Home Equity Extraction by Homeowners: 2000-2006

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Abstract

We develop a unique paired loan dataset containing information on multiple conventional conforming mortgage loans of households to examine home equity extraction decisions over the period 2000-2006. The main question addressed is how much households borrow when refinancing their current mortgage debt in cash-out transactions and what factors affect that decision. We also provide estimates of the marginal effect of certain borrower characteristics. Results contribute both to the literature on refinancing behavior and the role of house price appreciation in providing funds that may be used for consumer spending or other purposes.

JEL codes: E2, E4, G2

1. Introduction

Many commentators have noted the effect of home mortgage refinancing and equity extraction on economic growth, particularly consumer spending, over the period 2000-2006. For example, former Federal Reserve Chairman Alan Greenspan (2002) stated:

"Especially important in the United States have been the flexibility and the size of the secondary mortgage market. Since early 2000, this market has facilitated the large debt-financed extraction of home equity that, in turn, has been critical in supporting consumer outlays in the United States throughout the recent period of economic stress."

In addition, a Federal Reserve study that analyzed refinancing in 2001-2002 found that about 61 percent of the funds were directed toward home improvements and the repayment of other debts while use of the remaining funds was divided between consumer expenditures and various financial or business investments (Canner et al., 2002). Nothaft (2004) argues that home equity wealth accumulation is important both to overall household wealth accumulation and consumption spending. Mishkin (2007) outlines the relationship between home equity extraction and consumption, among other topics related to monetary policy.

As is well known, about 69% of U.S. households are homeowners and a large portion of their wealth is in the form of home equity. Mortgage debt is typically the largest financial liability. Refinancing home mortgage debt may benefit households in two distinct ways (Nothaft [2004]). First, if interest rate costs and debt service requirements are reduced, household free cash flow will increase. This free cash flow is then available for other consumer spending. This can allow a household to smooth its consumption in the face of unexpected income shocks, e.g. a spell of unemployment or major expenses. Second, if home equity wealth is extracted through cash out refinancing, these tax-free cash infusions to household balance sheets can allow repayment of other higher rate consumer debt obligations, fund larger consumer purchases such as autos, or provide funds for investments including business start-ups. While we do not have

information on household spending out of home equity extraction, we are able to examine magnitude and some determinants of home equity extraction in the conforming conventional loan market.

Figures 1 and 2 illustrate the growth of house prices in the United States and the trajectory of mortgage interest rates over this time period. Thirty-year fixed rate mortgage rates, as measured by the Freddie Mac Primary Mortgage Market Survey, dropped from over 8.0% in 2000 to below 7% in 2001 and below 6% in 2003. Rates remained low until 2006 when they first exceed 6%. House prices, as measured by the Case-Shiller repeat-sales composite index[1], more than doubled over the 2000-2005 time period before leveling off and beginning to decline in 2006, followed by a sharp drop in 2007 and 2008.. Clearly, the coincidence of these two economic phenomena created a major opportunity for home equity extraction by homeowners over the time period studied.

On the downside, equity extraction by homeowners may have contributed to the mortgage crisis of 2007-2008, as borrowers with higher levels of debt faced negative equity when house prices began to decline in many markets during 2006 and encountered difficulty refinancing due to the contraction in liquidity resulting from the financial crisis.

2. Literature Review

The research on mortgage refinancing is extensive, so our review here is necessarily limited (see LaCour-Little [2008]) for a survey). Important early work includes Green and Shoven (1986) and Quigley (1987), who considered both borrower mobility (not our focus here) and interest rate effects. Also of note are Schwartz and Torous (1989, 1992) who address the effect of prepayments on the valuation of mortgages and mortgage-backed securities. A difficulty with much of the research on mortgage prepayments is that researchers (and even lenders) often cannot distinguish between loan payoffs attributable to refinancing versus those resulting from borrower mobility. Since the data we analyze includes loans for refinancing purpose only and we observe characteristics of both the original loan and the loan refinancing it, we do not confront this problem.

Considerable research has also addressed institutional factors and market frictions that might limit refinancing even when interest rate movements indicate borrowers should have financial incentives to do so (Archer, Ling, and McGill [1996, 1997]; Peristiani, Bennett, Monsen, Peach, and Raiff [1997; Green and LaCour-Little [1999]). Caplin, Freeman, and Tracy (1997) focus on the macroeconomic implications of such constraints. They find that house price declines that trigger defaults and constrain prepayments also act to exacerbate regional recessions. We examine a time period when the opposite was occurring: house prices were rising very rapidly, facilitating refinancing.

Follain, Lekkas, and Lehman (1999) noted the trend toward increased use of cash-out refinancing, reporting that during the 1998 refinancing boom, 51% of borrowers in the conventional conforming market segment elected to take cash-out, up from 34% in 1993. Nothaft (2004) notes a similar pattern during 2001-2003. Similarly, Hurst and Stafford (2004), examined equity extraction by households during 1991-1994, another period during which interest rates fell sharply. Using Panel Study of Income Dynamics (PSID) data, Hurst and Stafford estimated that liquidity constrained households transformed over two-thirds of equity extracted into current consumption, producing an aggregate economic stimulus of at least $28 billion. While we cannot directly observe household level liquidity constraints, we infer that about 14% of our sample may be relatively more liquidity constrained based on their mortgage choices and, using this definition, obtain results consistent with those of Hurst and Stafford.

Pennington-Cross and Chomsisengphet (2007) address home equity extraction among subprime borrowers, an important, though controversial, new segment of the market that has grown rapidly over the last decade to almost $600 billion in origination volume during 2006 before the market collapse occurring in 2007. Pennington-Cross and Chomsisengphet find that equity extraction is relatively more frequent in the subprime market, compared to the prime market, and that such loans perform differently compared to other subprime mortgages, after controlling for key risk factors such as borrower credit score and loan-to-value ratio. They do not address, however, the amount of equity extracted.

Greenspan and Kennedy (2007) focus on a broader definition of equity extraction, including equity generated from sale of appreciated homes; use of home equity lines of credit; as well as the cash-out refinancing that is our topic here. They also address uses of equity extraction for consumer spending, which we do not, though we can determine that about 5% of our sample used equity extracted to purchase second homes or investment properties. Most important in terms of differences, Greenspan and Kennedy's analysis is at the aggregate level, while we examine individual consumer level behavior, allowing us to focus on micro-level factors related to home equity extraction.

Nothaft and Yang (2005) focus on the role of refinancing in building household wealth, arguing that spending financed by home equity extraction helps smooth household consumption and bolster the economy in economic downturns, but may reduce wealth accumulation. Using American Housing Survey data from 1985-2001, they find that lower income households tend to have less home equity and higher aggregate leverage than others. Indeed, many of the problems in the subprime mortgage segment in which lower-income households appear to be disproportionately represented may be due to excessive cash-out refinancing transactions often motivated by debt consolidation objectives.

Estimating the marginal propensity to consume out of housing wealth is another important strand in the literature, with studies using either aggregate time series (e.g. Case, Quigley, and Shiller [2005]; Benjamin, Chinloy, and Jud [2004]) or household-level data (e.g. Bostic, Gabriel, and Painter [2004]; Lehnert [2005]). These studies tend to find that the elasticity of consumer expenditure out of housing wealth is much higher than out of financial wealth, a topic we are not able to consider. Haurin and Rosenthal (2006) explicitly examine consumer spending and saving related to housing appreciation using 1983-2001 data from the Survey of Consumer Finances and the National Longitudinal Survey of Youth, surveys that allow detailed analyses of household expenditures. They report that for every dollar of house price appreciation, households take on roughly 15 cents additional debt, most of which is used to finance consumer expenditures. While we use quite different data and a more recent time period, many of our results are quite similar; e.g. we find that equity extracting households increase their level of mortgage debt by about 16%.

