Interest Rates and Equity Extraction During the Housing Boom*

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Abstract

Using detailed credit record data, we show that home equity extraction in the U.S. peaked in 2003 as interest rates reached record lows, well before the peak in house prices. This finding emphasizes the importance of monetary policy in influencing equity extraction, and establishes that extraction during the 2000s was not simply motivated by house price increases. We estimate that equity extraction was at least $240 billion higher from 2002–2004 than if mortgage rates had stayed closer to previous levels. The credit record data further allow us to explore heterogeneity in the response to interest rates and house price appreciation; younger homeowners and those with high credit card debt are less responsive to interest rate changes, and highly responsive to house price growth, consistent with such households facing credit constraints. Finally, we show that default by home equity extractors is closely related to the timing of extraction and house price declines, rather than a selection story where riskier households were more likely to extract in later years of the housing boom.

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I Introduction

The recent housing boom and bust was characterized by a "leverage cycle," with households reaching unprecedented levels of indebtedness relative to their incomes (Geanakoplos 2009). The growth in household debt during the 2000s was driven primarily by mortgage debt (Dynan and Kohn 2007), and when home prices fell, many borrowers ended up with negative home equity, contributing to a surge in mortgage defaults.

One way that households increased their leverage was by extracting equity from their homes, through cash-out refinancing and second lien home equity loans or lines of credit. It has been shown that homeowners extracted substantial equity in response to rising house prices, perhaps reflecting both wealth and collateral effects (Mian and Sufi 2011, Disney and Gathergood 2011). However, homeowners may also have been responding to historically low mortgage rates that simply made borrowing cheaper. As former Federal Reserve chairman Alan Greenspan posited in 2004 testimony to Congress, "The lowest home mortgage rates in decades were a major contributor to . . . a large extraction of cash from home equity."

In this paper, we use a large, high-frequency panel dataset of individual credit records merged with ZIP code level house price indices to explore the causes and consequences of equity extraction during the recent housing boom and bust.[1] One key objective is to trace out the time series pattern of extraction and estimate the relationship between interest rates and extraction during the 2000s, exploiting the geographic detail of the data to control for house price growth and employment conditions. In addition, the breadth of the credit record data allows us to control for variation in individual liquidity with credit card utilization rates.

Importantly, in our data we observe all types of extractions, not just cash-out refinancings, which has often been a limitation in past research. We show that over 50 percent of extraction decisions since 1999 occur in forms other than cash-out refinancings, and that the form of extraction, not surprisingly, is correlated with interest rates and the business cycle. Thus, our

[1] There is an extensive literature on wealth-maximizing refinance decisions focusing on the spread between a homeowner's mortgage rate and the prevailing market rate (see, e.g. Bennett, Peach, and Peristiani 2000), as opposed to the focus in this paper on equity extraction decisions for consumption smoothing purposes, which may or may not involve a refinancing.

data are important for understanding the link between interest rates and home equity extraction.

Underscoring the view that low mortgage rates were an important driver of equity extraction, we find that the likelihood of extracting equity among U.S. mortgage borrowers peaked in 2003, and then dissipated even as house prices continued to rise robustly. We identify extractions as instances when a borrower's mortgage debt increases by at least 10 percent over one year and exclude movers and second-home buyers. Thus the peak we observe in 2003 does not simply reflect small increases in balances associated with the refinance wave, when many homeowners rolled closing costs into the amount of their new mortgage.[2]

Using a two-tiered model to flexibly estimate both the intensive and extensive margins of extraction, we find that, all else equal, a one percentage point decrease in shorter-term mortgage rates was associated with an average increase in extraction of $723 or 13 percent more borrowing relative to a baseline predicted amount. In addition, we estimate that the dollar volume of equity extraction would have been about one-third lower, or nearly $250 billion lower, over the 2002-2004 period had interest rates stayed around prior (higher) levels.

Our data and empirical strategy also allow us to compare the effects of interest rates and house price growth on equity extraction, and study heterogeneity in the response to these variables across different groups. We find that a one percentage point increase in house price growth leads to an average increase in extraction of $331 or 6 percent — about half the size of the response to a one percentage point drop in short-term mortgage rates, as mentioned above.

Notably, this estimate of the effect of house price growth is quite close to the estimate of Mian and Sufi (2011). Like Mian and Sufi, we only examine the most recent housing cycle, and thus our estimates may have limited external validity because simultaneous improvements in the ease of accessing home equity during this period may have amplified the equity extraction response to both interest rates and house prices (Muellbauer 2007).

[2]Greenspan and Kennedy (2008) define extraction more expansively, including free cash generated from home sales, and consequently find, using aggregate data, that equity extraction continued to rise until 2006. Selling one's home to obtain cash suggests trading off housing consumption for non-housing consumption, whereas we are primarily interested in equity withdrawal through borrowing, which permits housing consumption to remain constant while trading future consumption for current non-housing consumption. Moreover, leveraged equity extraction is of key interest with respect to understanding the growth of household debt and the recent housing crisis.

With respect to response heterogeneity, we show that borrowers with low credit scores and borrowers with high credit card utilization rates are relatively less sensitive to changes in mortgage rates, and relatively more sensitive to house prices. These results are consistent with Hurst and Stafford (2004) who first showed empirically that home equity could help liquidity constrained households smooth consumption. We also find that younger homeowners are relatively more sensitive to house price growth, similar to Mian and Sufi (2011). It is possible that this finding is inconsistent with life-cycle models that predict older homeowners' consumption should be more responsive to house price gains (e.g. Campbell and Cocco 2007). However, it is important to keep in mind that we are only measuring the *borrowing* response to house price gains, and older homeowners could be consuming out of liquid savings instead of additional borrowing against their home.

Finally, we show that extraction, even when it occurs via home equity lines of credit, leads to persistently higher debt levels. Those who extracted towards the end of the housing boom would therefore have been particularly exposed to subsequent house price declines. Indeed, we find relatively high default rates during the housing crisis among those who extracted during 2005 and 2006, but not among those who extracted equity in earlier years, even after controlling for potential shifts in the composition of extractors over time. This result provides micro-level evidence of the "ratchet" effect, proposed by Khandani, Lo, and Merton (2010), which emphasizes the challenges in deleveraging mortgage debt. As mortgages are indivisible, a macroeconomic shock such as widespread house price appreciation leads to broad-based increases in household leverage, without a symmetric means of decreasing leverage during the subsequent downturn.

The next section describes a theoretical framework for the equity extraction decision. Section III describes our data sources and empirical approach. Section IV presents our findings, and Section V concludes with some broad policy implications related to the impact of equity extraction and leverage on the crisis.

II Conceptual Framework and Previous Literature

In this section, we describe a framework for thinking about the household equity extraction decision. An optimizing homeowner who maximizes over multiple periods may want to increase their collateralized borrowing for four potential reasons. First, a decrease in the interest rate, all else equal, lowers the price of credit and makes borrowing more desirable. Second, an increase in the value of collateral (housing wealth) can both increase the value of consumption smoothing across periods because of a wealth effect, and also relax a credit constraint that makes desired borrowing feasible. Third, a widening in the difference between current and future income, which could reflect either a negative shock to current income or a positive shock to expected future income, may encourage borrowing in the current period. Finally, a relaxation in credit standards allows households to borrow more at a given income level and house value.

To be more concrete, consider a homeowner with separable log utility who is choosing how much to consume over two periods, with the ability to tap into home equity to smooth consumption. The homeowner receives income in both periods (y_1, y_2), owns a home with value V, and can extract equity E up to a collateral constraint of aV $(0 \leq a \leq 1)$, at the prevailing mortgage rate, r.[3] Thus the homeowner solves the following constrained optimization problem:

$$\max u(c_1, c_2) = \max ln(c_1) + b * ln(c_2)$$

subject to

$$(1) c_1 = y_1 + E$$

$$(2) c_2 = y_2 - E(1 + r) + V$$

$$(3) E < aV$$

where b is the discount rate between periods. Note that the extraction value E could be negative under certain conditions, which implies that the homeowner is saving instead of borrowing. In

[3]The collateral constraint and interest rate in this simple framework are viewed as exogenous from the homeowner's perspective, and can be motivated by the fact that y_2 is unobserved by the lender.

this setting, the homeowner consumes all of their housing wealth in the second period.

Plugging in the equations for c_1 and c_2 and solving for the maximum, when the third constraint does not bind, it is straightforward to solve for the optimal level of equity extraction, E^*:

$$E^* = \frac{(V + y_2 - b(1+r)y_1)}{(1+r)(1+b)}$$

And if $E^* > aV$, then the collateral constraint will bind and extraction will be limited to aV.

Although this framework is quite simplistic, it provides the key predictions needed to empirically examine the extraction decision. First, a positive shock to home values V both increases the demand for credit and relaxes the collateral constraint. Second, for homeowners with high future income (such as young people), E^* will be large and the collateral constraint will be more likely to bind. Third, a negative shock to interest rates will increase E^*. However, homeowners who are already at the constrained extraction amount, aV, will be unable to respond to this shock. We quantify homeowners' extraction responses to these drivers in Section IV, but first describe our data and methodological approach.

III Data and Methodology

We use data from the Federal Reserve Bank of New York's Consumer Credit Panel (CCP), which is a nationally representative, ongoing longitudinal dataset with detailed information at a quarterly frequency beginning in 1999 on consumer debt and loan performance. The data are a 5 percent sample of all individual credit records maintained by Equifax (from which we draw a 2 percent sample) using a methodology to ensure that the same individuals can be tracked over time, and each quarter a random sample of people who enter into their credit record database (younger people typically) are added to the sample so that it is representative of the universe of credit records.[4]

[4]For more information on the CCP, see Lee and van der Klaauw (2010). It is important to note that all individuals in the data are anonymous: names, street addresses and social security numbers have been suppressed. Individuals are distinguished and can be linked over time through a unique, anonymous consumer identification

The CCP data provide quarterly information on individuals' debt holdings, payment history, credit scores and geographic location down to the census block.[5] Importantly, because the data are an individual-level panel, and because they provide information on all debt held, we can track the total mortgage debt of a given borrower from quarter to quarter and thus observe the precise timing of equity extractions, regardless of whether a borrower extracts equity through a cash-out refinancing, home equity loan or home equity line of credit (HELOC).

