of median income are also included in this specification. See Appendix T1 for a detailed description of each of the variables. Standard errors are reported in parentheses, and we adopt the usual convention: *** p<0.01, ** p<0.05, * p<0.1

APPENDIX T-I: SUMMARY STATISTICS

	COMPLETE SAMPLE		NO DELINQUENCY (2007)		REVOLVING DELINQUENCY (2007)		MORTGAGE DELINQUENCY (2007)		BOTH DELINQUENCIES (2007)	
VARIABLES	**MEAN**	**SD**	**MEAN**	**SD**	**MEAN**	**SD**	**MEAN**	**SD**	**MEAN**	**SD**
Age (2006)	39.48	8.66	39.58	8.64	37.29	8.02	34.85	8.60	34.74	8.19
Age (2007)	40.29	8.53	40.39	8.51	38.19	7.91	35.72	8.46	35.68	8.20
Total Available Credit (2006)	235,086	133,428	235,187	133,249	212,030	126,888	238,503	145,604	271,408	150,823
Total Available Credit (2007)	248,440	174,955	248,364	173,930	219,842	149,062	266,101	239,468	306,417	253,510
Available Cash Equivalent Credit (2006)	40,629	40,505	41,368	40,626	16,807	25,770	9,380	17,908	12,155	18,917
Available Cash Equivalent Credit (2007)	45,875	50,184	46,885	50,354	10,659	24,848	6,471	14,884	4,364	17,035
Divorced (2006)	0.09	0.03	0.09	0.03	0.10	0.03	0.10	0.03	0.10	0.03
Faced Shock (2006)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Faced Shock (2007)	0.03	0.16	0.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Bankrupt (2006)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Greater than HS equivalency (2006)	0.84	0.11	0.85	0.11	0.81	0.12	0.80	0.12	0.81	0.12
Installment Credit Limit (2006)	17,080	21,704	16,976	21,670	21,712	23,026	19,667	21,591	23,156	24,157
Installment Credit Limit (2007)	18,883	28,103	18,834	28,145	22,194	25,122	18,810	27,774	22,413	25,479
Income Growth (2006)	1.08	2.99	1.08	2.99	0.86	2.85	1.02	3.11	1.04	3.07
Delinquent Mortgage Account (2006)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delinquent Mortgage Account (2007)	0.01	0.12	0.00	0.00	0.00	0.00	1.00	0.00	1.00	0.00
Delinquent Revolving Account (2006)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Delinquent Revolving Account (2007)	0.01	0.12	0.00	0.00	1.00	0.00	0.00	0.00	1.00	0.00
Median Household Income (2006)	51,292	12,267	51,333	12,286	49,045	11,477	50,107	11,326	50,798	11,676
Mortgage Holder (2006)	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00	1.00	0.00
Mortgage Limit (2006)	162,755	109,701	162,261	109,288	154,292	105,630	197,886	130,129	214,722	131,887
Mortgage Limit (2007)	166,729	145,271	165,650	143,686	167,126	128,232	232,486	221,803	254,631	225,903
Mortgage Balance (2006)	147,473	108,203	146,727	107,671	146,890	105,226	193,018	130,752	210,791	132,688
Mortgage Balance (2007)	148,436	140,619	147,047	138,663	157,687	129,340	227,493	223,711	251,373	229,477
Mortgage Utilization Rate (2006)	87.81	20.44	87.61	20.61	93.28	11.79	96.04	9.32	97.19	7.30
Mortgage Utilization Rate (2007)	85.68	18.62	85.44	18.58	91.52	20.00	95.99	17.82	97.00	9.14
Amount of Delinquent Mortgage (2006)	0	0	0	0	0	0	0	0	0	0
Amount of Delinquent Mortgage (2007)	112	1,456	0	0	0	0	7,645	9,495	7,387	8,550
Percent with No Earnings (2006)	0.17	0.09	0.17	0.09	0.18	0.09	0.18	0.09	0.17	0.08
Percent Black (2006)	0.08	0.15	0.08	0.15	0.13	0.20	0.14	0.21	0.12	0.20
Percent Hispanic (2006)	0.11	0.16	0.10	0.16	0.12	0.18	0.15	0.19	0.15	0.19
Population Density (2006)	1,753	4,803	1,755	4,813	1,669	4,697	1,681	4,058	1,703	4,594
Poverty Rate (2006)	12.01	4.77	11.99	4.76	12.83	5.02	12.48	4.74	12.14	4.50
Percent on Public Assistance (2006)	0.03	0.03	0.03	0.03	0.03	0.03	0.04	0.04	0.03	0.03
Revolving Credit Limit (2006)	55,251	50,651	55,950	50,736	36,026	42,777	20,950	33,231	33,531	40,463
Revolving Credit Limit (2007)	62,828	63,899	63,880	64,106	30,522	41,298	14,805	30,399	29,372	47,860
Revolving Credit Balance (2006)	14,621	24,243	14,582	24,186	19,219	27,712	11,569	22,573	21,376	30,284
Revolving Credit Balance (2007)	16,953	31,530	16,995	31,584	19,864	29,891	8,334	22,104	25,008	42,034
Revolving Credit Utilization Rate (2006)	24.28	27.18	23.50	26.53	53.88	30.63	52.39	37.86	57.38	31.00
Revolving Credit Utilization Rate (2007)	24.16	27.95	23.08	26.48	76.44	43.80	50.95	40.35	88.90	47.14
Amount of Delinquent Revolving Credit (2006)	0	0	0	0	0	0	0	0	0	0
Amount of Delinquent Revolving Credit (2007)	10	161	0	0	604	952	0	0	982	1,631
Credit Score (2006)	715	123	719	119	554	116	527	133	547	115
Credit Score (2007)	711	135	720	124	391	113	385	90	317	73
Unemployment Rate (2006)	4.98	1.25	4.97	1.25	5.19	1.30	5.17	1.36	5.06	1.32
Uninsured (2006)	15.59	4.28	15.58	4.27	15.71	4.40	15.94	4.36	16.04	4.16
Number of observations:	350,386	351,366	342,242	342,242	3,920	3,920	4,055	4,055	1,149	1,149

Notes: Based on authors' calculations using credit bureau data, Census, and other information as described in the text. All data pertains to the year specified in the variable name.