Choice of Refinancing and Hand-to-mouth Status*

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Abstract

What does the choice of refinancing reveal about the Hand-to-mouth (HtM) status of households? Preliminary empirical analysis from the SCF corroborates the interlinkage between household debt & HtM status. Further evidence from refinance approvals indicate strong demand for home equity extraction in periods of high unemployment often aided by higher house prices. Following Kaplan et al. (2014), I motivate their measurement by setting up a 3 period partial equilibrium model with heterogeneous preferences to investigate the importance of considering mortgages distinctly from other illiquid assets in the determination of HtM status. Better estimates of the same is imperative for understanding the transmission and redistributive effects of monetary policy & fiscal transfers. Simple qualitative experiments in a calibrated model strongly match the current trends in house prices, unemployment and mortgage refinancing.

Keywords: hand-to-mouth; heterogeneous agents; mortgage; refinance; cash-out

JEL Codes: E21; E31; G28; G51; R38

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1 Introduction

Kaplan et al. (2014) (hereafter KVW) initiated the discourse on a detailed classification and determination of households' hand-to-mouth (hereafter HtM) status based on wealth. Briefly, HtM refers to households living paycheck to paycheck due to zero savings. The simplistic categorization of households based on negative net worth has proven inadequate for understanding monetary policy transmission. In standard Representative Agent New Keynesian models, monetary policy efficacy diminishes with lower-than-empirical Marginal Propensity to Consume (MPC) values, a phenomenon also seen with transitory fiscal transfers in fiscal policy. The existing one-asset spender-saver models in both complete and incomplete market setups fall short in portraying agents' consumption dynamics, particularly in response to lump-sum tax rebates and government transfers. KVW introduced a new household category termed wealthy HtM, characterized by significant holdings in illiquid assets like housing and retirement accounts, but minimal liquid asset holdings. This classification reveals unique consumption dynamics, substantiated by the Panel study of income dynamics (PSID) and is affirmed to be substantial after analysis using the Survey of Consumer Finances (SCF). In this paper, I propose a further subdivision of wealthy HtM agents based on their home equity extraction choices. This delineation would not only provide a clearer estimation of households at their borrowing limits but also unveil diverse MPCs compared to those determined by KVW. This variation, when extrapolated, offers intriguing insights into aggregate MPC, significantly impacting monetary policy transmission and redistribution.

Secondly, I advocate for categorizing housing as a distinct class of illiquid assets, given its unique utility and role as collateral, unlike other illiquid assets like retirement accounts or 401k plans. These assets, although capable of facilitating income transfers before maturity, lack the direct utility provided by homeownership.[1] The preference for homeownership over solely investing in retirement accounts is mirrored by nearly 65.8% of US households owning homes, marking it as the predominant source of illiquid assets.[2] Furthermore, leveraging a home for loans differs from diminishing other illiquid assets, entailing distinct transaction costs. With a majority (62.9%[3]) of US households owning homes through mortgages, understanding the interplay between mortgages and other illiquid assets is pivotal. The refinance decision, central to this interplay, is contingent on various aggregate and idiosyncratic

[1] This diverges from the theory posited by Kaplan and Violante (2014a) and subsequent literature, which acknowledges intermediate transfers from illiquid assets but overlooks the direct utility gains.

[2] Source: US Census Bureau, 2021 https://www.census.gov/housing/hvs/files/currenthvspress.pdf

[3] Source: Zillow Research (2019)

macroeconomic factors per household, gaining particular relevance in the current economic milieu.

COVID-19, which brought about a severe negative labor income shock with skyrocketing unemployment rates, paradoxically highlighted the US housing sector as a potential leader in post-lockdown recovery, reminiscent of its pivotal role in the 2008 crisis. Driven by historically low mortgage rates, thanks to near-zero federal interest rates, the demand for housing surged despite pandemic restrictions and a chronic undersupply, fueling a housing price boom. However, tighter lending restrictions and increased application costs slowed down mortgage purchase applications compared to refinances, as illustrated in Figure 1. Uniquely, this crisis displayed a positive correlation between housing prices and unemployment rates, unlike the inverse relationship seen in 2008. The lower household homeownership during the 2002 crisis weakened the impact of refinancing and home equity extraction channels, starkly contrasting with today's near-record home equity cash-out volumes, with Black Knight estimating $ 6.2 trillion of liquidatable home equity as of Q1 2020.[4]

Upon refinancing approval, households were faced with three options: cash-out, no cash-out, or cash-in refinance. The prevalent no cash-out refinance, accounting for approximately 97.7% of US mortgages[5], typically reduced Fixed Rate Mortgage (FRM) payments, while cash-out refinancing or an additional Home Equity Line of Credit (HELOC) provided emergency liquidity, albeit likely at a higher new FRM rate or increased unpaid balance[6]. Rising house prices eased borrowing constraints, with cash-out refinancing decisions largely driven by precautionary savings and household liquidity needs amid income uncertainties[7]. A deeper exploration into the portfolio composition of home equity-extracting households, especially under KVW's wealthy HtM classification, became imperative to understand their unique HtM status and the broader monetary implications intertwined with the current dynamics of the housing sector.

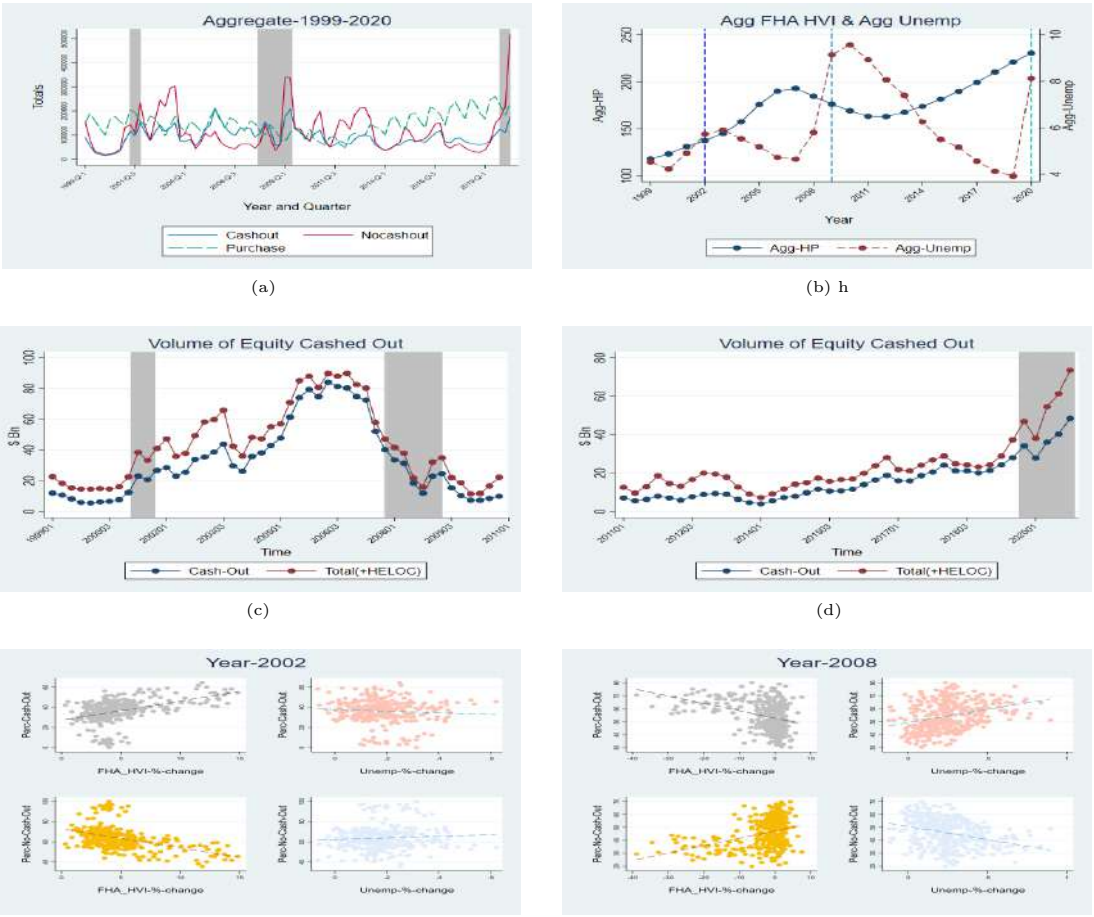
Panel (f) of Figure 1 displays a strong correlation between the frequency of cash-out refinance as a percentage of total refinances and unemployment changes, hinting at a liquidity demand channel for constrained households. This effect was subdued during the GFC by plummeting house prices. Unlike in 2002, as shown in panel (e) of Figure 1, where cash-out refinances

[4] Source: https://www.blackknightinc.com/black-knights-january-2020-mortgage-monitor/

[5] Source: Origination Report Ellie Mae (2021) https://static.elliemae.com/pdf/origination-insight-reports/ICE_OIR_JAN2021.pdf

[6] For more details, see Chen et al. (2020)

[7] For a recent discussion & observed empirical trends using bank account data see Farrell et al. (2020)



(a) (b) h

(c) (d)

(e) Near about 2002 recession (f) During 2008 crisis

Correlation between choice of refinance & % changes in house prices & unemployment rates

Figure 1: Motivating graphs

correlated positively with house prices due to lesser unemployment increases, indicating a preference for no cash-out refinance. The 2020 crisis, marked by severe negative labor income shocks, has seen a different trend. The persistent shocks, courtesy of slow post-pandemic restriction easing, alongside surging house prices, favor cash-out refinance for constrained households, typically categorized as wealthy HtM with minimal liquid assets. The record-long expansion prior has likely left these households under-leveraged, further from their idiosyncratic borrowing constraints, hence capable of extracting additional home equity. The easing constraints, a stark contrast to the GFC scenario, now enable significant welfare gains for wealthy HtM households. Therefore, a deeper subdivision of wealthy HtM based on refinance choices and the interplay between housing and other illiquid assets is crucial, both empirically and theoretically, for a nuanced understanding of the various channels through

which monetary policy impacts the real sector.

	2010		2019	
	Total HtM	**% of Wealthy HtM**	**Total HtM**	**% of Wealthy HtM**
Overall	0.3404	59.60	0.2507	65.13
Extracted HE	0.2913	85.41	0.1871	99.86
Did not extract HE	0.2150	100	0.2418	100

Table 1: Share of W-HtM for all 3 relevant subsets of data in 2010 vs 2019

To empirically substantiate my arguments, I undertake two exercises using public data. Initially, I emulate KVW's method with the latest SCF data to determine the wealthy HtM's share and analyze their portfolio composition, presenting a tailored subset of results for clarity; detailed insights are in Section 3.1. Notably, since KVW's data ended around the GFC in 2010, and the latest data is from 2019, the wealthy HtM share has predictably dwindled as shown in Table 1. Yet, the housing wealth share among illiquid assets for this group significantly rose, indicating a preference for home equity extraction for emergency funding, as evidenced by Table 2.[8]

Next, subdividing data based on home equity extraction decisions reveals a higher wealthy HtM share among those not opting for extraction or refinance, as seen in Table 1. However, those extracting home equity held more housing wealth in 2019 than in 2010, implying a potential shift among agents towards extracting home equity to mitigate reduced labor earnings amidst the Covid-19 crisis, though recession-induced refinance barriers could hinder this transition as inferred from Table 2. The leverage ratio analysis in Figure 8 shows most wealthy HtM are considerably leveraged, with a notable portion facing negative home equity, suggesting rising house prices not only ease collateral constraints but also facilitate home equity extraction. In conclusion, this exploration sheds light on the heightened importance of housing within wealthy HtM's illiquid asset portfolio, underlining the quantitative significance for my hypothesis and potential policy implications.