Using the geographic location of mortgage borrowers, we are able to merge in several time-varying measures of local economic conditions (e.g. county unemployment rate), as well as house price indices (HPIs) at the ZIP code level from CoreLogic. These HPIs are monthly, repeat-sales indexes, and are available for over 6,000 ZIP codes, covering roughly 60 percent of the national population.[6] Information on house prices at such a disaggregated level is of first-order importance for obtaining precise estimates of the relationship between house price appreciation and equity extraction given the considerable within-MSA heterogeneity in house price dynamics (Dorsey et al. 2010; Ferreira and Gyourko 2011).

For our primary analysis, we draw repeated cross sections from the CCP data, and follow each individual that meets our sample selection criteria for one year. Our sample consists of homeowners (people with a mortgage) who did not move during the year (their census block location was constant) and who do not appear to be real estate investors (that is, those who we can reasonably infer to have just one mortgaged property at the beginning and end of a year).[7] Thus in each year of the analysis, we maintain a representative cross-section of stable non-investor homeowners.

number assigned by Equifax. For information about Equifax, one of the three national consumer credit reporting agencies, see `www.equifax.com/home/en_us`.

[5]Credit scores for each individual are based on the Equifax 3.0 model, which is similar conceptually and numerically to the FICO score. The Equifax score ranges from 280 to 850, with higher scores associated with a lower expected likelihood of default. See `https://help.equifax.com/app/answers/detail/a_id/244/noIntercept/1` for more information.

[6]The ZIP code coverage of the dataset depends on factors such as state sales price disclosure laws, the corporate history of CoreLogic, and the thickness of the ZIP code's real estate market. Coverage of California, for instance, is better than coverage in some other states. In future work, we plan to weight the data to adjust for these issues, but the results thus far suggest bias arising from coverage issues is fairly minor.

[7]A borrower is classified as an investor if (1) he has exactly two closed-end mortgages where the smaller loan is at least one-third the size of the larger, (2) he has three or more closed-end mortgages with positive balances, or (3) he has two closed-end mortgages with positive balances and at least one home equity line of credit.

We identify equity extractions in the data as instances when a borrower's outstanding mortgage debt increases by more than 10% and at least $1,000 over a one year period. This increase in outstanding mortgage debt can come from a cash-out refinancing, taking on a second lien / home equity loan, or drawing on a HELOC. We are able to identify the method of extraction because, for each individual, we have trade line information on each mortgage held. Thus, if a borrower's total mortgage debt rises from $100,000 to $110,000, we observe whether that occurred on a first-lien closed-end mortgage, a home equity line of credit, a junior-lien closed-end mortgage, or some combination.[8]

Our primary analysis involves regressing the probability of extraction on interest rates, recent house price appreciation and local economic conditions, with baseline regressions of the form:

$$\begin{aligned} Pr(extract_{itzc}) = \quad & \alpha + \beta_1(rate_t) + \beta_2(HPIgrowth_{tz}) + \beta_3(creditconditions_t) + \beta_4(unemp_{tc}) \\ & + \beta_5(empgrowth_{tc}) + \beta_6(wagegrowth_{tc}) + e_{itzc} \end{aligned}$$

for person i in ZIP code z and county c during year t. In the above equation, *rate* is the lowest annual percentage rate (APR) on a 1-year adjustable rate mortgage (ARM) achieved during the year, and $HPIgrowth$ represents the average annual house price growth rate over the past 3 years. The coefficients on these two variables are of primary interest, in addition to their interaction, which we include in subsequent specifications.

The variable *empgrowth* is the average annual employment growth over the past 3 years; *wagegrowth* is the average annual growth in the average wage per worker over the past 3 years; and *unemp* is the average unemployment rate during the year. These three variables are measured at the county level and computed from data from the Bureau of Labor Statistics. Finally, *creditconditions* is a proxy measured from the CCP data as the fraction of lower-score credit applicants who were able to obtain credit during the year.[9]

[8] Lien status is not reported by lenders, so we infer it from the relative size of the closed-end mortgages on file.

[9] Our measure of credit conditions is a proxy for the approval rate on any type of credit that would be the basis for a credit inquiry by a consumer. We estimate this variable as the share of borrowers with credit scores between 550 and 600 and at least one credit inquiry during the year who opened at least one new credit account during the year. In the regression specifications, this credit availability measure varies annually at the census region level.

In subsequent specifications we add in individual-level controls, such as credit score, age, credit card utilization rate and the year of origination of their current mortgage from the CCP data, and neighborhood controls from 2000 Census data, such as the owner-occupied share of housing units, average educational attainment and racial composition. These variables help control for compositional changes of the mortgage borrowing population over time that may have affected the likelihood of equity extraction.

IV Results

IV.A Summary Statistics

The characteristics of our sample are described in Tables 1 and 2. Column 1 of Table 1 shows the number of potential equity extractors each year — those with at least $5,000 of mortgage debt at the start of the year, excluding movers and investors as discussed earlier — and columns 2 and 3 show the number and share who extracted equity each year. Nearly 10 percent extracted equity on average in any given year between 1999 and 2010. Although the initial mortgage balance of extractors rose sharply over the period (column 4), this pattern tracks the growth in house prices in bubble states relatively closely. Notably, borrowers who extracted appeared to extract roughly the same proportion of their existing balance, regardless of when they extracted or what method they used to extract equity (column 5).

Unlike previous research, the richness of the credit bureau data allows us to distinguish between the extraction methods used. The final four columns of Table 1 decompose equity extractions into possible methods.[10] Over the course of the decade, the popularity of different methods of extraction varied, with cash-out refinancing being the most common method of extraction during the low interest rate years, but falling off sharply in 2004 as interest rates rose. In 2006–2007, HELOCs were the most prevalent method of equity extraction. When interest rates rose, a HELOC or junior lien may have been used in lieu of a cash-out refinance

[10]The method of extraction has to be inferred from patterns in the mortgage balances and number of home-related lines of debt. See the data appendix for details.

to avoid resetting one's entire mortgage balance to a higher rate.

Table 2 shows that the median age of the homeowners in our sample (across all years) is 48, and the median Equifax risk score is 752. About 11 percent of homeowners do not have credit cards, and homeowners with credit cards are utilizing, on average, about a third of their total available credit (this number does not distinguish between revolvers and non-revolvers). Just over 20 percent of homeowners have an open home equity line of credit.

IV.B Patterns of Equity Extraction over Time

Figure 1 presents the key relationship between the timing of equity extraction and short-term mortgage rates. The solid line represents the fraction of homeowners in a given year who extracted home equity (again, increasing their mortgage balance by at least 10% and $1,000), while the dotted line represents the relevant interest rate, which is the minimum APR the one-year ARM takes on in that calendar year.[11] Equity extraction activity is likely to respond shorter-term rates because rates for home equity lines and home equity loans will be priced off of the shorter end of the yield curve. In addition, ARMs tend to be popular among those who take cash-out when refinancing (Canner, et al. 2002).

During 2001–2004, short-term interest rates plummeted as the Federal Reserve responded to the dot-com bust and ensuing recession. The APR on the one-year ARM reached a then-historic low in 2003 below 4 percent. Simultaneously, the extraction rate series rises and peaks in 2003, with just over 16 percent of sample homeowners extracting equity in that year.[12]

The broader macroeconomic patterns over the period 1999 to 2010 are shown in Figure 2. All of the series in the figure are re-scaled to be 100 in 1999q1. The top-left and middle-left panels replicate the time-series patterns shown in Figure 1. The likelihood of extraction generally fell after 2003, even though house prices, shown in the upper-right panel, continued to grow robustly through 2006. This pattern is suggestive of the importance of interest rates in

[11] Interest rate and points data comes from Freddie Mac's weekly survey of mortgage lenders. We estimate an APR based on the rate and points offered by lenders. The 5-year ARM rate may be more appropriate to use in theory, but it tracks the 1-year rate closely and data for the 5-year was not available as far back as 1999.

[12] Using less stringent definitions of equity extraction, such as a five percent rise in mortgage balances, yields the same time series pattern with somewhat higher levels and sharper peaks in 2003, which we show in the appendix.

homeowners' equity extraction decision.

The unemployment rate, shown in the middle-right panel, rose moderately in 2002 and 2003, suggesting that some equity extraction may have been due to liquidity constraints. Finally, in the bottom-left panel, we present the time-series of our proxy for credit conditions (defined above). The series has little variation between 1999 and 2007, and thus cannot explain the variation in equity extraction in the aggregate. After 2007, credit access tightened considerably and remains 20–25% tighter than during the early 2000s.

The overall national time series pattern of extraction varied substantially by geographic location and credit score group, as Figure 3 shows, providing some initial evidence on who extracted equity and why. First, the top-left panel of Figure 3 separates the equity extraction rate by credit score category.[13] High credit score homeowners (shown as the solid line) are less likely to extract equity on average, perhaps because they have other sources of credit or are less liquidity constrained. When these high credit borrowers do choose to extract equity, their timing is highly correlated with the mortgage rate, with a sharp peak in their extraction rates in 2003. Middle credit score homeowners (the dashed line) are more likely to extract equity than their high credit score counterparts, and also appear to respond to low interest rates. Indeed, nearly 20 percent of all middle score homeowners extracted equity in 2003.

