The Marginal Propensity to Extract Housing Wealth: Evidence from Home Equity Windfalls*

Alvaro Mezza†
Federal Reserve Board

Daniel Ringo‡
Federal Reserve Board

Kamila Sommer§
Federal Reserve Board

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Abstract

We estimate the marginal propensity to extract home equity (MPX), exploiting the housing wealth shock that occurs when a household buys a home priced below true market value. Extraction builds over time, with households extracting 4 percent of the windfall in the first year post-purchase to 13 percent, cumulatively, by year seven. Furthermore, we estimate a strong MPX among households not bound by collateral constraints, suggesting important wealth effects. Our results imply substantial lags in the transmission of housing wealth shocks to expenditures, advancing the understanding of how monetary policy and other macro events affect spending through house prices.

Keywords: Marginal propensity to consume, equity extraction, housing, house prices

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†alvaro.a.mezza@frb.gov

‡daniel.r.ringo@frb.gov

§kamila.sommer@frb.gov

1 Introduction

The strong co-movement between house prices and aggregate spending has long prompted economists to investigate the causal link between housing wealth and household's propensity to spend it, particularly through the use of collateralized borrowing (i.e., equity extraction). For the conduct of macroeconomic and monetary policy, understanding the full dynamic path of how households convert housing wealth into expenditures is critical for forecasting aggregate demand effects and calibrating policy responses. However, the estimation of the marginal propensity to extract equity presents significant empirical challenges, primarily due to the endogeneity of housing wealth to other determinants of consumption and investment at both individual and regional levels. Moreover, existing estimates predominantly focus on short-run responses, potentially missing substantial adjustments that occur over longer horizons and understating the cumulative economic impact of housing wealth shocks.

In this paper, we provide new estimates of the marginal propensity to extract equity (MPX), exploiting individual-level shocks to housing wealth that occur when a household fortuitously buys a house for a price below its true market value. We contribute to the existing literature, which we review in detail below, in three key ways. First, our empirical design enables us to trace the evolution of the MPX over an extended period following home purchase. In particular, we find the effect of this equity windfall builds up gradually over time, from 4 percent of the windfall being extracted in the first year after purchase to approximately 13 percent by year 7, for a long-run MPX of 0.13. This extended time frame advances a literature that has focused on more contemporaneous effects, and reveals the relatively long lags in the transmission of housing wealth shocks to spending.[1] Second, by utilizing individual-level shocks, we can control flexibly for local trends that potentially confound studies employing shift-share instruments common in the U.S.-based literature. Third, we provide new evidence on the importance of wealth effects in driving the MPX, finding a large effect among households who are clearly not collateral constrained. This

[1] We also show that other consumer borrowing is little changed in response to windfall equity over the 7-year window, suggesting the equity extracted is spent, rather than being used to pay down or substitute for other consumer debts.

finding complements an empirical literature that has focused on evidence for the importance of binding collateral constraints. A strong wealth effect channel predicts a pro-cyclical MPX, which we also show evidence for.[2]

Our analysis utilizes an administrative dataset that merges millions of FHA mortgage loans originated between 2007 and 2015 with subsequent borrowing information on those households through 2022 from Equifax credit reports and property sale and lien histories from Cotality's deeds data. Our identifying shock occurs when a home buyer purchases a home below its true market value. We measure this shock to the buyer's wealth at purchase as the (positive) difference between a third-party appraisal of the home's value and the purchase price actually paid. This "excess equity" is the windfall the borrower receives. Using our data on individual loan and credit bureau records, we are uniquely able to trace out the effects of these shocks on borrowing and other financial decisions over the subsequent seven years.

For an identification strategy exploiting this shock to be valid, several conditions must be met. For one, appraisals in excess of the purchase price must actually capture the true value of the home. To validate the measure, we match the FHA loan data to deeds records to determine the price each home received from its *next* sale. We find that home appraisers are quite accurate when they deem a home's purchase price is below its market value. Indeed, we show that the gap between appraised value and associated purchase price predicts the growth in that home's subsequent sale price over county-level trends nearly one-for-one. The difference between appraised value and sale price thus represents an accurate measure of the shock to the borrower's wealth acquired at the time of the initial purchase.[3]

Furthermore, to the extent that finding a home priced substantially below market is a matter of luck, windfall equity can be considered a random endowment and its correlations with subsequent outcomes can be treated as causal. However, the concern is that buyers

[2]See Guren et al. (2021) for a model of the cyclicality of equity extraction.

[3]Several papers in the literature have highlighted the incentives that can cause appraisers to write inacurate appraisals (see Conklin et al., 2020, Calem et al., 2021, and Fout et al., 2022, for example). As this literature explains, and as we we discuss in Section 3.1, these concerns apply asymmetrically to cases in which the true value of the house is *below* the contracted value. The skewed incentives disappear for homes whose true value is above the sale price, hence, as we show, appraisers become quite accurate in this region.

who pay below-market prices may be a selected group—represented, for example, by savvy home buyers—whose tendency to extract home equity may differ systematically from the general population. If so, correlations between equity windfalls and subsequent borrowing and spending would reflect these selection effects in addition to the effect of the equity itself.

To address these endogeneity concerns, we proceed in three steps. First, we show that windfall equity is slightly more likely among first-time home buyers, and slightly negatively correlated with borrower credit score—findings at odds with the narrative of buyer savvy. Rather, we find a strong negative correlation between windfall equity and borrower income. Since mispricing is more likely among smaller, older, cheaper homes that have fewer close comparison sales to anchor asking prices to (Jiang and Zhang, 2022), the lower-income households searching in this sector are more likely to match with a home that is significantly underpriced.

This finding does raise the concern that lower-income borrowers may be more aggressive bargain hunters, for example, and have different propensities to extract equity than the general population. In a second set of tests, however, we show that the correlations between windfall equity and subsequent extraction are invariant to the inclusion or omission of a rich set of borrower controls, including a measure of first-time homebuyer status, flexible controls for borrower income and credit score at origination, and county-by-month fixed effects. If there are any omitted variables biasing our estimates of MPX, they must be uncorrelated with any of this extensive set of controls. That is, while borrower income is correlated with the probability of receiving windfall equity, neither income nor any unobservables closely correlated with income mediate that equity's effect on future borrowing.

Third, we exploit the fact that some home buyers in our sample took more than one FHA mortgage purchase loan over the period our sample covers. We use these repeat observations to test whether the repeat-buyers exhibit a consistent ability in getting good deals across their home purchases—that is, whether there exists a non-luck component to obtaining a home equity windfall. To this end, we regress the excess equity the buyer obtains from their next purchase on the excess equity from their current purchase. Across specifications, we find that the correlation between current and future excess equity is close to zero, suggesting

little role for skill of the buyer in determining the size of the equity windfall. The lack of a correlation between current and future excess equity supports our treatment of the distribution of excess equity as essentially as good as random.

A large literature documents positive correlations between housing wealth and household consumption. However, these correlational estimates face severe identification challenges.[4] In the context of the U.S., recent studies have striven to address endogeneity concerns by instrumenting for house prices using shift-share instruments. In a seminal study, Mian et al. (2013) instrumented for house prices with measures of local housing supply (Saiz, 2010) to estimate the response of bank card spending and auto title registrations over the 2006-2009 housing bust.[5] Building on their approach, Aladangady (2017) instrumented for house prices with measures of local housing supply interacted with interest rates to estimate the marginal propensity to consume (MPC) in the Consumer Expenditure Survey. Guren et al. (2021) exploited differences in city-level exposures of house prices to regional cycles to estimate the MPC, proxied by retail employment. Graham and Makridis (2023) instrumented for local house prices with differential fluctuations in the pricing of various hedonic components of housing interacted with their local prevalence and estimated its effect on nondurable household consumption expenditures. The common feature of these studies, a geographic shift-share approach, potentially suffers from bias due to correlations between local shocks and initial conditions (the "share" variables)—see Davidoff (2016), for example. To the best of our knowledge, our paper is the first that uses within-market, individual-level shocks to elicit the MPX out of housing wealth in the U.S.[6]

[4]Early studies using either aggregate time-series data or household level panel data (see, e.g., Case et al., 2013, Lettau and Ludvigson, 2004, Campbell and Cocco, 2007, Carroll et al., 2011, Attanasio et al., 2009, or Bhutta and Keys, 2016) typically estimate marginal propensities to consume (MPCs) out of housing wealth between 2 and 9 cents per dollar. Housing wealth changes are not randomly assigned across households or regions—they correlate with omitted variables such as local economic conditions, income expectations, or credit availability. Consequently, correlational estimates of housing wealth effects likely suffer from substantial bias.

[5]Mian and Sufi (2011) are the first to use this instrument but focus on changes in total household leverage (which is not directly tied to spending) during the 2002-2006 housing boom.

[6]Other authors have also used individual-level variation to estimate MPCs out of housing wealth in other countries. For example, Andersen and Leth-Petersen (2021) use Danish survey respondents' estimates of their homes value to estimate that households spend 3 to 5 percent of unanticipated house price increases in the next year. However, it is difficult to directly compare the size of these estimates to those for the U.S. as the marginal propensity to extract and consume home equity may depend on institutional settings. For example, in the U.K., the prevalence of mortgages with an initial fixed-rate period followed by a floating-rate period

While the existing studies have highlighted the importance of differentiating between short-run and longer-run MPC responses, none of the studies cited above has been able to trace out the size of the effect over time. For example, Aladangady (2017) estimated a contemporaneous response of spending of 4.5 cents for every dollar of housing wealth shock, while Guren et al. (2021) estimated 3.3 cents on the dollar within one year of the receipt of the shock, and Graham and Makridis (2023) estimated the 1-year non-durable MPC to be just under 1 cent on the dollar. Meanwhile, Mian et al. (2013) estimated a somewhat larger cumulative MPC of about 5 to 7 cents on the dollar over a three-year window. Our estimates suggest that the effect continues to accumulate past three years, gradually levelling off through year 7 following the housing wealth shock. With the home equity of U.S. households having grown approximately $15 trillion dollars since the onset of the COVID-19 pandemic, our estimates suggest this wealth could fund hundreds of billions of dollars of annual expenditures for many years.

Additionally, our estimation approach allows us to shed new light on the important question of mechanism. Straightforward wealth effects can cause increased extraction, as richer households want to spend more and increase borrowing against their home equity to fund it. Housing wealth can also increase extraction by easing collateral constraints, as lenders allow higher borrowing limits for households with more valuable collateral, so constrained households increase their borrowing when they receive a positive home equity shock. Several studies have pointed to this collateral constraint channel as the mechanism of action (see, for example, Mian et al., 2013, Aladangady, 2017, and Cloyne et al., 2019). In contrast, Kaplan et al. (2020) provide an alternative explanation derived from the view point of standard consumption theory, with the economic mechanism driven by a wealth effect, without any role for credit constraints. We test for the importance of wealth effects by isolating a set of geographic markets and time periods in which essentially all homeowners should be free of collateral constraints due to rapid recent home price appreciation (those

induces households to regularly refinance. Cloyne et al. (2019) exploit the interaction of these predictable refinancing events with house price fluctuations to estimate a house price elasticity of loan demand of 0.2 to 0.3 between two refinancing events, typically 2-5 years apart. These large estimates, relative to literature based on U.S. data, may be due to the salience of additional borrowing brought on by the incentive to regularly refinance.

experiencing over 75 percent house price growth in a 7-year period). Even among this unconstrained group, we find MPXs that are as large as in our overall estimation sample, suggesting an important role for pure wealth effects.

Finally, we advance the literature by studying the release of equity by sale of the property. We find that home equity windfalls have a very small effect on the household's probability of moving. Conditional on moving, however, greater windfalls lead to greater housing investment in their next home. For every dollar of initial housing wealth, movers increase their next down payment by 37 cents and the purchase price of their next home by 61 cents. The quality of the neighborhood the household moves to is unaffected, however.

A caveat to our findings is that we study effects of a housing wealth shock among a particular population (FHA borrowers) who received their wealth shock at the time of home purchase. The MPX out of this shock could be different from the MPX of the overall population. That said, our estimated MPX in the first year post-shock is in line with estimates of the contemporaneous MPX or MPC in the literature. Furthermore, we show continued effects on extraction many years subsequent to the shock, suggesting that the short-run dynamics of spending around home purchase are not driving our results.

2 Data

2.1 Data Construction

We combine several different sources of loan- and property-level data for this project. The primary sample consists of FHA loans for the purposes of home purchase with an insurance endorsement date between 2007 and 2015. The Department of Housing and Urban Development (HUD) directly provided the data for these loans, including borrower and property characteristics at mortgage loan origination. Crucially for our study, the data contain both purchase and appraised values of the home, which we later use to construct our measure of equity windfall. We restrict the sample to loans against single family properties and drop Section 203K loans (loans for the dual purpose of home purchase and improvement). This

leaves us with 6.6 million loans.

To track the subsequent borrowing of homeowners associated with the FHA mortgage loans, we use the Equifax Credit Risk Insight Servicing McDash (CRISM) data, provided jointly by ICE/McDash and Equifax. These data combine monthly mortgage servicing records from ICE/McDash with credit bureau records of borrowers from Equifax for approximately two thirds of the U.S. mortgage market. Credit bureau records continue to be populated in the CRISM data until six months after the termination of the mortgage loan, so these data allow us to observe equity extraction after the initial home purchase as well as non-mortgage borrowing by the same individual. We match observations in the CRISM and FHA data using ZIP code and tract information, credit score at origination, month of origination, and loan amount. This leaves us with approximately 3.9 million loans with a unique match between the two data sets.

We follow home buyers in the CRISM data up to seven years after their home purchase, so our sample covers equity extraction events from 2007 through 2022. These years encompass some of the largest swings in housing market conditions the country has experienced. Home owners kept extracting equity through it all, however. Even in the teeth of the housing bust in 2009 and 2010, over 5 percent of home owners with a mortgage extracted some equity each year (see Bhutta and Keys, 2016).

Following Anenberg et al. (2025), our baseline definition of equity extraction borrowing includes the origination of a new HELOC, closed-end second lien, or cash-out refinance loan. A refinance is identified as a new first lien that appears within six months of the payoff of the original first lien without the borrower moving. We consider a refinance to be a cash-out if the amount of the new lien is more than $5,000 plus two percent of the payoff amount of the old loan greater than that payoff amount. As in Anenberg et al. (2025), this cushion allows for the common practice of borrowers financing the closing costs of fundamentally rate-and-term refinances without a cash-out purpose.

Occasionally, when a borrower prepays their loan or refinances, the servicer of their next loan does not start reporting to the credit bureaus within six months of the old loan prepaying. In these cases, the characteristics of that next loan do not appear in the CRISM data.

To fill this gap, we augment our FHA-CRISM data with the lien and transaction records from deeds data collected and cleaned by Cotality. Notably, Cotality provides a unique property ID which can be used to then observe any subsequent refinancings or sales (including the sale price) of properties in our FHA-CRISM sample. While the deeds data cover approximately 98 percent of residential real estate transactions in the U.S., the reporting of liens associated with these transactions varies by jurisdiction. For the subset of deeds with a recorded mortgage lien, we match each deed record to the initial, FHA-financed purchase of the home using Census tract, closing month, loan amount, and interest rate (if recorded on the deed).[7] Restricting to unique matches, we have 1.4 million home purchases that we can link between the FHA, CRISM, and Cotality data sets.