Secondly, I utilize publicly available Freddie Mac approvals data to proxy household liq-

[8] For a recent exploration regarding loan-to-income (LTI) & payment-to-income (PTI) constraints, see Greenwald (2018)

	2010			2019		
Total Wealthy HtM (in %)	**Only Housing**	**Housing + other illiquid assets**	**Other Illiquid Assets**	**Only Housing**	**Housing + other illiquid assets**	**Other Illiquid Assets**
Overall	21.99	57.43	20.59	34.86	44.72	20.42
Extracted HE	14.16	83.86	1.98	29.72	70.28	0.00
Did not extract HE	20.26	79.74	0.00	55.11	44.89	0.00

Table 2: Portfolio Shares of Wealthy HtM by their holdings of illiquid assets in 2010 vs 2019

uidity demand via refinance choice. The analysis, focusing on cash-out refinance frequency against various regressors in my logit model, provides reassuring results devoid of counterfactuals. Predictably, households with higher Debt to Income (DTI) ratios, higher Loan to Value (LTV), and lower credit scores lean towards cash-out over no cash-out refinance, with opposite inclinations for higher outstanding loan balances and lower original interest rates. The significance of house prices and unemployment emerges during crises.[9] The analysis denotes a stronger home equity extraction channel amid recessions with soaring unemployment, showcasing notable interactions across unemployment quantiles.

Inspired by the empirical findings, I propose a 3-period partial equilibrium model, extending KVW's setup with minimal deviations, to delve into HtM dynamics based on home equity extraction.[10] In this model, housing-owning agents weigh refinance options against their heterogeneous discount rates, now exogenously set. Impatient agents, favoring immediate consumption, opt for cash-out refinance, undeterred by future higher debt burdens. Conversely, agents valuing future utility more, dictated by a calibrated threshold, choose no cash-out refinance. A higher likelihood of HtM status is observed among cash-out choosers, confirmed via baseline calibration and preliminary shock experiments. The current crisis scenario—rising house prices, dwindling labor incomes, and falling mortgage rates—indicates an uptick in wealthy HtM share among cash-out refinance opters, albeit with a decline in total cash-out refinance instances, consistent with evidence in panel (a) of Figure 1.

[9] Contrasting proprietary data usage in literature, as seen in Bhutta and Keys (2016), Beraja et al. (2019), and Chen et al. (2020), my findings align with these studies.

[10] For a deeper dive into the model, refer to section 4.

Related Literature - This paper primarily expands upon the Wealthy HtM estimation pioneered by KVW, and further delves into the refinance choice revealing HtM status from the SCF data. It contributes a three-period partial equilibrium model, inspired by empirical findings, endogenizing refinance choice and aligning with current economic conditions. Additionally, it explores home equity extraction, as discussed in Bhutta and Keys (2016), revealing a nuanced relationship between wealthy HtM and home equity extraction, consequently impacting MPCs, a critical aspect for policy implications. The empirical channels evaluated underscore the dominance of unemployment rate changes over interest rate channels in crisis times, aligning with wealthy HtM's insensitivity to interest rate shifts, as elucidated in Farrell et al. (2020) and Beraja et al. (2019). This work, while correlating with studies like Kaplan and Violante (2014a) and Kaplan and Violante (2014b), distinctively emphasizes housing within the broader discourse on liquidity, refinance choices, and their implications on economic policy and HtM characterization.

This paper explores the "Houses as ATM" channel, aligning with Chen et al. (2020), and highlights the role of household liquidity demand in mortgage refinancing and home equity extraction. It corroborates the diminished sensitivity of refinancing behavior to interest rate changes under liquidity constraints, as discussed in Beraja et al. (2019) and Maggio et al. (2020). The paper also touches on the decreased effectiveness of monetary policy when initial debt is high, as noted by Alpanda and Zubairy (2019), and how negative income shocks, amid exogenous positive monetary policy shocks, encourage home equity extraction, especially among wealthy HtM households. It delves into the impact of house price declines and interest rate hikes on refinancing activities, referencing Berger and Vavra (2015) and Berger et al. (2018). Unlike previous works relying on proprietary data, this study utilizes publicly available Freddie Mac approvals data to examine HtM status in relation to household liquidity demand during low income periods, revealing strong preliminary evidence in support.[11] The paper briefly discusses refinance denials and home equity extraction restrictions, as documented by DeFusco and Mondragon (2020) and Boar et al. (2017), acknowledging the bias in the observed liquidity demand channel due to sample selection and denials, especially during economic hardships, as further analyzed in Agarwal et al. (2020).[12] Despite this bias, the findings capture the correct directional impact, suggesting actual estimates might be higher.

Lastly but not the least, though the 3 period partial equilibrium approach developed here is

[11]For related fiscal policy insights, see Agarwal et al. (2015).

[12]See Keys et al. (2016) for more on refinance denials.

primarily to motivate the measurement of HtM based on their decision to extract home equity using a HELOC and/or cash-out refinance, it can be nested in a general equilibrium setup to study the importance of housing as a separate class of illiquid assets and its consequent interaction with other assets (Auclert (2019)) in a possibly 3 asset heterogeneous agent along the lines of Kaplan et al. (2018) who stress the importance of considering 2 asset incomplete markets model with heterogeneous MPCs to enrich our understanding about monetary policy transmission & redistribution. To study the role of idiosyncratic collateral constraints, it can be expanded along the lines of the theoretical work of Iacoviello (2005) and the literature that follows emphasizing the dynamic nature of housing debt and its influence on monetary policy.

The rest of the paper is structured as follows. Section 2 details the data sources and my empirical methodology. Results are presented in Section 3. Section 4 develops the model and benchmark calibration to rationalize & motivate the empirical measurement for Section 2 while Section 5 concludes. Relevant empirical results not present in the main text is provided in Appendices A & B.

2 Empirical Exercise

2.1 Quantifying the HtM

I use the Survey of Consumer Finances (SCF) data till 2019 to empirically estimate the share of HtM. Details about the survey are also available in Appendix C.1 of KVW. Here, I present only some features. The study is conducted every three years and it collects all the relevant information. It is sponsored by the Federal Reserve System and the Statistics of Income Division of the Internal Revenue Service (IRS). I follow the procedure of KVW in cleaning the data and determining the selected samples. They examine a narrower definition of net liquid wealth that excludes directly held mutual funds, stocks, and bonds from liquid assets, and a broader one that includes outstanding debt in home-equity lines of credit as liquid debt. Net illiquid wealth in the SCF includes the value of housing, residential and non-residential real estate net of mortgages and home equity loans, private retirement accounts (such as 401(k)s, IRAs, thrift accounts, and future pensions), cash value of life insurance policies, certificates of deposit, and saving bonds. For the empirical study, KVW had used survey data till 2010 for the US. I update the data and present here the results of interest.

The methodology is also exactly in line with KVW with minimal changes which I detail in the next paragraph.[13] The SCF is an extensive survey with a very detailed documentation. Some variables of interest are removed/added in every survey. Specifically, I change the definition of illiquid assets slightly by augmenting them with newly introduced variables for quantifying HELOCs. I also add the balance payable after a mortgage is due to the illiquid assets. Similarly, other variables of interest which have been added for later rounds of the survey regarding the amount borrowed/refinanced have been suitably included in the measures for illiquid assets. Categorical variables controlling for the decision to refinance (which proxies for cash-out refinance and/or the decision to extract home equity by taking another HELOC) have also been accommodated. These changes are necessary in keeping with the purposes of the empirical study that aim to get a better estimate in quantifying the interlinkage between household refinance & HtM status.

The theoretical procedure for motivating the classification of households into wealthy HtM and poor HtM depending on their holdings of the illiquid/liquid assets is detailed in KVW Section 3 and Appendix B. I follow their procedure identically. I present here the amended motivation for the need to study the data based on the decision to extract home equity by adopting a three period partial equilibrium framework that underscores the importance of housing.[14]

2.2 Refinance choice & Collateral Constraint

The chief objective is to observe how the probability of choosing one refinance option over the other varies with a set of commonly used regressors and controls as determined by the literature. My data comes from three sources (all of which are publicly available). First, the Freddie Mac single family data set which is the mainstay of the analysis. The data is available at quarterly frequency and the period of the study is from 1999-2020. Each data set is an exhaustive list of all mortgage loans that were approved for either purchase or refinance along with other information on individual debt-to-income, FICO scores, unpaid loan balance, remaining months to maturity, loan-to-value and combined loan-to-value (which include HELOCs and other second liens). The data is at the Metropolitan Statistical Area (MSA) level. I clean the data following the steps listed in Freddie Mac user guide & combine

[13] All the variables are not present every survey the data is missing for these years. This can be observed in the graphs in section 3.1.

[14] For more details, see section 4.1 which also contains baseline calibration & simple qualitative experiments.

the quarterly data to get the combined yearly dataset. I merge the resulting data with unemployment data from BLS & FHA home value index, both of which are at the MSA level. After obtaining the cleaned data, I proceed with the empirical analysis using the choice of refinance as my initial dependent variable. Before running a formal logistic regression on the set of regressors, I divide the yearly data into quantiles of 3 and 5 for each of the 8 regressors to study the trends in the cash-out refinance (as a percentage of total refinances) over the years. These simple plots serve to provide added motivation for the choice of regressions. Results for the 3 quantiles have been included in the main text while those for 5 quantiles have been included in Appendix B.

I label the event of being approved for a cash-out refinance as a success with the alternative of being approved for a no cash-out refinance as a failure. I estimate yearly logistic regressions at the aggregate level separately for all the twenty two years of data available. I also run the model on separate pooled data to get an estimate of the time fixed effects. Specifically, I carry out the following yearly regressions.

$$Pr(cash-out\ \ refinace) = \alpha_1 FICO + \alpha_2 DTI + \alpha_3 UPB + \alpha_4 IR + \alpha_5 LoanAge + \alpha_6 hppc + \alpha_7 unemppc + \alpha_8 HE \quad (1)$$

where home equity has been measured following Beraja et al. (2019) and the yearly percentage changes in the home value index & unemployment rates have been considered. For the pooled logit, equation (1) is augmented with the appropriate time dummies to control for the year fixed effects by the term $\sum_{i=2000}^{2020} t_i$ with 1999 being the base year.

Since the data is composed of different units, the stand alone coefficients might give misleading quantitative implications since they cannot be directly compared. Therefore, I also carry out a variance decomposition of the results to get improved estimates for shares of variations in the dependent variable over time and jointly. I begin at the aggregate level and expand by dividing the data further into quantiles of the interested regressors. Results for observing possible regional variations have been included in Appendix B. Besides the dummies for controlling the base level estimates, I also include possible interaction effects for the various possible levels. I start off with splitting the data into 3 quantiles before generalizing to 5 quantiles. The results in the main body of the paper pertains to 3 quantiles. Since the data is only till quarter 2 for 2020, the effect for the Covid-19 shock will not be showing up since the impact on refinance decisions due to the corresponding regressors is most likely to be lagged by atleast one or two quarters. Consistent with the household motives for liquidity

demand and precautionary savings, the cash-out refinance percentage is likely to pick up pace going forward vis a vis a no cash-out refinance once the full data is available.

3 Results

3.1 SCF Data

First, I present the relevant results that follow KVW with the modified procedure as detailed in Section 2.1 with the pooled data from the 1989-2019 waves of the SCF. Standard error of the estimates for most of the figures have been included in Appendix A.