In contrast, equity extraction by low credit score homeowners (the dotted line) peaked in 2005. Low score households could be more responsive to a given house price shock than higher score homeowners because a rise in house prices is more likely to relax a collateral constraint for low score households. Alternatively, the differential pattern for low score homeowners could reflect differential house price growth; that is, house price growth may have been exceptionally strong in neighborhoods with higher concentrations of subprime homeowners (Mayer and Pence 2009; Mian and Sufi 2009). Yet another possible story is that credit was extremely loose around 2005, allowing lower score borrowers the opportunity to take on additional mortgage debt regardless of home price dynamics. Our regression analysis below will help distinguish between these

[13] We classify homeowners with credit scores above 780 as "high," between 660 and 780 as "medium," and below 660 as "low."

competing explanations, but the remaining panels of Figure 3 suggest the primary explanation is that lower score borrowers were relatively more responsive to house price increases.

The remaining three panels of Figure 3 show how dramatically house price appreciation affected equity extraction rates in the "sand states." Starting in the upper-right panel, equity extraction rates in California were generally much higher than in the rest of the United States. Even though house price growth in California was most rapid around 2004, the timing of extraction for high and middle score homeowners peaked prior to these house price gains in 2003. In contrast, low score homeowners extracted equity at very high rates between 2004 and 2006 in California, likely responding to increases in the value of their homes.

In Arizona, Florida, and Nevada, house prices rose more abruptly in the mid-2000s than in California (especially in AZ and NV; not shown). The lower-left panel of Figure 3 presents extraction rates in these states. Middle credit score homeowners' extraction rates peaked in 2005, while low credit score home equity extraction peaked sharply in 2006, with nearly 30 percent of all borrowers in this credit category extracting equity in that calendar year. Higher score homeowners' extraction, once again, peaked in 2003.

Outside the sand states, house price swings were less dramatic. The lower-right panel of Figure 3 shows equity extraction rates for the rest of the country. Similar to the nation as a whole, high credit and middle credit homeowners were most likely to extract equity in 2003, while low credit score homeowners' likelihood of equity extraction exhibits a blunt peak in 2004.

IV.C Determinants of Equity Extraction

To estimate the magnitude of the homeowner equity extraction response to changes in interest rates and house prices, Table 3 presents regression specifications of the form described above in Section III. Column 1 of Table 3 presents coefficients from a linear probability model of the decision to extract equity on interest rates, house price growth, credit conditions, and local economic variables. The unit of observation is the homeowner-year, and similar to the figures, excludes movers and investors in a given year. All of the regressions include state fixed effects and standard errors are clustered at the state level.

The regression results in Table 3 show that lower interest rates lead to more equity extraction. When rates fall by one percentage point, the likelihood of extraction increases by about 1.3 percentage points. An increase in house price appreciation (as measured by the three-year change in ZIP code average prices) also increases the probability of extraction. Specifically, a one percentage point increase in house price appreciation increases the likelihood of extraction by 0.5 percentage points. Thus the basic patterns from the figures are reflected in the regression results, namely that both interest rates and house price appreciation affect equity extraction.

The regression provides little evidence that local economic shocks impact the likelihood of extraction. County-level unemployment rates and employment growth appear to be unrelated to the homeowner extraction decision, while wage growth is only marginally statistically significant. Subsequent specifications will use individual level liquidity measures from the credit records that may be more precise and powerful predictors of equity extraction.

Because the specification relies on the aggregate time series trend in interest rates, the credit conditions variable serves as a proxy for other macroeconomic aggregate trends, and shows up positive and significant, largely reflecting the sharp downturn in credit access after the crisis. Columns 2–4 add additional controls for macroeconomic trends and information about the borrower, mortgage, and census tract, while columns 3 and 4 also include a full set of year of origination controls. Despite the addition of this broad set of controls, the coefficients on mortgage rates and house price growth are largely unchanged. The final two columns of Table 3 exclude the observations from 2008 to 2010, because of the dramatic changes to both the housing market and credit markets since the housing downturn. The results in column 5 show that the relationships between interest rates, house prices, and equity extraction were even stronger in the 1999-2007 period.

Column 6 of Table 3 includes an interaction term between interest rates and house prices, and the coefficient suggests that a rise of one percentage point in the short-term APR mitigates the effect of house price growth on the likelihood of extraction by 20 percent. Given the direction of the interaction coefficient, the inclusion of the interaction term has the predicted impact on the house price and interest rate coefficients. Finding a statistically and economically significant

role for the interaction term highlights and quantifies how the transmission of monetary policy depends in part on house price growth, and suggests that the persistent house price declines of recent years have moderated the effects of accommodative monetary policy on home equity withdrawal.

Taken as a whole, the regression results support the straightforward predictions of the framework described in Section II. Homeowners respond to the declining cost of borrowing by extracting equity from their homes. When their housing wealth increases, homeowners are more likely to extract equity to smooth consumption. When credit was more easily accessible (prior to the crisis), homeowners were more likely to extract equity. The findings underscore the view that in addition to house price appreciation, other variables such as interest rates played an important role in the home equity extraction decision.

IV.D Aggregate Equity Extraction and Counterfactual Exercise

The results thus far have focused on the extraction decision of homeowners — the extensive margin. However, the amount extracted — the intensive margin — may vary with the price of credit and home price growth as well. Figure 4 plots the aggregate amount extracted based on the CCP and our definition of extraction over the period 1999 to 2010.[14] The dashed line represents the aggregate increase in mortgage balances for equity extractors (again, excluding investors, movers, and renters) for the full, representative sample, while the solid line represents aggregate extractions from the subsample where we have HPI data coverage. The figure shows that annual aggregate equity extraction rose sharply to nearly $300 billion in 2003 and in 2005, but the amount extracted fell sharply after 2007.

Comparing the aggregate amount extracted (Figure 4) to the likelihood of extraction (Figure 1), the graphs indicate that extraction done in the later years of the housing boom, 2004 to 2006, led to larger amounts being extracted on average. Thus, as the price of credit was rising

[14]Our estimate of the dollar volume of extractions in a given year is defined as the dollar change in mortgage balances over a given year across extractors. The CCP data provide information on jointly held mortgage accounts and we adjust appropriately for such accounts before aggregating up. Notably, aggregates calculated from the CCP for various types of credit align quite well other sources such as the Federal Reserve's Flow of Funds (see Lee and van der Klaauw 2010)

between 2004 and 2006, extractors' average amount borrowed was actually increasing. This increase in the average amount borrowed likely reflects compositional changes, as lower credit score homeowners in high appreciation states responded to increased home values in the later years of the housing boom (recall Figure 3).

To estimate the overall equity extraction response to interest rates and house price growth that is, the combined intensive and extensive margin responses we employ a two-tiered model combining probit estimation of the extensive margin (the decision to extract) and OLS estimation of the intensive margin (how much to extract).[15] Thus, we estimate:

$(1) Pr(extract_{it} = 1|\boldsymbol{x}) = \Phi(\boldsymbol{x\delta})$, and

$(2) E[ln(amountextracted_{it})|\boldsymbol{x\beta}, extract_{it} = 1]$

Expected extraction at the mean of $\boldsymbol{x}$, our baseline, can then be estimated as

$$\Phi(\boldsymbol{x}\hat{\boldsymbol{\delta}})exp(\boldsymbol{x}\hat{\boldsymbol{\beta}} + \frac{\hat{\sigma}^2}{2})$$

where $\hat{\sigma}$ is the standard error from the intensive margin OLS regression. Based on this framework, we estimate that a one percentage point decrease in the short-term APR leads to an average increase in extraction of $723 or 13 percent above the baseline extraction prediction, while a one percentage point increase in house price growth leads to an average increase in extraction of $331 or 6 percent above the baseline (shown in Table 4).[16]

To get a better sense of the aggregate effect of the drop in interest rates in the early 2000s, we estimate how much home equity would have been extracted had the 1-year mortgage APR stayed near 7 percent, as it was in 1999, using the coefficients from our two-tiered model. Figure 5 shows three lines: (1) the actual amount extracted each year (solid line); (2) the

[15] For a discussion of this approach, see Wooldridge (2002), pg. 536. This method is more flexible than a Tobit model as it allows the coefficients on the explanatory variables to affect the intensive and extensive margins differently. Also, we are able to include a time-trend in the intensive margin OLS regression to account for a natural rise in extraction amounts over time.

[16] Somewhat surprisingly, the intensive margin are quite small (not shown), implying that most of the equity extraction response to interest rates and house price growth occurs along the extensive margin.

expected amount extracted each year based on the coefficients of the model (dashed line); and (3) a "counterfactual" amount extracted using the coefficients from the two-tiered model and holding rates constant at 7 percent over the entire period (dotted line). From 2002–2004, the counterfactual estimates are about 33 percent lower than the predicted estimates (dotted vs. dashed lines). Given the roughly $730 billion in cumulative extraction from 2002–2004 shown in Figure 4 (dashed line), our estimates suggest that the drop in short-term rates may have been responsible for about $240 billion of equity extraction during these three years.

Note that this estimate is a lower bound as higher interest rates could have also had a direct effect on house price appreciation, which would further dampen the equity extraction response. Although our approach yields an oversimplified counterfactual that does not capture any of the general equilibrium response to increased interest rates, the counterfactual underscores the importance of interest rate declines in the early 2000s in partly driving the equity extraction boom.

IV.E Heterogeneity in the Equity Extraction Response

Table 5 presents regression specifications where we stratify our sample by creditworthiness and geography. The first three columns show coefficients from separate regressions on a sample of high, medium, and low credit scores, respectively. The next two columns split the sample by the high price appreciation "sand states" and the rest of the United States. The results in the first three columns suggest that low credit score homeowners are most sensitive to house price growth and least sensitive to interest rates in making their extraction decisions. As discussed in Section II, those with binding collateral constraints cannot respond to lower rates, while house price growth helps alleviate collateral constraints.