In summary, our contribution here is to extend several lines of research by analyzing a more recent time period utilizing, utilizing a larger data, set and examining an environment in which many of the constraints noted earlier appear to be less binding. Both Caplin et al (1997) and Hurst and Stafford (2004) used data from the 1990s. Haurin and Rosenthal (2006) use data up to survey year 2001. Pennington-Cross and Chomsisengphet (2007) use data that covers 1996- 2004, but their focus is the subprime segment of the market and they address neither the amount borrowed nor geographic variation in household borrowing behavior. Greenspan and Kennedy (2007) use data spanning the time period we consider and longer, though they focus on aggregate levels of equity extraction, defining the phenomenon more broadly.

Our key findings are that house price appreciation and interest rate movements played key roles in cash out refinancing decisions and that, at least in the conforming conventional market segment, households were relatively conservative in their choice of amount to borrow. While debt amounts increased, on average, by about 10%, lower interest rates produced only a 3% increase in monthly debt service costs. Moreover, households choosing to refinance with cash out tended to be middle-income, middle-aged households with moderate credit scores.

The plan for the balance of the paper is as follows. In the next section we describe our data and empirical methodology. In the following section, we report results of models of the equity extraction, defined first as amount borrowed and second as amount of equity extracted. We also provide estimates the marginal effects of key household characteristics. The final section concludes and identifies potential extensions to the research.

3. Data and Empirical Methodology

We began by extracting a random sample of loans from a very large data base of a major secondary mortgage market participant who prefers anonymity. We then searched for matching pairs of borrowers to identify households for whom data on two consecutive mortgage loans would be available, where the first of the two loans was a home purchase loan. From this matching process we identified 808,086 pairs of loans. If borrowers

retained the same address across two loans, we infer that they refinanced. This proved to be the largest component, representing 83% of the sample, consistent with the multiple waves of refinancing that occurred as interest rates fell over the study period. The match rule does not preclude loans for the purpose of purchasing second homes or investor property; however, this is a relatively small portion (about 5.4%) of the sample. The remaining 17% of the sample, represent borrowers who relocated, hence, their second loan was a home purchase loan as opposed to a loan for refinancing purposes. Hence, as opposed to many mortgage studies based on loan level data to which borrower characteristics may be appended, our unit of observation is a household with multiple mortgage loans[2]. We also limited the second (refinancing) mortgage to the origination period 2000-2006 to capture behavior during the recent housing cycle. The initial home purchase loans were originated between 1975 and 2006.

It might be objected that the relationship examined here is entirely conditional on the borrower's decision to refinance into a new conventional conforming loan (or to move) during the observation window, and this is a fair point. In an earlier version of the paper, we attempted to incorporate the conditional relationship by using Heckman's two-step procedure. The coefficient on "lambda" was significant but other coefficients did not change materially. While we do not report those results, they are available from the authors upon request. We believe our results are valid for the conventional conforming market but do not claim that they would necessarily be valid for the subprime or other non-conforming segments of the market.

Since our focus is the refinancing decisions of households, each of the refinancing loans was then matched to credit report data to determine the outstanding loan balance of the first loan as well as, for example, the amount of non-mortgage debt then outstanding. Given this process, nearly all characteristics of both mortgages are available, including note rates at origination, dates, original and remaining loan balance, loan term, product type, loan-to-value ratio (LTV), occupancy status and loan purpose. Important risk factors, such as borrower credit score (FICO) and related borrower financial information is also available, including monthly income, debt, housing expense, and borrower age. As a result, we have a remarkably clear and complete picture of household refinancing decisions, conditional of course on their decision to refinance during this time period. To

comply with privacy law restrictions, no identifying information (such as borrower name, birth date, social security number, or street address) was retained. We do retain zip code, however, and use that geographic measure to estimate house price appreciation over the holding period of the first loan.

Figure 3 compares refinance volume in 2000-2006 at the aggregate level based on different data sources. Our sample is drawn from Loan Performance (LP): conforming segment. LP data has a smaller coverage than either HMDA data or MBA survey. The population of our sample is even smaller than that. Nevertheless, the time trends seem to match one another very well. Based on LP data, Table 1 rank the top and bottom 10 states in terms of share as well as numbers of cash out refinance originations. California is the top state measured by both share and numbers. This single state accounts for 18.5% of all cash out originations during the time period. Florida has the second highest volume, but the share of cash out relative to total originations in the state is much lower.

Table 2 provides definitions and descriptive statistics for the variables used in the analysis. We report contract note rates and time-varying market interest rate (defined as national average effective market refinancing rate) for both the refinancing and home purchase loans (N=808,086). For other variables, we limit the descriptive statistics to the loans for refinancing (N=667,478). We will use the two rate variables to compute a measure of the refinance incentive for each borrower and ultimately use this to identify liquidity-constrained borrowers. Table 3 (discussed later in the Results section) provides descriptive statistics for the first and second loan and allows some interesting comparisons. Table 4 (also discussed later) tabulates equity extraction amounts by state and year.

Following Richard and Roll (1989) and Caplin et al. (1997), we use the Principal/Value (PV) ratio as our basis for measuring the incentive to refinance. The *PV* is defined to be the unpaid principal balance (UPB) outstanding at time *t* divided by the present value of the current mortgage payments using the current market rate at time *t.* This measure may be characterized as the ratio of the book value of the mortgage to the market value:

$$PV = \frac{R_t}{R_0}\left\{\frac{1-(1+R_0)^{t-360}}{1-(1+R_t)^{t-360}}\right\}, \qquad (1)$$

where R_t and R_0 are note rates at origination of current and previous mortgage respectively. If the current rate is higher than the origination rate on the previous mortgage, then $PV > 1$ and there is no gain in refinancing the previous mortgage. Thus they are more liquidity constrained. If the current rate is below the previous rate, then $PV < 1$ and there is a positive incentive to refinance. Over the time, the base market refinance rate also fluctuates. A borrower is less likely to refinance when the market rate is higher. Therefore, we anticipate that refinance decision would be negatively related to both *PV* and the market rate.

All other variables in Table 2 are conditional on the refinance decision. *Refi_Time* measures the length of time the first mortgage was outstanding prior to refinancing. The mean value is 36 months. The mean outstanding balance on the first loan is $163,674 at time of refinancing.

To determine the loan-to-value ratio (LTV) at the time of refinancing, we do not rely on the appraisal made at the time, since those values have been shown to contain a significant bias (An et al, 2007). Rather, using a proprietary zip-level repeat transaction home price index[3], we estimated home value at the point of origination of the refinancing loan. We estimated this value as follows:

$$\text{hpival\_2} = \text{value\_1} * \frac{\text{HPI}_2}{\text{HPI}_1} \tag{2}$$

where *Value_1* is the home purchase price when the first mortgage was originated and HPI_1 and HPI_2 are zip-level home price indices at the two loan origination dates. These home price indices are estimated using repeat sales index model originally proposed by Case and Shiller (1987) and later extended by others to account for the quadratic dispersion. The resulting home value represents a point estimate of maximum home equity available to the homeowner when he/she decides to refinance. Based on this calculation, the mean amount taken out by the homeowner represents 60% of estimated available home equity. The remaining UPB accounts for 86% of the total refinance amount, i.e. borrowers increased their level of mortgage indebtedness by about 16% on average. In other words, homeowners infuse about 16% of these tax-free dollars to re-pay other higher rate consumer debt obligations, fund larger consumer purchases or finance investments.