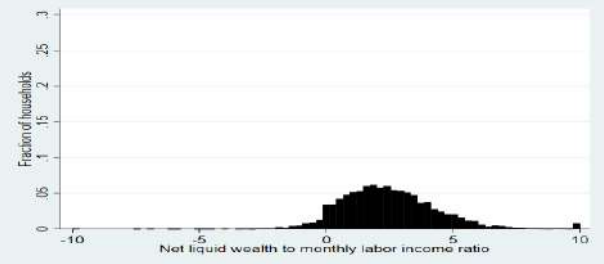


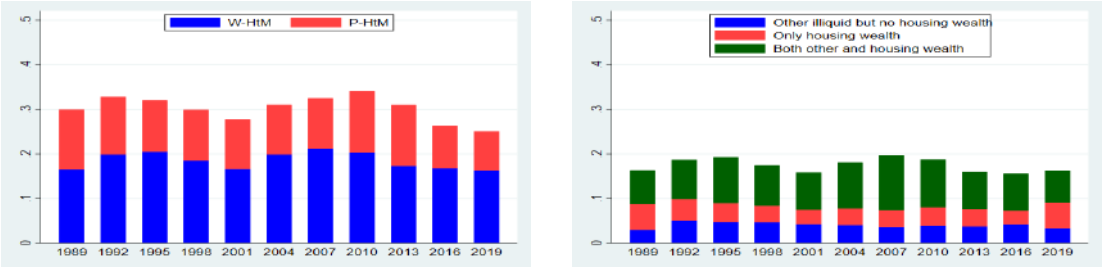
Figure 2: For the US from the SCF 1989-2019

	US: 2010		US: 2019	
	Median	Frac. Pos.	Median	Frac. Pos.
Income (age 22-59)	47040	0.984	55425	0.984
Net Worth	56721	0.883	66820	0.884
Net liquid wealth	1714	0.750	2019	0.752
Cash, checking, saving, MM accounts	2640	0.923	3111	0.923
Directly held stocks	0	0.142	0	0.142
Directly held bonds	0	0.014	0	0.014
Revolving credit card debt	0	0.382	0	0.382
Net illiquid wealth	52000	0.761	61269	0.762
Housing net of mortgages	29000	0.629	34169	0.629
Retirement accounts	1508	0.526	1777	0.526
Life insurance	0	0.186	0	0.186

Table 3: Descriptive Statistics for the SCF data

Figure 2 shows that the total share of households with fraction of net liquid wealth to its labor income being negative is pretty low in 2019 perhaps owing to the largest expansion

on record post the GFC.[15] The feature of interest in 2019 is shown by Table 3. Without classification of households as per their HtM status, it is the rise in housing wealth net of mortgages with the rise being higher than the corresponding rise in retirement account wealth in absolute terms suggesting the growing importance of housing as the economy heads into the Covid-19 recession.



(a) Share of total, wealthy, and poor HtM

(b) Share of total, wealthy, and poor HtM

Figure 3: Time-series of fraction of HtM households in the U.S

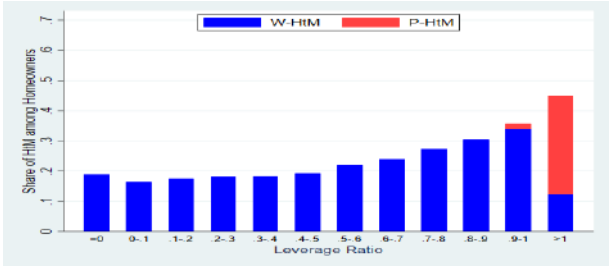
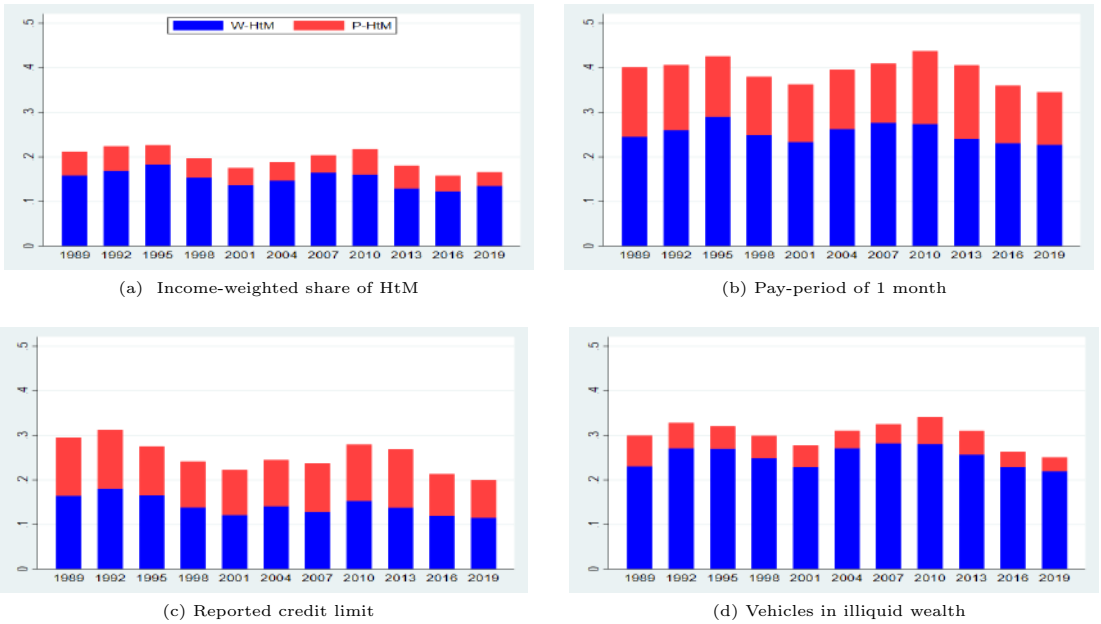


Figure 4: Share of HtM households among homeowners by leverage ratio, SCF 1989-2019.

The main results that are particularly relevant are given in Figure 3 and Figure 4. The survey data in 2010 is reflecting the GFC or just post GFC. Predictably, the total share of HtM in the population has declined since then. The last survey in 2019 was also conducted before the Covid crisis. The wealthy HtM has as a percentage of the total HtM has decreased post the GFC. However, if we are to examine the portfolio decomposition trends post 2010 for the wealthy HtM, we find that the share of housing wealth as a fraction of the illiquid assets held has clearly increased going into 2019 as compared to 2010. This is significant heading into the Covid crisis since the refinance channel has become stronger because there is a significant uptick in the fraction of people who would like to do a cash-out refinance when hit by a sequence of negative income shocks. High household liquidity demand should be the rational behaviour for the wealthy HtM provided the benefits of a refinance are exceeding their costs. Equally significant is the fact that the share of other illiquid assets

[15]The results for Figure 2 are not directly comparable with the counterpart in KVW since the data has not been adjusted for tax returns. Doing so would lead to little difference.

in the portfolio of the wealthy HtM has decreased implying a greater propensity to use the house (and implicitly mortgage) to tide over the negative income shocks. Figure 4 also clearly indicates the majority of wealthy HtM who are homeowners are not highly leveraged implying that they are more likely to be eligible for a cash-out refinance since they are not at their respective borrowing limits. Moreover, higher house prices have been relaxing the collateral constraint for households leading to higher levels of accumulated home equity. The evidence in particularly Figure 4 and Figure 3 (b) also indicate that the cash-out refinance channel is particularly strong. The standard errors for the estimates are very small in comparison to the size of the means no matter the robustness criteria used in Table 4. These preliminary results without further conditioning of the data based on the decision to extract home equity are promising and points to the need to analyze the trends based on the former mentioned decomposition.



(a) Income-weighted share of HtM

(b) Pay-period of 1 month

(c) Reported credit limit

(d) Vehicles in illiquid wealth

Figure 5: Time series of fraction of HtM households in the U.S., alternate definitions.

Figure 5 and Table 4 summarizes the sensitivity analysis as followed by the paper depending on the measurement criteria used to produce the estimates for the HtM status. As compared with KVW, using reported credit limit or weighting by the income weighted shares produces similar estimates as the baseline measurement. The reason for the decline in the total fraction of HtM individuals may well be because of the fact that the biggest expansion on record was only ended by a completely unforeseen crisis. The last survey in 2010 was during or just after the recession and hence picked up a higher HtM share. The trends are pretty similar with KVW across the various definitions. Before I carry out a formal decomposition of the

	1989-2010					1989-2019				
	P-HtM	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**	**P-HtM**	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**
Baseline	0.121	0.192	0.687	0.313	0.137	0.116	0.185	0.699	0.301	0.132
Usually c > y	0.089	0.156	0.756	0.244	–	0.088	0.147	0.765	0.235	–
Financially fragile households	0.169	0.316	0.515	0.485	0.203	0.174	0.307	0.519	0.481	0.207
Reported credit limit	0.114	0.148	0.738	0.262	0.126	0.111	0.141	0.749	0.251	0.123
1 year income credit limit	0.102	0.119	0.779	0.221	0.108	0.099	0.113	0.788	0.212	0.104
Weekly pay period	0.106	0.15	0.744	0.256	0.119	0.098	0.144	0.758	0.242	0.112
Monthly pay period	0.141	0.262	0.597	0.403	0.164	0.14	0.253	0.608	0.392	0.163
Higher illiquid wealth cutoff	0.13	0.183	0.687	0.313	0.137	0.125	0.176	0.699	0.301	0.132
Ret. acc. as liquid for 60+	0.121	0.183	0.696	0.304	0.137	0.116	0.174	0.71	0.29	0.132
Businesses as illiquid assets	0.113	0.194	0.693	0.307	0.129	0.11	0.187	0.704	0.296	0.125
Direct as illiquid assets	0.119	0.218	0.663	0.337	0.137	0.115	0.206	0.679	0.321	0.132
Other valuables as illiquid assets	0.117	0.196	0.687	0.313	0.132	0.112	0.189	0.699	0.301	0.128
Excludes cc puzzle households	0.163	0.184	0.654	0.346	0.176	0.155	0.172	0.673	0.327	0.169
HELOCs as liquid debt	0.119	0.182	0.699	0.301	0.135	0.115	0.175	0.71	0.29	0.131
Usual income	0.119	0.198	0.683	0.317	0.136	0.116	0.188	0.697	0.303	0.133
Disposable income - Reported	0.121	0.192	0.687	0.313	0.137	0.116	0.185	0.699	0.301	0.132
Disposable income - Single	0.121	0.192	0.687	0.313	0.137	0.116	0.185	0.699	0.301	0.132
Comm. cons. - beg. of period	0.101	0.166	0.732	0.268	0.116	0.096	0.159	0.745	0.255	0.111
Comm. cons. - end of period	0.149	0.272	0.579	0.421	0.174	0.151	0.263	0.586	0.414	0.176

Note-For details please see corresponding table in KVW.

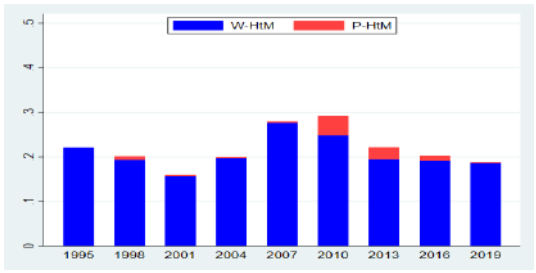
Table 4: Robustness results for fraction HtM in each category in the SCF pooled comparison

data for explicitly focusing on the home equity extraction channel, I note that the above results provide ample evidence of the importance of housing relative to other illiquid assets for the wealthy HtM from the latest survey data. Coupled with the fact that the majority of the wealthy HtM are still far off from their borrowing constraints, I predict a surge in cash-out refinances among the wealthy HtM which is masked by the overall rise in no cash-out refinance since the majority of the population is non HtM. This is not very different to what we observe in the data, Figure 1 panel (a).

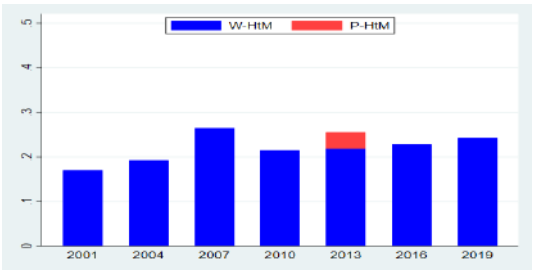
The next set of results is selecting only the households who extracted home equity while refinancing and comparing them with the set of household who did not refinance and/or didn't extract home equity. I use the appropriate data after conditioning on the relevant categorical variables. The data is unfortunately not uniformly present for all the years. Figure 6 panel (a) and panel (b) show the wealthy HtM among the population who extracted home equity. The poor HtM in this case is measuring the household who have negative home equity as was common during & just after the GFC when house prices collapsed. Panel (b) does not explicitly state whether these individuals decided not to extract home equity or whether their applications were denied.[16] Panels (c) and (d) perform a similar portfolio

[16]Or whether due to sample selection, they did not apply. For more details see Boar et al. (2017) as well as DeFusco and Mondragon (2020).