The final four columns of Table 5 explore the differences in extraction response for those who might be liquidity-constrained, as indicated by credit card utilization rates. Columns 6 and 7 split the sample into high and low credit card use, defined as utilizing more than 50% of their available credit card lines.[17] This measure is a more direct indicator of liquidity constraints

[17]Only 25 percent of people in our sample use 50 percent or more of their credit card lines. That said, lenders

relative to proxies used in the previous literature that have not had credit record information. We find that high-card-use homeowners, conditional on credit score, age, and other factors, are much more responsive to house price growth, with a coefficient on HPI growth twice as large as for other homeowners. This finding is qualitatively similar to Mian and Sufi (2011), who also use credit record data. However, by analyzing the time series of extraction, we are further able to show that high-card-use homeowners are also less responsive to interest rates.

Looking at young and old homeowners in columns 8 and 9, respectively, younger homeowners are about 50 percent more responsive to home price growth than older homeowners, but similarly responsive to interest rates. Overall, the results in Table 5 support the view that house price appreciation during the boom likely relaxed credit constraints for certain individuals.

IV.F Equity Extraction and Default During the Housing Crisis

Finally, we attempt to relate the timing of equity extraction to subsequent mortgage default during the recent housing bust from 2008–2010. Figure 6 offers a first-pass at describing this relationship. The top panel of the figure plots the probability of default (having at least one mortgage account in or near foreclosure) during 2008–2010 for equity extractors versus non-extractors, by year of potential extraction. In other words, we plot the vector of coefficients on the interaction terms ($\boldsymbol{b_{2c}}$) from the following regression:

$$Default0810_{ic} = \boldsymbol{a} + \sum_{c=1999}^{2007} b_{1c} * year_c + \sum_{c=1999}^{2007} b_{2c} * year_c * extract_{ic} + e_{ic}$$

where c refers to the homeowner's year of potential extraction (cohort). The graph shows, perhaps surprisingly, that homeowners who extracted equity between 2000 and 2003 were no more likely to default than those with a mortgage in the same years who did not extract equity. On the other hand, homeowners who extracted equity in 2005 or 2006 were significantly more likely to default between 2008 and 2010 than their non-extracting counterparts. In other words, equity extractions in 2003 and earlier do not appear to have contributed to the recent mortgage

do not report the amount of credit card balances that are being revolved as opposed to paid every month, and thus this measure of liquidity is not free of noise.

crisis. In contrast, individuals who extracted equity between 2005 and 2006 were more likely to subsequently default on their mortgages relative to non-extractors in those years.

One might suspect that the difference between 2005 extractors and 2003 extractors is a change in composition towards inherently riskier borrowers as credit standards loosened. However, when we control for credit score and a few other borrower characteristics such as age, the 2005 and 2006 interaction term coefficients are only somewhat attenuated (not shown, but results are available in an appendix). This result implies that the rise in the default rate of extractors relative to non-extractors was not simply a function of changes in the composition of extractors towards lower score borrowers or borrowers in the "sand states." Indeed, Table 6 provides summary statistics for 2003 extractors and 2006 extractors. Surprisingly, the characteristics of extractors appear to have held quite steady from 2003 to 2006, and the average score of extractors overall is generally comparable to non-extractors. Only the scores of those doing cash-out refinancings dropped noticeably between 2003 and 2006, but as shown in table 1, cash-outs comprised only a third of extractions by 2006.

So why did 2006-extractors exhibit excessive default risk? One possible reason is that these later extractors were more at-risk of reaching negative equity because the act of equity extraction has a "ratchet" effect on leverage (Khandani, Lo, and Merton 2010). We present direct micro-level evidence of this effect in Figure 7. In the figure, we focus on the total mortgage debt of borrowers who extracted in 2003, but the figures for other years are qualitatively similar. The mean and median amounts of mortgage debt are plotted in the event-study style, with t=0 representing the year in which the borrower extracted equity. The graph shows that borrowers increase their mortgage debt sharply in the year in which they extract, but deleverage very slowly thereafter. Even seven years later (t is measured in years on the x-axis), most borrowers have significantly more mortgage debt than prior to the period of extraction.

Notably, this "ratchet" effect is extremely persistent and present regardless of the method of extraction. In Figure 8, we show the total mortgage debt amount for borrowers who used HELOCs, second liens, and cash-out refinancing methods. Each method of extraction leads to a semi-permanent increase in mortgage debt, paid down very slowly. This asymmetry of leveraging

and deleveraging likely contributed to the broader systemic risk of the housing market.

V Conclusion

While home equity extraction is a key way consumers can tap into their wealth to smooth consumption, and is thought to have played an important role in the rise of household debt and subsequent financial crisis, the household extraction decision is relatively understudied. In this paper we use unique credit record panel data combined with ZIP code level house price indices and detailed economic and demographic data to provide new insight into the determinants of home equity extraction. Our results suggest that an important portion of the growth in household leverage during the housing boom can be traced to the low interest rate environment of the early 2000s. We show that households across the credit score spectrum responded to interest rate shocks, especially medium and higher credit score households. We estimate that if rates had not dropped sharply from 2002–2004 cumulative equity extraction in these years would have been at least $240 billion lower.

Finally, with millions of households falling underwater as house prices plummeted, it is important to understand the impact that equity extraction had on increased leverage and on default and foreclosure rates. We have documented that the timing of equity extraction is closely related to default during the recent housing crisis. Homeowners who extracted equity in 2005 and 2006 were significantly more likely to default between 2008 and 2010 than non-extracting homeowners, whereas households who extracted in 2002 and 2003 were no more likely to default than their non-extracting counterparts. Moreover, we show that there was little compositional change in the risk characteristics of equity extractors from 2003 to 2006. It appears that much of the reason recent equity extractors were more likely to default is simply that they leveraged up at an inopportune time — just as house prices were about to fall.

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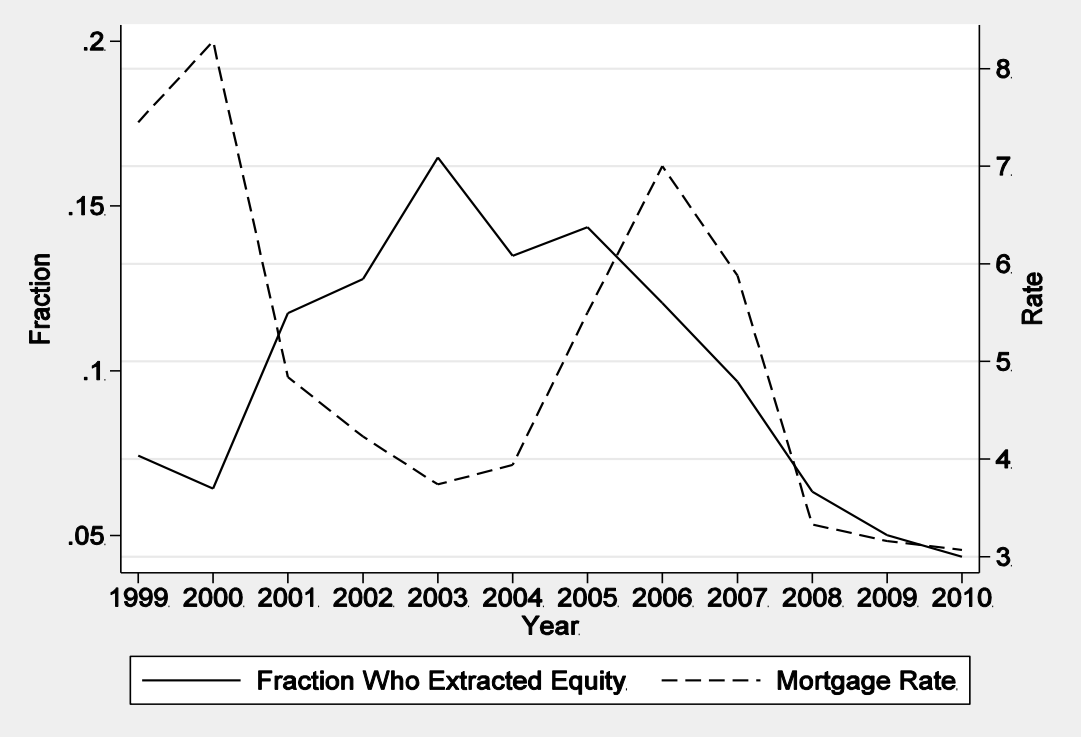
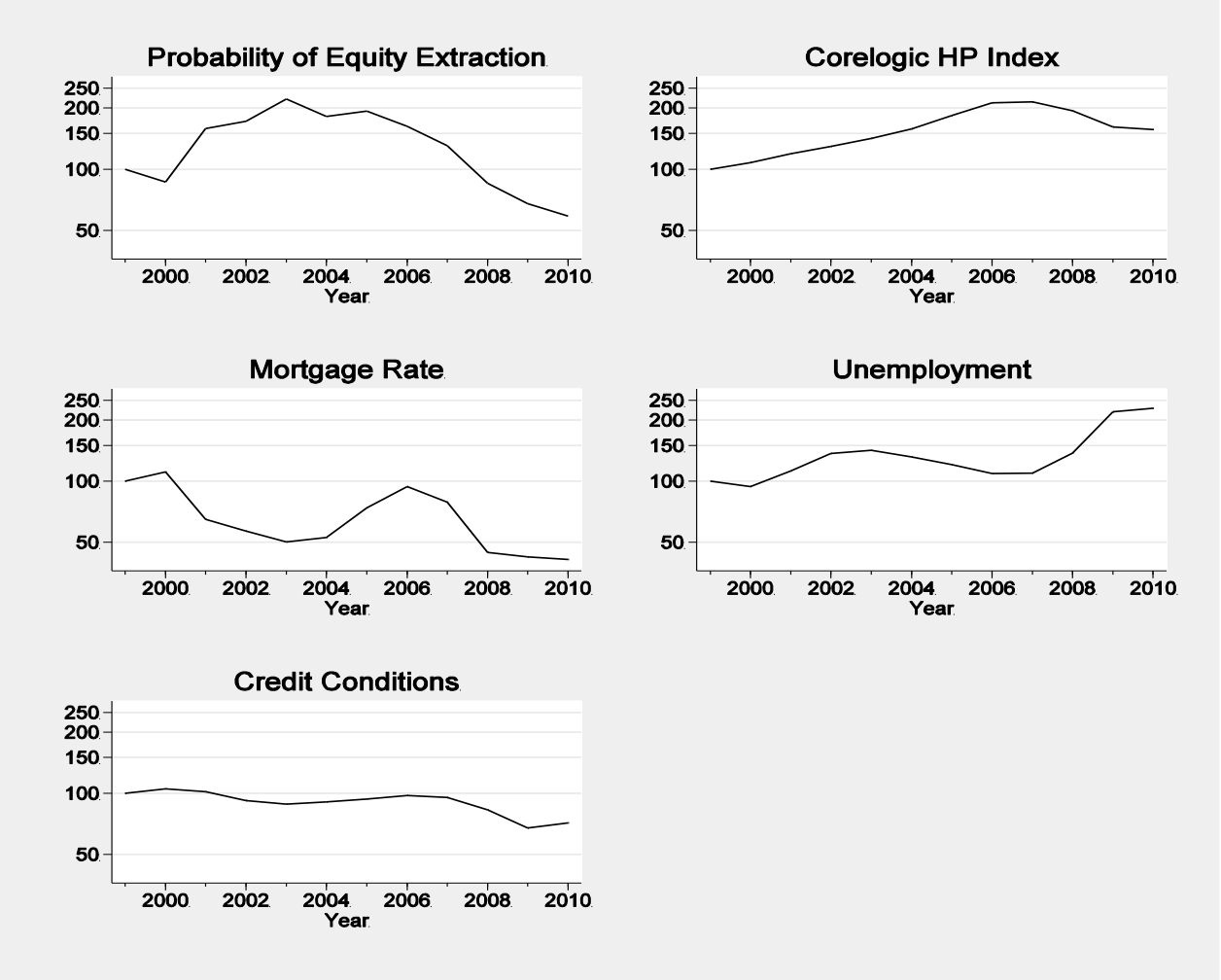
Figure 1. Probability of Equity Extraction vs Short-term Mortgage APR