Given our refinance sample, loan amount (including cash out after satisfying the existing mortgage debt) can be explained by a number of factors: available equity, the current mortgage liability measured by the remaining UPB, the level of other consumer non-mortgage debt, borrower income, age and credit score. We model this relationship using natural log transformations (all variables measured at the time of the second, refinancing loan):

$$\log origam\_2 = \beta_0 + \beta_1 * \log value + \beta_2 * \log actupbrm + \beta_3 * bo\_age\_2 + \beta_4 * fico\_b2 + \beta_5 * nmdebt\_2 + \beta_6 * inc\_2 \quad (3)$$

where *logorigam_2* = natural log of loan amount

logvalue = natural log of estimated home value

logactupbrm = natural log of remaining UPB

bo_age_2 = primary borrower age

fico_b2= borrower FICO score

nmdebt_2 = borrower monthly non-mortgage debt payment

Borrower age, credit score, non-mortgage debt, and income are all coded as categorical variables to capture potential nonlinear relationships with loan amount. Other variables used in continuous form are log transformed, allowing convenient interpretation of coefficient as elasticity with comparable magnitudes. We also tested the significance of including PV, measure of refi incentive, into the equation, and found that either loan amount or cash extracted does not depend on the degree of refi incentive. Nevertheless, it's a determinant of whether to refi or not prior to borrower deciding how much to be extracted.

4. Results

Prior to considering regression results, examination of the descriptive statistics for the two loans as shown in Table 3 provides an interesting comparison and illustration of the benefits to households of refinancing during this time period. Table 4 tabulates actual dollar amounts extracted by state and year, depicting the magnitude and geographic variation in this phenomenon.

Although origination loan amounts increased by roughly 10%, monthly housing expense (including principal, interest, taxes, and insurance) increased by only about 3%. This results from the decrease in note rate from almost 7% to below 6%, a 110 basis point reduction on average. As expected, borrowers who did not extract equity obtained a greater rate reduction than those who did: 125 basis points vs. 89 basis points. Equity extractors had, on average, a 12% greater loan amount, $174,600 vs. $155,422, compared to those who did not extract equity. Importantly, too, average LTV declines from 73% to 65%, indicating that borrowers in our sample became less-leveraged, on average, as a result of refinancing, even while 43% extracted equity. This result is contrary to the popular view of consumers recklessly dipping into home equity to finance frivolous consumer expenditures in recent years.

Table 4 summarizes cash out amounts by state and year based on our sample. Across all states and years a total of $23.7 billion was extracted, with the largest amounts from larger states and states with relatively rapid rates of house appreciation. For example, households in California extracted over $5 billion, while households in Texas (a similarly large state though one with a much slower rate of house price appreciation) extracted only about $0.7 billion. Over time, equity extraction peaked at $7.8 billion in 2003, the year in which interest rates reached historical lows. This pattern is consistent with estimates from Greenspan and Kennedy (2007) whose aggregate figures also show extraction amounts peaking in 2003. The difference arises from the fact that our sample is restricted to the conventional conforming loan population while Green and Kennedy's figures are derived from HMDA data.

Given the refinance decision, we estimate Equation (3) using OLS to examine the determinants of the new loan amount. Results appear in Table 5. The model explains

about 82% of the variation in log-transformed refinance amount. Based on t-statistics, most coefficients are significantly different from zero with signs as anticipated. The largest single effect is current mortgage amount since, of course, that amount must be refinanced except in the unlikely case that the borrower brings in other funds to pay down the loan at closing. Following this variable house value is the second largest single coefficient with a value of 0.330, implying that for every 1% of house value appreciation, households borrow 0.33% after satisfying the existing mortgage obligation.[4] We will show later that the marginal home equity extraction per addition dollar of home value varies with initial home value. Likewise, the elasticity of refinance amount with respect to the previously outstanding loan balance is 0.494, implying that for every 1% of loan balance, households borrow 0.5% controlling for other factors. Without controlling for other factors, the coefficient of previous loan balance would be 0.74, implying the substantial majority of new balance is used to pay off the existing loan balance.

Turning to borrower characteristics, borrower age has a non-monotonic effect, first increasing loan amount and then decreasing it, consistent with lifecycle theories. Likewise, an increase in borrower credit score initially increases loan amount, then decreases it, with borrowers in the score category 620-650 borrowing the most. The effect of non-mortgage debt, however, appears monotonic, consistent with the notion that larger loans are required to retire greater levels of non-mortgage debt outstanding. Likewise, loan amount is monotonically increasing in borrower income, presumably reflecting debt service capacity. These results are broadly consistent with LaCour-Little (2004) who examined the propensity of borrowers to take out second liens and found similar patterns in which middle-age and middle-income households were the most likely category of household to borrow.

As a robustness check, we have also estimated the same model based on two restricted samples: one is limited to owner-occupied properties and the other is for PV < = 1. Results for both models are reported in Table 6. Borrowers buying vacation homes or investor properties can differ from those buying owner-occupied homes because they are less willing to retain the ownership when a negative shock occurs to the homeowner. Excluding these 5% loans in the sample generate similar coefficients as the main model. However, the elasticity of refinance with respect to home equity is a little smaller, 0.323,

compared to 0.330 in the main model. Thus, vacation home or investor property buyers through refinance extract a slightly greater share of home equity or seek greater leverage than those intended for owner-occupied homes. All the other coefficients are almost identical. Overall, the results in the main model are general, with almost no differences when refinancing was for the purpose of acquiring second homes or investor properties.

We also examined the effect of excluding the likely liquidity-constrained borrowers by limiting PV to no more than 1 (86% of the sample). This turns out to make much more of a difference. These borrowers take out less home equity on a per dollar basis, 0.311 vs. the original 0.330. But the reduction is offset by an increase in the elasticity of refinance amount with respect to previous loan balance. For every 1% of outstanding loan balance, borrowers now take out 0.513% home equity rather than 0.494%. Thus, borrowers facing liquidity constraints are more likely to extract more from available home equity, but less relative to the balance of the existing mortgage. The reason for this pattern is that loans with PV > 1 are mostly older loans with smaller outstanding balances. Overall results suggest that borrowers with greater values of PV seek greater leverage when refinancing.

5. Analysis of Marginal Effects

So far we have examined the behavior of the average borrower in our sample. An interesting extension is to consider marginal effects of different characteristics. To do so, we define a baseline home equity extraction as the predicted value when all explanatory variables are at their sample means. In this context, an average borrower is one with a FICO score in the 680-720 range, between 46 and 55 years old, with monthly income between $6,000 and $8, 000, and monthly payments on non-mortgage debt in the $500-$1,000 range, who owns a house valued at $235,000. Given the average incentive to refinance over our study period, this typical borrower would extract $32,460 after repaying all the obligations from previous mortgage, which accounts for roughly 14% of the home value. Marginal effects measure the deviation in predicted equity extracted from this baseline amount given changes in explanatory variable. These are then purely marginal effects due to changes in the value in one of the explanatory variables.

Figures 4 through 7 plot marginal effects of different borrower characteristics, where the difference between extraction amount and baseline level is the marginal effect. Borrowers with mid-range FICO scores take out the most cash. At the peak are those with FICO between 620 and 650, who would take out $36,907 setting all other characteristics to their sample means; this amount is $4,447 more than the baseline. In contrast, when credit scores are below 580 or above 720, homeowners tend to extract less[5]. At the highest FICO category, borrowers took out the least: $19,242, or 59% less than the baseline. In general, homeowners appear to extract less as borrower age increases. The only exception appears for households younger than 25. Households between ages 26 and 35 are in the prime age bracket for family formation and, hence, would be expected to have the highest demand for liquidity. This group has the highest level of equity extraction. This pattern may reflect level of financial sophistication or relative familiarity with the mortgage lending process or could be a correlate of household wealth, since older households tend to have greater wealth and higher credit scores. In Figures 6 and 7, cash out amount increases with both income and non-mortgage debt. Higher income borrowers would be able to support greater levels of debt and households with greater levels of non-mortgage debt would have a larger incentive to substitute mortgage debt for consumer debt.