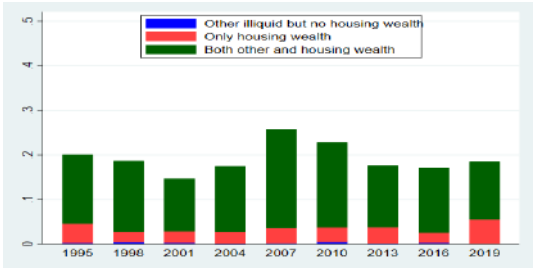
decomposition as in Figure 3 panel (b). As compared to 2010, the share of housing (as a percentage of the illiquid asset holdings) has gone up for the households who did extract home equity. This reinforces the proposed channel as Wealthy HtM have a far greater share of their illiquid assets in housing. Similarly, given 2019 was before the Covid shock hit the economy, in next surveys we should see that many wealthy HtM in panel (d) would move to join panel (a) provided they have the necessary resources to get their applications approved. This ties up with the issue of mortgage denials which is weakening the quantitative significance of the channel. This is especially true during recessions when the denial rates would most likely to increase. Both the channels would undeniably lead to a rise in the wealthy HtM shares. Table 5 provides the same robustness checks for the former subset of households while Table 6 provides the same for the households in the latter group. Analogous to Figure 5, the robustness checks for these 2 groups are presented in Figure 7.



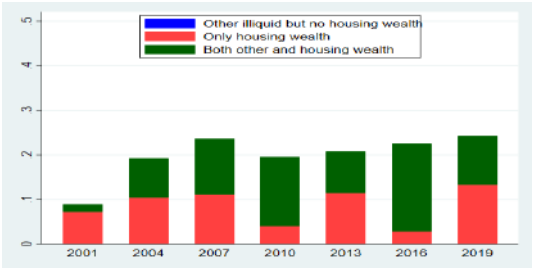
(a) Refinanced & extracted home equity



(b) Did not refinance and/or extract HE



(c) Portfolio composition for HE extracted wealthy HtM



(d) And for wealthy HtM who didn't extract HE or refinance

Figure 6: HtM households and the portfolio composition of wealthy HtM by refinance decision

The last result I present from the SCF is Figure 8 which shows the leverage ratio among homeowners who extracted home equity by a refinance against those who did not refinance and/or extract home equity. The poor HtM in this case measures again those household with negative home equity. The first indication of denials and sample selection in the approvals data that I present the results in Section 3.2 comes to light with the poor HtM being substantially more indebted with the leverage ratio greater than or equal to 0.9. Similarly, the wealthy HtM share is higher at higher leverage ratios proving that people with higher leverage ratios cannot opt for home equity extraction. Higher house prices would relax the constraints

Figure 7: Time series of fraction of HtM households in the U.S., alternate definitions. conditioned on Home Equity Extraction

	1989-2010					1989-2019				
	P-HtM	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**	**P-HtM**	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**
Baseline	0.011	0.22	0.768	0.232	0.023	0.012	0.21	0.778	0.222	0.027
Usually c > y	0.007	0.162	0.831	0.169	-	0.01	0.158	0.833	0.167	-
Financially fragile households	0.015	0.331	0.655	0.345	0.026	0.018	0.321	0.661	0.339	0.031
Reported credit limit	0.006	0.122	0.872	0.128	0.015	0.007	0.119	0.874	0.126	0.021
1 year income credit limit	0.004	0.099	0.897	0.103	0.006	0.006	0.094	0.9	0.1	0.009
Weekly pay period	0.01	0.17	0.82	0.18	0.022	0.01	0.163	0.826	0.174	0.026
Monthly pay period	0.013	0.303	0.683	0.317	0.025	0.016	0.291	0.694	0.306	0.030
Higher illiquid wealth cutoff	0.012	0.219	0.768	0.232	0.023	0.013	0.209	0.778	0.222	0.027
Ret. acc. as liquid for 60+	0.011	0.203	0.786	0.214	0.023	0.012	0.189	0.798	0.202	0.027
Businesses as illiquid assets	0.01	0.218	0.772	0.228	0.020	0.011	0.208	0.781	0.219	0.024
Direct as illiquid assets	0.012	0.255	0.734	0.266	0.023	0.013	0.238	0.749	0.251	0.027
Other valuables as illiquid assets	0.011	0.22	0.768	0.232	0.023	0.012	0.21	0.778	0.222	0.027
Excludes cc puzzle households	0.014	0.19	0.796	0.204	0.026	0.015	0.175	0.81	0.19	0.030
HELOCs as liquid debt	0.01	0.197	0.793	0.207	0.021	0.011	0.189	0.8	0.2	0.026
Usual income	0.011	0.224	0.765	0.235	0.023	0.013	0.213	0.775	0.225	0.027
Disposable income - Reported	0.011	0.22	0.768	0.232	0.023	0.012	0.21	0.778	0.222	0.027
Disposable income - Single	0.011	0.22	0.768	0.232	0.023	0.012	0.21	0.778	0.222	0.027
Comm. cons. - beg. of period	0.01	0.189	0.801	0.199	0.022	0.01	0.181	0.809	0.191	0.027
Comm. cons. - end of period	0.015	0.33	0.655	0.345	0.026	0.018	0.317	0.665	0.335	0.031

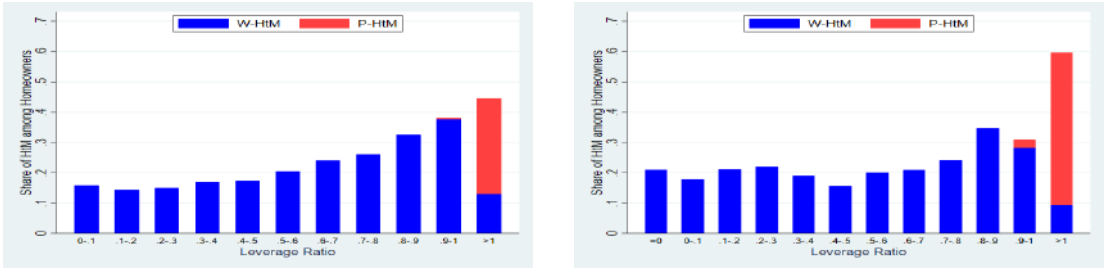
Note- The results in the above table are for those agents who did refinanced and extracted home equity. home equity extraction from the mortgage is either through a cash-out refinance or taking additional HELOCs. The rest of the table definitions and notes follow exactly Table 4.

Table 5: Robustness results for Refinance in each category in the SCF pooled comparison

	1989-2010					1989-2019				
	P-HtM	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**	**P-HtM**	**W-HtM**	**N-HtM**	**HtM**	**HtM-NW**
Baseline	0.13	0.183	0.687	0.313	0.142	0.128	0.184	0.689	0.311	0.14
Usually c > y	0.102	0.181	0.717	0.283	-	0.101	0.181	0.718	0.282	-
Financially fragile households	0.176	0.315	0.508	0.492	0.209	0.174	0.317	0.509	0.491	0.206
Reported credit limit	0.129	0.172	0.698	0.302	0.14	0.127	0.172	0.7	0.3	0.138
1 year income credit limit	0.114	0.128	0.758	0.242	0.119	0.112	0.128	0.76	0.24	0.117
Weekly pay period	0.116	0.14	0.744	0.256	0.126	0.115	0.14	0.745	0.255	0.124
Monthly pay period	0.149	0.253	0.599	0.401	0.169	0.146	0.254	0.6	0.4	0.167
Higher illiquid wealth cutoff	0.14	0.173	0.687	0.313	0.142	0.138	0.174	0.689	0.311	0.14
Ret. acc. as liquid for 60+	0.13	0.178	0.692	0.308	0.142	0.128	0.179	0.694	0.306	0.14
Businesses as illiquid assets	0.119	0.183	0.698	0.302	0.133	0.118	0.184	0.698	0.302	0.131
Direct as illiquid assets	0.129	0.204	0.667	0.333	0.142	0.127	0.205	0.668	0.332	0.14
Other valuables as illiquid assets	0.126	0.187	0.687	0.313	0.138	0.124	0.188	0.689	0.311	0.136
Excludes cc puzzle households	0.174	0.186	0.64	0.36	0.186	0.172	0.186	0.642	0.358	0.184
HELOCs as liquid debt	0.128	0.176	0.696	0.304	0.14	0.126	0.177	0.697	0.303	0.138
Usual income	0	0.218	0.782	0.218	0.002	0.005	0.217	0.777	0.223	0.009
Disposable income - Reported	0.13	0.183	0.687	0.313	0.142	0.128	0.184	0.689	0.311	0.14
Disposable income - Single	0.13	0.183	0.687	0.313	0.142	0.128	0.184	0.689	0.311	0.14
Comm. cons. - beg. of period	0.109	0.159	0.732	0.268	0.12	0.108	0.159	0.733	0.267	0.119
Comm. cons. - end of period	0.154	0.26	0.586	0.414	0.177	0.152	0.261	0.587	0.413	0.174

Note- The results in the above table are for those agents who did not extract home equity and/or did not refinance. home equity extraction from the mortgage is either through a cash-out refinance or taking additional HELOCs. The rest of the table definitions and notes follow exactly Table 4.

Table 6: Robustness results for those who did not extracted home equity in each category in the SCF pooled comparison



(a) Refinanced to extract home equity

(b) Did not extract HE by refinance

Figure 8: Time-series of fraction of HtM households in the U.S

and allow the much needed cash-out refinance during periods of high unemployment quite similar to the situation that the US economy found itself in the Covid crisis.

3.2 Freddie Mac Approvals

Before running the regressions to motivate the choice of refinance for households, I present some evidence on cash-out refinance frequency. Figure 9 shows how the frequency of cash-

out refinance (as a percentage of total refinance) varies with the values of the independent variables used in the regression. The results presented here are obtained by sorting and dividing the data each variable into 3 quantiles for each year.

Figure 9: Frequency of Cash-out refinance for 3 quantile levels

The results are broadly in line with intuition and serve as checks to indicate that the cash-out refinance channel indicates strong demand for household liquidity if the household is perceived to have a higher debt level as indicated by higher DTI, lower FICO and higher LTV, higher unpaid loan balance. The original interest rate on the loan is becoming more important in recent years. This could be because of monetary policy which has been broadly keeping interest rates consistently low post-GFC indicating that the new interest payments

for the increased mortgage amount from opting or choosing a cash-out refinance are going to be lower as compared to pre-GFC.[17] As house price increase, especially pre-GFC, the frequency of cash-out refinances increases. The resulting higher mortgage debt per household probably also contributed to the subsequent defaults. The effect was also pronounced across quantiles during the 2002 recession. Surprisingly on dividing the MSAs by the average unemployment, the effect is muted across quantiles. This might be simply because the average unemployment rate does not matter that much for the decision as compared to the year-on-year percentage changes in unemployment (which is a better proxy for idiosyncratic changes in the household incomes).