The resulting FHA-CRISM-Cotality data set allows us to identify the missing refinance transactions in the CRISM data (i.e, when a loan prepays without another first lien appearing in CRISM). If the loan prepays and another lien appears in the deeds data against the property within six months without the property transacting, we consider the borrower to have refinanced. We then use the amount of the new lien to define if the refinance was a cash-out. If the property transacted in that six month time window, we consider the borrower to have instead moved. In addition, the merger of the deeds data allows us to track equity extraction through home sales. The price home sellers get for their home is not captured in CRISM, but is available in the deeds records.

Equity extracted via the sale of a home may not stay extracted for long. In particular, many households will reinvest their proceeds into their next home if they are moving between owner-occupied houses. To measure how much of the extracted equity is put back into residential investment, we need to observe the equity they hold in their next home (i.e., the difference between its purchase price and the amount of their next mortgage). We do this for the set of borrowers whose subsequent mortgage also happens to be in the CRISM data, linking them via Equifax's individual identifier.[8] Finally, we merge in county-level house price data, sourced from Zillow, and average adjusted gross income (AGI), sourced from the

[7]Deeds associated with all-cash home purchases do not have a lien associated with those deeds.

[8]The deeds data also contain information on subsequent mortgages, but in the deeds data these mortgages are associated with the property and not the borrowers.

Internal Revenue Service.

In what follows, we measure the total amount of equity extracted within t years of the borrower purchasing their home as the sum of the maximum balance on new HELOCs and closed-end second liens originated within t years since purchase, and any amount extracted by cash-out refinance.[9]

2.2 Summary Statistics

Summary statistics describing borrowers in our sample at origination are provided in Table 1. FHA home purchase borrowers tend to have lower credit scores and incomes than conventional mortgage borrowers, and are more likely to be first-time home buyers. Indeed, as shown in Table 1, the median borrower in our sample is a first-time homebuyer with a loan-to-value (LTV) ratio of over 97 percent, as most FHA loans include a down payment of only 3.5 to 5 percent. Moreover, many borrowers finance the upfront mortgage insurance premium the FHA charges, pushing their notional LTVs even higher. On paper, FHA borrowers have close to no home equity at origination.

We describe the financial behavior of our borrowers over the 7 years post-purchase, by year, in Table 2. In Column 2, we show the cumulative share of borrowers who extracted equity in the form of a second lien, HELOC, and cash-out refinance. Equity extraction is quite rare at first (unsurprising, given low levels of equity for most FHA purchasers), with about one percent of homeowners extracting equity in the first year following a home purchase. The share grows over time, however, with approximately 14 percent of borrowers having extracted equity by year 7 in our sample. The cumulative amount of equity borrowing similarly rises over time, from about $2,500 extracted on average in the first year post-purchase to over $7,700 extracted by year 7 (Column 3).

As mortgage loans season, the probability of a household moving rises (Column 4). In the first year post-purchase, 4 percent of households in our sample have moved, whereas about one third of our sample has moved by year 7. In Columns (5), we track the growth in

[9]The CRISM data following an individual loan end six months after the loan pays off. Our measures would therefore miss any second-lien home equity borrowing that occurs after a refinancing of the original purchase loan.

the amount of consumer debt that is not secured by a residence, which also grows over time.

3 Empirical Design

Our purpose in this paper is to estimate how homeowners respond (in particular, via borrowing) to a wealth shock in the form of increased equity in their homes. We do this by exploiting cross-sectional variation in the home equity of recent home buyers induced by the difference between the realized price they paid for their home and its true underlying value. We measure this true value by the results of a professional, third-party appraisal. In other words, we identify certain buyers who received a particularly good deal on their home purchase and, as a result, receive a positive home equity wealth shock when the purchase takes place. We then trace out the effects of this wealth shock on their behavior over the next several years, relative to otherwise similar home buyers who did not get such a good deal.

3.1 Appraisals and Excess Equity

Consider a home buyer, i, who uses a mortgage to purchase a home in year y for price P. As part of the mortgage underwriting process, the home's value is appraised by a third-party professional. After considering a range of factors, the appraiser judges that the home is worth A, with $A \geq P$ or $A < P$.[10] In cases where the appraisal exceeds the sales price of the property (i.e., $A > P$), we define the *excess equity* that home buyer i incurs from the transaction (the wealth shock) as $EE_i = A_i - P_i$.

The size of the appraisal A relative to the sales price P affects the mortgage underwriting process, but its effect is asymmetric, as the homebuyer's loan-to-value ratio (LTV) at

[10]When assessing the value of the property, appraisers almost universally rely on the comparable sales approach, which has four main parts (Fout et al., 2022). First, the appraiser inspects the subject property for observable characteristics, such as size, condition, and number of bedrooms. Second, the appraiser identifies comparable recent sales and listings. Third, the appraiser adjusts the price of comparable sales for the differences between these sales and the subject property. Finally, the appraiser applies weights to the adjusted prices of the comparable sales to settle on an assessed value for the subject property. In addition to the comparable sales approach, the income-generating approach can be used for investment properties and the cost approach can be used for new construction.

mortgage origination is calculated as the ratio of the loan value and the *minimum* between the appraised value and the sales price. Thus, the appraisal enters the calculation of the LTV only when the appraisal falls short of the sale price ($A < P$). For borrowers who are up against their lender's maximum LTV constraint, an appraisal that comes in below the sales price means they must either renegotiate the contract price or come up with extra down payment funds; otherwise, the loan is not originated. Buyers, sellers, and lenders (who may put the credit risk off to investors and insurers) are united in their desire for the appraisal to come in at the sale price. The resulting pressure may cause appraisers to deviate from their best estimate of the property's value and deliver an at-price appraisal even if they think the property is worth less (see, e.g., Conklin et al., 2020 and Calem et al., 2021). This incentive structure may explain the suspiciously large number of appraisals that come in almost exactly at the contract price.

The situation is different when the appraiser think the value of the home is greater than the sale price ($A > P$), however. No other party has an incentive to care about A, provided it is at least equal to P.[11] The appraiser only has their professional reputation to consider, and can honestly report their best estimate. Indeed, in Section 4.1, we show that appraisers are quite accurate when they deviate positively from sale prices: excess equity predicts higher subsequent sale prices nearly one-for-one.[12]

In Figure 1, we plot the empirical distribution of the ratio of appraised value to sale price of FHA home purchase loans in our estimation sample. Consistent with the literature, we find a large mass of appraisals exactly at or just above the sale price. Appraised values even slightly below the sale price are rare—only about 2 percent of all loans have a ratio of appraised value to sale price less than one.[13] The loans that managed to get originated

[11]The appraisal is generally only valid for the origination of the loan associated with it. Any future equity withdrawal transactions usually cannot use the appraisal associated with the purchase loan, so a high appraisal only increases the equity the home owner can borrow against to the extent that future appraisers will agree with the original one (i.e., if it reflects the true market value of the home). However, in certain cases, for homes with very recent appraisals (e.g., from a home purchase within the last few months), some lenders may waive the appraisal requirement.

[12]In testing the accuracy of appraisals, Fout et al. (2022) compare the appraised values to predictions from a Fannie Mae automatic valuation model and find the Automatic Valuation Models are generally close to the appraised value, suggesting that appraisals are not too far off from model, on average.

[13]Using GSE mortgage loan application data, Fout et al. (2022) find that about 10 percent of home-purchase loan applications have initial contract prices above the appraised value but most of these loans

despite a low appraisal are heavily selected, as they are associated with borrowers who were most likely able to come up with additional down payment to meet the lender-required LTV cutoff. We therefore limit the estimation sample to loans with an appraised value equal to or above the sale price.

The right half of the distribution is much fatter, and this is the variation we exploit. In particular, approximately 45 percent of the sample has an appraised value within one percentage point of the sale price, while a further 45 percent has an appraised value between one and 10 percent above its sale price. In addition, there is an appreciable mass of loans with very high deviations between appraised value and sale price, including a few where the difference is more than 20 percent.

A key consideration is whether the distribution of the windfall can be treated as random. In Section 5, we will show evidence that these wealth shocks from buying under-priced homes are distributed essentially as good as randomly with respect to the borrower's propensity to extract.

3.2 Estimation Strategy

We model various borrower outcomes (such as the probability of extracting equity, or the amount extracted as a percentage of sale price), Y, measured t years post-purchase, as a flexible function of excess equity ($EE_i = A_i - P_i$), measured as a percentage of sale price (P_i). That is,

$$Y_{i,t} = \alpha_t + \sum_{k=1}^{K} \beta_t^k \mathbb{1}\left[\frac{k}{100} \leq \frac{EE_i}{P_i} < \frac{k+1}{100}\right] + \boldsymbol{\gamma_t X_{i,t}} + \epsilon_{i,t} \tag{1}$$

where k represents one-percentage point buckets of excess equity and $\mathbf{X}$ is a vector of individual-level controls. Because the identifying variation happens at the individual level, we can include location-by-time fixed effects in $\mathbf{X}$, which eliminates the location-specific endogeneity concerns that trouble the use of local house price growth or shift-share instruments

renegotiate the contract price, resulting in only a small share of loan applications that fail the appraisal process.

common in the literature.

The parameters β_t^k indicate the effect of a given level of excess equity on the outcome variable, relative to an otherwise similar borrower with zero excess equity. We estimate effects on both the extensive and intensive margins of equity extraction—that is, both whether and how much to borrow. For the *extensive* margin estimates, we take Y as a dummy variable indicating any amount of borrowing. We can then interpret, for example, the coefficient $\hat{\beta}_2^{10}$ as the estimated effect of having an appraised home value 10 percent greater than the price paid on the probability of extracting equity within 2 years of that purchase.

On the *intensive* margin, we take Y as a continuous measure of how much the household has borrowed. Our interpretation of, for example, the coefficient $\hat{\beta}_5^{20}$ is then the estimated effect of having 20 percent excess equity on the amount extracted within five years of purchase. The fraction of excess equity extracted from a property in equity bucket k as of year t is then defined as $\frac{\hat{\beta}_t^k}{k}$. These ratios of estimated βs to excess equity buckets (i.e., $\frac{\beta}{k}$) represent the marginal propensity of households in each bucket to extract equity through year t.

To reduce the number of parameter estimates and facilitate comparisons with the existing literature, we also run regressions in which we model total equity extracted in dollars (again represented below by Y) as linear in dollars of excess equity. That is,

$$Y_{i,t} = \alpha_t + \beta_t EE_i + \boldsymbol{\gamma_t} \boldsymbol{X_{i,t}} + \epsilon_{i,t}, \tag{2}$$

where β_t represents the fraction of the excess equity gained on purchase that has been extracted by t years after purchase. This is the marginal propensity to extract equity (MPX), a key parameter for understanding the macroeconomic consequences of house prices. In other words, equation 2 models the β^ks from equation 1 as linear in k, and the slope is interpretable as the sample average marginal propensity to extract.

4 Results

In this section, we present our estimates of the effect of a housing wealth shock on equity extraction. We begin in Section 4.1 with an assessment of the accuracy of home appraisals when they exceed the contracted sale price, validating our measure of housing wealth. We then turn to our first set of main results in Section 4.2, estimating the effect of excess equity on the probability of using various forms of equity extraction over time. Finally, in Section 4.3, we estimate the marginal propensity to extract equity.

4.1 Accuracy of Appraised Home Values

Throughout the paper, we use the difference between the appraised value and sale price of a home as our measure of excess equity—the wealth shock a home buyer receives from buying an under-priced house. First, however, we need to establish that the appraised value is actually a good measure of the true value of the home. By "true value", we mean the value the homeowner will be able to borrow against in the future, or the expected realized sale price from a subsequent transaction. When appraisals deviate substantially from sale prices, it would be reasonable *ex ante* to suspect that the appraiser, rather than the home's seller, has misvalued the home.

We test appraiser's accuracy by estimating the predictive power of the appraised value, conditional on actual sale price, on the *next* sale price of the same property. To do this, we use a version of equation 1 (we include all properties that have a subsequent sale, regardless of the timing, so the t subscripts are omitted from the parameters). The natural log of the subsequent sale price (Y) is regressed against indicators for 1 percentage point buckets of excess equity. In $\mathbf{X}$, we control for the log of current sale price in year y, as well as the growth in county-level house prices between year y and $y+t$ (when the next sale occurred). We additionally control for county-by-month fixed effects and flexible controls for borrower income and credit score, and first-time-buyer status.[14] If appraisers were perfect oracles, we would expect subsequent sale price to increase one-for-one with excess equity. If, on the

[14] In the Appendix, we show that results are robust to dropping these controls.

other hand, appraisers had no additional expertise and added only random noise to the sale price, subsequent sale price should be uncorrelated with excess equity and the $\hat{\beta}^k$s should be zero.

Estimates of the β^ks are presented in Figure 2. Relative to a home that was appraised at exactly its sale price, each one percentage point increase in excess equity increases its subsequent sale price by close to one log point, particularly when measured excess equity was 10 percentage points or less. This suggests appraisers are very accurate on average, and measured excess equity is a good proxy for the true value of the home, when the appraisal exceeds sale price. As excess equity increases above 10 percent, accuracy deteriorates somewhat. Extremely high values of excess equity are rare (see Figure 1), but they do still contain important predictive information. A home buyer whose purchase appraised fully 20 percent above its sale price would be expected to reap an approximately 15 percent premium upon resale.

Appraisals are thus quite accurate when they deviate above the sale price by single-digit percentages, which encompasses the bulk of our estimation sample. An extremely high appraisal relative to sale price is less trustworthy, but still indicates a large amount of "true" excess equity. We therefore use the difference between appraised value and sale price as our measure of excess equity throughout the paper.

A potential confounder to the conclusion of this section is the possibility that households borrow against their excess equity for the purposes of home improvement. This behavior could increase the subsequent sale price of the home and bias upward the estimated partial correlation between appraised value and subsequent sale price. However, we show in Appendix Figure A.2 that the same relationship between appraised value and subsequent sale price holds among households who did not engage in any equity extraction borrowing, suggesting home improvements are not a meaningful confounder.

4.2 Effects on the Probability of Extraction

A shock to housing wealth can affect both the extensive and intensive margins of equity extraction. In this section, we begin with the extensive margin: the effect on the probability of engaging in any additional borrowing against home equity. Specifically, using equation 1, we regress an indicator for having engaged in any equity extraction in the t years since purchase on indicators for buckets of excess equity. The outcome variable is cumulative, such that a home buyer who extracts equity in year t ($Y_{i,t} = 1$) will also be measured as $Y_{i,t'} = 1$ for all $t' > t$. Our baseline regressions control for county-by-month fixed effects, a first time buyer indicator, and flexible functions of credit score and income at purchase.

Results are presented in Figure 3, showing the estimated β_t^ks for excess equity buckets $k = \{1, \ldots, 30\}$ across years $t = \{1, \ldots, 6\}$. There is a positive relationship between excess equity and the probability of extraction already in the first year post-purchase, but the slope of the relationship is quite shallow. Over time, the strength of the relationship builds. For example, a home buyer who gets a 10 percent excess equity wealth shock upon purchase is approximately 1 percentage point more likely to extract equity in the first year than a buyer with zero excess equity. By the third year they are 3 percentage points more likely to have extracted equity, and by the sixth year 4.5 percentage points more likely. Notably, the relationship between excess equity and probability of extraction retains its nearly linear pattern over time, with the slope increasing year-to-year.