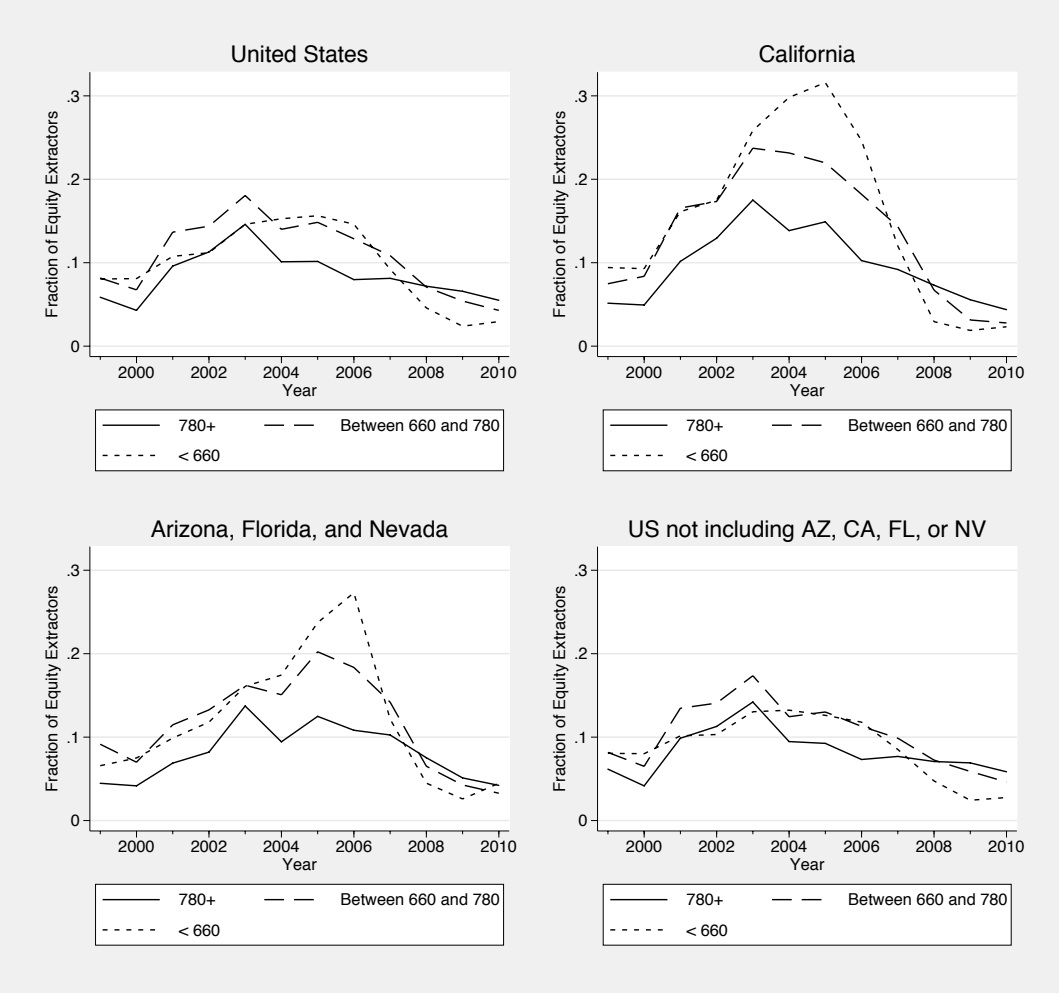
Sources: FRBNY/Equifax CCP and Freddie Mac PMMS. Mortgage rate measures the minimum APR achieved during a given year. Sample of potential equity extractors restricted to those with HPI and Census tract data coverage. Equity extraction defined as an increase in total mortgage debt of at least 10% ($1000 minimum) during a given year. Real estate investors and movers during a given year are excluded. See text for more details.

Figure 2. Probability of equity extraction versus other macroeconomic indicators



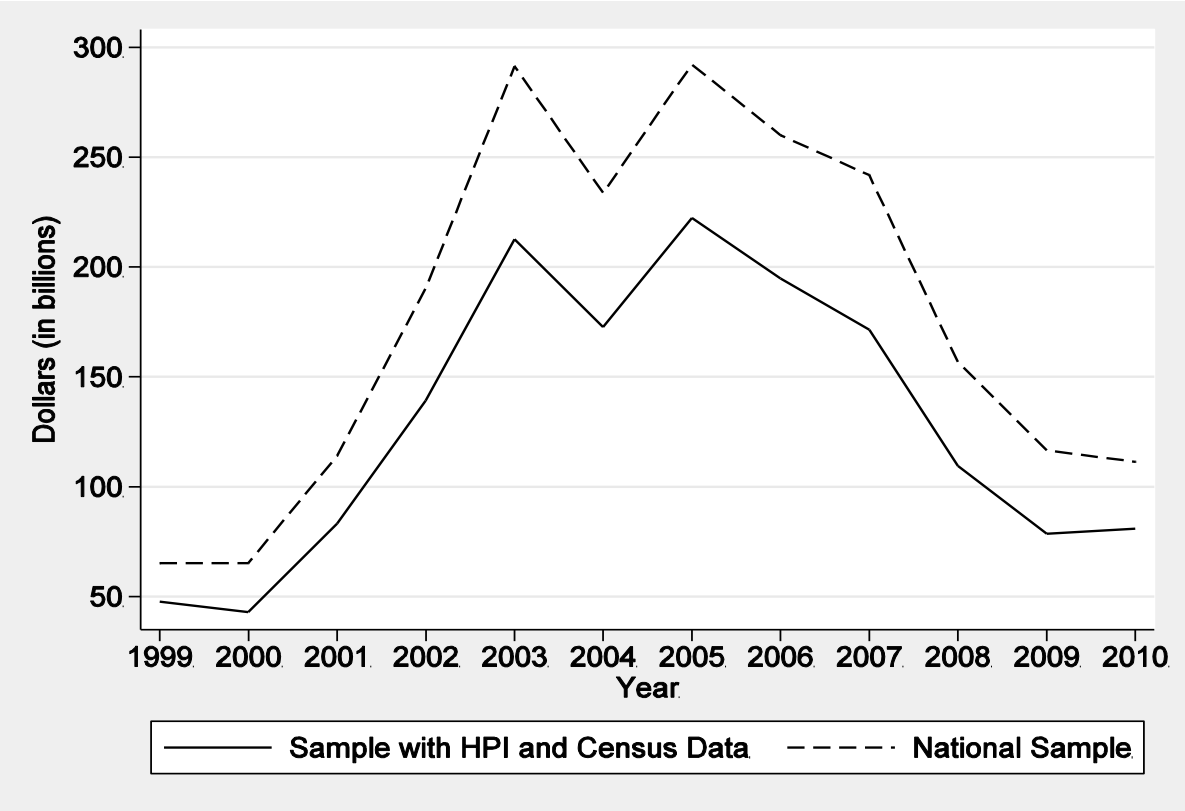
Sources: FRBNY/Equifax CCP, Freddie Mac PMMS, BLS, CoreLogic. All series indexed to 100 in 1999. See text and notes from figure 1 for more details.