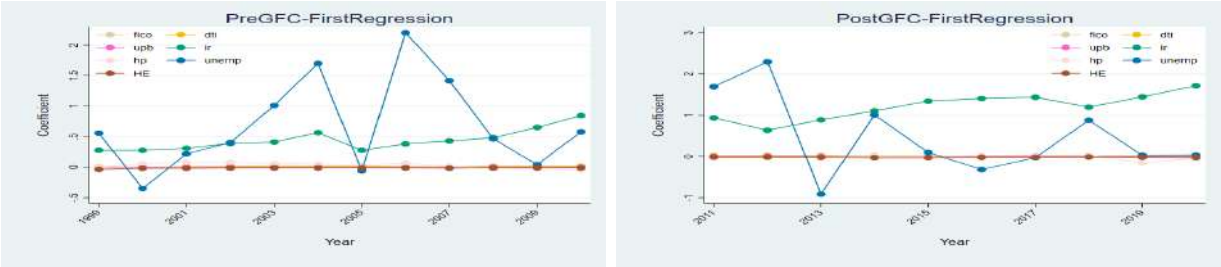


Figure 10: Coefficients from yearly regression-1999-2020

Figure 10 shows the value of coefficients. Percentage changes in unemployment had the highest effect on the probability of refinance till almost 2013 showing the strong motive for liquidity. The original interest rate became gradually important over time. This reduces the costs involved with cash-out refinance. The results with region dummies added is presented in Appendix B.

Since the variables are all in different units to get a broad picture of the amount of variation that each variable is responsible for over the years, Figure 11 plots the variations over time. The unemployment channel is accounting for a substantial fraction of the variation for the cash-out refinance before 2010. Post GFC, the effect is slightly muted and coincided with house price. The other interesting channels of home equity and original interest rate appear far less effective confirming that the former are majorly responsible for household liquidity demand aided by higher house prices, working in conjunction with higher unemployment rates.

For the pooled regression over 1999-2020, the time fixed effects is the highest (Table 7) and accounts for a substantial amount of the variation. Even then, the effect of unemployment is

[17]This result can be contrasted with the findings of Bhutta and Keys (2016) who find that changes in interest rate were one of the most relevant variables before GFC.

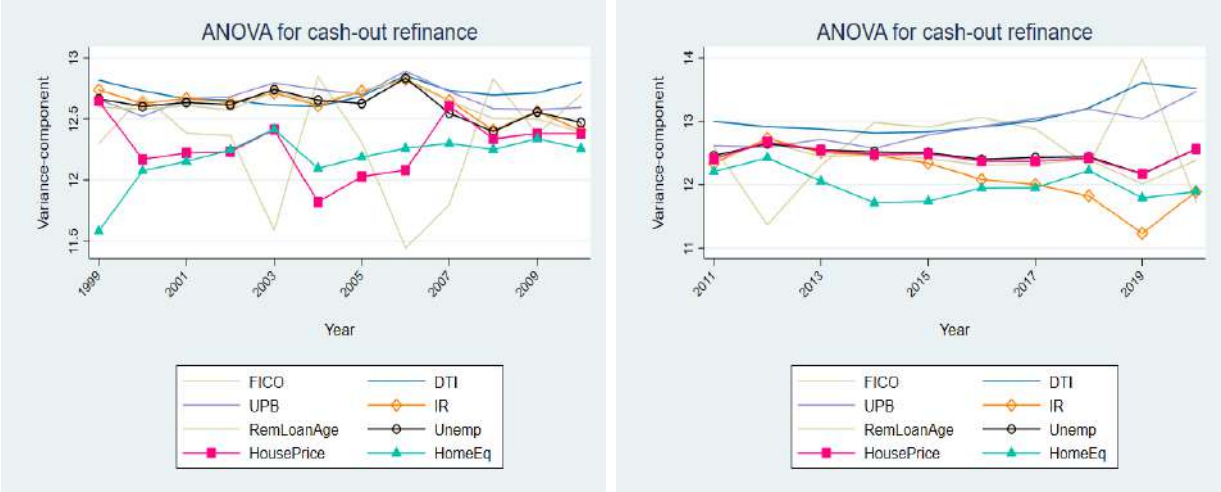


Figure 11: Variance Decomposition-1999-2020

Variable	Percentage of Variance Decomposition	Corresponding p-val
FICO	3.60777	0
ODTI	3.55847	0
IR	3.56524	0
UnpaidBalance	3.54332	0
RemLoanAge	3.54812	0
Unemp-%-change	3.55566	0
house price-%-change	3.53427	0
home equity	3.45755	0
Time fixed Effects	41.11557	0
	Coefficient	**Corresponding p-val**
FICO	-0.00416	0
ODTI	0.01393	0
IR	0.00000	0
UnpaidBalance	0.58026	0
RemLoanAge	-0.00158	0
Unemp-%-change	0.06283	0
house price-%-change	0.02044	0
home equity	-0.02001	0

Table 7: Pooled data variance decomposition from 1999-2020

the higher than that of home equity and house price. The interest rate effect is only slightly higher. Additional empirical robustness checks are presented in Appendix section 3.2.

4 Wealthy HtM behaviour: simple 3 period PE model

4.1 No other illiquid Asset besides a House

The objective is to develop a theoretical mechanism which motivates a cash-out refinance over a no cash-out in the face of sustained negative income shocks and its interaction with the HtM status of households. As referred earlier, this rationalizes the measurement of wealthy HtM based on their decision to extract home equity as in section 2.1. TO keep the setup simple, the only illiquid asset available to an agent is a house which needs to be purchased using a mortgage. The baseline model does not include any income transfer or access to unsecured credit at $t = 1$.[18] Owning a house gives an additional constant non-zero utility and is strictly preferred to not owning a house. It is however always not affordable. Depending on the initial endowment of ω at $t = 0$ they can divide agents into 2 groups. Group 1 is unable to own a house while Group 2 buys a house offering a lifetime consumption equivalent of H units by purchasing a single fixed rate mortgage (FRM) worth M. To simplify matters, the endowment after purchasing the mortgage for an agent belonging to Group 2 is equal to the initial endowment of an agent belonging to Group 1. In both cases, the value post the decision of purchasing the house is normalized to $\omega = 1$.

Per-period utility for both the agents is log-utility. Consumers earn an income of y_1^k in period 1 and y_2^k in period 2 and consume in periods 1 and 2 where $k = 1, 2$ denotes the group. At $t = 1$, agents decide how much to allocate between liquid assets m_2^k and how much to consume c_1^k. The return on liquid assets is fixed at 1. At $t = 2$, agents do not save and consume their entire income and accumulated savings. Agents owning a house make fixed payments of rM in each of the two periods. In a departure from KVW (2014), Agents of Group 1 are representative with discount rate ρ^1 while agents of group 2 are heterogeneous with a continuum of discount rates $\rho^{2,j} \in [0, 1]$. Agents of both groups therefore maximize their discounted lifetime utility. Period utility is CES with $\sigma = 1$ or log utility. Since the representative agent of group 1 does not own a house, the discount rate ρ^1 can be controlled independently of $\rho^{2,j}$ $\forall$ $j \in [0, \infty)$. No matter how impatient/patient an agent j of group 2 is, the utility from owning the house is preferred to not owning one irrespective of the refinance strategy.

Group 1: Since Group 1 does not have the necessary initial endowment to purchase the

[18] Adding these features would lead to more tedious algebra results with gain for motivating the measurement of HtM empirically. See Appendix A.3 & A.4 of KVW.

house, their problem is exactly identical to the setup without illiquid assets as detailed in Appendix A.1 of KVW (2014). The problem faced by the household at $t = 1$,

$$\begin{aligned} V^1 &= \max_{c_1, c_2} \; ln\,(c_1^1) + \frac{1}{1+\rho^1}\, ln\,(c_2^1) \\ \text{s.t. } c_1^1 + m_2^1 &= y_1^1 + m_1^1 \\ m_2^1 &\geq 0 \\ c_2^1 &= y_2^1 + m_2 \end{aligned}$$

which has the solution

$$m_2^1 = \max \left\{ \frac{y_1^1 + m_1^1 - y_2^1(1+\rho^1)}{2+\rho^1}, 0 \right\}.$$

The interior solution for m_2^1 implies $c_1^1 = (1+\rho^1)(y_1^1 + m_1^1 + y_2^1)/(2+\rho^1)$ and $c_2^1 = (y_1^1 + y_2^1 + m_1^1)/(2+\rho^1)$ where the consumption smoothing result no longer holds due to the introduction of the discount rate. The corner solution remains unchanged with $c_1^1 = m_1^1 + y_1^1$ and $c_2^1 = y_2^1$. Since there are no other illiquid assets available at $t = 0$, $m_1^k = 1$ for both groups, $k = 1, 2$.

Group 2: Besides owning the house, each agent has 3 choices. Upon realization of income y_1^2, house prices and the prevailing mortgage rate at $t = 1$, he/she can either decide to refinance their mortgage or not. Upon deciding to refinance, he/she chooses whether to opt for a cash-out over a no cash-out refinance.[19] Opting for a no cash-out refinance would lead to reduced mortgage payments in period 2 which can be treated equivalently as receiving a discounted lump sum transfer at $t = 1$. Alternatively, a cash-out refinance would entail an immediate liquidity transfer at $t = 1$ trading off with higher mortgage payments at $t = 2$. Assuming that an agent owning a house can always undertake a no cash-out refinance once the overall mortgage rate is realized to be lower than the rate at which the mortgage was purchased at $t = 0$ net of transaction costs (which increases overall lifetime utility with certainty), opting for a no cash-out refinance dominates the choice of not refinancing the mortgage at $t = 1$. Therefore, at $t = 1$, once the respective state variables have been realized, agents decide to whether opt for a cash-out or a no cash-out refinance in conjunction with the portfolio allocation decision of their counterparts in Group 1. As before, since there is no other illiquid asset available at $t = 0$, $m_1^{2,j} = 1$ for any agent $j, j \in [0, \infty)$.

The problem faced by the household $j, j \in [0, \infty)$, who opts for a no cash-out refinance is

[19] Since the empirical evidence is based on approvals data, implicitly each agent receives certain approval for their choice of refinance.

given by

$$\begin{aligned} V_{\text{NC}}^{2,j} &= \max_{c_1^{2,j}, c_2^{2,j}} \; ln\,(c_1^{2,j}) + \frac{1}{1+\rho^{2,j}}\, ln\,(c_2^{2,j}) + ln\, H \\ \text{s.t. } c_1^{2,j} + m_2^{2,j} &= y_1^{2,j} + m_1^{2,j} - rM + \frac{1}{1+\rho^{2,j}}\Delta rM \\ m_2^{2,j} &\geq 0 \\ c_2^{2,j} &= y_2^{2,j} + m_2^{2,j} - rM \end{aligned}$$

which has the solution

$$m_2^{2,j} = \max \left\{ \frac{y_1^{2,j} + m_1^{2,j} + rM\rho^{2,j} + (\Delta rM - y_2^{2,j})(1+\rho^{2,j})}{2+\rho^{2,j}}, 0 \right\}.$$

They are more likely to get an interior solution as the value of Δr increases cet. par. An agent is less likely to be HtM if they opt for a no cash-out refinance and the discounted payments received can act as insurance against negative income shocks experienced at $t = 1$. On the contrary, if the agent is HtM with $m_2^{2,j} = 0$, then $c_1^{2,j} = y_1^{2,j} + m_1^{2,j} - rM + \Delta rM/(1+\rho^{2,j})$ and $c_2^{2,j} = y_2^{2,j} - rM$ again indicating the use of the mortgage as an insurance against unexpected income shocks.