The presence of housing wealth clearly prompts homeowners into extracting equity. The total effect is quite lagged, however. Housing wealth shocks continue to induce new home equity borrowing at least six years after they are experienced. In the next section, we estimate what fraction of this wealth is extracted.

4.3 Marginal Propensity to Extract

We next turn to the intensive margin of equity extraction. To start with, we use equation 1 to flexibly estimate the amount of equity extracted as a percentage of sale price (i.e., $Y = 100 \cdot \frac{B}{P}$) as a function of excess equity buckets k. Note that outcomes are expressed in percentage

points for comparison with the excess equity buckets, as both the outcome and excess equity are defined as percentages of the sale price. Once again, the outcome variable is cumulative (the maximum amount extracted by year t) and regressions include controls for county-by-month fixed effects, first time buyer status, credit score, and income.

Results by excess equity buckets $k = \{1, \ldots, 30\}$ across years $t = \{1, \ldots, 6\}$ are presented in Figure 4. From our discussion in Section 3.2, recall that the ratios of estimated βs to excess equity buckets (i.e., $\frac{\beta}{k}$) represent the marginal propensity of households in each bucket to extract equity through year t. Thus, for example, a $\hat{\beta}_1^{20}$ (i.e., the effect of having 20 percent excess equity on extraction within one year of purchase) of 0.5 means that households with 20 percent excess equity extracted $\frac{0.5}{20} = 2.5$ percent of that equity within one year of loan origination. Like the extensive margin effects, the effects on dollars extracted increase over time. Households with 20 percent excess equity at purchase extracted 5 percent and 7.5 percent of it by years 3 and 6, respectively. Again, the relationship between excess equity and the amount of equity extracted as a percentage of sale price exhibits a linear pattern over time, with the slope increasing year-to-year.

Finally, we estimate the average marginal propensity to extract (MPX). The MPX is the central focus of the literature on house price effects, as it is a key parameter for macroeconomics and policy decisions. The average MPX is represented in equation 2 by the coefficient on excess equity, β_t. In this specification, we model the β^ks from equation 1 as linear in k, consistent with our findings in Figures 3 and 4 that revealed a nearly linear relationship between measures of equity extraction on the extensive and intensive margins and excess equity buckets k. In Figure 5, we plot the estimated effect of a dollar of excess equity on equity borrowing by year since loan origination, t. In the first year post-origination, we estimate an MPX of 0.04, approximately in line with estimates of contemporaneous MPXs and MPCs estimated in the literature. As the figure shows, the marginal propensity to extract equity via borrowing rises with time, continuing to increase even seven years after the housing wealth shock. The rate of increase is clearly slowing over time, however. By seven years post-shock, the marginal propensity to have extracted equity is approximately 0.13, meaning that thirteen cents of every dollar of additional housing wealth was borrowed

against.

5 Tests of Endogeneity

Can we interpret the partial correlations between excess equity and subsequent equity extraction, obtained by estimating equations 1 and 2 using OLS, as the true causal relationship? For consistent estimation, we need $E(\epsilon|EE, \mathbf{X}) = 0$. That is, whatever forces grant certain borrowers good deals on their home purchases cannot be correlated with the forces that lead them to extract equity, except through the excess equity itself. This would be the case if a buyer's chance of matching with a seller who has set a below-market asking price is more or less a matter of random luck. By contrast, if certain buyers have an unobservable skill that allows them to find good deals, the consistency of our estimates is threatened. These hypothetical savvy-type buyers could have systematically different preferences for equity extraction than their less savvy peers, leading to omitted variable bias.

We investigate this potential endogeneity problem in several ways. First, we look at the characteristics of the types of buyers who obtain high levels of excess equity, to see if they are consistent with a story of random luck or buyer savvy. Specifically, we use equation 1 to estimate the correlation between excess equity and borrower credit score, first time buyer status, and income (as measured at loan origination), controlling for county-by-month fixed effects.

Results are presented in Figure 6. There is not a consistent relationship between excess equity and credit score or first time buyer status among those with less than 10 percent excess equity, where most of our sample lies. It seems that very high levels of excess equity are slightly more common among first time buyers and those with lower credit scores, confounding the story of experienced, sophisticated buyers getting the good deals.

Instead, we see a very strong negative relationship between excess equity and borrower income. This finding dovetails with past research that has found that smaller, older homes are more likely to be mispriced because of the lack of similar sales for comparison (Jiang and Zhang, 2022). As a result, the lower-income buyers who tend to search in this market

segment could be more likely to luck into finding a home that has been priced well below its true value.

Even if the variation in excess equity is entirely driven by the supply side (i.e., by seller mistakes in the pricing of their for-sale homes), we still need to be worried about selection effects. Lower-income home buyers may have different propensities to extract equity than higher-income buyers. We therefore control for income (as well as credit score and first-time buyer status) in our main regressions.

Next, we show that our MPX estimates are not affected by the inclusion or exclusion of a rich set of controls. If unobservable determinants of excess equity are correlated with borrower income, credit score or first time home buyer status, or vary over time and geography, they might also be correlated with other determinants of equity extraction. However, as we show in Figure 7, none of these controls meaningfully mediates the correlation between excess equity and extraction. This suggests that selection on income (or on unobservables highly correlated with income), for example, is not an important source of bias.

Finally, we directly test whether buyers with higher excess equity are of an unobservably different type. To do this, we take advantage of the fact that some buyers make more than one home purchase with an FHA loan across our sample period. Using individual-level identifiers in the credit bureau data, we can link these repeated purchases. Just over 23,000 such borrowers appear in our data. For these buyers, we get multiple observations of the excess equity they are able to obtain when buying a home. This allows us to estimate the partial correlation between excess equity on subsequent purchases—testing whether buyers show a consistent ability to get good deals, or whether obtaining excess equity is a matter of luck. If excess equity is distributed as good as randomly, this partial correlation should be zero.

To investigate the existence of a latent buyer ability to buy a home at a below-market price, we re-purpose equation 2, regressing the excess equity the buyer will obtain from their next purchase (future excess equity) on the excess equity from their current purchase. If getting good deals was purely a matter of skill, we would expect the coefficient on excess equity to be close to one. If good deals were purely a matter of luck, the coefficient should

be zero. Results are presented in Table 3.[15] Regardless of whether equity (and future excess equity) are measured in dollars or percentages of sale price, and whether individual-level controls are included or omitted, the partial correlation between current and future excess equity is close to zero and not statistically significant. This means any difference in permanent skill across home buyers explains at most a trivial fraction of the variation. Obtaining an excess equity windfall appears to be a matter of luck.

The evidence presented in this section suggests we can treat the distribution of excess equity as essentially as-good-as-random.

6 Equating the Propensity to Extract with the Propensity to Spend

Standard equity extraction tools (i.e., cash-out refinance mortgage loans, HELOCs, and second liens) enable households to match the timing and the size of equity extracted to the timing and the size of their spending and financing needs. The extracted equity can be used to finance spending, including consumption (Abdallah and Lastrapes, 2012), large home improvement projects (Aladangady and O'Flaherty, 2020), and small business investment (Lastrapes et al., 2022, Kerr et al., 2022). It may therefore be reasonable, as is common in the literature, to equate the marginal propensity to extract equity with the marginal propensity to spend.

This assumption is complicated by the presence of other consumer debt markets. On one hand, many households may use equity extraction products to pay down other, more expensive consumer debts. Anenberg et al. (2025), for example, find that the marginal equity extraction induced by the stance of monetary policy is almost entirely a substitute for other forms of consumer credit. The macroeconomic implications of equity extraction are very different if it represents a re-balancing of household liabilities, rather than new consumption or investment. On the other hand, consumer debt can also represent a channel by which

[15]The reported sample sizes in these regressions are lower than the 23,000 borrowers mentioned because singletons in our fine grid of fixed effects are dropped.

marginal spending out of home equity takes place. Via the wealth effect channel, households receiving a home equity windfall may choose to increase their spending without directly tapping into that equity.[16]

To explore how the housing wealth shock affects other consumer debts, we estimate the net effect of excess equity on the level of other consumer debt balances. We define our outcome variable, $Y_{i,t}$, as the dollar change in consumer debt balances over the t years after household i purchases their home. Consumer balances are summed over credit cards, auto loans, student loans, and other smaller categories. We re-estimate equation 2, finding the marginal propensity to turn dollars of home equity into dollars of consumer debt. If home equity borrowing induced by housing wealth shocks is primarily a substitute for other consumer borrowing, we would expect to see a negative effect. If the wealth effect causes households to engage in additional consumer borrowing, however, we would expect a positive effect.

Results are shown in Figure 8. There is no evidence of a meaningful effect of excess equity on other consumer balances. Taking the point estimate at face value, consumer debts increase by 1 percent or less of the value of the excess home equity. In the Appendix, we show this result holds for each consumer debt type individually, and without imposing the potentially restrictive linear form of equation 2. This null result presents an interesting contrast with the findings of Anenberg et al. (2025). While Anenberg et al. (2025) show that the marginal home equity extraction induced by a *monetary policy shock* is almost entirely a substitute for other consumer debt, we find that the marginal home equity extraction induced by a *housing wealth shock* has no discernible effect on other consumer debt.

Overall, our results provide support for interpreting our estimated marginal propensities to extract equity out of housing wealth shocks as marginal propensities to spend.

[16]In addition to increasing spending or paying down other debts, borrowers could reinvest the funds freed through equity extraction into other higher yielding financial investments (e.g., stocks or retirement accounts). However, since our sample skews toward lower-income, credit-constrained households and first-time home buyers, we think that these latter uses, such as stock market investment, are likely uncommon. Moreover, Kumar and Liang (2024) argue that extracted equity is instead used to reduce labor supply. Unfortunately, we do not have the data necessary to test for effects on labor supply.

7 Mechanisms

There are several distinct channels by which marginal housing wealth can induce homeowners to extract equity and spend. First, there is the wealth effect. Richer households will desire a higher level of expenditure, and, if their wealth is in the form of home equity, must liquidate a portion of that equity to fund it. Second, marginal housing wealth can ease collateral constraints which may be binding on some borrowers. That is, lenders impose a maximum LTV ratio on homeowners seeking to extract equity (either via second lien or cash-out refinance). A shock to housing wealth (the denominator of the LTV ratio) will increase the household's borrowing limit and hence the actual borrowing of any household whose desired level of borrowing was above the old limit.[17] The empirical literature has highlighted the role of collateral constraints, with Mian et al. (2013) finding larger MPCs in highly-leveraged neighborhoods and Aladangady (2017) finding larger MPCs among highly-leveraged borrowers.[18]

We disentangle the wealth effect from the collateral constraint effect by identifying a subsample of home buyers for whom the collateral constraint almost surely does not bind. For borrowers who are far from their borrowing limit, marginal additional home equity does not ease any collateral constraints. If collateral constraints were the exclusive channel by which housing wealth affected extraction, then the MPX among such unconstrained borrowers should be zero. Any marginal propensity to extract out of excess equity among the unconstrained population can therefore be attributed to a pure wealth effect.

Our estimator uses individual-level variation in housing wealth shocks, so we can estimate heterogeneous MPXs across time and space, including in markets where rapid house price growth has lifted essentially all borrowers off of the collateral constraint. For this test,

[17] Housing wealth shocks can also affect spending through a third channel, general equilibrium effects. That is, any additional spending by wealthier home owners may encourage employment growth triggering further spending by other parties, etc. See Arouba et al. (2026). Relatedly, Stroebel and Vavra (2019) found that housing wealth shocks increase markups as wealthier home owners' demand elasticities decrease, suggesting some of the increase in expenditures are absorbed by inflation. Some of these general equilibrium effect would be picked up in cross-market comparisons, such as the shift-share instrumental variables strategies commonly used in this literature. In contrast, the individual-level variation we exploit ensures we are picking up the partial equilibrium effect of a housing wealth shock.

[18] Kaplan et al. (2020) argue that the findings of Mian et al. (2013) could also be explained by a more standard model of wealth effects.

we restrict our estimation to the subsample of counties and origination years that experienced at least 75 percent price growth over the subsequent seven years.[19] These make up approximately 20 percent of our observations, and the mean price growth experienced by this subsample was 100 percent. Almost all home buyers in these counties and years, regardless of their initial excess equity shock, should have accumulated substantial equity to borrow against within a few years and be unbound by collateral constraints.

We estimate the MPX by year for this unconstrained group and plot it in Figure 9. The MPX estimated for the remaining 80 percent of our estimation sample is plotted in the same figure for comparison. The MPX of the unconstrained sample is at least as large as that of the general population—the point estimates suggest it is even slightly larger, although the confidence intervals overlap. This suggests the wealth effect is an important driver of the MPX. Even among borrowers who already have a substantial home equity cushion due to rapidly rising house prices, an additional home equity windfall increases their extraction by as much as it does among the more constrained population.

A potential concern with this test is that this 75 plus percent price growth does not happen all at once, so in the first few years post-origination even our "unconstrained" sample may in fact face some binding collateral constraints. If early-year constraints were driving the MPX in this group, we would expect the control group (borrowers without any initial excess equity) to be delayed in achieving their optimal level of borrowing, but to eventually be able to access it as price growth ultimately lifts them off of their collateral constraint. This would show up as a pattern of initially growing MPX out of excess equity, which then reverses and attenuates toward zero as all borrowers are able to reach their optimum regardless of initial excess equity. Instead, we see a cumulative MPX that remains strong through seven years post-origination, consistent with a wealth effect. In the Appendix, we show that a similar pattern of greater MPXs in less-constrained markets occurs when the samples are split out by price growth quintiles through each individual year post-origination.

Determining the strengths of the different potential mechanisms is important because they provide different predictions for how the marginal propensity to extract home equity

[19]County level price growth measured using Zillow's Home Value Index.

varies with the aggregate state. Consider first the collateral constraints mechanism. This operates through households just on the margin of their borrowing limit: their extraction will increase with their borrowing limit in response to a housing wealth shock. A similar increase in borrowing limit does not affect households whose equity positions are well below the limit (they are already at their bliss points) or those well above the limit (their equity extraction is constrained to be zero regardless). The MPX is thus determined by the density of the equity distribution of home owners around the maximum allowed LTV ratio. This density is likely to be highest when that maximum is closer to the central mass of the equity distribution, e.g., after recent house price declines have offset the reduction in loan balances due to amortization and home owners have been pushed back toward their borrowing limit. The collateral constraint channel thus implies stronger MPXs among those who have experienced a recent slump in housing markets.

The wealth effect channel, in contrast, operates on non-marginal (inframarginal) households. Home owners' optimal amount of home equity borrowing increases with their wealth, and so wealth shocks increase extraction all along the home equity distribution. The exception is households above the borrowing limit, whose extraction is still constrained to be zero. The MPX via the wealth channel is thus determined by the mass of the equity distribution of home owners below the maximum allowed LTV ratio. This mass will be lower after significant house price declines have pushed a large portion of the population above the LTV maximum. The wealth effect channel thus implies weaker MPXs among those who have experienced a recent slump in housing markets.

As shown in the model of Guren et al. (2021), the cyclicality of the overall MPX depends on which of the two channels is stronger, as the cyclical variations in their strengths may be partially offsetting. In Figure 10 we plot the estimated MPX contour for each origination year 2007 through 2015. As can be seen, the MPXs are notably muted for households that bought their homes in 2007 and 2008, i.e., those who immediately experienced a lengthy downturn of the housing market. MPXs are much larger for households that bought in 2012 and 2013, and who got to enjoy rapidly growing prices as the market recovered. This evidence supports the hypothesized dampening effect of inframarginally-constrained households associated with a

dominant role for the wealth effect.