Figure 3. Probability of equity extraction, by credit score group and geography



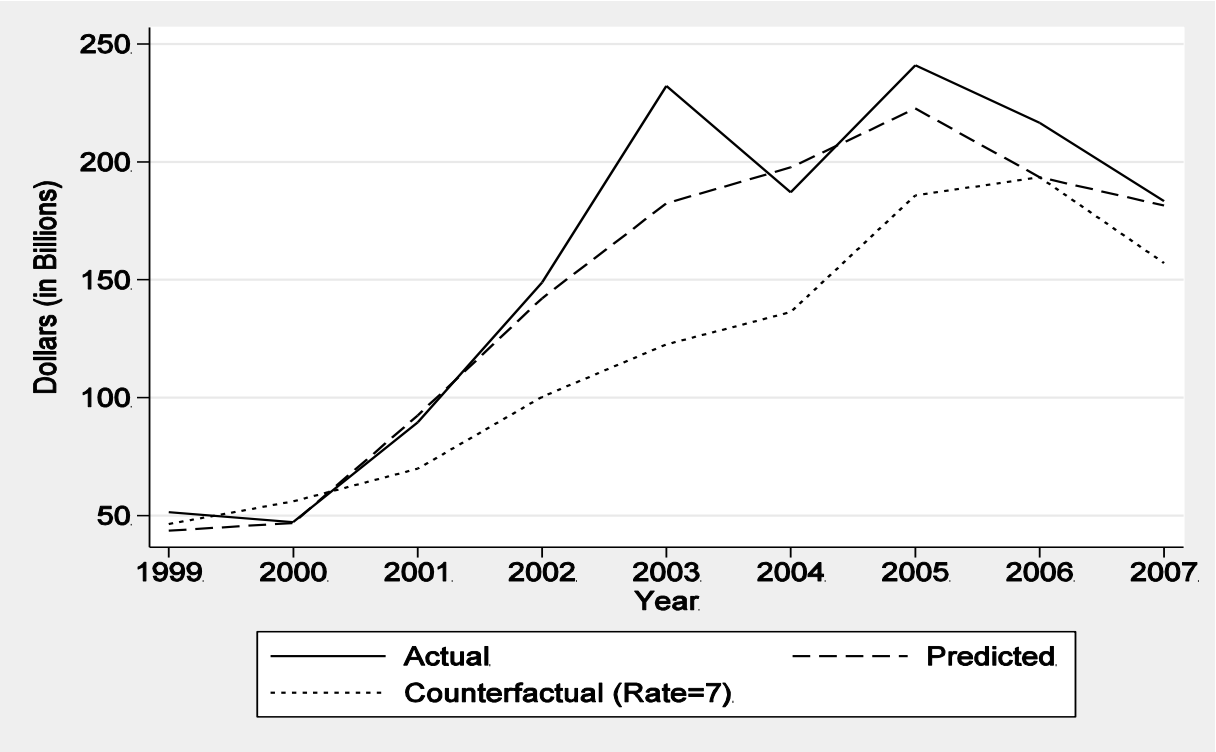
Source: Authors' estimates from FRBNY/Equifax CCP. Sample restricted to potential equity extractors with HPI and census tract data coverage. See Figure 1 note or text for definition of equity extraction and text for further data details.

Figure 4. Aggregate Increase in Balances for Equity Extractors



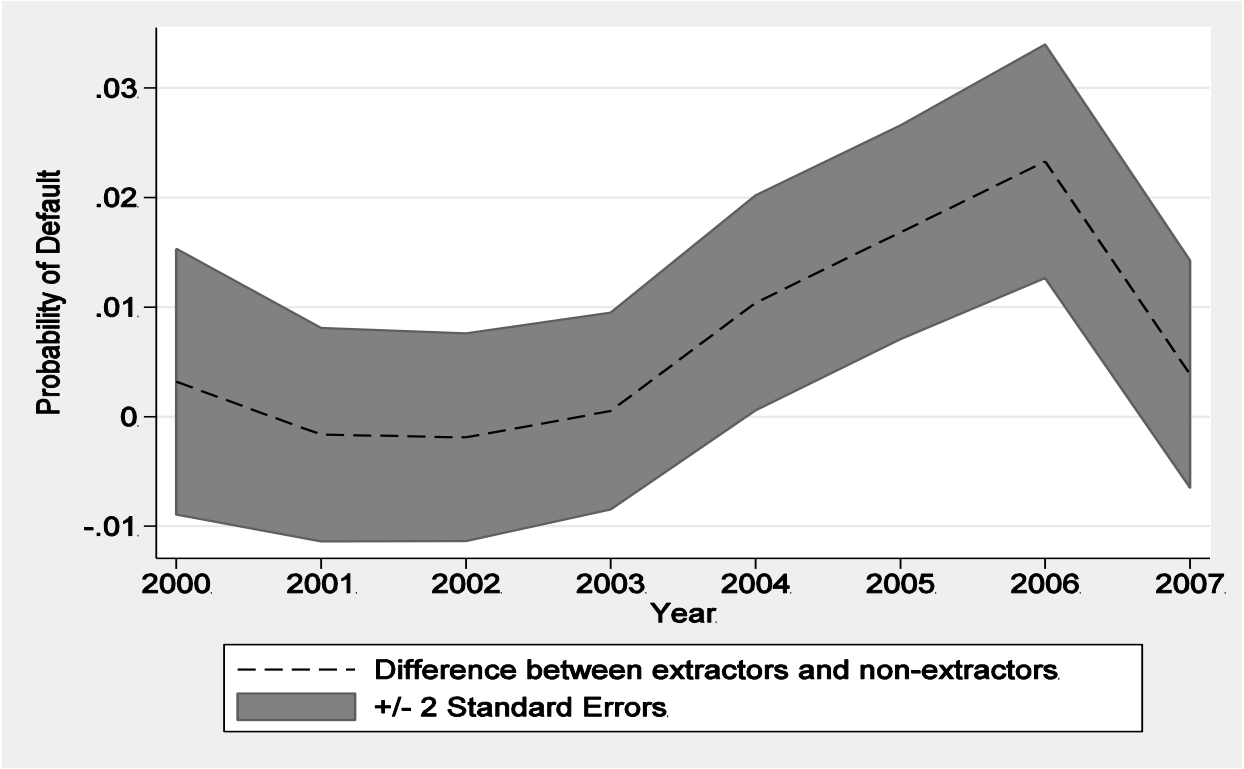
corresponds to our sample for regressions. National sample refers to a full sample of the CCP. Aggregate numbers are adjusted downward to account for joint accounts. See figure 1 note or text for definition of equity extraction and text for further details on data.

Figure 5. Aggregate Balance for Equity Extractors, Sample v Predicted



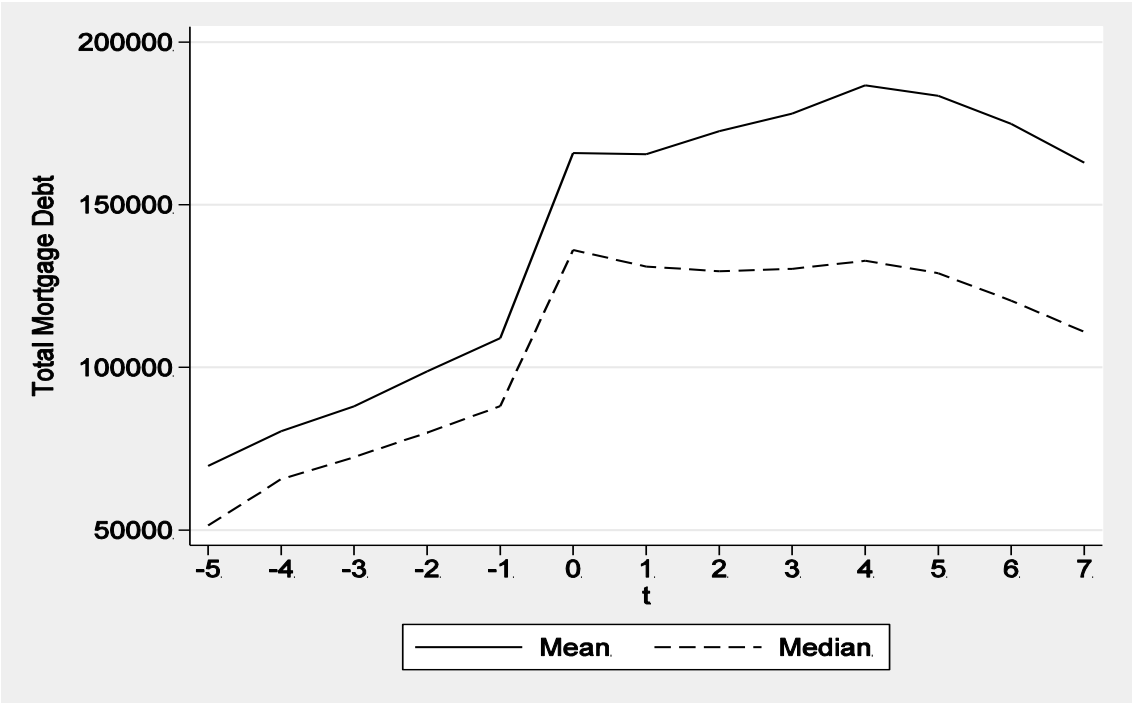
Source: FRBNY/Equifax CPP and authors estimates. 'Actual' corresponds to the solid line in Figure 4. 'Predicted' comes from predictions of a two-tiered model of equity extraction, and 'counterfactual' is predicted equity extraction from the same model holding the interest rate fixed at 7 percent. See figure 1 note or text for definition of equity extraction and text for further details on data and estimation procedure.