Agents can alternatively opt for a cash-out refinance which is equivalent to borrowing at $t = 1$ using accumulated home equity while repaying higher mortgage payments at $t = 2$ net of transaction costs. In this case, I assume that the future interest rate remains the same as the one in the original mortgage contract post the cash-out refinance. The problem faced by the household who opts for a cash-out refinance is given by

$$\begin{aligned} V_{\text{C}}^{2,j} &= \max_{c_1^{2,j}, c_2^{2,j}} \; ln\,(c_1^{2,j}) + \frac{1}{1+\rho^{2,j}}\, ln\,(c_2^{2,j}) + ln\, H \\ \text{s.t. } c_1^{2,j} + m_2^{2,j} &= y_1^{2} + m_1^{2,j} - rM \\ -\theta P &\leq m_2^{2,j} \leq 0 \\ c_2^{2,j} &= y_2^{2} + rm_2^{2,j} - rM \end{aligned}$$

which has the solution

$$m_2^{2,j} = \max \left\{ -\frac{y_2^2(1+\rho^{2,j}) - y_1^2 - m_1^{2,j} - \rho^{2,j} rM}{r(1+\rho^{2,j}) + 1}, -\theta P \right\}.$$

The more interesting case is the corner solution where $m_2^{2,j} = -\theta P$ with $c_1^{2,j} = y_1^2 + m_1^{2,j} - rM + \theta P$ and $c_2^{2,j} = y_2^2 - r(M + \theta P)$. The HtM agent opts for higher consumption today by taking an additional loan using the house as a collateral trading off with a lower consumption in the future when the repayment reduces the income available for consumption. More importantly, higher house prices relaxes the collateral constraint and allows greater borrowing irrespective of HtM status for the household indicating the strong demand for liquidity to smooth consumption today in the face of income shocks while settling for a reduced consumption in the future. The mathematical expression indicates that households opting for a cash-out refinance could be more likely to be HtM than their counterparts since the condition for not borrowing upto the limit is harder to satisfy once they have adopted the framework where the income of the agent in period 2 is always the same across groups. Intuitively, such households are likely to be more impatient and have a higher value of $\rho^{2,j}$ and value the future less than those opting for a no cash-out refinance.

The choice at $t = 1$ for a household owning a house is thereby given by the following expression:

$$V^{2,j} = \max \ \{V_{\text{NC}}^{2,j}, V_{\text{C}}^{2,j}\}$$

Even such a minimal departure from the KVW (2014) renders the model analytically intractable and I have to rely on numerical simulations. Given parameter values, the refinance strategy depends on a threshold value of $\rho^{2,j}$, namely $\rho^{2,c}$. Broadly, they have to compare the value functions from the two choices: no cash-out vs cash-out. For $\rho^{2,j} > \rho^{2,c}$, agents opt for a cash-out over a no cash-out & vice-versa. For equality, they are indifferent. As is also clear from the above expressions, the model developed can satisfactorily explain the mechanism at hand intuitively. An agent opting for a no cash-out refinance is less likely to be HtM than his/her counterpart who opts for a cash-out refinance since the former is likely to be more patient valuing the future more than the latter. In either case, the agent is acting rationally maximizing their total lifetime utility.

4.2 Benchmark Model Calibration

The first step to calibrating the benchmark model would be determining the shares of the Poor and wealthy HtM for each group of agents. For agent 1 who does not not own a house, the only parameters under my control are the incomes in the two periods. If $m_2^1 > 0$, they are not HtM and vice versa. Choosing a grid of discount rates ρ, I report the values of y_1^1 and y_2^1 in the Table 8. Following the SCF (2019) the average Poor HtM not owning a

house has been estimated to be 7-8% (row 1, column 3 of Table 1). Targeting the share, the representative agent discount rate is fixed to be 0.8911. As mentioned previously, the discount rate ρ^1 can be set independently of $\rho^{2,j}\ \forall\ j \in [0, \infty)$.

Parameter	y_1^1	y_2^1	ρ^1	**Target P-HtM (in %)**
Agent 1	6.3	3.8	0.8911	7-8

Table 8: For Representative Agent 1 - No House

For agents of group 2, to ensure that they would always derive a lifetime utility which is higher from owning a house to not, I set H=1.6 which ensures that for my chosen grid of ρ the simulated value function is from opting for a non-cash-out refinance is always higher than not owning a house with the income parameters as defined in the above Table 8. To match the share of the HtM among those opting for cash-out refinance the other parameter values that I select for Group 2 are $y_1^2 = 5.4, y_2^2 = 4.2, \theta = 0.8, M = 7.8, r = 0.1, \Delta = 1.2$ & $P = 1$. This would form my benchmark calibration on which I run certain numerical experiments. The results are as obtained in the first row of Table 9. The numbers are motivated by the SCF (2019) estimates.

Experiment	**Cash-out over no cash out** $(\boldsymbol{\rho^{2,j} > \rho^{2,c}})$	**Total cash-out (in %)**	**Cash-out at limit (in %)**
Baseline	$\rho^{2,j} > 0.81$	20	7
$P \uparrow 10\%$	$\rho^{2,j} > 0.81$	20	5
$\Delta \uparrow 10\%$	$\rho^{2,j} > 0.83$	18	7
$y_1^2 \downarrow 10\%$	$\rho^{2,j} > 0.67$	35	25
All together	$\rho^{2,j} > 0.68$	34	21
Joint Shock	$\rho^{2,j} > 0.84$	18	9

Table 9: For Heterogeneous Agent 2 who owns a house

The value of the threshold discount rate $\rho^{2,c}$ above which agents are sufficiently impatient to ignore the cost of higher future mortgage payments is determined to be 0.81. The incomes are not the same as the agents in Group 1. This would be not be very far from reality since there is a substantial fraction of people who own a house but are not in high paying jobs or have the necessary skill set. Conversely, higher education and being a part of the

skilled labor force would not guarantee ownership of the house.Though the setup is purely to motivate the empirical measurement of HtM agents based on their decision to opt for cash-out refinance and/or taking additional HELOcs, I conduct some simple comparative statics below to demonstrate qualitative consistency with currently observed macroeconomic facts.[20]

Experiment 1 - Increase P by 10%: Increasing house price P by 10%, we observe that not surprisingly the percentage of individuals opting for a cash-out refinance over a no cash-out remains as the house price does not affect the cash-out refinance individuals who are not at their borrowing limit explicitly. It only relaxes the borrowing constraint. However the cash-out HtM who are at their borrowing constraint utilize the increased borrowing limits and the total number of cash-out HtM decreases by around 2%. By the design of the setup, the price increase does not affect the agents opting for a no cash-out refinance.

Experiment 2 - Increase Δ by 10%: This predictably increases the no cash-out refinance share and the threshold discount rate $\rho^{2,c}$ increases to 0.83. The share of the HtM in cash-out remains unchanged from the benchmark case. Allowing higher discounted payments at $t = 1$ disincentives the cash-out refinance decision.

Experiment 3 - Decrease y_1 by 10%: The main experiment of interest is reducing the income in period 1 by 10% for an agent of Group 2. The results are in line with the proposed mechanism. The number of agents opting for a cash-out refinance in this toy setup almost doubles with the share of HtM going up by more than a factor of 3. Consequently, the threshold value of $\rho^{2,c}$ reduces to only 0.67 as more agents use the "House as an ATM" to get emergency liquidity. In the benchmark model, there is no precautionary savings motive. Suitably altered preference would lead to more enhanced results.

Experiment 4 - Combining Experiments 1-3: The joint shock of 1, 2 and 3 would well characterize the economic environment during Covid. Labor incomes shrank from the shock that originated in the labor markets while house prices have been surging. Aided by a emergency expansionary monetary policy, the mortgage rates have also declined to historically low levels. Given the joint shock, the results suggest that the unemployment shock with the strong urge for emergency liquidity has the maximum impact. More subtly, the house price increase only aids the cash-out HtM. The share reduces by 4% while the the percentage of agents opting for the cash-out refinance more or less remains the same. Stronger well calibrated shocks with state of the art income processes would make the toy setup closer

[20]These results are consistent with an infinitely lived representative agent model with dynamically changing collateral constraints; see Iacoviello (2005) and others.

to reality. The only purpose of the benchmark calibration is to ensure that the PE model makes sense and retains the promise of delivering a quantitatively meaningful channel in a more enriched general equilibrium setup even in the absence of any other competing illiquid asset to housing.

Experiment 5 - The Joint shock: For an improved calibration that matches the empirical evidence shown in panel (1) of Figure 1 & Table 1 qualitatively, the joint shock is composed of $P \uparrow$ 10%, $\Delta \uparrow$ 10%, $y_1^2 \downarrow$ 10%. Specifically, the total frequency of no cash-out refinances increase while the share of wealthy HtM among the agents opting for a cash-out refinance have increased. This is broadly in line by the intuitive predictions from the second & third row, column 6 of Table 2.

5 Conclusion

The economic turmoil during the COVID-19 pandemic showcased a distinctive trend of rising house prices amidst record unemployment, with mortgage rates reaching historic lows. This scenario likely amplified the demand for refinancing, positioning the housing sector as a pivotal element for the post-pandemic economic recovery. Evidence from the Survey of Consumer Finances indicated that a significant portion of households extracting home equity were categorized as Hand-to-Mouth (HtM). Additional analysis using Freddie Mac approvals data showed that households experiencing idiosyncratic income shocks were inclined to leverage home equity extraction to buffer against prolonged decreases in labor income. Nevertheless, these positive findings might be somewhat underestimated due to the increased barriers to refinancing approvals and home equity extraction, which tend to intensify during economic downturns.

To enhance empirical insight, it was recommended to estimate the Marginal Propensity to Consume (MPC) for affluent Hand-to-Mouth (HtM) individuals, both those who refinanced and those who did not, using Panel Study of Income Dynamics data. These estimates were integrated into a partial equilibrium framework within a general equilibrium model, treating housing as an illiquid asset. The research employed a three-period model that endogenized the refinancing decision based on a threshold discount rate, providing a theoretical basis for assessing HtM status. This model effectively showed how economic shocks during the pandemic influenced households' HtM status based on homeownership and refinancing decisions. A significant development was linking household mortgage positions to Unhedged Interest Rate Exposures (UREs), which, coupled with the decline in real interest rates, suggested

potential welfare gains for households with negative UREs holding long-term assets and adjustable-rate mortgages (ARMs). Additionally, the possibility of increasing debt through home equity extraction, such as cash-out refinancing or Home Equity Lines of Credit (HELOCs) for fixed-rate mortgages, could exacerbate UREs and alter the distribution of welfare gains from monetary policy expansions.

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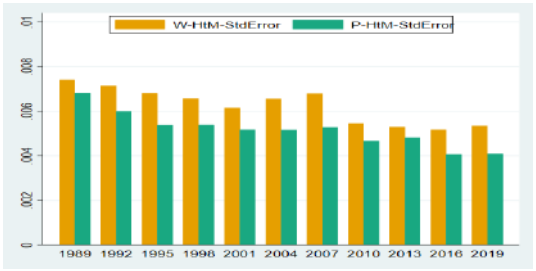
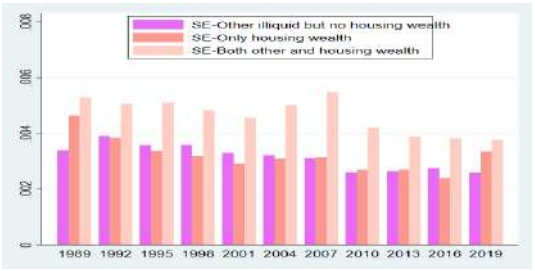
Appendix

A HtM Estimate Standard Errors

I present here the standard errors of the HtM estimates as a robustness check analogous to Figures 3, 4, 5, 6 & 7 to in the main text. Figure 5 has been split into 2 parts: Figure A.3 and Figure A.4. In all the figures, the standard errors are extremely low suggesting the measurement for the mean estimates is accurate enough for empirical purposes.



(a) Share of total, wealthy, and poor HtM



(b) Share of total, wealthy, and poor HtM

Figure A.1: SE of estimates for the time-series of fraction of HtM households in the U.S

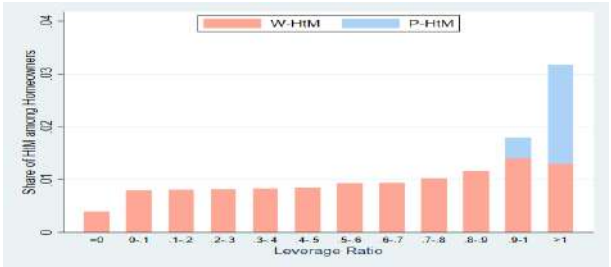


Figure A.2: SE of estimates for the share of HtM households among homeowners by leverage ratio, SCF 1989-2019.