These findings do not imply that there is no role for the collateral constraints mechanism. Certainly, some borrowers are bound by LTV limits and would increase their borrowing were these limits to relax. DeFusco (2018), for example, is quite convincing on this point, finding a significant borrowing response to changes in home equity borrowing limits holding housing wealth constant. However, in the presence of wealth effects, frequently binding collateral constraints can reduce the overall MPX, even as they raise the MPX for marginally constrained households. In particular, the large number of households who lost access to home equity borrowing due to GFC-era house price declines may have caused a reduction in overall MPX. This reduction could have tempered expenditures, contributing to subdued economic growth in the ensuing years, even as house prices started to rise again. Conversely, the rarity of binding collateral constraints during the Covid pandemic-era housing boom may have boosted the MPX, contributing to the high levels of expenditures in recent years.

8 Equity Extracted as Proceeds from Home Sales

To this point, we have been measuring equity extraction as the use of mortgage equity withdrawal products—cash-out refinances, home equity lines of credit, and closed-end second liens. However, homeowners can also liquidate the equity in their homes by selling the property. Therefore, estimates of total equity extraction that include home sales proceeds may be of separate interest, although—as we will argue—these estimates are more difficult to map into contemporaneous spending.

Since home buyers with excess equity from their purchase may wish to re-optimize their location or housing consumption in light of their increased wealth, we begin by testing for an effect of excess equity on the probability of sale. We re-estimate a version of equation 2, with the outcome variable defined as an indicator for whether the home buyer had moved within t years of purchasing their home. For this regression, we use excess equity expressed as a percentage of the purchase price (rather than in dollars).

Results are presented in Figure 11. Excess equity does seem to have some effect on

home buyers' probability of moving again, particularly in the early years post-purchase. However, even at the peak of its effect in year $t = 3$, the magnitude of the effect is quite small. Three years after the initial purchase, 10 percentage points of excess equity would be expected to increase the home owner's probability of having moved over that span by one half of a percentage point.[20] By the sixth year after the purchase, any effect on moving has disappeared. As with equity extraction, the estimates plotted here are cumulative over time, so a null result in year six means no net effect on the probability of having moved by then. Thus, the decision to move seems to be fairly inelastic to housing wealth shocks.

While the decision to move is not much affected by excess equity, the proceeds realized from sale clearly are: we showed in Figure 2 that subsequent sale prices increase nearly one-for-one with excess equity. What do moving households do with the equity they extract via sale of their home? As we just showed, the decision to move is largely exogenous to the excess equity shock, so the extraction is an incidental outcome of the move, rather than a deliberate goal. We therefore do not think it likely that much of the equity extracted this way would be spent contemporaneously on non-housing consumption. Rather, many moving homeowners will purchase another home and may reinvest the proceeds from the sale into their new home, either by paying down their next mortgage or purchasing a more expensive house.[21] Much of the remainder may be saved in other financial assets. For these reasons, we do not think the equity extracted via sale should be included in the measure of the marginal propensity to spend out of housing wealth.

Nevertheless, the different potential uses of equity extracted through sales are of independent interest, as they inform us how households tend to convert their wealth into additional consumption of housing services (either by buying a higher quality structure or moving to a more desirable neighborhood), or continuing to save it in various forms.

To understand what effect home equity has on movers' housing and financial choices, we use the sample of movers whose subsequent home purchase loan also happened to be

[20] From Section 4.2, the same amount of excess equity increases the borrowers probability of engaging in equity extraction borrowing by three percentage points by that point.

[21] Increasing the next down payment is a form of saving (i.e., deleveraging) rather than consumption. Purchasing a higher quality home also does not directly affect GDP if it is an existing structure.

captured in the ICE, McDash data. For these borrowers we can observe the sale price of, and the down payment they made on, that next purchase. We estimate the effect of dollars of excess equity on dollars of sale price and down payments using equation 2. As we did in Section 4.1, we run the regression on all of the immediately subsequent transactions and drop the time subscripts.

Results are shown in columns 1 and 2 of Table 4. For every dollar of excess equity the homeowner has in their current home, the purchase price of their next home increases by approximately 61 cents and their down payment on that home increases by 37 cents. Households apparently reinvest a substantial minority (37 percent) of their excess equity in their next home. They also increase the value of their next home by more than the increase in their down payment ($61 > 37$), indicating some additional leveraging of their extracted equity. Just under two thirds ($1.00 - $0.37 = $0.63) of the excess equity extracted from sale is reserved for other purposes. Unfortunately, we do not have data on these borrowers' other assets, so we cannot be sure what the remainder is used for. Likely much of it is saved in other financial assets.

Finally, we can ask whether the higher price that movers with excess equity pay buys them a better location. For movers in our sample, we take their next neighborhood to be the ZIP code of their next home purchase loan, if it occurs within seven years of the initial purchase and appears in the ICE/McDash data. We regress the change in local average house prices and taxable incomes (AGI) movers experience—both measured in percentage terms—against their excess equity, measured in percentage of initial sale price, and present results in columns 3 and 4 of Table 4. We do not find a meaningful effect on neighborhood quality. Rather than affecting their decision of where to move to, excess equity mostly seems to spur movers to purchase a higher quality structure.

9 Implications

Our finding of a large marginal propensity to extract home equity that persists for many years after the initial housing wealth shock has important macroeconomic implications. The home

equity owned by US households has exploded in recent years, increasing by approximately $15 trillion since 2020. In section 4.3, we found that 13 percent of marginal home equity had been extracted via borrowing seven years after the wealth shock. Current levels of home equity would therefore be predicted to support trillions of dollars of additional consumption and investment over the coming decade. Conversely, if house prices were to decline significantly (due, say, to persistently high mortgage rates), much of this additional predicted activity would be wiped away. Our estimates therefore suggest that the path of house prices has first-order implications for the business cycle.

Furthermore, our finding of a strong-but-lagged propensity to extract home equity complicates the conduct of monetary policy. The literature generally finds that monetary policy affects house prices with a lag of multiple years (see, e.g., Kuttner, 2014, Jarocinski and Smets, 2008, Williams, 2016, and papers cited therein). On top of this, we find that marginal equity extraction also operates with a multi-year delay. By implication, the monetary policy stance today will be affecting consumption and business activity many years in the future through these cumulatively lagged effects, when cyclical conditions may be very different. Again, our findings present an interesting contrast with those of Anenberg et al. (2025), who found the equity extraction response to a rate shock was a substitute for other consumer borrowing. Our findings suggest that no such substitution would occur when monetary policy operates through the house price channel. However, the long delays we describe mean this channel is unlikely to be an effective counter-cyclical policy tool.

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Table 1: Summary Statistics at Origination

	Mean	Median	Std. Dev.
Credit Score	693.9	688	53.3
LTV Ratio	95	97.2	5.6
First Time Buyer	0.79	1	0.41
Sale Price	193473	169000	106548
Appraised Value	197595	172000	107659
DTI Ratio	40.8	41.7	9.1
Income	69063	59328	41692
N = 1,351,482			

Note: This table reports summary statistics of the FHA home purchase loans in our estimation sample. Source: HUD.

Table 2: Summary Statistics Post-Origination

Year Since Purchase	Any Extraction Borrowing	Amount of Home Equity Borrowing	Moved	Consumer Debt Balance Growth
1	0.01	2475.27	0.04	4337.75
2	0.03	3019.26	0.07	6438.28
3	0.05	3757.72	0.11	7763.30
4	0.08	4614.97	0.17	8917.49
5	0.10	5528.03	0.23	9851.66
6	0.13	6624.39	0.28	10697.24
7	0.14	7720.48	0.33	11580.98
N = 1,351,482				

Note: This table reports average equity extraction and related activity for each of the seven years after the initial FHA home purchase origination. Source: HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Table 3: Regressions of Future Excess Equity on Current Excess Equity

	Future Excess Equity (%)		Future Excess Equity ($)	
	(1)	(2)	(3)	(4)
Excess Equity (%)	0.001	0.030		
	(0.003)	(0.024)		
Excess Equity ($)			0.001	0.001
			(0.001)	(0.001)
Individual-Level Controls	NO	YES	NO	YES
County-by-Month FEs	YES	YES	YES	YES
R^2	0.284	0.544	0.323	0.595
N	18828	10812	18831	10813

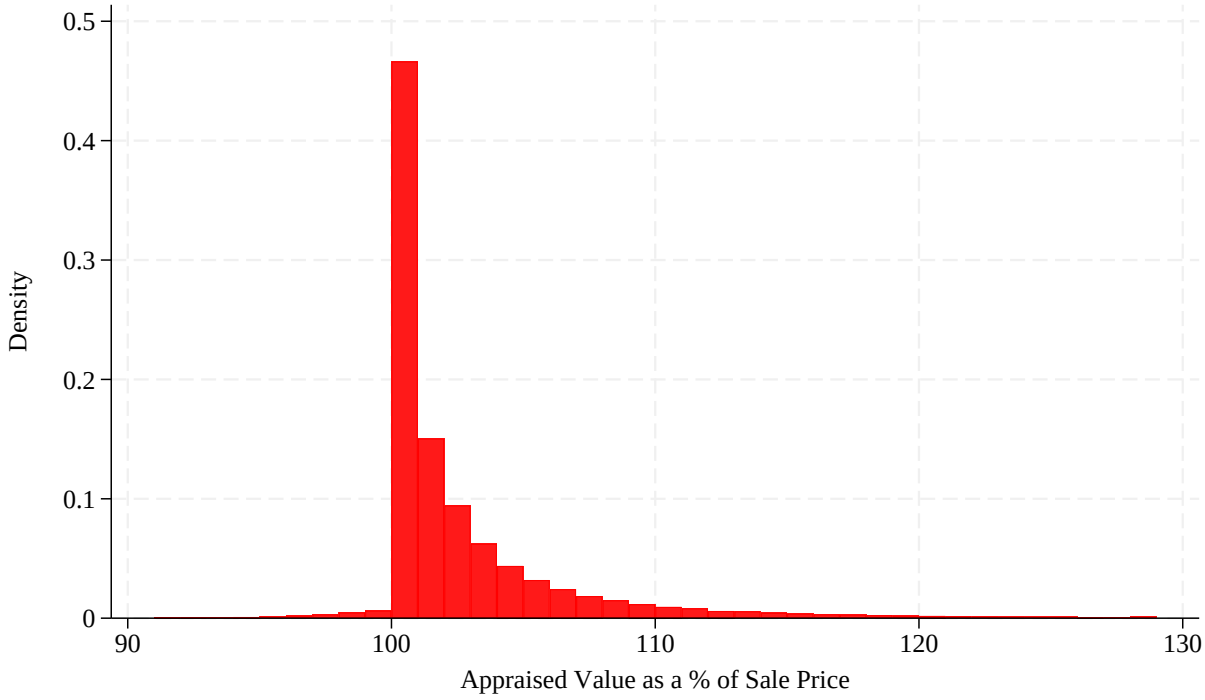
Note: This table reports the estimated partial correlation between excess equity in the borrower's current home and in their next one. See Section 5. Sample limited to individuals who obtained more than one FHA purchase loan in our estimation sample over the years 2007-2015. Individual-level controls include indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. Standard errors robust to clustering at the county level are shown in parentheses. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.
***: $p < 0.01$
**: $p < 0.05$
*: $p < 0.1$

Table 4: Effect of Excess Equity on Next Purchase Loan and Next Neighborhood

	Purchase Price ($)	Down Payment ($)	Neighborhood Income (%)	Average Neighborhood House Price (%)
	(1)	(2)	(3)	(4)
Excess Equity ($)	0.609***	0.374***		
	(0.087)	(0.062)		
Excess Equity (%)			-0.018	-0.012
			(0.022)	(0.009)
R^2	0.401	0.088	0.163	0.194
N	228422	228422	219593	224820

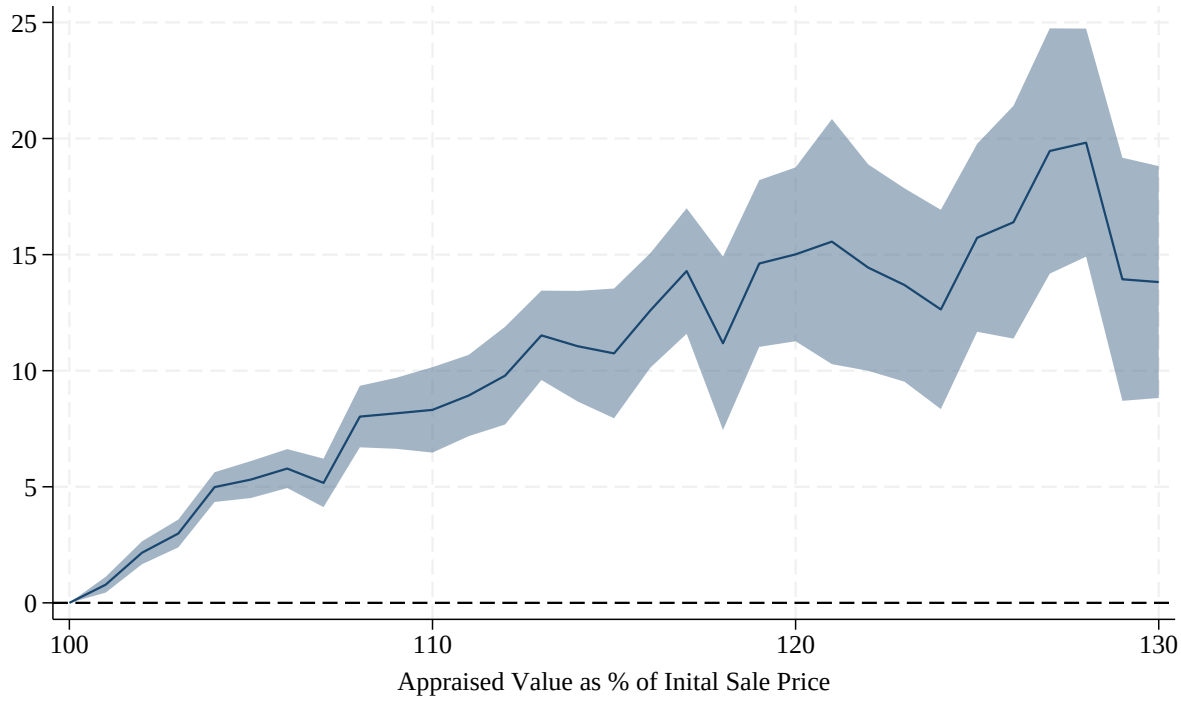
Note: This table reports the estimated effects of excess equity on characteristics of the borrower's next home purchase loan and on their next neighborhood. See Section 8. Outcomes in columns (1) and (2) are the price of the next home purchased with a loan in the ICE, McDash data set, and the down payment used for that purchase, both in dollars. Outcomes in columns (3) and (4) are the percentage change in the average ZIP code income and average ZIP code house price between the initial and subsequent purchase. All regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. Standard errors robust to clustering at the county level are shown in parentheses. Regression estimates from data provided by IRS, HUD, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.
***: $p < 0.01$
**: $p < 0.05$
*: $p < 0.1$