Figure 8 plots both marginal effect and marginal equity extraction as a function of home value. Marginal equity extraction is defined as the change in the cash out amount per additional dollar increase of home value. Although our model in Equation (5) estimates a linear relationship between home equity balance and equity extraction, the marginal effect varies with the initial value of house price. With a starting home value of $150,000, households are estimated to take out about $0.27 per additional dollar of home appreciation. Marginal equity extraction declines steadily to about $0.09 per additional dollar for home values above $650, 000. Thus, marginal equity extraction declines with home value. Of course, some of this pattern may be due to the conforming loan limit which would tend to push borrowers with higher-priced homes into the jumbo segment of the market, a category for which we have no data.

6. Conclusions

We have empirically analyzed the factors affecting the decision of households to extract home equity over the time period 2000-2006. Overall, 43% of households in our sample chose to take out equity when they refinanced; however, housing appreciation was sufficiently great to actually decrease loan-to-value ratios, on average, over this time period. This result is contrary to the popular media characterization of borrowers taking on ever greater levels of housing leverage in recent years. We found that housing appreciation was the dominant factor explaining the amount borrowed, although there were significant differences across borrower types as well. In general, middle-income and middle-aged households extracted greater amounts of housing equity. Results, of course, are conditional on data used. In particular, we cannot address analogous behavior in jumbo or subprime segments of the mortgage market over this time period since our data is based on the conforming conventional loan market. We note, however, that the conventional conforming segment comprises at least 70% of the total residential mortgage market[6].

Several caveats are essential. Unlike researchers who use survey research which collects details on consumer expenditures and savings behavior, we cannot determine the use of the home equity extraction funds documented. Moreover, since our data is limited to pairs of conventional conforming loans, we miss households who may have had sufficient housing appreciation to trade up to the jumbo market and those households for whom financial difficulties may have required them to trade down to the subprime market. For the broad middle of the market, however, we think our results are probably not too far off.

Interesting extensions to the research include examining the effect of the home equity extraction on regional economic performance, including consumer spending and home improvement expenditures. In addition, the downturn in the housing market that began in 2006 and accelerated during 2007 and 2008 will provide an interesting period for comparison. Will equity extraction decline as house prices fall, interest rates rise, and underwriting standards tighten? Or is there sufficient accumulated equity that households will continue to tap home equity and potentially smooth their consumption? Further research is necessary to address these and related questions.

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Figure 1: 30-Year Fixed Mortgage Rates: 2000-2006