For some of the figures, since the variable denoting the refinancing choice is not present every survey, the values are absent for some survey years, inline with the figures in the main text.

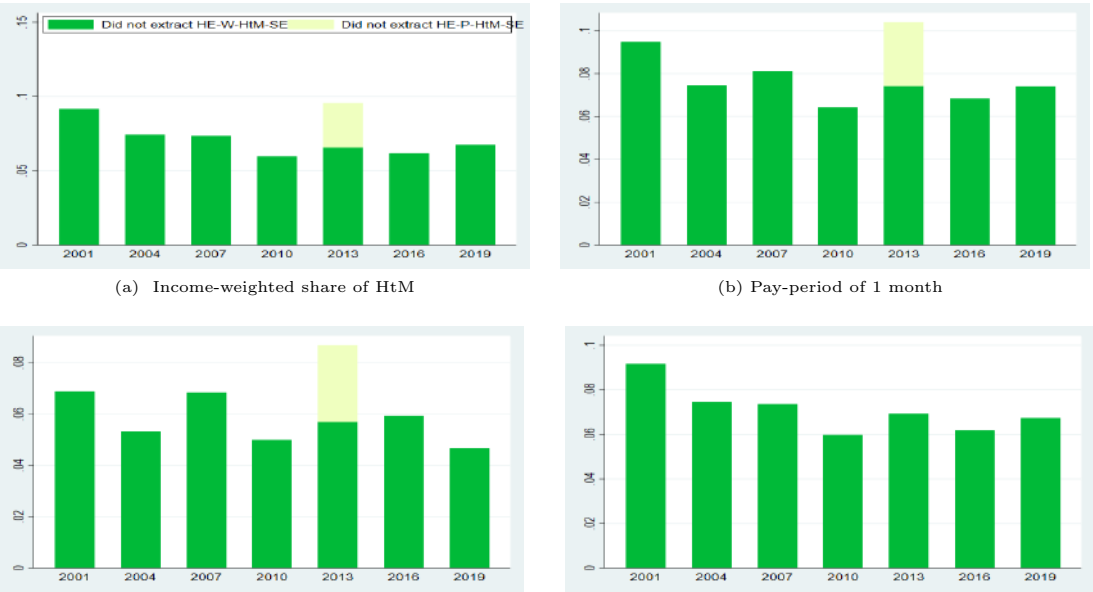
(a) Income-weighted share of HtM

(b) Pay-period of 1 month

(c) Reported credit limit

(d) Vehicles in illiquid wealth

Figure A.3: SE of estimates for the time series of fraction of HtM households in the U.S. who extracted Home Equity, alternate definitions.



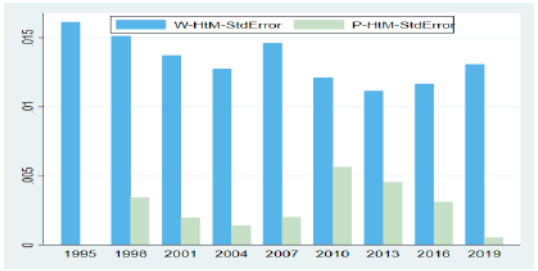
(a) Income-weighted share of HtM

(b) Pay-period of 1 month

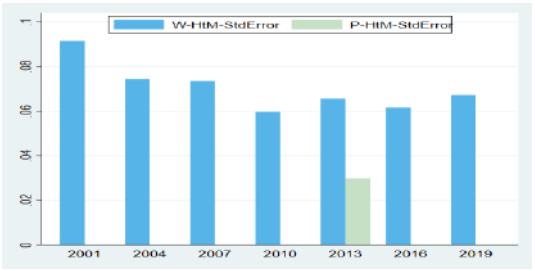
(c) Reported credit limit

(d) Vehicles in illiquid wealth

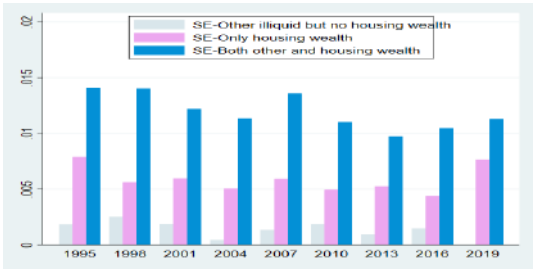
Figure A.4: SE of estimates for the time series of fraction of HtM households in the U.S. who did not extract Home Equity, alternate definitions.



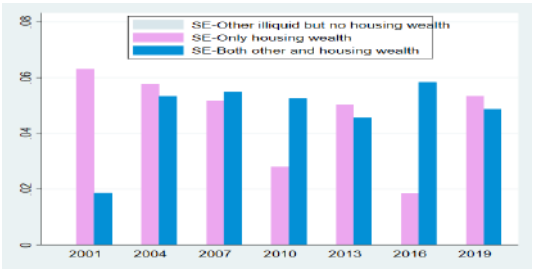
(a) Refinanced & extracted home equity



(b) Did not refinance and/or extract HE



(c) Portfolio composition for HE extracted wealthy HtM



(d) And for wealthy HtM who didn't extract HE or refinance

Figure A.5: SE of estimates for the HtM households and the portfolio composition of wealthy HtM by refinance decision

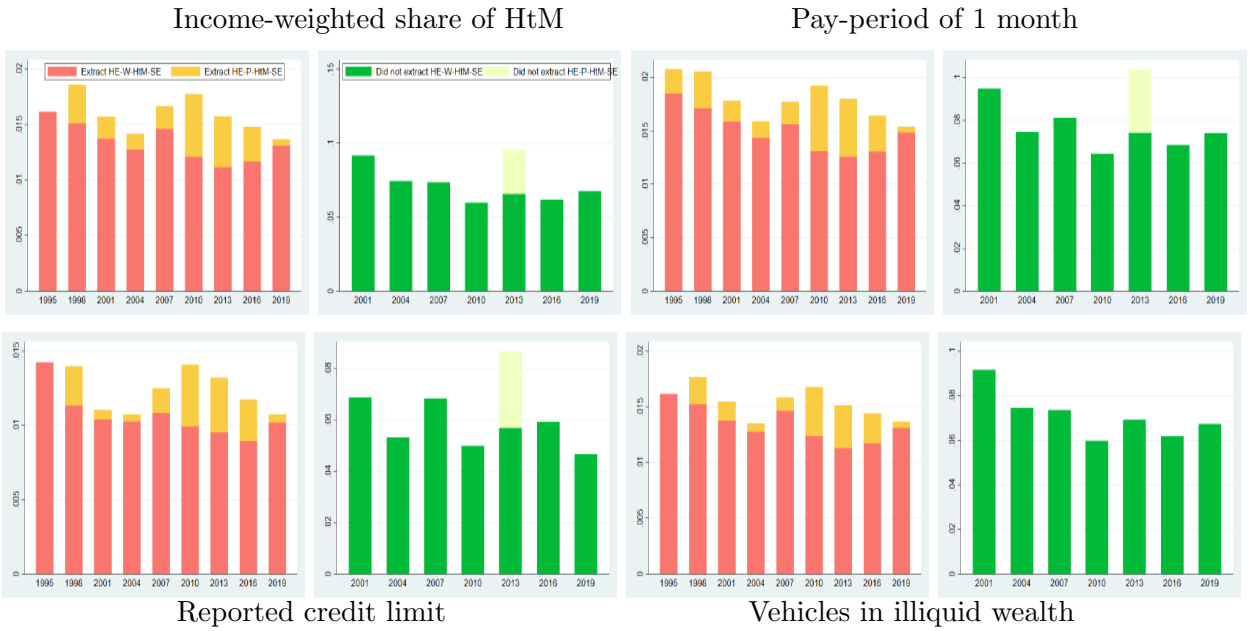
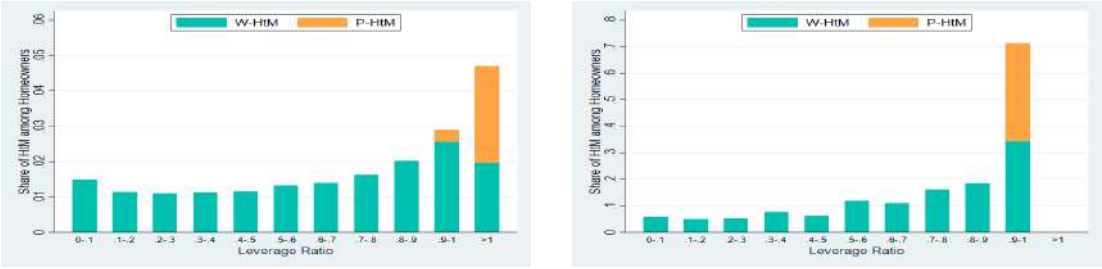


Figure A.6: SE of estimates for the time series of fraction of HtM households in the U.S., alternate definitions. conditioned on Home Equity Extraction

B Freddie Mac Approvals

This section contains the detailed results for the Freddie Mac data that motivates the importance of unemployment percentage changes in proxying for idiosyncratic income shocks. The



(a) Refinanced to extract home equity

(b) Did not extract HE by refinance

Figure A.7: SE of estimates for the time-series of fraction of HtM households in the U.S

results serve to broaden the evidence of how the same can be used to map to the individual collateral constraint.

Additionally, I present the results conditioned on various quantiles presented in Figures Figure B.1 and Figure B.3. I choose 3 quantiles. The base level and two added dummies for each of the variables that I choose to condition on. The coefficients give similar results as shown by the level variables at the aggregate. Unemployment and interest rates are the only regressors with substantial variation. This effect is consistent with the interest rate effect picking up off late and the unemployment effect reducing in the recent years. The dummy values indicate the trends that are seen with the frequency of refinancings in Figure 9. Higher DTI, lower FICO and higher LTV, higher unpaid loan balance all lead to higher dummy values indicating stronger probability of cash-out refinance across the MSAs.

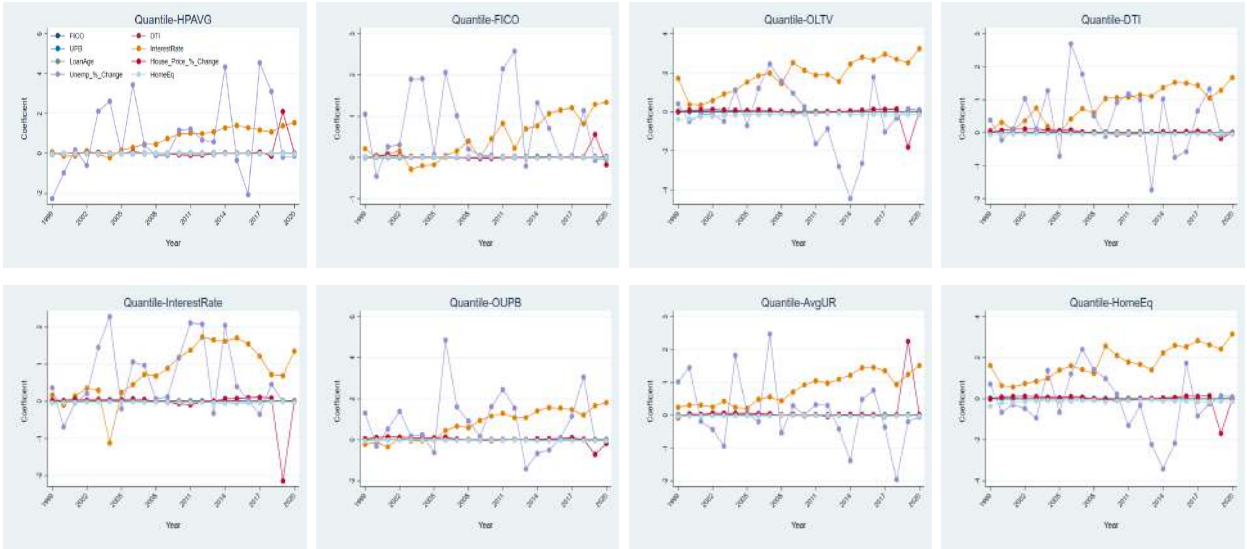


Figure B.1: Coefficient values-3 quantiles

Figure B.2: ANOVA for Coefficient values-3 quantiles

Figure B.3: Dummy values-3 quantiles

From Figure B.2, I infer that the most important variables governing the decision to undertake a cash-out refinance over a no cash out are the debt-to-income, FICO and unpaid balance. Surprisingly, higher unpaid balance leads to a greater propensity to undertake a cash-out refinance which may well be because the interest rates on the new mortgage amount would be far lesser owing to mortgage rates being at their historic lows.[21] Moreover, I can safely claim that these variables are positively correlated with unemployment changes (proxying for the idiosyncratic income shocks at the individual level). This would increase the true

[21]This is in contrast to results obtained by Chen et al. (2020).

variation captured by the percentages changes in the MSA level unemployment rates. These variables are less correlated with the aggregate changes in the house prices. Interest rate changes and the amount of available home equity explain less of the variation. This effect is consistent across quantiles. The results further strengthen the House as ATM channel with changes in unemployment & being a significantly important driver for the choice of refinance activity. On the other hand, the original interest rates are significantly less effective.