Figure 1: Distribution of Appraised Value Relative to Sale Price



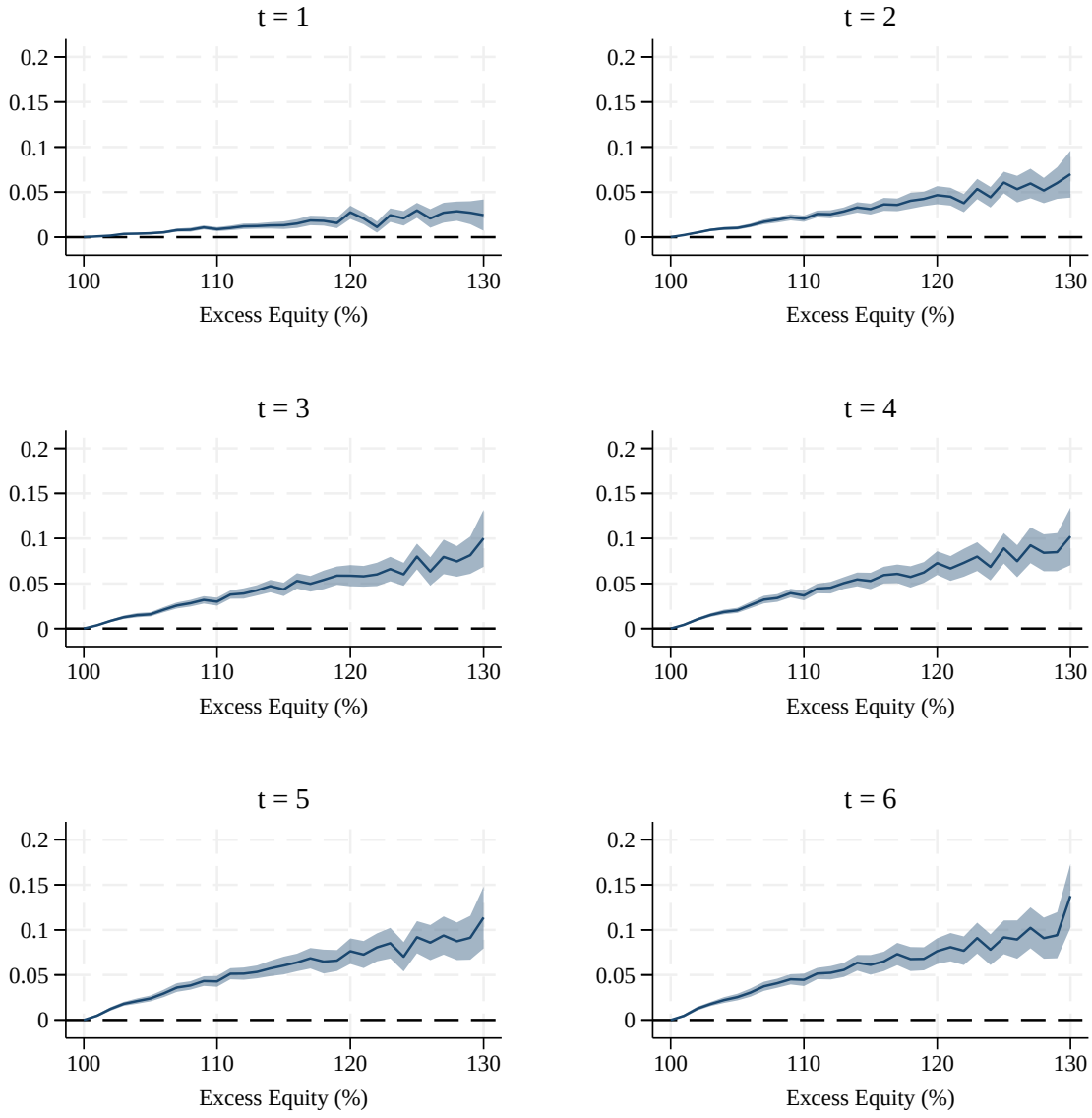
Note: This figure shows the distribution of the ratio between appraised home values and sale prices among 1.4 million FHA home purchase loans endorsed between 2007 and 2015. Source: HUD.

Figure 2: Accuracy of Appraised Values



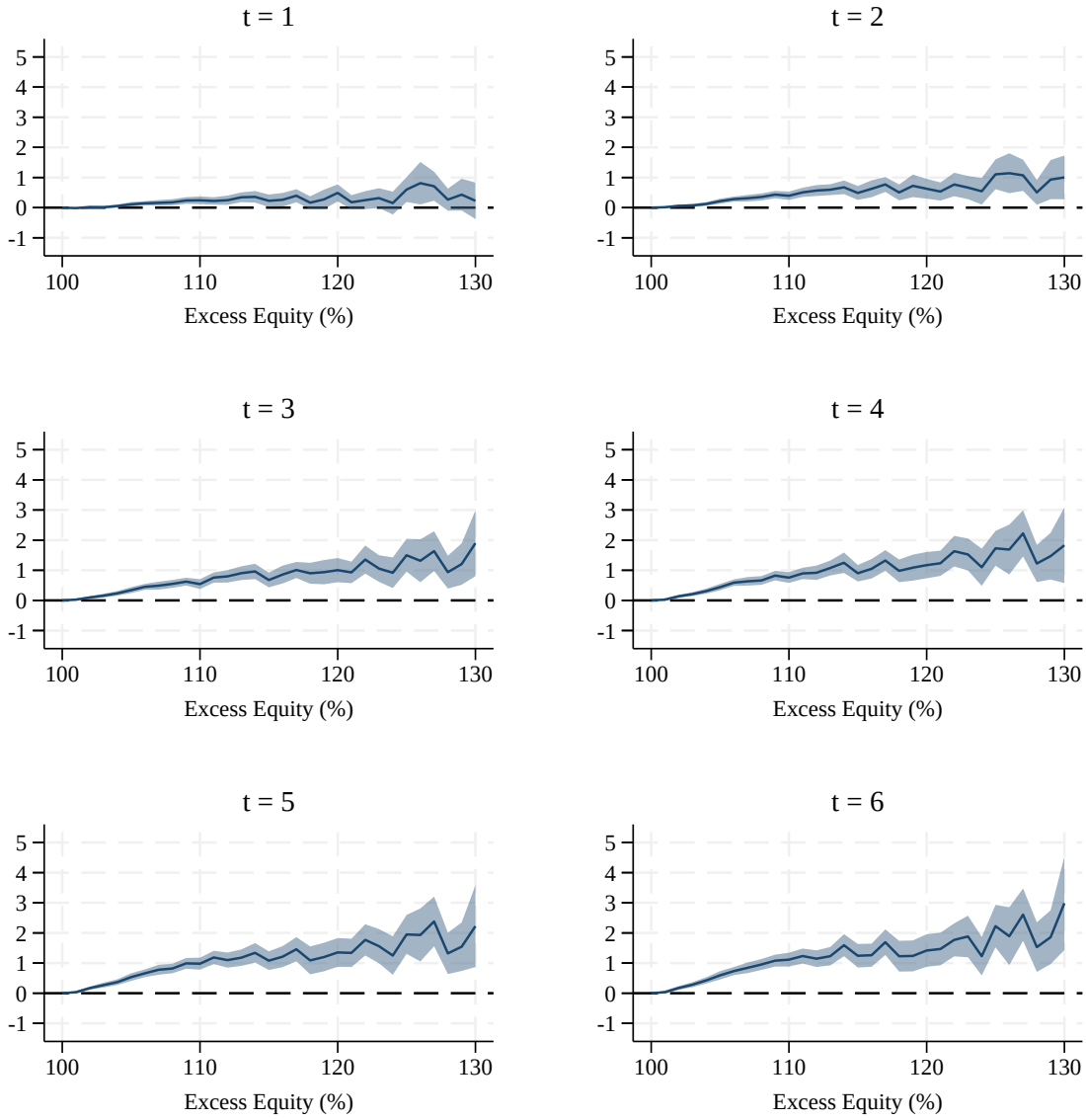
Note: This figure shows the estimated partial correlation between appraised values when they deviate from sale prices and subsequent sale prices of the home as described in Section 4.1. The units on the y-axis are hundredths of a log point. For example, the figure suggests an appraised value 20 percent above initial sale price (an x-axis value of 120) will lead to a 15 percent higher subsequent sale price (y-axis value approximately 15). Regressions control for log of initial sale price, log of county-level house price growth between initial and subsequent sale dates, county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 3: Effect of Excess Equity on Probability of Home Equity Borrowing



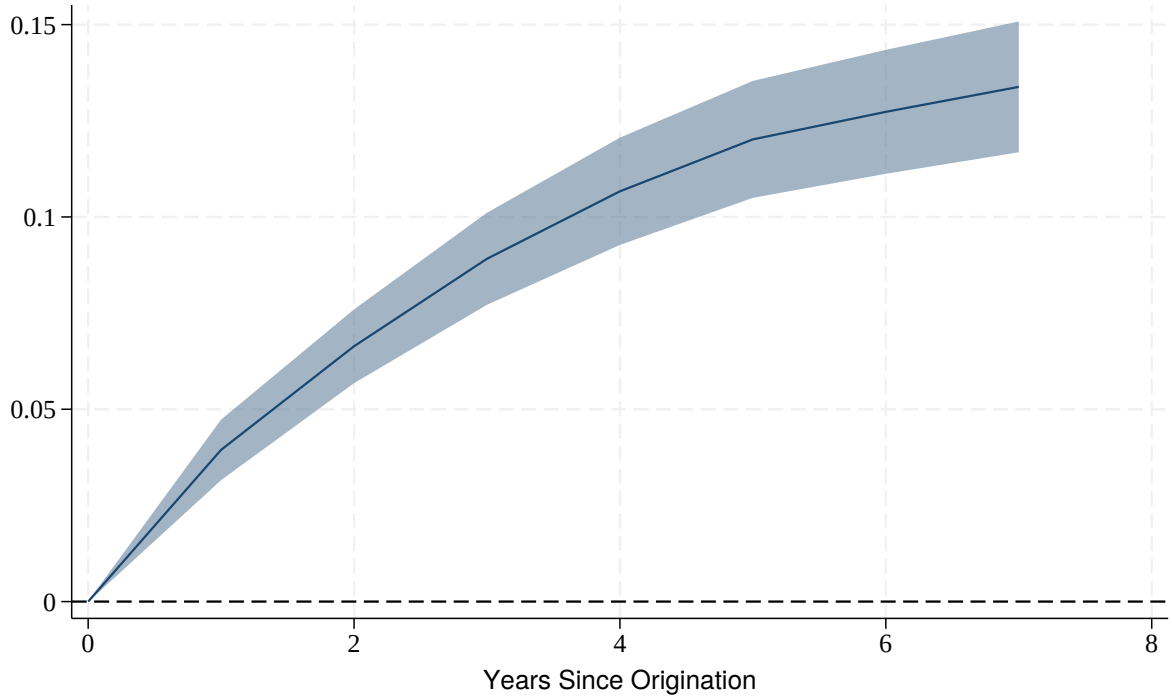
Note: This figure shows the estimated effect of excess equity (measured as appraised values as a percentage of sale prices) on the probability of having engaged in any home equity borrowing within t years after purchase, as described in Section 4.2. Probabilities on the y-axis are expressed in decimals, from 0 to 1. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 4: Effect of Excess Equity on Amount of Home Equity Borrowing



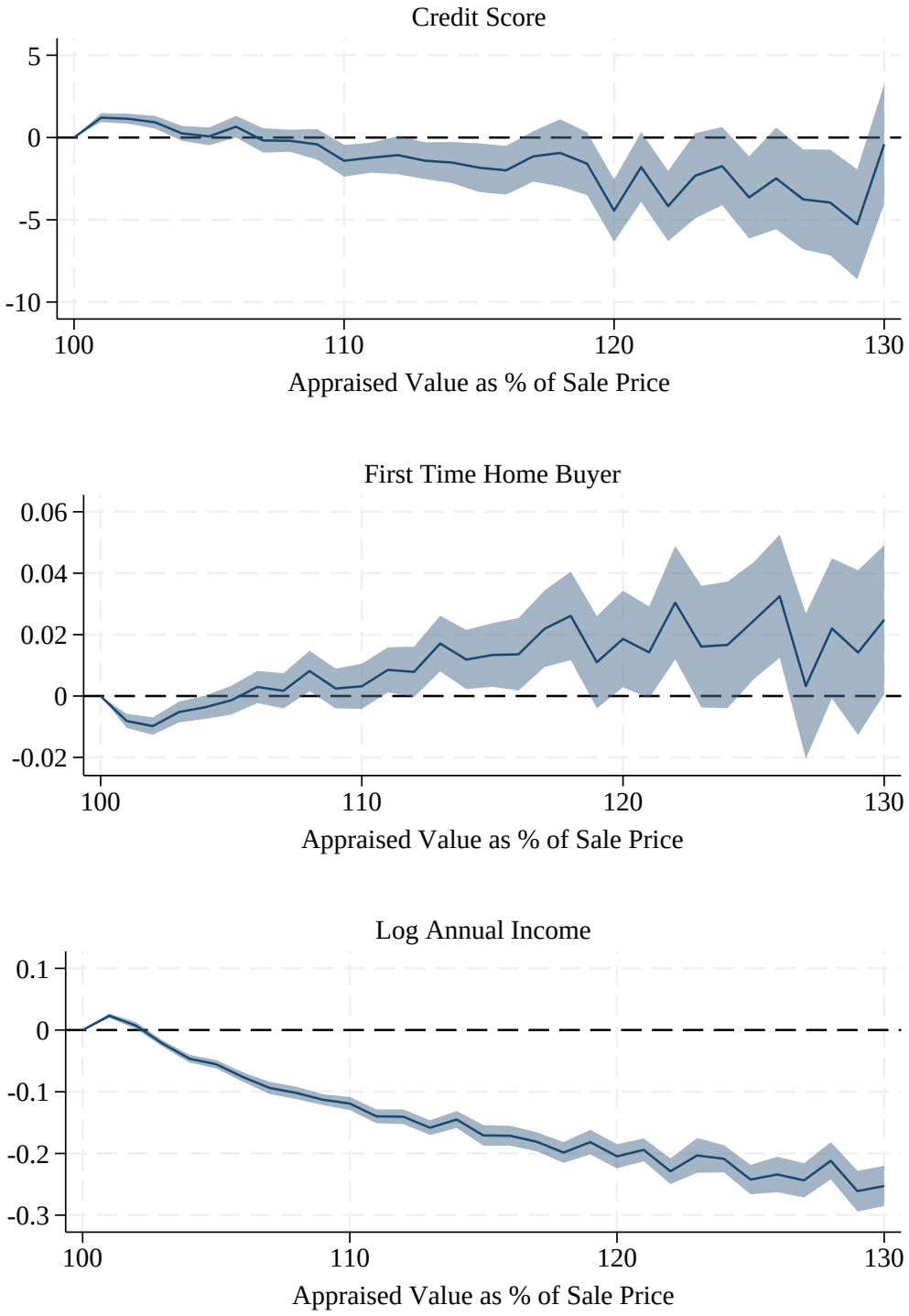
Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the amount of home equity borrowing within t years after purchase (measured as a percentage of sale prices), as described in Section 4.3. Extraction amounts on the y-axis are expressed in percentage points, from 0 to 100. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 5: Marginal Propensity to Extract Equity, by Year