Figure 6. Probabilty of default between 2008q1 and 2010q1 for equity extractors relative to non-extractors, by year of potential extraction



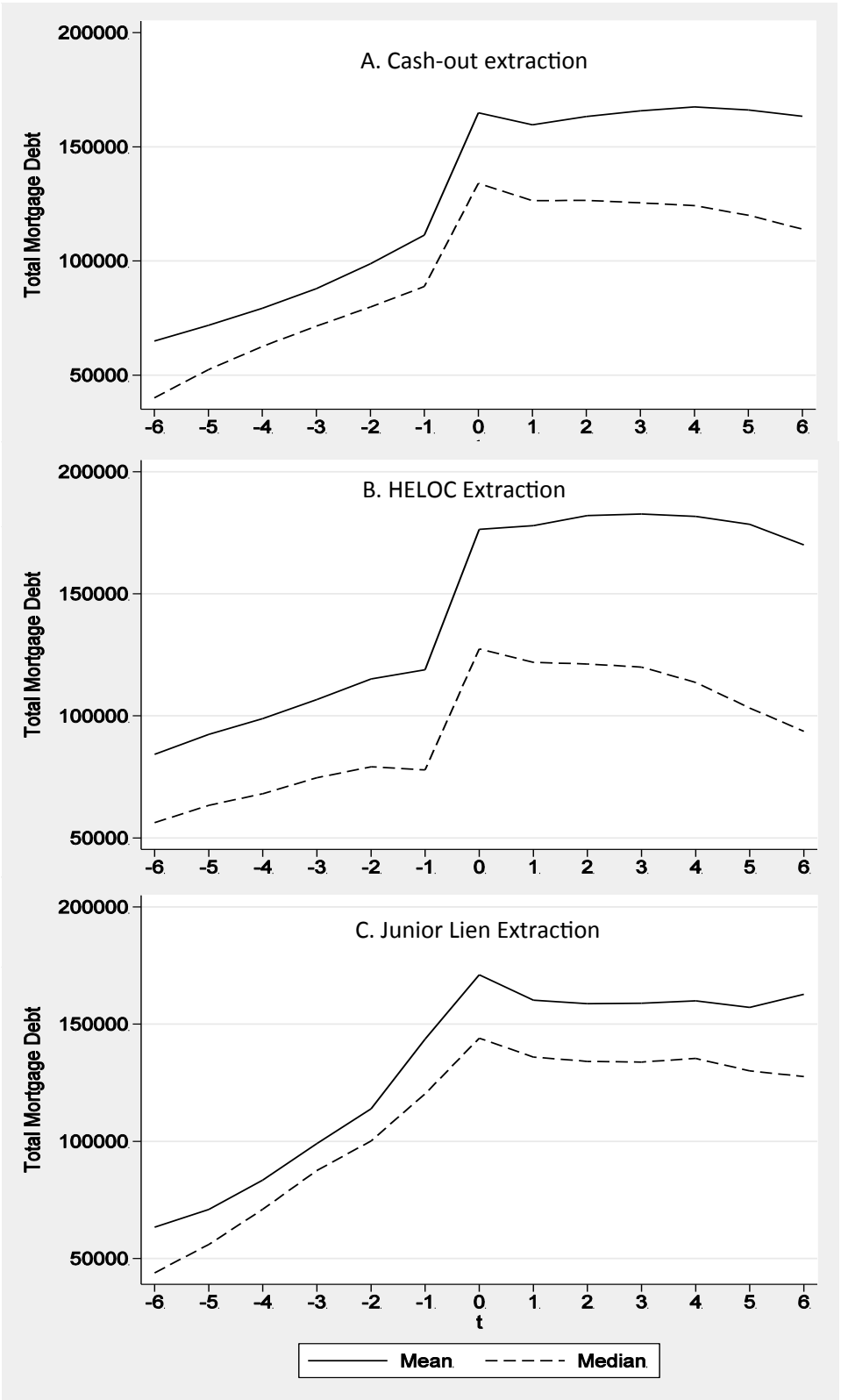
Graph provides estimates of the probability of having a record of a mortgage default occuring betwee 2008q1 and 2010q1 for extractors relative to non-extractors, for each year. See Section IV for more details.

Figure 7. Mean and median balance over time of 2003 extractors



Source: Authors' calculations from FRBNY/Equifax CCP. t =-1 corresponds to 2003q1, and other x-axis values refer to years before and after this date. This graph uses the long-term panel aspect of the CCP, following all 2003 extractors over time regardless of whether they move, become or were investors, or pay off all mortgage debt.

Figure 8. Mean and median balance before and after extraction, by type of extraction



Authors' calculations from FRBNY/Equifax CCP. Each uses extractors from all sample years, with time zero corresponding to the end of the year in which the extraction occurred. For those who extracted multiple times, time zero refers to the first extraction, and such individuals are classified by the type of their first extraction.

Table 1. Observations by year with HPI and Census data coverage

				Extractors					
						Inferred method of extraction			
Year	**N**	**Extracted Equity**	**Fraction Who Extracts**	**Initial balance ($) (median)**	**% Change in balance (median)**	**Cash-out Refi**	**HELOC Draw**	**2nd mortgage**	**Other**
1999	23,579	1,750	0.074	70,258	30.3%	0.34	0.18	0.21	0.26
2000	24,353	1,565	0.064	83,732	28.4%	0.26	0.18	0.27	0.29
2001	26,017	3,056	0.117	91,799	29.5%	0.51	0.14	0.10	0.25
2002	31,598	4,041	0.128	95,855	30.2%	0.55	0.19	0.07	0.20
2003	33,945	5,591	0.165	99,361	31.5%	0.54	0.21	0.05	0.19
2004	32,951	4,444	0.135	116,000	28.7%	0.41	0.26	0.06	0.26
2005	36,214	5,197	0.144	129,000	28.2%	0.38	0.32	0.07	0.23
2006	36,091	4,352	0.121	130,193	27.1%	0.33	0.35	0.10	0.22
2007	37,455	3,621	0.097	123,415	26.9%	0.29	0.40	0.09	0.21
2008	39,025	2,468	0.063	107,242	27.7%	0.28	0.49	0.04	0.18
2009	38,625	1,938	0.050	94,897	28.7%	0.36	0.45	0.03	0.16
2010	38,541	1,681	0.044	86,868	30.6%	0.36	0.41	0.04	0.19
All Years	398,394	39,704	0.100	106,000	29.0%	0.41	0.29	0.08	0.22

Source: Author's calculations from FRBNY/Equifax CCP. Sample each year reflects a random sample of the CCP of individuals with positive mortgage debt as of the end of the first quarter on just one property, did not move or accumulate debt on a second property during the year, and live in ZIP codes covered by the CoreLogic data. Extractors are those whose mortgage debt grows by at least 10 percent after one year.

Table 2. Summary Statistics

	Mean	Standard Deviation	Median
Mortgage APR (Min of 1 yr ARM)	4.860	1.640	4.230
ZIP HPI 3-Year Growth Rate (annualized)	4.198	8.809	4.632
County Unemp Rate Annual Avg	5.782	2.446	5.200
County Employment 3-Year Growth Rate	0.833	2.386	0.772
County Wage 3-Year Growth Rate	3.314	1.687	3.361
Credit Conditions	0.519	0.074	0.538
Individual-Level Variables from CPP			
Has a HELOC	0.212	0.409	0.000
Equifax Risk Score	7.237	0.938	7.520
Credit Card Utilization Rate	0.428	0.552	0.216
Does not have Credit Card	0.111	0.315	0.000
Age of Borrower	48.54	12.69	48.00
Age of Oldest Mortgage (In months)	112.10	73.42	107.00
Tract-level Variables			
Median House Value ($)	172,443	108,071	145,500
Proportion of HH Owner Occupied	0.740	0.186	0.784
Proportion Black Population	0.091	0.165	0.031
Proportion Hispanic Population	0.107	0.161	0.044
Proportion White Population	0.742	0.245	0.835
Proportion 25+ with BA+	0.383	0.173	0.363
Median Family Income (Relative to MSA)	1.184	0.397	1.126

Summary statistics across all observations in all years. Tract-level variables measured from 2000 Census. Credit conditions variable derived from CCP data; see text for details.

Table 3. Linear probability models for whether homeowner *i* extracted equity in year *t*