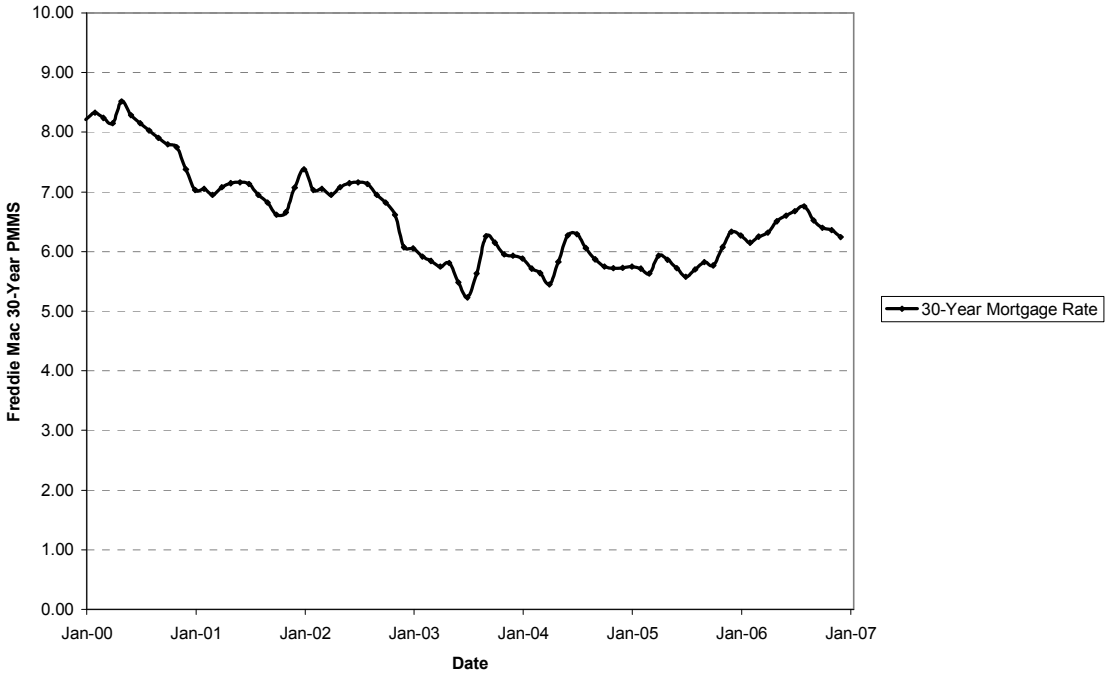

Figure 2: U.S. House Price Growth 2000-2006

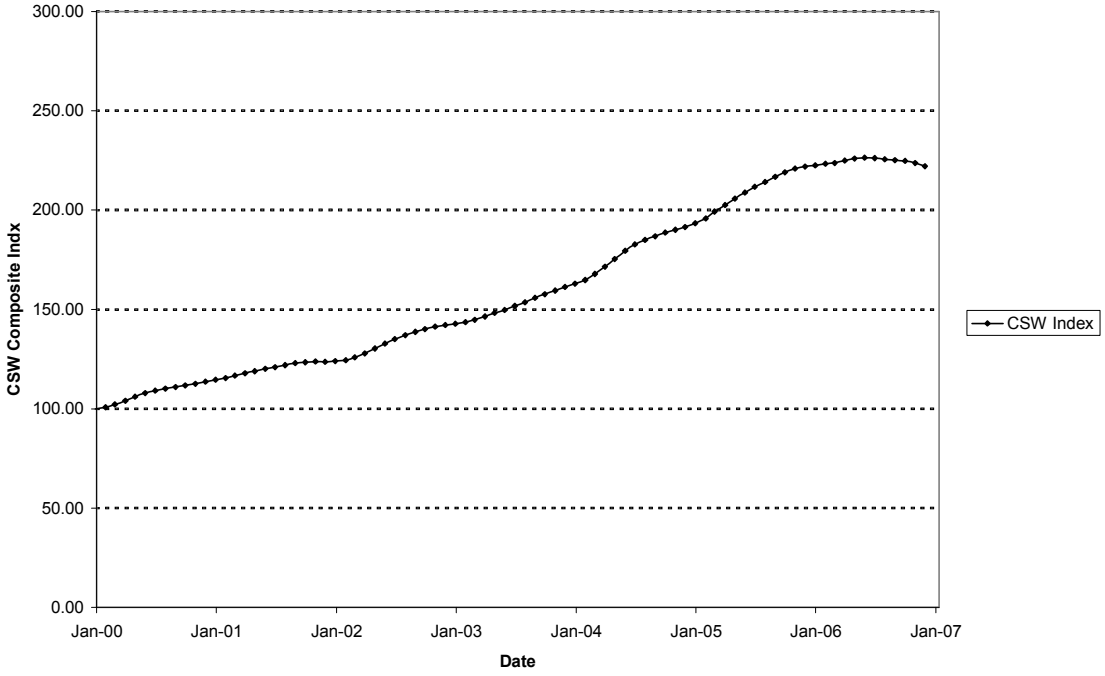

Figure 3

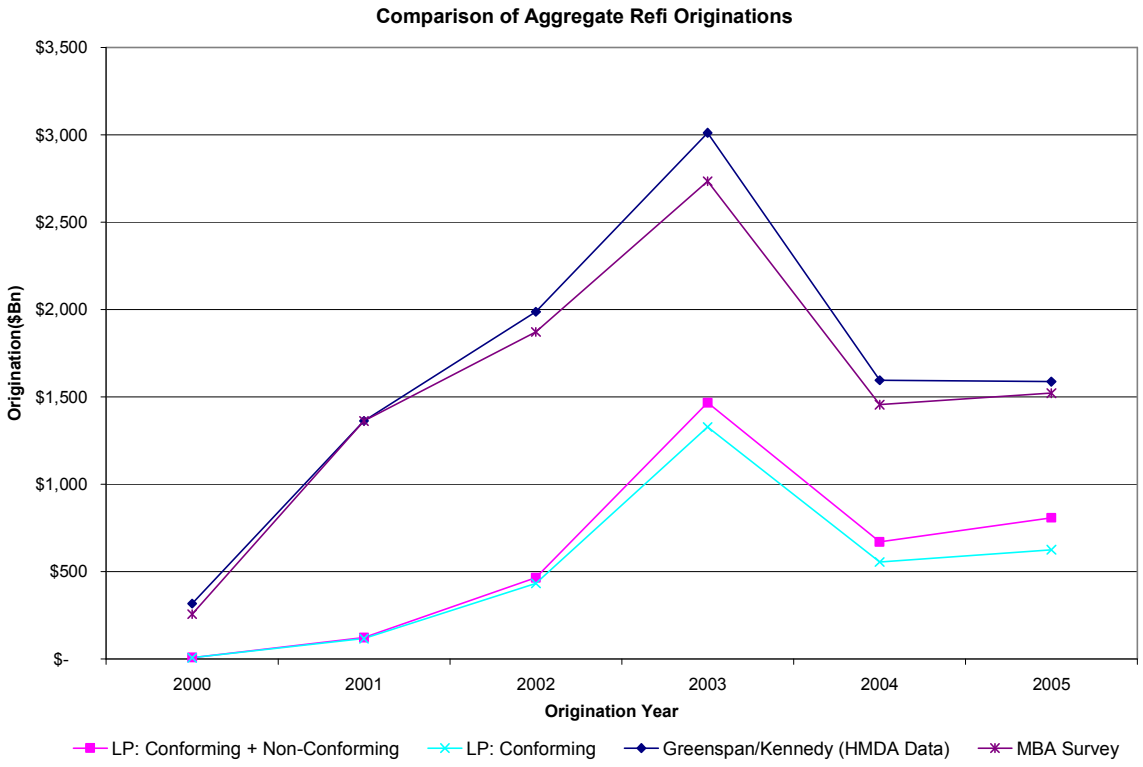
Comparison of Aggregate Refi Originations
$3,500
$3,000
$2,500
$2,000
$1,500
$1,000
$500
$-
Origination($Bn)
2000
2001
2002
2003
2004
2005
Origination Year
LP: Conforming + Non-Conforming
LP: Conforming
Greenspan/Kennedy (HMDA Data)
MBA Survey

Figure 4

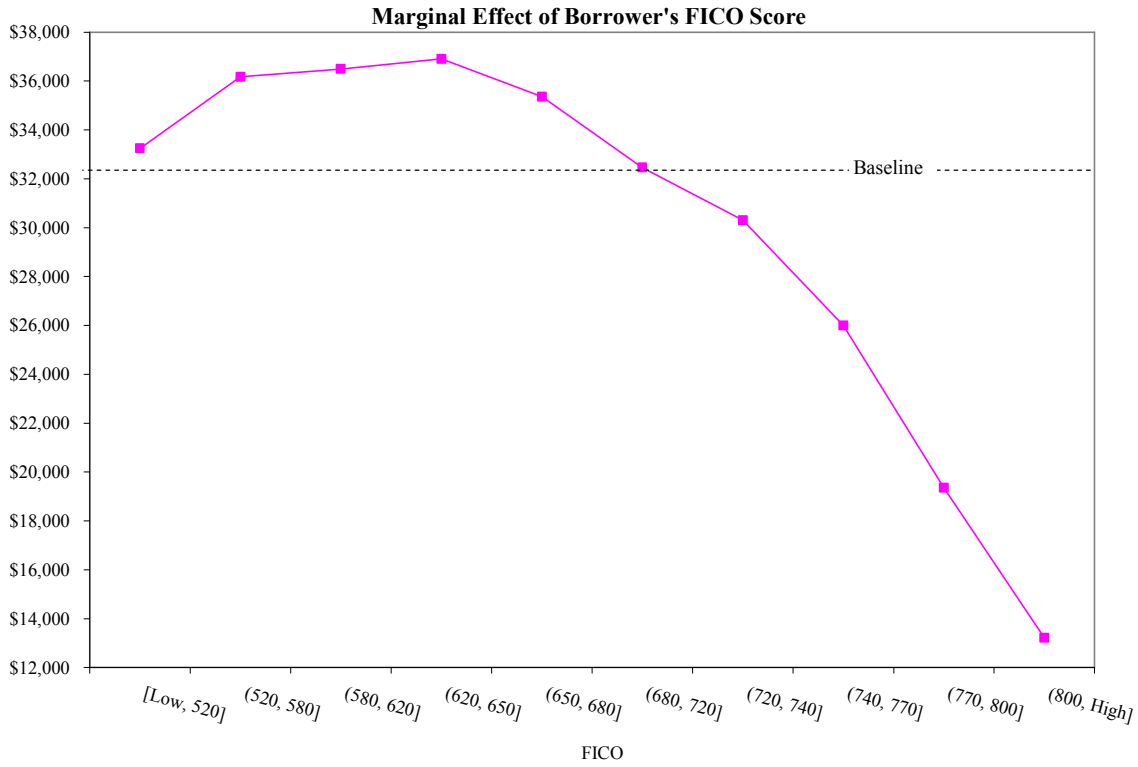
Marginal Effect of Borrower's FICO Score
$38,000
$36,000
$34,000
$32,000
$30,000
$28,000
$26,000
$24,000
$22,000
$20,000
$18,000
$16,000
$14,000
$12,000
Baseline
[Low, 520]
(520, 580]
(580, 620]
(620, 650]
(650, 680]
(680, 720]
(720, 740]
(740, 770]
(770, 800]
(800, High]
FICO

Figure 5

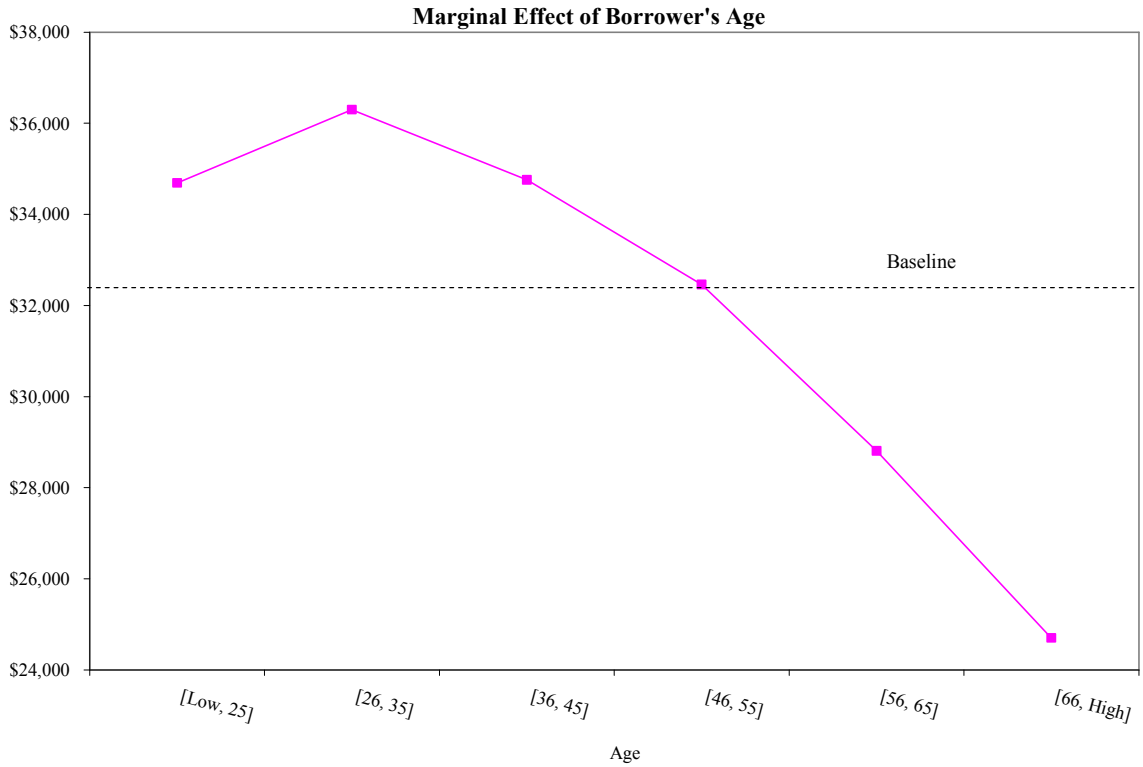
Marginal Effect of Borrower's Age
$38,000
$36,000
$34,000
$32,000
$30,000
$28,000
$26,000
$24,000
Baseline
[Low, 25]
[26, 35]
[36, 45]
[46, 55]
[56, 65]
[66, High]
Age