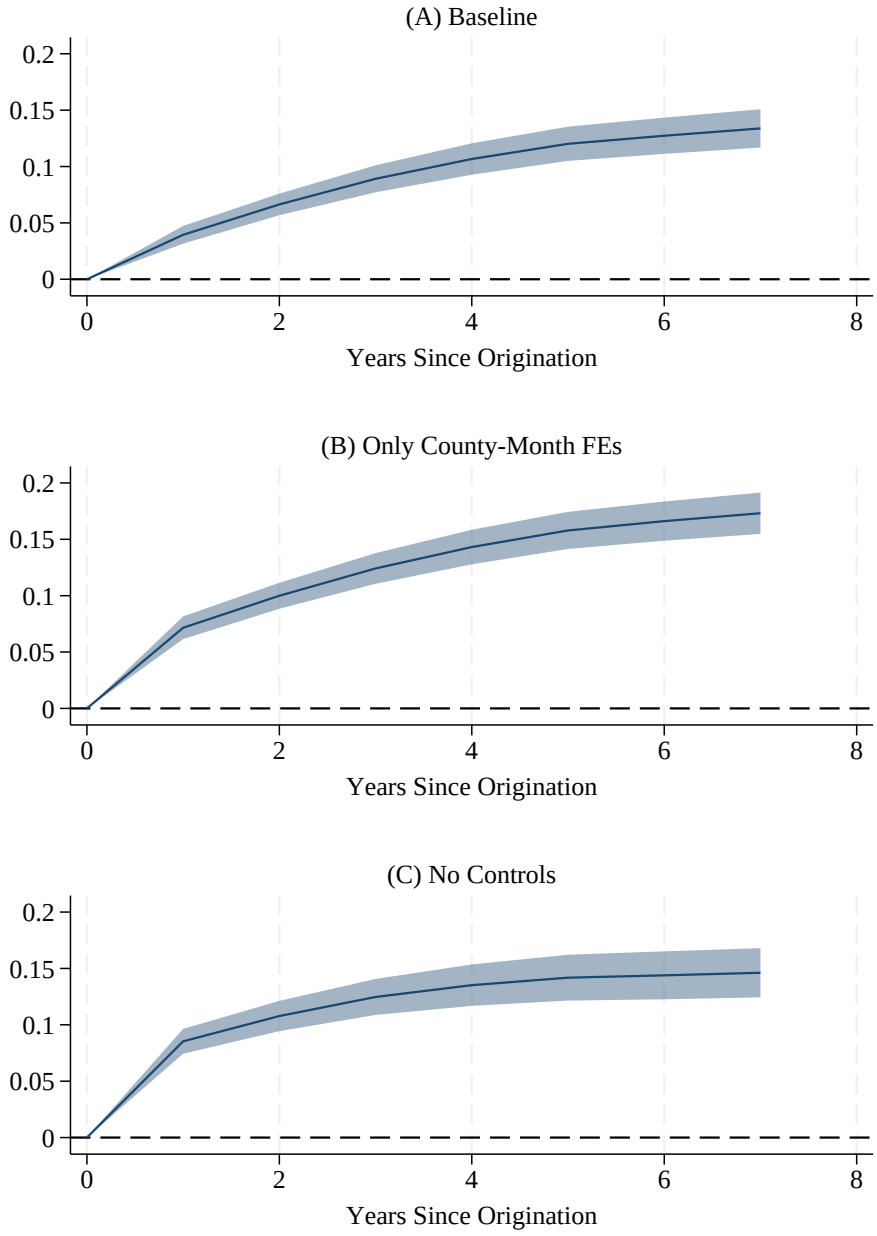
Note: This figure shows the estimated marginal propensity to extract equity within t years of home purchase as described in Section 4.3. Marginal propensities on the y-axis are expressed in decimals, from 0 to 1. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 6: Characteristics of Buyers with Excess Equity



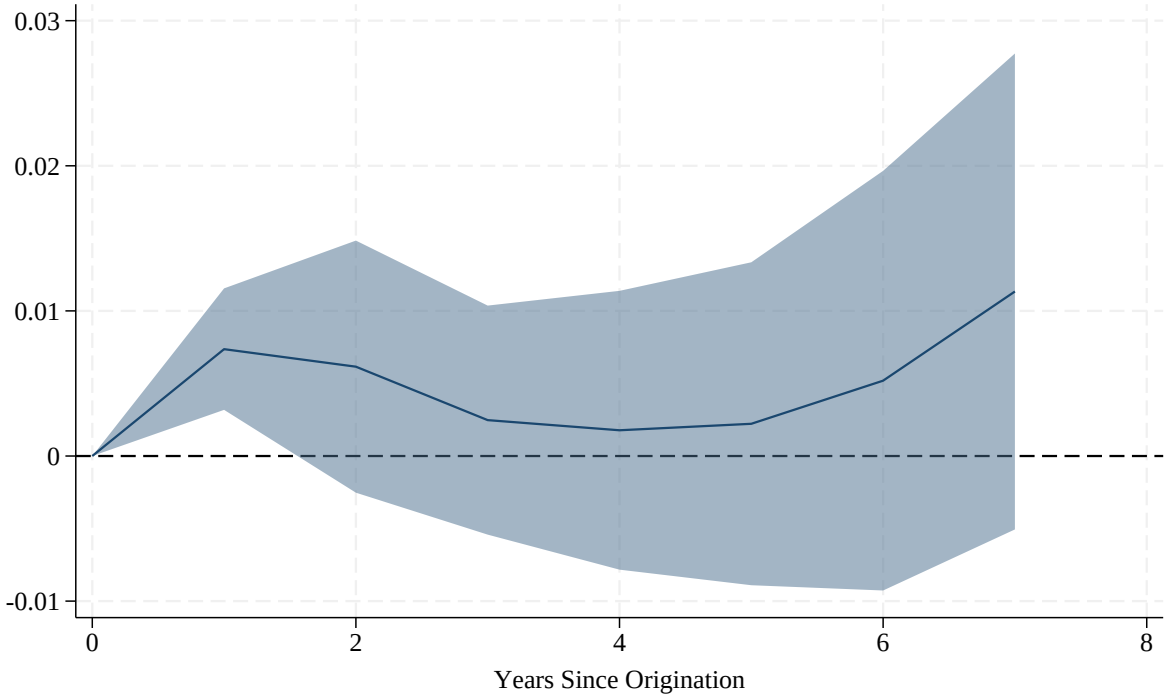
Note: This figure shows the estimated partial correlations between excess equity (measured as appraised values as a percentage of sale prices) and borrower characteristics as described in Section 5. Regressions control for county-by-month fixed effects. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 7: Marginal Propensity to Extract Equity, by Year



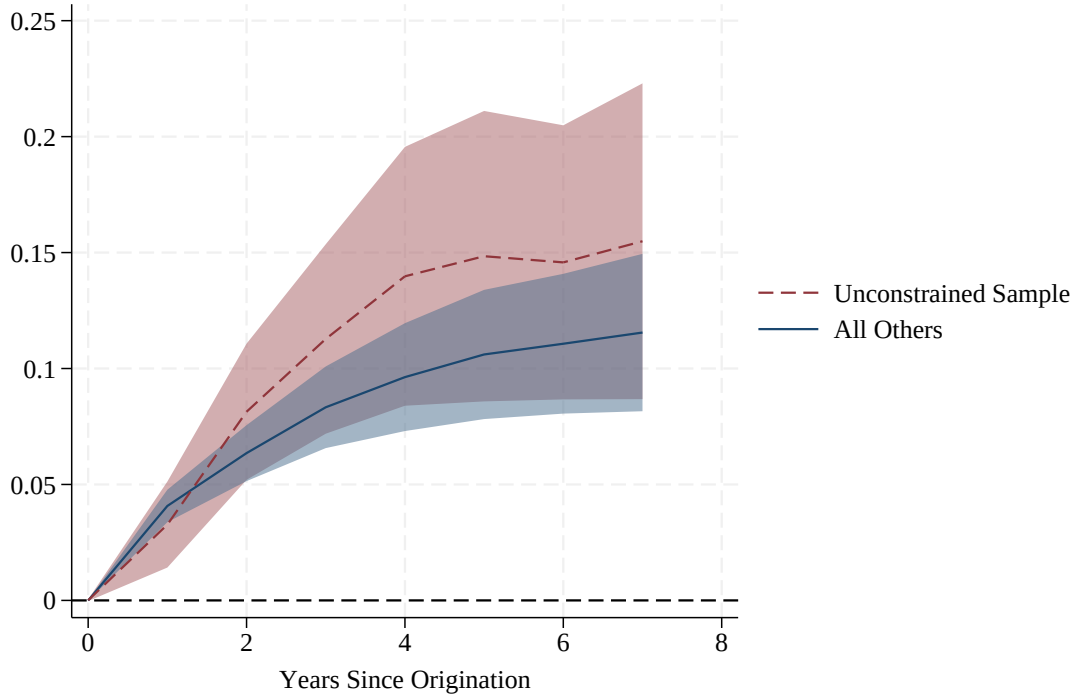
Note: This figure shows the estimated marginal propensity to extract equity within t years of home purchase as described in Section 4.3. Marginal propensities on the y-axis are expressed in decimals, from 0 to 1. In panel A, regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. In panel B, regressions control for only county-by-month fixed effects. In panel C, regressions do not include any controls. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 8: Effect of Excess Equity on Consumer Balances



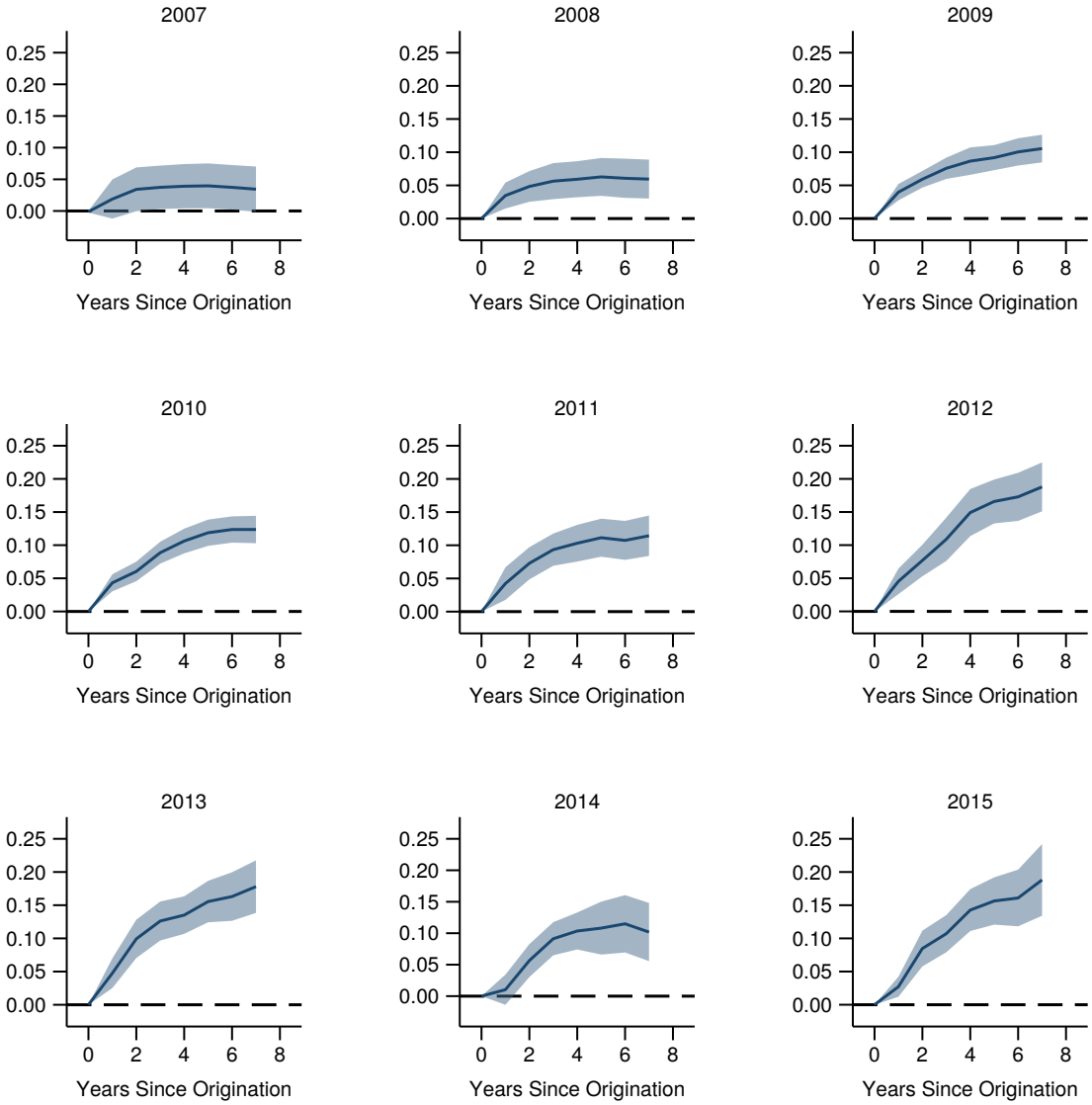
Note: This figure shows the estimated effect of excess equity (in dollars) on the balances of non-home equity consumer debt products (in dollars) t years after purchase, as described in Section 6. Consumer balances on the y-axis are expressed in decimals, from 0 to 1. For example, the estimated coefficient for $t = 1$ is approximately 0.005. This means that for every dollar of excess equity, consumer balances are \$0.005 higher in the first year after purchase. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and \$5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 9: Marginal Propensity to Extract Equity, Unconstrained Population



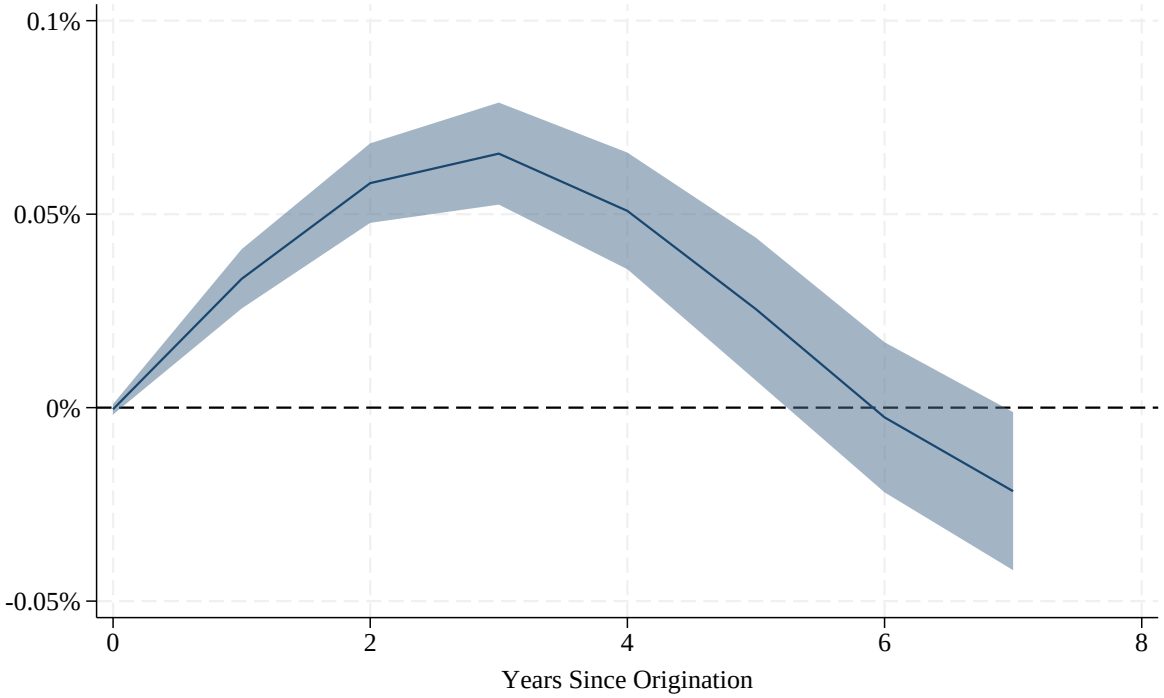
Note: This figure shows the estimated marginal propensity to extract equity within t years of home purchase as described in Section 4.3. Marginal propensities on the y-axis are expressed in decimals, from 0 to 1. The dashed maroon line plots estimates for the population who bought homes in counties that experienced at least 75 percent price growth over the next 7 years ("Unconstrained Sample") . The solid navy line plots estimates for the rest of the estimation sample ("All Others"). Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 10: Marginal Propensity to Extract Equity by Year of Purchase



Note: This figure shows the estimated marginal propensity to extract equity within t years of home purchase as described in Section 4.3, by year of home purchase. Marginal propensities on the y-axis are expressed in decimals, from 0 to 1. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure 11: Effect of Excess Equity on Moving



Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the probability of moving within t years after purchase, as described in Section 8. Moving probabilities on the y-axis are expressed in percentage points, from 0 to 100. For example, one percentage point additional excess equity is estimated to increase the odds of moving by approximately 0.05 percentage points by three years after purchase. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Internet Appendix for "The Marginal Propensity to Extract Housing Wealth: Evidence from Home Equity Windfalls"

Alvaro Mezza, Daniel Ringo, and Kamila Sommer

September 29, 2026

A Appendix

A.1 Robustness to Controls

In this section, we show that our appraisal accuracy results are not sensitive to dropping the rich set of individual and local control variables we include in our baseline regressions.