	Outcome variable is $Extract_{it}$ = {0,1}						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mortgage APR_t	-0.013***	-0.012***	-0.013***	-0.012***	-0.014***	-0.014***	-0.008***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
HPIgrowth3	0.005***	0.005***	0.005***	0.005***	0.005***	0.005***	0.009***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Mortgage APRt*HPIgrowth						-0.001**	-0.001**
						(0.000)	(0.000)
Credit looseness	0.169**	0.121*	0.168***	0.151***	-0.080	-0.078	-0.001**
	(0.050)	(0.054)	(0.040)	(0.040)	(0.064)	(0.060)	(0.000)
Post-Lehman dummy		-0.010*	-0.003	0.001			
		(0.004)	(0.004)	(0.004)			
County unemp rate	0.000	0.001	0.001	0.001*	-0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
County emp growth	-0.000	-0.000	0.000	-0.000	0.001	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
County wage growth	-0.003*	-0.003*	-0.002*	-0.002*	-0.002	-0.002	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Has a HELOC at beginning of period			0.035***	0.036***	0.042***	0.042***	0.042***
			(0.002)	(0.002)	(0.004)	(0.004)	(0.004)
Credit card utilization rate				0.022***	0.029***	0.029***	0.029***
				(0.004)	(0.005)	(0.005)	(0.005)
No credit cards dummy				-0.124***	-0.160***	-0.160***	-0.160***
				(0.020)	(0.025)	(0.025)	(0.025)
ln(months since oldest mortgage account established)				0.010***	0.013***	0.014***	0.014***
				(0.001)	(0.001)	(0.001)	(0.001)
ln(age)				-0.022***	-0.033***	-0.033***	-0.033***
				(0.004)	(0.006)	(0.006)	(0.006)
Credit score (divided by 100)				0.210***	0.309***	0.308***	0.308***
				(0.015)	(0.023)	(0.022)	(0.022)
Credit score^2				-0.016***	-0.024***	-0.024***	-0.024***
				(0.001)	(0.002)	(0.002)	(0.002)
ln(tract med home value)				0.006	0.004	0.005	0.005
				(0.006)	(0.005)	(0.004)	(0.004)
Tract proportion black				-0.011***	-0.015***	-0.015***	-0.015***
				(0.003)	(0.004)	(0.004)	(0.004)
Tract proportion Hispanic				-0.014***	-0.017***	-0.019***	-0.019***
				(0.003)	(0.004)	(0.004)	(0.004)
Tract proportion units owner-occupied				0.018**	0.018**	0.018*	0.018*
				(0.006)	(0.007)	(0.007)	(0.007)
Tract proportion pop over 25 years with B.A.				-0.015**	-0.012*	-0.014*	-0.014*
				(0.004)	(0.006)	(0.006)	(0.006)
Tract-to-MSA median family income				0.003	0.004	0.004	0.004
				(0.004)	(0.004)	(0.004)	(0.004)
Constant	0.019	0.044	0.170***	-0.476***	-0.584***	-0.586***	-0.587***
	(0.027)	(0.029)	(0.021)	(0.059)	(0.067)	(0.066)	(0.063)
State Fixed Effects	Y	Y	Y	Y	Y	Y	Y
Year of origination dummies[1]			Y	Y	Y	Y	Y
Excludes 2008-2010 observations					Y	Y	Y
R2	0.024	0.024	0.047	0.053	0.049	0.049	0.049
N	398,394	398,394	398,394	380,077	267,763	267,763	267,763

* p < 0.10; ** p < 0.05; *** p < 0.01. Standard errors, clustered at state level, in parentheses

1. Year of origination of person *i*'s primary mortgage at the beginning of year *t*. See text for more data details.

Table 4. Combined intensive margin and extensive margin estimates of the effect of interest rates and house price growth on dollar amount extracted

	Dollar change	Percent change
Change in amount extracted given a 1 percentage point increase in interest rate (at mean of 3-year annual HPI growth)	-$722.67	-13.04%
Change in amount extracted given a 1 percentage point increase in 3-year annual HPI growth (at mean of interest rate)	$331.17	5.97%

Intensive margin estimates based on regression of ln(change in balance) for extractors only on interest rates, 3-year HPI growth, their interaction, a time trend and other covariates as in the last column of table 3. Combined extensive and intensive margin estimates are based on a two-tiered model combining probit estimates of the probability of extracting equity with the intensive margin estimates of the amount extracted given extraction.

Table 5. Linear probability models for whether homeowner *i* extracted equity in year *t*, stratified by geography borrower characteristics

	Outcome variable is $Extract_{it}$ = {0,1}								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Credit score			Geography		Credit Card Utilization		Borrower Age	
	> 780	660-780	< 660	AZ, CA, FL, or NV	Other states	"High"	"Low"	<= 40	> 40
Mortgage APR_t	-0.012***	-0.017***	-0.008**	-0.017*	-0.013***	-0.008***	-0.012***	-0.010***	-0.011***
	(0.001)	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
HPIgrowth3	0.003***	0.006***	0.008***	0.006***	0.004***	0.015***	0.007***	0.013***	0.008***
	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.002)	(0.001)	(0.002)	(0.001)
Mortgage APRt*HPIgrowth	-0.000*	-0.001***	-0.001	-0.001**	-0.001**	-0.001**	-0.001**	-0.001***	-0.001*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Credit looseness	-0.091	-0.107	-0.137	-0.104	-0.065	-0.131	-0.121*	-0.159*	-0.057
	(0.062)	(0.064)	(0.105)	(0.075)	(0.067)	(0.124)	(0.051)	(0.065)	(0.073)
County unemp rate	0.002*	-0.001	-0.004**	0.000	-0.000	-0.001	0.000	-0.002*	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
County emp growth	0.001	0.001	-0.002***	0.002	0.000	-0.001	0.001	-0.000	0.001*
	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)	(0.001)	(0.000)
County wage growth	-0.002*	-0.002	-0.001	-0.003*	-0.001	-0.000	-0.002**	-0.001	-0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Has a HELOC at beginning of period	0.064***	0.032***	0.002	0.052**	0.037***	0.016**	0.048***	0.015***	0.050***
	(0.004)	(0.005)	(0.008)	(0.005)	(0.004)	(0.006)	(0.004)	(0.004)	(0.004)
Credit card utilization rate	0.098***	0.071***	-0.004	0.041	0.025***	-0.020***	0.119***	0.027***	0.030***
	(0.010)	(0.006)	(0.003)	(0.014)	(0.004)	(0.004)	(0.007)	(0.005)	(0.005)
No credit cards dummy	-0.487***	-0.360***	-0.017	-0.222*	-0.138***			-0.146***	-0.165***
	(0.047)	(0.032)	(0.014)	(0.066)	(0.020)			(0.026)	(0.026)
ln(age oldest mortgage account)	0.009***	0.018***	0.011***	0.015**	0.013***	0.013***	0.013***	0.018***	0.008***
	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
ln(age)	-0.041***	-0.041***	-0.010	-0.063**	-0.021***	-0.016	-0.038***	0.010	-0.065***
	(0.005)	(0.009)	(0.007)	(0.006)	(0.004)	(0.012)	(0.005)	(0.009)	(0.009)
Credit score (divided by 100)	0.255	0.586***	0.042	0.387***	0.277***	0.202***	0.264***	0.299***	0.309***
	(0.645)	(0.109)	(0.024)	(0.024)	(0.019)	(0.024)	(0.020)	(0.031)	(0.019)
Credit score^2	-0.019	-0.043***	-0.000	-0.030***	-0.022***	-0.015***	-0.020***	-0.023***	-0.024***
	(0.040)	(0.007)	(0.002)	(0.002)	(0.001)	(0.002)	(0.001)	(0.002)	(0.001)
ln(tract med home value)	0.008**	0.006	-0.004	0.010*	0.012***	-0.001	0.007	0.004	0.004
	(0.003)	(0.006)	(0.005)	(0.002)	(0.003)	(0.005)	(0.004)	(0.008)	(0.003)
Tract proportion black	-0.002	-0.032***	-0.003	-0.007	-0.018***	-0.021*	-0.014*	-0.031***	-0.010*
	(0.008)	(0.007)	(0.006)	(0.004)	(0.004)	(0.008)	(0.006)	(0.008)	(0.005)
Tract proportion Hispanic	-0.023***	-0.029***	-0.010	-0.032**	-0.020**	-0.014	-0.019**	-0.027***	-0.019**
	(0.006)	(0.005)	(0.012)	(0.005)	(0.006)	(0.011)	(0.006)	(0.007)	(0.006)
Tract proportion units owner-occupied	0.008	0.020*	0.032**	0.036*	0.012	0.032*	0.014*	0.017	0.016**
	(0.006)	(0.009)	(0.011)	(0.009)	(0.007)	(0.012)	(0.006)	(0.013)	(0.006)
Tract prop over 25 years with B.A.	-0.014*	-0.022*	0.006	-0.040**	-0.009	0.013	-0.026***	-0.043***	0.000
	(0.007)	(0.010)	(0.015)	(0.005)	(0.007)	(0.014)	(0.007)	(0.012)	(0.008)
Tract-to-MSA median family income	-0.001	0.002	0.005	0.002	-0.003	-0.006	0.004	0.010	0.000
	(0.004)	(0.006)	(0.005)	(0.010)	(0.005)	(0.007)	(0.004)	(0.008)	(0.003)
Constant	-0.489	-1.558***	0.219*	-0.740**	-0.630***	-0.199	-0.412***	-0.454***	-0.437***
	(2.583)	(0.398)	(0.089)	(0.112)	(0.084)	(0.106)	(0.086)	(0.089)	(0.065)
r2	0.048	0.051	0.055	0.057	0.043	0.053	0.051	0.059	0.049
N	86,781	123,792	57,190	71,433	196,330	67,325	173,156	81,976	185,787

* p < 0.10; ** p < 0.05; *** p < 0.01. All regressions include state fixed effects, dummies for the year of origination of person *i*'s primary mortgage at the beginning of year *t,* and exclude observations from 2008-2010. Standard errors, clustered at the state level, are in parentheses.

Table 6. Characteristics of extractors vs. non-extractors, 2003 and 2006

	2003 Sample					
	Non-Extractor	Extractor	Cash-out Refi	HELOC Draw	2nd mortgage	Other
Equifax Risk Score	713.27	717.73	706.46	745.12	703.41	723.59
Credit Card Utilization Rate	0.31	0.34	0.37	0.25	0.39	0.33
Does not have Credit Card	0.11	0.08	0.09	0.06	0.07	0.06
Age of Borrower	47.88	47.30	46.66	50.78	42.79	46.53

	2006 Sample					
	Non-Extractor	Extractor	Cash-out Refi	HELOC Draw	2nd mortgage	Other
Equifax Risk Score	732.67	712.64	676.48	747.48	703.03	714.69
Credit Card Utilization Rate	0.26	0.34	0.40	0.26	0.38	0.35
Does not have Credit Card	0.10	0.09	0.15	0.06	0.08	0.07
Age of Borrower	48.90	48.38	47.28	51.30	43.89	47.32

Source: Authors calculations from FRBNY/Equifax CCP. 2003 and 2006 samples refer to the same samples as shown in Table 1 and used throughout paper.