Figure 6

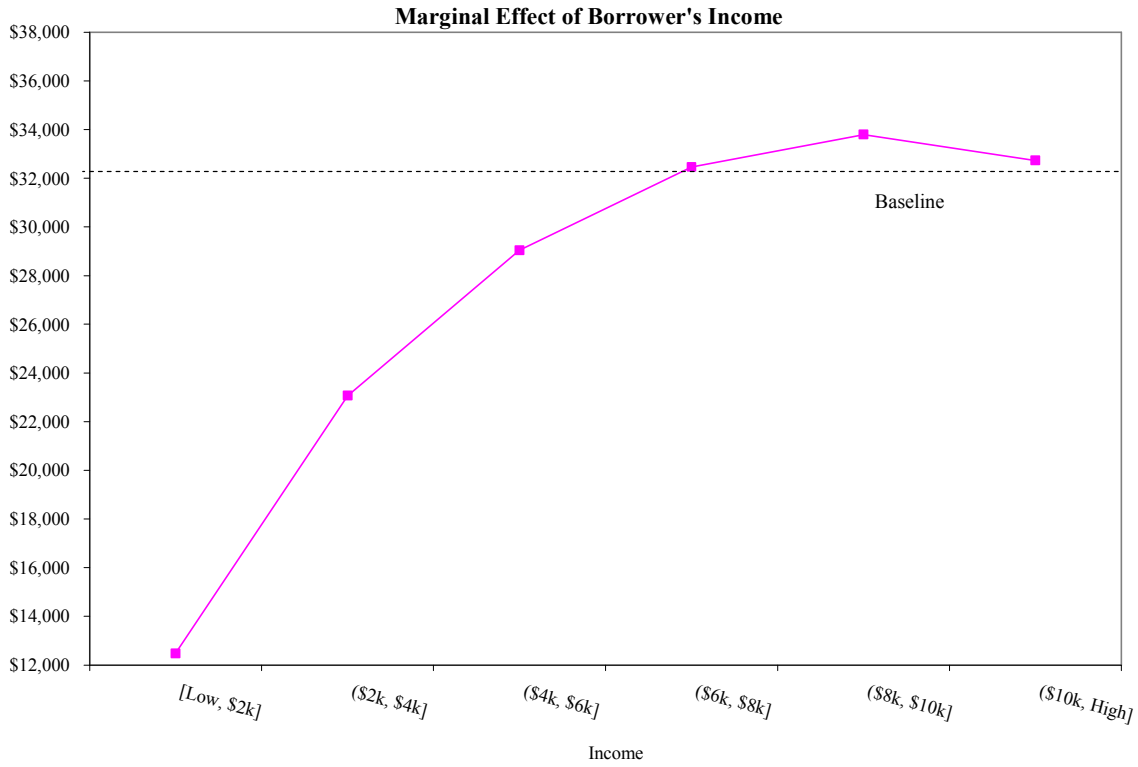
Marginal Effect of Borrower's Income
$38,000
$36,000
$34,000
$32,000
$30,000
$28,000
$26,000
$24,000
$22,000
$20,000
$18,000
$16,000
$14,000
$12,000
Baseline
[Low, $2k]
($2k, $4k]
($4k, $6k]
($6k, $8k]
($8k, $10k]
($10k, High]
Income

Figure 7

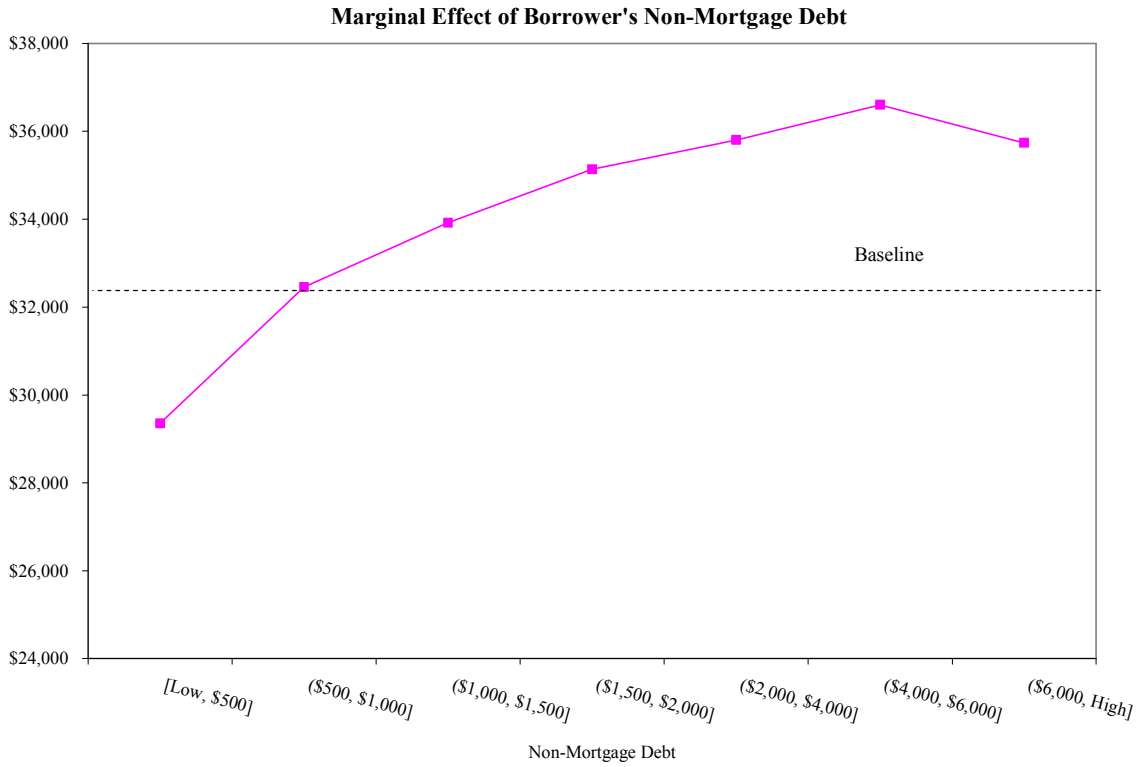
Marginal Effect of Borrower's Non-Mortgage Debt
$38,000
$36,000
$34,000
$32,000
$30,000
$28,000
$26,000
$24,000
Baseline
[Low, $500]
($500, $1,000]
($1,000, $1,500]
($1,500, $2,000]
($2,000, $4,000]
($4,000, $6,000]
($6,000, High]
Non-Mortgage Debt