Our baseline regression includes county-by-month fixed effects, and indicators for 20-point buckets of credit score, $5,000 buckets of income at origination, and first-time home buyer status. We regressed the log of the next sale price of the home on the difference (in percentage terms) between the appraised and original sale price, the log of that original sale price, county-level house price growth between original and subsequent sale, and the aforementioned individual controls. Results were shown in Figure 2. We replicate this figure in the top panel (panel A) of Appendix Figure A.1.

In the middle panel (panel B) we drop the individual controls, keeping the county-by-month fixed effects. There is little difference between the estimates in panels A and B. Appraised values still accurately predict subsequent sale price, particularly when appraisals are within 10 percent of that initial sale price.

In the bottom panel (panel C) we drop the county-by-month fixed effects, keeping only initial sale price and county-level house price growth as controls. Again, the estimated partial correlation between appraised value and subsequent sale price is little changed. It seems that the estimated accuracy of appraised values is not sensitive to any particular combination of control variables.

In Figure 7, we showed a similar robustness of our main MPX results to the inclusion or omission of these same controls.

A.2 Additional Results on Consumer Balances

In Section 6, we showed there was little average effect of excess equity on overall consumer balances. In this section, we show this result holds using the more flexible estimator described in equation 1, and for disaggregated consumer debt categories.

We begin with all consumer debts together. We regress debt balances, measured as a percentage of initial home sale price, against indicators for buckets of excess equity (also measured as a percentage of initial sale price). Results are shown in Appendix Figure A.3 for each of the first six years after purchase. There is no indication of a meaningful. effect in any year or range of excess equity.

We then repeat these regressions for balances in each of three major consumer debt categories: auto loans, credit cards, and student loans. Results are shown in Appendix Figures A.4, A.5, and A.6 respectively. Nowhere do we see a meaningful effect of excess equity on consumer debt.

A.3 Additional Estimates of MPX by Local House Price Growth

In Section 7 we showed that the MPX estimated among the top quintile of counties in terms of seven-year house price growth was as large as, or larger than, that of the remaining 80 percent of our estimation sample (see Figure 9). In this section, we show that pattern of higher MPXs among counties with greater house price growth holds more generally.

For each of the seven years t post-origination, we divide observations in our sample into quintiles by the rate of county-level house price growth experienced by the borrower between origination and year t. Unlike the analysis presented in Figure 9, counties may switch quintiles between years. The price growth cutoffs used to define these quintiles are presented in Table A.1. Many borrowers faced price declines in the first few years post-origination, but by years five, six, and seven, price growth was generally positive (and in some cases, extremely high).

In Table A.2, we present estimated MPXs for each time horizon and county-level house price growth quintile. As can be seen, there is a general trend of higher estimated MPXs among counties experiencing higher house price growth. As described in Section 7, this suggests an important role for wealth effects driving the overall MPX.

Table A.1: Cutoffs for Quintiles of County House Price Growth

	Years Since Origination						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
First Quintile	-7%	-10%	-9%	-5%	1%	7%	14%
Second Quintile	-2%	-3%	2%	9%	17%	25%	34%
Third Quintile	2%	7%	14%	22%	30%	41%	53%
Fourth Quintile	7%	17%	27%	37%	47%	60%	75%

Note: This table reports the cutoffs of county-level house price growth in the t years since origination used to define the quintiles of house price growth in Table A.2. Source: HUD and Zillow.

Table A.2: Marginal Propensity to Extract by Local House Price Growth

	Years Since Origination						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
First Quintile	0.044***	0.056***	0.065***	0.070***	0.079***	0.088***	0.101***
	(0.008)	(0.009)	(0.009)	(0.010)	(0.011)	(0.012)	(0.012)
Second Quintile	0.047***	0.058***	0.089***	0.106***	0.122***	0.133***	0.128***
	(0.007)	(0.008)	(0.008)	(0.011)	(0.010)	(0.011)	(0.011)
Third Quintile	0.036***	0.072***	0.089***	0.108***	0.127***	0.126***	0.144***
	(0.010)	(0.008)	(0.009)	(0.010)	(0.011)	(0.013)	(0.013)
Fourth Quintile	0.024***	0.064***	0.099***	0.123***	0.124***	0.126***	0.149***
	(0.008)	(0.013)	(0.011)	(0.015)	(0.014)	(0.016)	(0.017)
Fifth Quintile	0.039***	0.093***	0.124***	0.156***	0.175***	0.190***	0.175***
	(0.007)	(0.013)	(0.017)	(0.016)	(0.020)	(0.022)	(0.025)
R^2	0.091	0.091	0.090	0.092	0.094	0.093	0.091
N	1456741	1445151	1431297	1417601	1406458	1397884	1391902

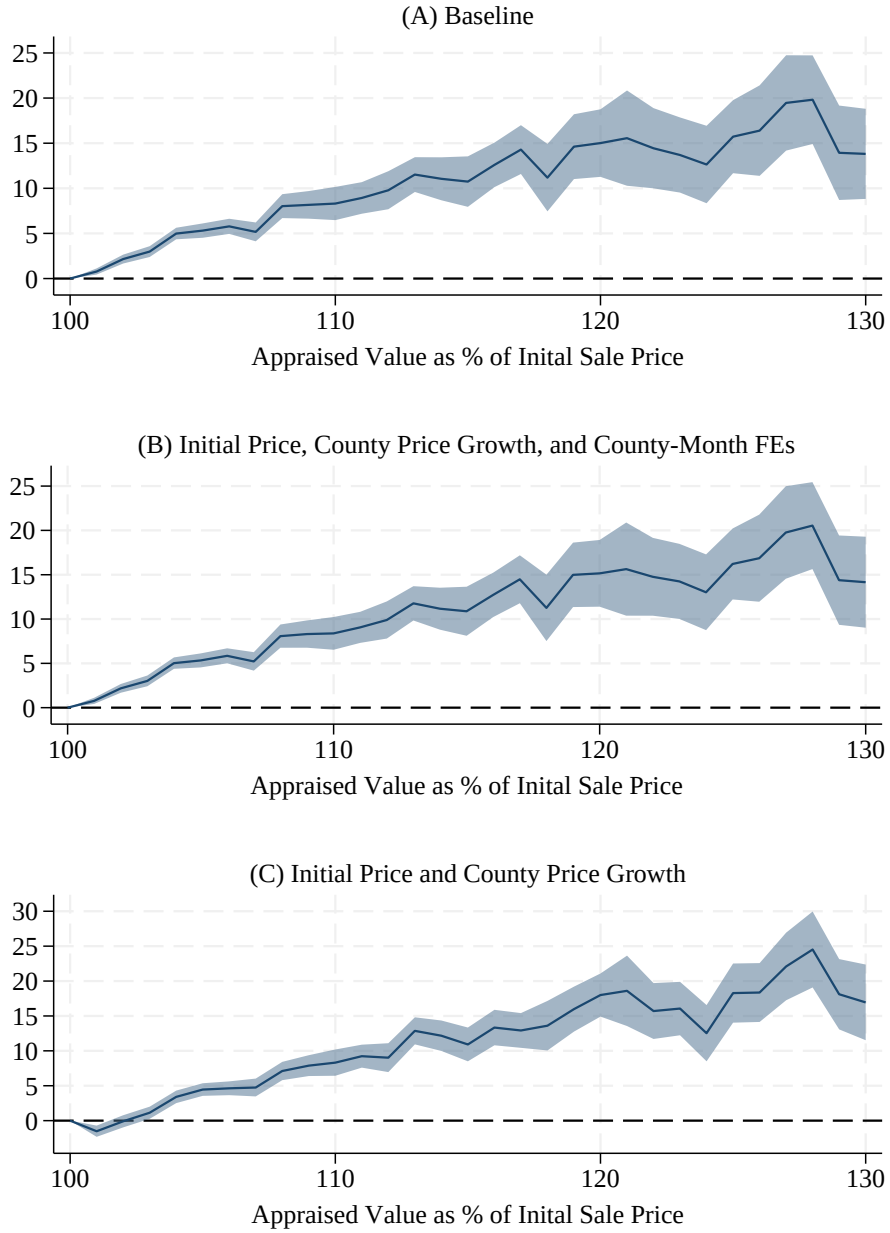
Note: This table reports the estimated marginal propensity to extract equity within t years of home purchase by quintiles of county house price growth. Growth quintiles are defined by year, such that counties may be in different quintiles for different time horizons. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first time home buyer status. Standard errors, shown in parenthesis, are robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

***: $p < 0.01$

**: $p < 0.05$

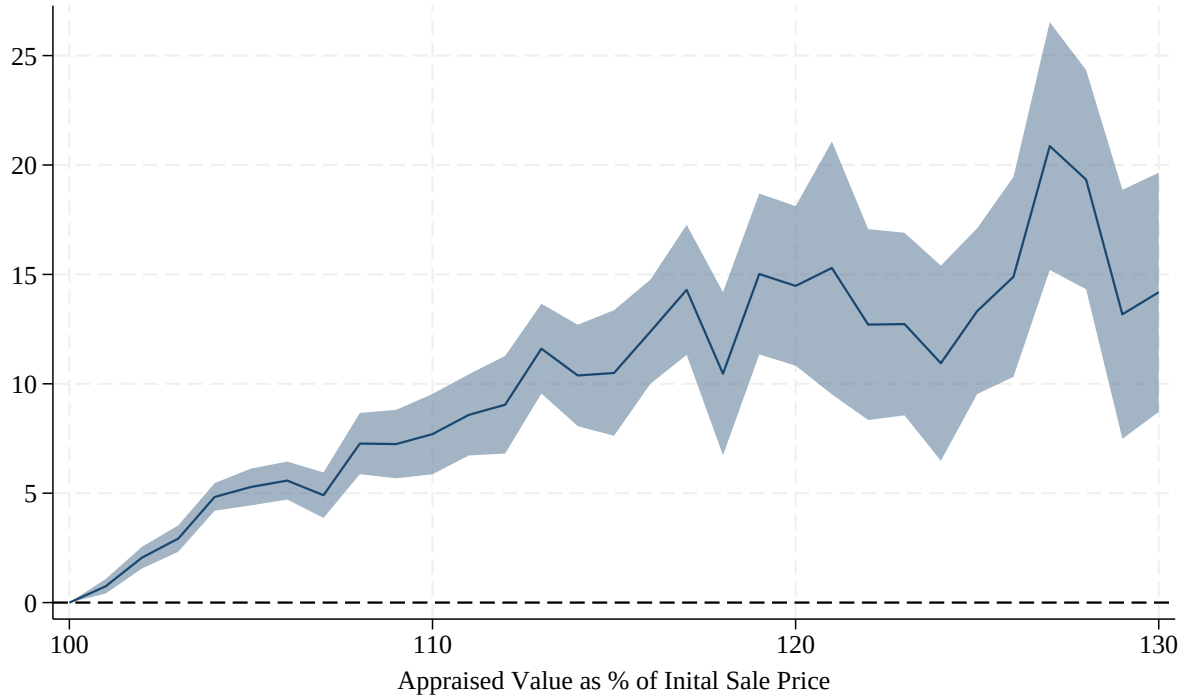
*: $p < 0.1$

Figure A.1: Accuracy of Appraised Values, Robustness



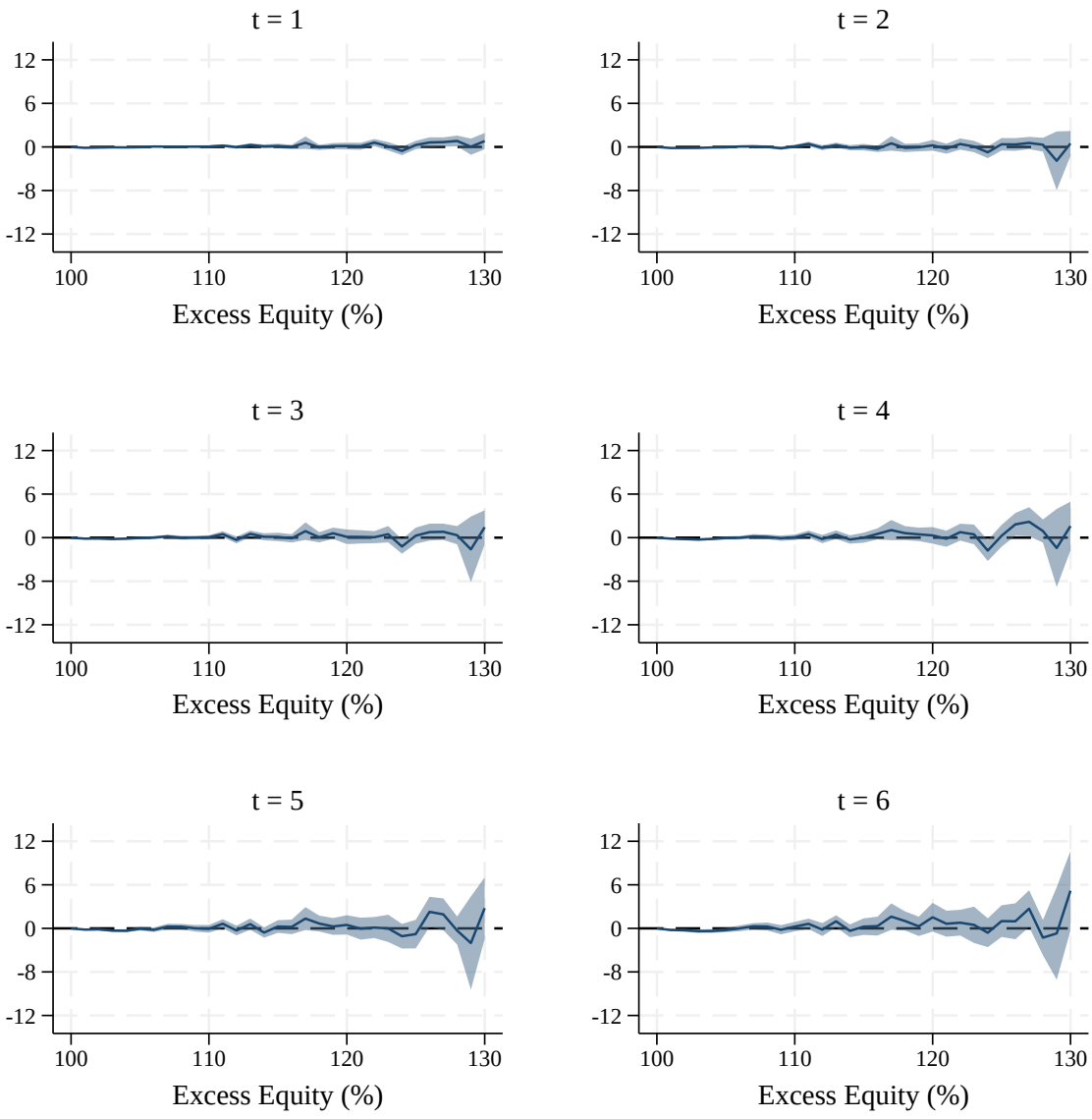
Note: This figure shows the estimated partial correlation between appraised values when they deviate from sale prices and subsequent sale prices of the home as described in Section 4.1. The units on the y-axis are hundredths of a log point. For example, the figure suggests an appraised value 10 percent above initial sale price (an x-axis value of 110) will lead to a 9 percent higher subsequent sale price (y-axis value approximately 9). All regressions control for the log of the initial sale price and county-level house price growth between initial purchase and subsequent sale. In panel A, regressions additionally control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. In panel B, regressions additionally control for only county-by-month fixed effects. In panel C, regressions do not include any additional controls. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Corelogic, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure A.2: Accuracy of Appraised Values, Dropping Equity Extractors