Figure 8

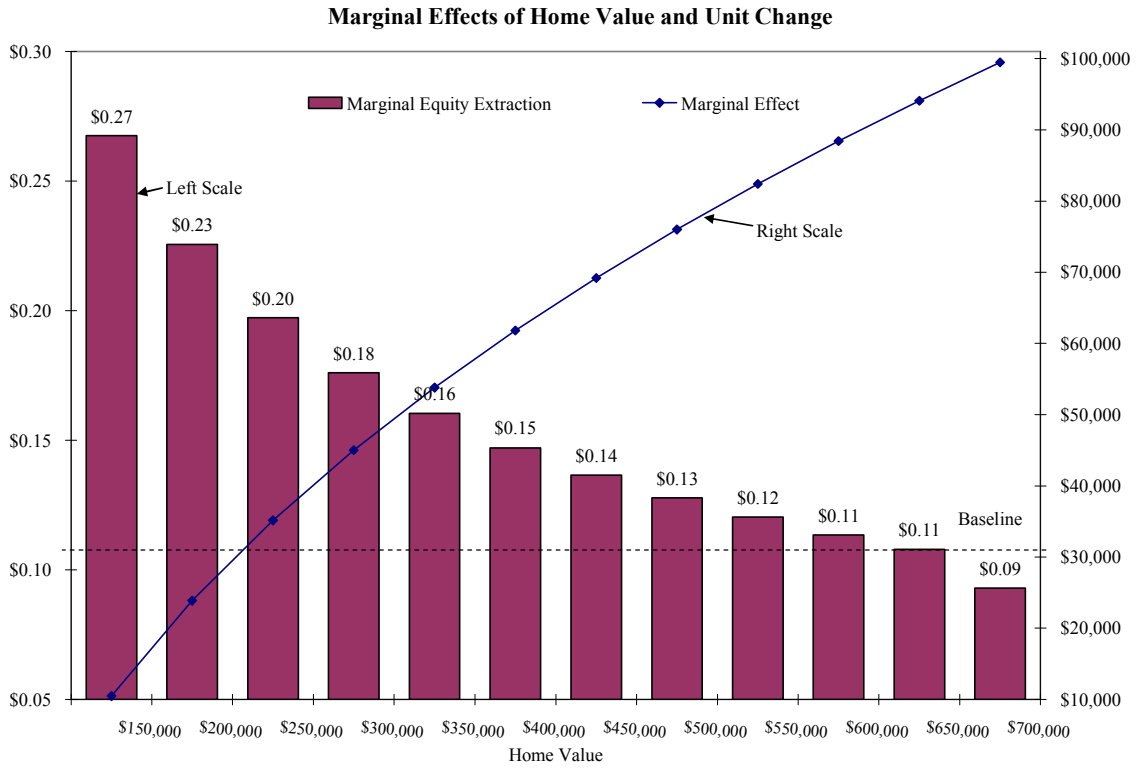
Marginal Effects of Home Value and Unit Change
Marginal Equity Extraction
Marginal Effect
Left Scale
Right Scale
$0.27
$0.23
$0.20
$0.18
$0.16
$0.15
$0.14
$0.13
$0.12
$0.11
$0.11
$0.09
Baseline
$0.30
$0.25
$0.20
$0.15
$0.10
$0.05
$100,000
$90,000
$80,000
$70,000
$60,000
$50,000
$40,000
$30,000
$20,000
$10,000
$150,000
$200,000
$250,000
$300,000
$350,000
$400,000
$450,000
$500,000
$550,000
$600,000
$650,000
$700,000
Home Value

Table 1

By Share of Cash Out Originations in 2000-2006			
Top 10 States		Bottow 10 States	
Rhode Island	41%	Oklahoma	22%
California	40%	Mississippi	22%
Massachusetts	38%	Louisiana	21%
New Hampshire	37%	North Carolina	21%
Hawaii	37%	Georgia	21%
Maine	35%	South Carolina	21%
Maryland	35%	Nebraska	21%
Minnesota	35%	Tennessee	20%
Vermont	34%	Utah	20%
DC	34%	Texas	8%
By Cash Out Originations in 2000-2006			
Top 10 States		Bottow 10 States	
California	1,547,560	Mississippi	31,446
Florida	667,784	Delaware	29,163
New York	412,115	West Virginia	28,575
Michigan	346,989	Montana	27,996
Illinois	325,084	Vermont	22,039
Ohio	285,053	DC	19,432
New Jersey	276,521	South Dakota	16,757
Virginia	274,034	Alaska	14,522
Pennsylvania	258,653	Wyoming	13,947
Minnesota	256,830	North Dakota	11,436

Source: Loan Performance

Table 2 Data Description

Variable	Definition	Obs	Mean	Std Dev
mktrefi_2	Market refinance rate when the loan is refinanced	808,086	5.523	0.635
PV	Principal/Value ratio	808,086	0.917	0.095
Refi_Time	Number of Months between previous mortgage origination date and current refinance date	667,478	36.492	34.286
logorigam_2	Natural log of refinance amount	667,478	11.899	0.478
origam_2	Refinance amount	667,478	$163,674	$ 73,195
logvalue	=log(hpival_2)	667,478	12.377	0.525
hpival_2	Home value when the previous mortgage was originated * cumulative zip-level home price appreciation	667,478	$272,553	$157,534
logactupbrm	=log(actupbrm_1)	667,478	11.725	0.548
actupbrm_1	Remaining unpaid principal balance of previous mortgage as of refinance time	667,478	$140,789	$ 67,307
bo_age_2	Primary borrower's age when the loan is refinanced	667,478	45.619	11.636
fico_b2	Borrower's FICO score when the loan is refinanced	667,478	728.885	54.814
nmdebt_2	Borrower's monthly non-mortgage debt when the loan is refinanced	667,478	$807.172	$940.184
inc_2	Borrower's monthly income when the loan is refinanced	667,478	$ 7,100.790	$ 6,713.520

Table 3: Difference between Two Mortgages

	Loan 1	Loan 2
Origination Term	318	292
Monthly Debt	$1,989.50	$2,069.80
Monthly Housing Expense	$1,353.43	$1,392.01
FICO	730	722
Monthly Income	$6,477.77	$7,100.79
LTV	72.7	64.6
Origination Amount	$149,371.26	$ 163,674.16
Note Rate	6.97	5.88

Table 4	Total Cash Our Amount by State and Year							
State	2000	2001	2002	2003	2004	2005	2006	Total
AK	1.59	3.14	5.08	8.09	3.55	4.52	5.46	31.4
AL	8.27	22.37	26.29	35.64	20.58	27.46	28.36	169.0
AR	4.47	13.67	15.44	21.89	12.73	15.02	13.18	96.4
AZ	23.36	67.95	97.95	119.13	80.85	151.04	129.94	670.2
CA	152.53	629.83	967.19	1423.47	790.04	786.45	551.82	5,301.3
CO	44.08	141.37	165.99	167.93	73.97	68.70	60.50	722.6
CT	10.18	33.23	54.49	84.64	51.44	55.48	39.35	328.8
DE	2.98	7.82	11.03	19.34	10.55	13.30	10.80	75.8
FL	54.05	139.22	227.08	328.64	207.04	317.07	280.77	1,553.9
GA	38.30	102.69	109.68	135.55	63.30	73.22	76.13	598.9
HI	4.31	14.77	22.35	47.22	28.72	36.92	27.99	182.3
IA	6.15	14.72	17.05	26.26	12.49	15.94	12.58	105.2
ID	2.46	8.46	8.85	12.87	8.43	14.03	18.44	73.5
IL	53.41	150.96	207.35	266.53	145.31	146.51	124.11	1,094.2
IN	15.32	50.35	60.55	67.63	33.53	33.28	27.15	287.8
KS	6.43	15.19	20.63	28.38	13.94	12.98	11.82	109.4
KY	7.24	19.87	23.74	28.54	15.43	14.39	13.90	123.1
LA	10.97	31.82	36.65	47.71	24.19	24.37	27.08	202.8
MA	33.58	148.40	212.63	283.32	137.21	117.94	78.78	1,011.9
MD	19.74	58.39	101.13	156.39	90.73	123.38	108.60	658.4
ME	2.11	6.86	9.50	13.59	9.54	12.91	7.99	62.5
MI	69.33	191.61	218.85	230.54	103.67	85.20	59.68	958.9
MN	21.83	83.51	108.62	136.95	63.07	66.66	47.41	528.1
MO	15.34	49.84	70.82	88.17	53.01	49.19	40.04	366.4
MS	4.27	10.67	13.75	17.16	9.66	10.73	10.06	76.3
MT	0.81	4.40	8.37	11.65	7.31	9.02	8.84	50.4
NC	23.36	50.21	69.45	80.46	42.84	54.80	55.00	376.1
ND	0.20	1.65	2.83	2.84	1.55	2.19	1.93	13.2
NE	4.53	10.47	15.39	17.25	11.81	8.52	6.53	74.5
NH	5.14	21.36	35.46	39.99	22.69	22.94	15.83	163.4
NJ	30.07	99.64	157.49	243.66	135.06	148.82	123.45	938.2
NM	3.84	10.58	17.11	22.26	13.12	15.57	13.54	96.0
NV	8.42	27.91	37.82	61.67	69.38	74.43	51.13	330.8
NY	30.64	109.11	170.19	274.83	138.52	154.09	127.90	1,005.3
OH	48.13	132.73	140.78	159.74	80.84	72.86	57.21	692.3
OK	4.98	13.25	19.09	24.38	13.54	15.30	12.62	103.2
OR	14.33	47.82	57.48	82.23	42.97	63.19	57.39	365.4
PA	26.57	68.40	95.59	133.41	80.12	92.98	81.07	578.1
RI	3.93	14.17	24.59	38.75	22.87	19.66	15.18	139.1
SC	7.81	25.33	30.06	37.78	20.93	28.87	30.71	181.5
SD	1.29	3.28	5.67	6.92	4.01	2.37	1.59	25.1
TN	14.03	32.43	45.01	52.86	33.62	41.97	42.21	262.1
TX	54.79	100.33	127.44	166.26	84.80	82.84	91.26	707.7
UT	9.51	28.12	35.52	37.08	18.50	24.12	32.96	185.8
VA	23.60	67.64	117.50	178.16	117.10	140.08	116.25	760.3
VT	0.53	1.85	3.40	5.02	3.38	4.02	4.61	22.8
WA	34.20	118.32	141.34	192.81	102.00	116.52	121.84	827.0
WI	13.44	63.31	77.81	87.07	53.68	51.77	33.25	380.3
WV	0.66	2.44	2.94	3.76	3.09	2.61	3.02	18.5
WY	0.89	3.37	4.65	6.82	3.99	3.51	5.59	28.8
All States	2,978.0	5,075.8	6,257.7	7,766.2	5,194.7	5,534.8	4,928.9	23,715.1

Table 5 Estimates of Refinance Amount
Dependent variable: Log of Refinance Loan Amount

Variable		Estimate	t-stat
Intercept		1.920	193.300
Log House Value		0.330	400.920
Log Outstanding Loan Balance		0.494	636.620
Borrower Age	[Low, 25]	0.065	21.350
	[26, 35]	0.075	50.860
	[36, 45]	0.066	47.030
	[46, 55]	0.051	36.470
	[56, 65]	0.027	18.150
	[66, High]	0.000	.
Borrower FICO	[Low, 520]	0.137	15.530
	(520, 580]	0.155	46.480
	(580, 620]	0.157	69.180
	(620, 650]	0.160	83.640
	(650, 680]	0.150	86.860
	(680, 720]	0.132	82.650
	(720, 740]	0.118	70.440
	(740, 770]	0.089	57.090
	(770, 800]	0.044	28.280
	(800, High]	0.000	.
Non-mortgage debt	[Low, $500]	-0.041	-8.100
	($500, $1,000]	-0.021	-4.120
	($1,000, $1,500]	-0.012	-2.280
	($1,500, $2,000]	-0.004	-0.750
	($2,000, $4,000]	0.000	0.080
	($4,000, $6,000]	0.005	0.920
	($6,000, High]	0.000	.
Income	[Low, $2k]	-0.139	-54.460
	($2k, $4k]	-0.064	-53.930
	($4k, $6k]	-0.024	-23.740
	($6k, $8k]	-0.002	-1.710
	($8k, $10k]	0.007	6.330
	($10k, High]	0.000	.
R^2		0.817	
F-stat		83051.6	
Obs used		667,478	

Table 6 Estimates based on Restricted Samples

		Owner-occupied Only		PV<=1	
Variable		Estimate	t-stat	Estimate	t-stat
Intercept		1.960	170.550	1.910	187.650
Log House Value		0.323	382.210	0.311	369.470
Log Outstanding Loan Balance		0.498	628.460	0.513	647.770
Borrower Age	[Low, 25]	0.059	19.350	0.063	20.230
(categories)	[26, 35]	0.071	46.570	0.075	49.410
	[36, 45]	0.062	43.440	0.065	45.420
	[46, 55]	0.049	33.830	0.051	35.650
	[56, 65]	0.026	16.820	0.027	17.320
	[66, High]	0.000	.	0.000	.
Borrower FICO Score	[Low, 520]	0.139	15.740	0.113	11.510
(categories)	(520, 580]	0.157	47.000	0.137	37.850
	(580, 620]	0.157	68.810	0.151	64.400
	(620, 650]	0.159	82.640	0.156	80.120
	(650, 680]	0.150	85.860	0.147	83.490
	(680, 720]	0.132	81.770	0.129	80.050
	(720, 740]	0.118	69.680	0.116	68.500
	(740, 770]	0.089	56.480	0.089	56.480
	(770, 800]	0.044	27.900	0.046	29.180
	(800, High]	0.000	.	0.000	.
Non-mortgage debt	[Low, $500]	-0.037	-5.170	-0.037	-6.990
(categories)	($500, $1,000]	-0.017	-2.330	-0.016	-3.060
	($1,000, $1,500]	-0.007	-0.960	-0.008	-1.460
	($1,500, $2,000]	0.003	0.480	0.000	-0.050
	($2,000, $4,000]	0.008	1.120	0.003	0.540
	($4,000, $6,000]	0.019	2.320	0.003	0.510
	($6,000, High]	0.000	.	0.000	.
Income	[Low, $2k]	-0.144	-56.070	-0.130	-50.490
(categories)	($2k, $4k]	-0.069	-56.530	-0.061	-50.730
	($4k, $6k]	-0.028	-26.700	-0.023	-22.670
	($6k, $8k]	-0.005	-4.500	-0.002	-1.670
	($8k, $10k]	0.005	4.590	0.007	6.090
	($10k, High]	0.000	.	0.000	.
R^2		0.818		0.825	
F-stat		83,012		80,665	
Obs used		631,693		607,250	

[1] Futures and options on the house price index are traded on the Chicago Mercantile Exchange. See http://www.cme.com/trading/prd/re/housing.html for more details. The index itself is attributable to the work of Case and Shiller (1989).

[2] LaCour-Little (1999) uses data structured in a similar fashion; however, that study is based on a single lender's data as opposed to multiple lenders as in our case.

[3] Both CaseShillerWeiss and FirstAmerican offer similar products commercially. The repeat sales method of constructing the index is developed in Case and Shiller (1987) and owes a debt to to Bailey, Muth and Nourse (1963). The methodology for the HPI we use is standard though the tool itself is proprietary and confidentiality considerations preclude divulging further details.

[4] Contreras and Nichols (2007) find that the elasticity of consumption out of the permanent shocks was more than three times that of the elasticity of consumption out of the transitory shocks. The distinction reflects more complex relationship between home price appreciation and equity extraction at the aggregate level.

[55] Borrowers with credit scores below 580 would typically be considered subprime and, hence, would be less likely to refinance in the conforming loan segment of the market due to underwriting standards.

[6] Calculation based on 2005-2006 origination volume, data from First American LoanPerformance Servicing database.