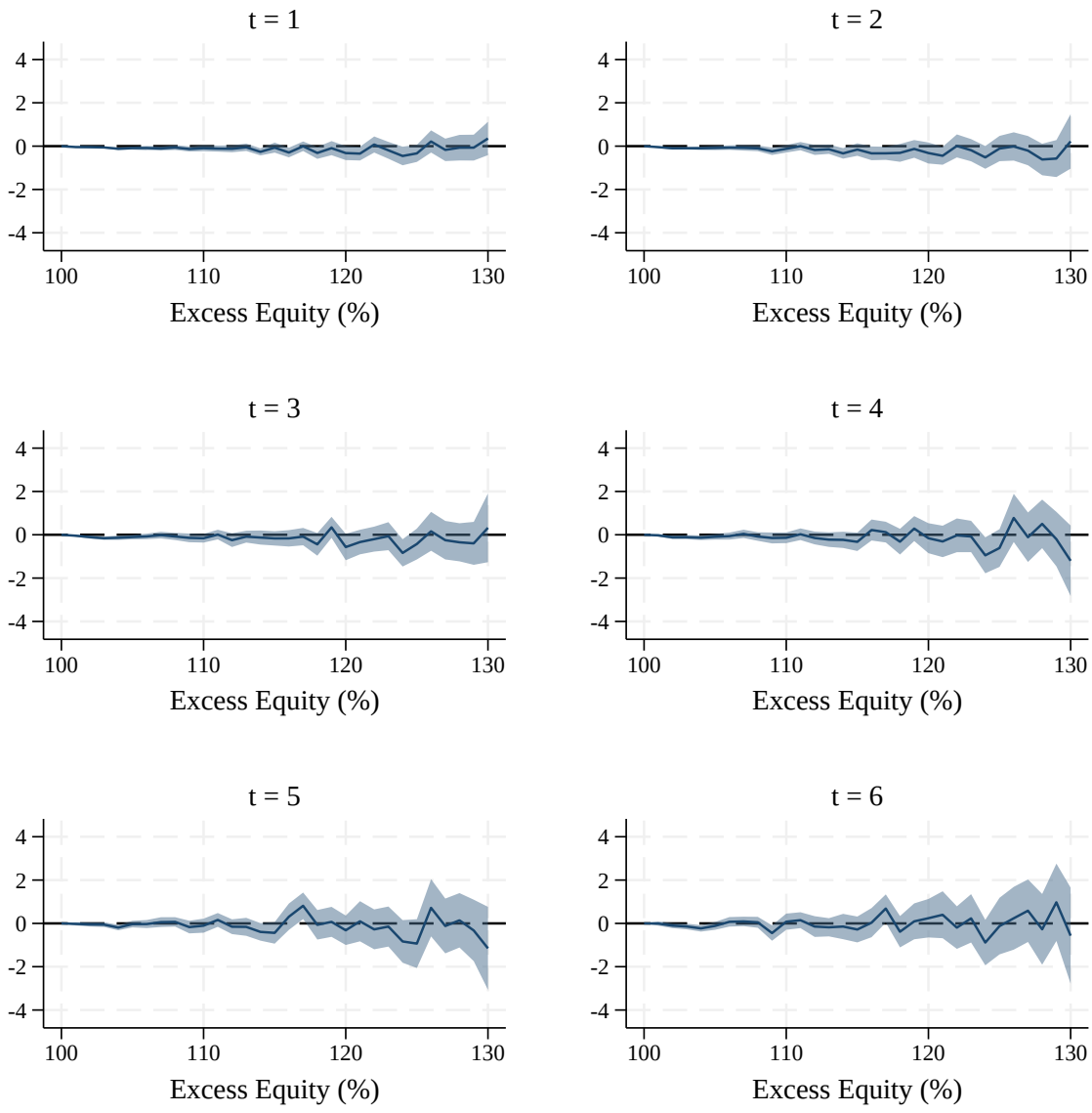
Note: This figure shows the estimated partial correlation between appraised values when they deviate from sale prices and subsequent sale prices of the home as described in Section 4.1. The estimation sample excludes any households that extracted equity within seven years of home purchase. The units on the y-axis are hundredths of a log point. For example, the figure suggests an appraised value 20 percent above initial sale price (an x-axis value of 120) will lead to a 15 percent higher subsequent sale price (y-axis value approximately 15). Regressions control for log of initial sale price, log of county-level house price growth between initial and subsequent sale dates, county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Cotality, Zillow, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure A.3: Effect of Excess Equity on Consumer Balances, Detail



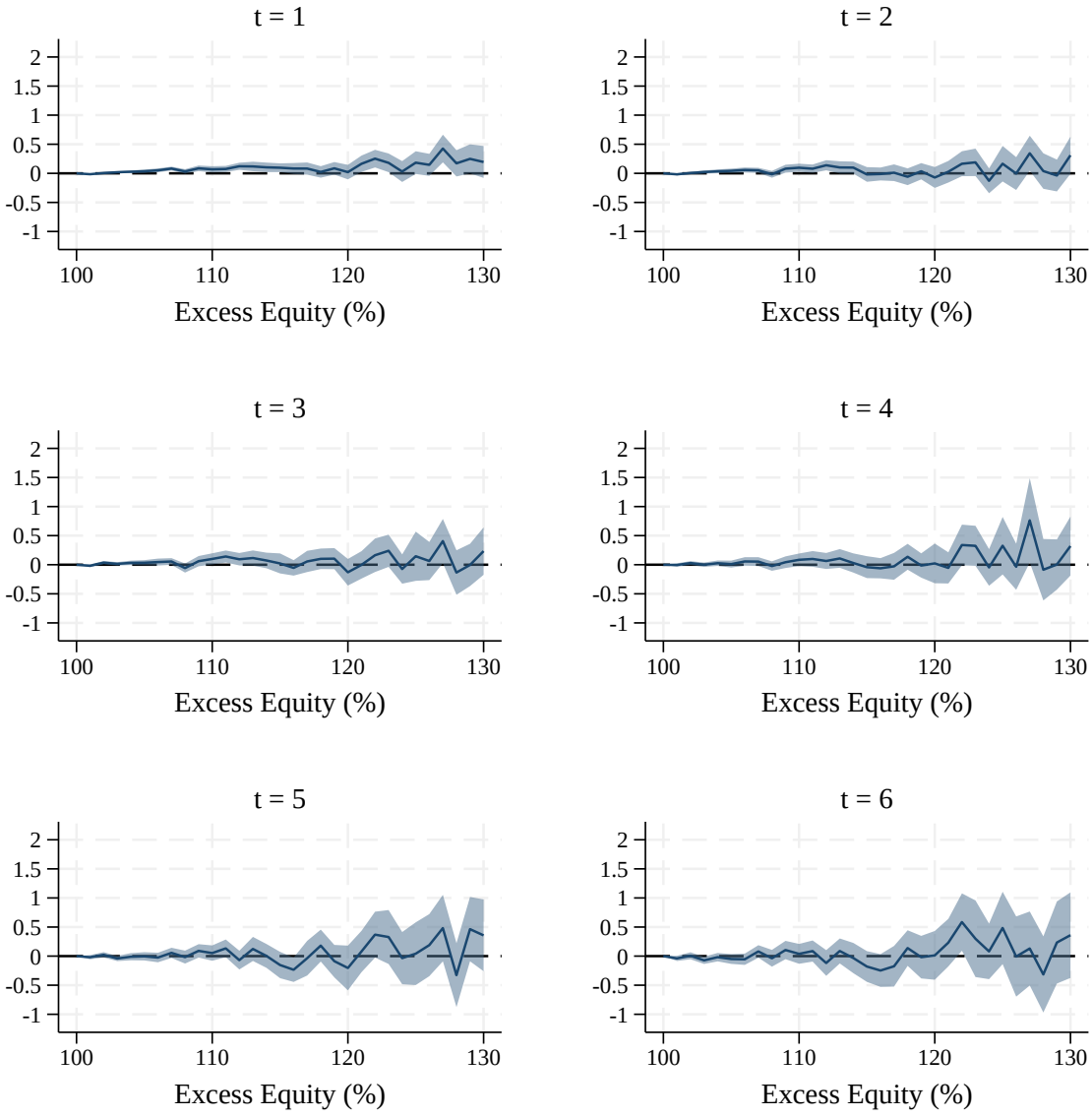
Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the amount of non-home equity consumer debt balances t years after purchase (measured as a percentage of sale prices). Extraction amounts on the y-axis are expressed in percentage points, from 0 to 100. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure A.4: Effect of Excess Equity on Auto Loan Balances, Detail



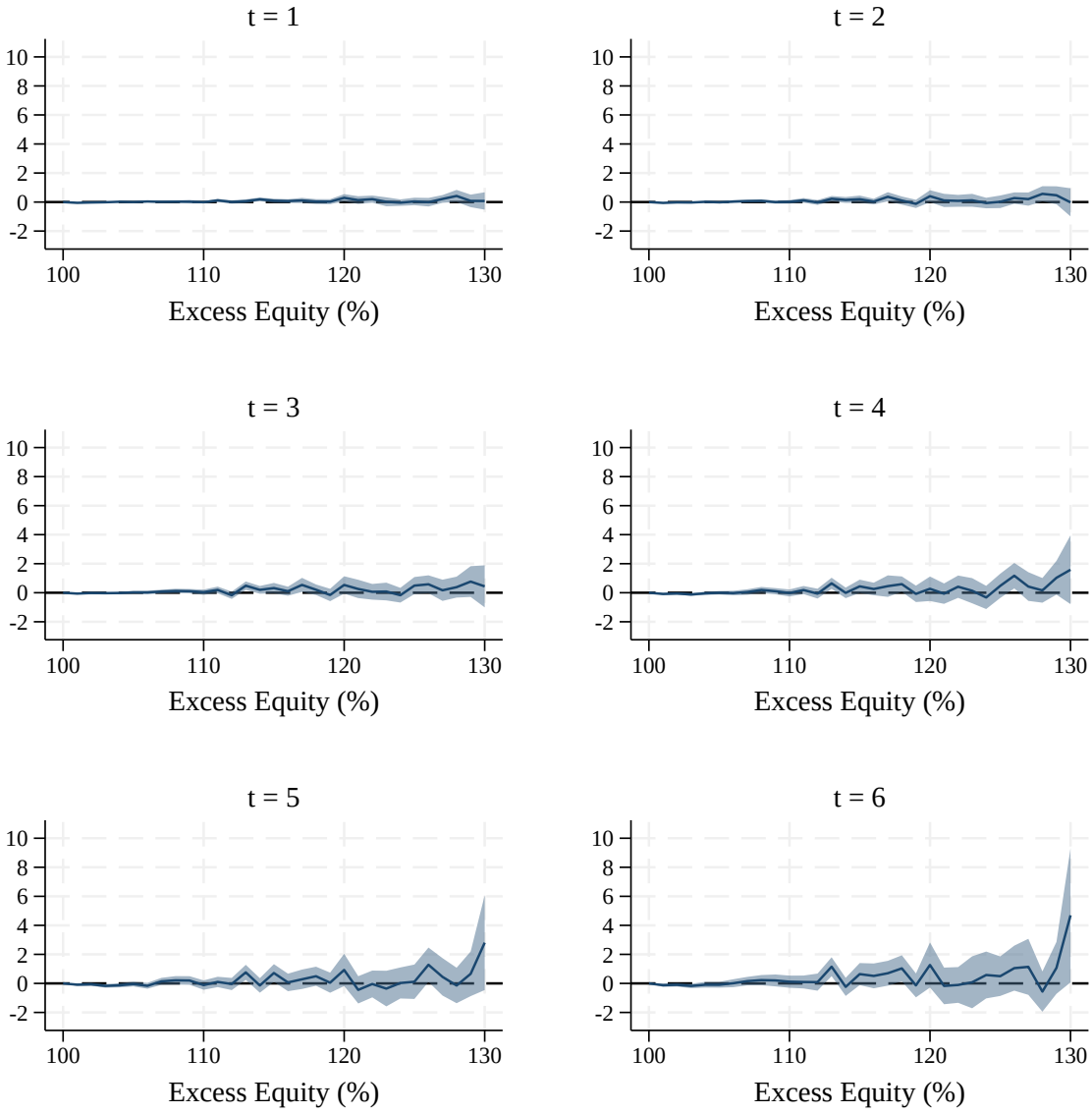
Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the amount of auto loan debt balances t years after purchase (measured as a percentage of sale prices). Extraction amounts on the y-axis are expressed in percentage points, from 0 to 100. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure A.5: Effect of Excess Equity on Credit Card Balances, Detail



Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the amount of credit card balances t years after purchase (measured as a percentage of sale prices). Extraction amounts on the y-axis are expressed in percentage points, from 0 to 100. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.

Figure A.6: Effect of Excess Equity on Student Loan Balances, Detail



Note: This figure shows the estimated effect of excess equity (measured as a percentage of sale prices) on the amount of student loan debt balances t years after purchase (measured as a percentage of sale prices). Extraction amounts on the y-axis are expressed in percentage points, from 0 to 100. Regressions control for county-by-month fixed effects, indicators for 20-point buckets of credit score and $5,000 buckets of income at origination, and first-time home buyer status. 95% confidence intervals are shown, calculated using standard errors robust to clustering at the county level. Regression estimates from data provided by HUD, Equifax Credit Risk Insight Servicing and ICE, McDash ®Data.