Figure B.4: ANOVA for Dummy values-3 quantiles

If I further study the interaction effects across quantiles as presented in Figures Figure B.5 and Figure B.7, I find that the unemployment percentage changes is the most significant across the various quantiles and this is true for both levels 2 and 3 for the various regressors and variables that have been divided into various quantiles. The interest rates also have become quantitatively significant off late as observed previously. The results confirm my hypothesis that the choice of refinance can be used as an imperfect substitute to proprietary data in studying the incentives for home equity extraction without explicitly relying on the exact amount of home equity extracted per loan. This is sufficient for the interests of the current paper with the strong evidence for household liquidity demand in the face of idiosyncratic income shocks given by the percentage changes in unemployment at the MSA level. The same is also exacerbated if the erstwhile household debt levels are higher as indicated by the various levels of the dummy especially for FICO scores and the debt-to-income along with larger unpaid balances.

To get a better picture about the importance of each regressor of interest in accounting for the interaction and base level effects, I study the corresponding variance decomposition

Figure B.5: Interaction effects-Quantile 2

effects for the two dummy levels across quantiles in Figure B.4 (analogous to Figure B.3) followed by the interaction effects of interest for the mid and high level in Figures Figure B.6 & Figure B.8 (analogous to Figures Figure B.5 & Figure B.7) respectively.

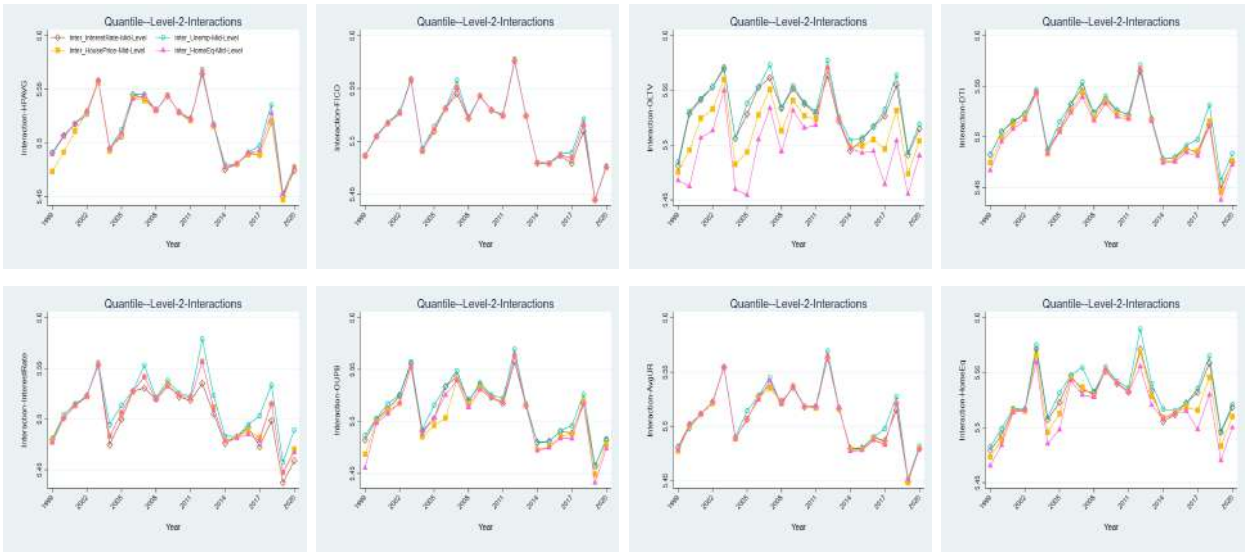


Figure B.6: ANOVA for Interaction effects-Quantile 2

Looking at the variance decomposition for the middle quantile (Figures Figure B.4 & Figure B.6) we find that the effects are more or less similar for all the quantile variables except the levels for original loan to value (LTV). Having a larger LTV would mean the effect of unemployment changes is much greater than the effects of changes in house prices & interest rates). This result seem to slightly surprising suggesting that agents who seem to be more

constrained have greater urge to undertake cash-out refinance. Since the data indicates only approvals, the explanation that more constrained agents getting approved for a cash-out refinance that would further increase their LTVs holds and the initiation for the same is coming from negative income shocks indicated or proxied by the unemployment percentage changes.[22] Overall, there does not seem to be any significant changes across the middle quantile. The order of magnitude of the variations are all the same for both the base level coefficients and the diff-in-diff effects captured by the dummy & interaction terms for various quantiles as evidenced by Figures Figure B.2, Figure B.4 and Figure B.6 suggesting little heterogeneity across agents for the middle level.

Figure B.7: Interaction effects-Quantile 3

Similarly, if we are to look at the variation for the third level (denoted by high) we find the results to be significantly different. This is evidenced by Figures Figure B.4 (for the third level) & Figure B.8. The interaction effects are quantitatively different for the quantiles of the debt-to-income, average house prices, FICO score and Home Equity. Higher DTI & FICO scores (both indicating agents who are expected to be significantly constrained comparatively) have higher sensitivity to the unemployment rates and individual interest rates over home equity & house price changes. This further reinforces the fact that wealthy HtM having received higher income shocks has a greater propensity to opt for a cash-out refinance corroborating the significance of my proposed mechanism for a significant fraction

[22]This could be also due to the endogeneity with increasing house prices. Chen et al. (2020) find that a looser LTI constraint can also enable more households to become homeowners or switch to a bigger house, which would relax the LTV constraint and further increase the amount of borrowing and the results are broadly consistent.

of agents whose main illiquid asset is the house that they own through mortgages. The importance of the evidence is especially relevant under the current crisis where we would like to have more precise estimates of the proportion of people who are HtM and can use their house to get an emergency liquidity transfer.

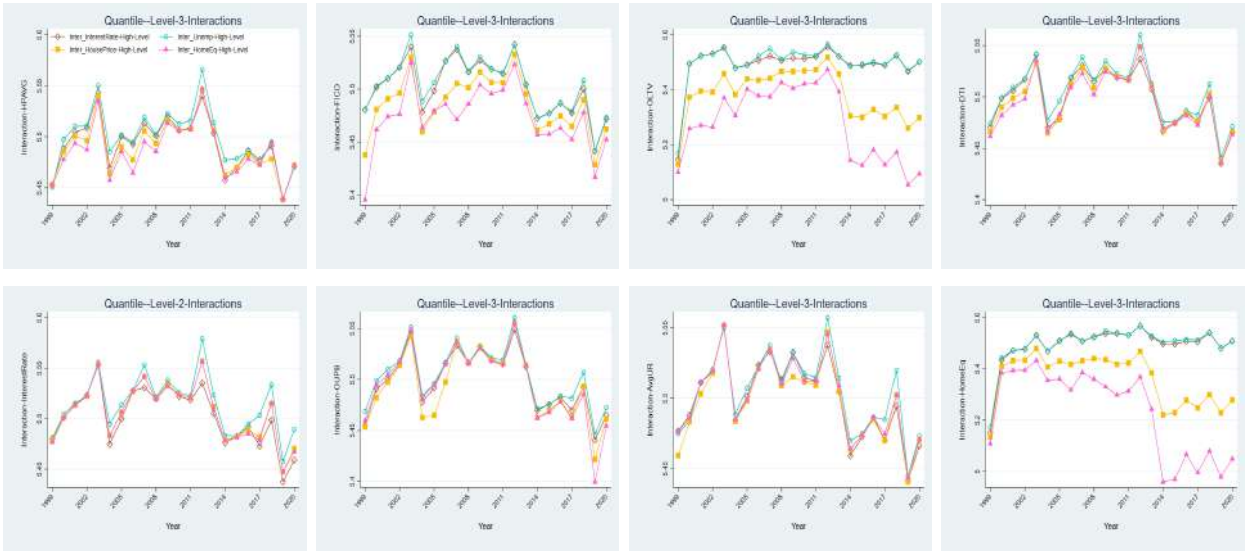


Figure B.8: ANOVA for Interaction effects-Quantile 3

Figure B.9 indicates that there are very slight differences on expanding the number of quantiles. Reassuringly, the results are intuitive and in line with the ones obtained for 3 quantiles in Figure 9 in the main text.

I have excluded home equity and unemployment quantiles since the results were more or less identical to the ones given in the main text for 3 quantiles. Analogous to Figure B.1, Figure B.10 shows the value of coefficients for 5 quantiles. The graphs look almost identical for the case of 3 quantiles suggesting very little improvement in adding more quantiles. There is surprisingly little variation across quantiles. This effect is carried over to the dummy values and the interaction terms for the various quantile levels.

Observing, it can be claimed that Figure B.11 is quite different from Figure B.3 in terms of the magnitudes of the values. The effects are qualitatively and intuitively similar to the corresponding results in the main text with some important exceptions. Within the quantiles, when the data is divided based on the loan-to-value, there is little difference except during the crisis in 2008. Interestingly, the interest rate effect stays muted except for the GFC period. This once again reinforces the main results in the text and is consistent with the HtM status of such households. Interest rate changes are not an important determinant of

Figure B.9: Frequency of Cash-out refinance for 5 quantile levels

the probability in preferring a cash-out refinance.

The effects of interest rate increase when considering 5 quantiles. The major effect is still the unemployment percentage change as in the main text suggesting the effects of sudden negative shocks to labor income are stronger in reality. This augments both my theoretical model that motivates the measurement and the motivation behind measuring the hand-to-mouth status. Figure B.12 and Figure B.13 show the interaction effects for the second and third quantile. Comparing with Figure B.5 & Figure B.7, the magnitude of the interest rate is significantly different from near zero. However, the impact of the unemployment percentage change does not diminish in any way and the results survive on considering

Figure B.10: Coefficient values-5 quantiles

different quantiles. Additionally, Figure B.14 & Figure B.15 show the impacts due to the interaction effects for the fourth and fifth quantiles. Observing the panels for interest rate, the impact of further changes in the mortgage rate are inconsequential and the effects are again linked with changes in the unemployment rates.

Lastly, for completeness and for understanding the importance of regional factors, I present the results for various regions in Figure B.16. The effect of unemployment remains strong for all quantiles while the effects of interest rate are strongest only for South. This suggests region specific factors are possibly heterogeneous. I carry out the analogous exercises to the aggregate level for the various regions. However, I observe that the heterogeneity is not that significant. I therefore do not include the figures for rest of the results for the four regions in the interest of space.

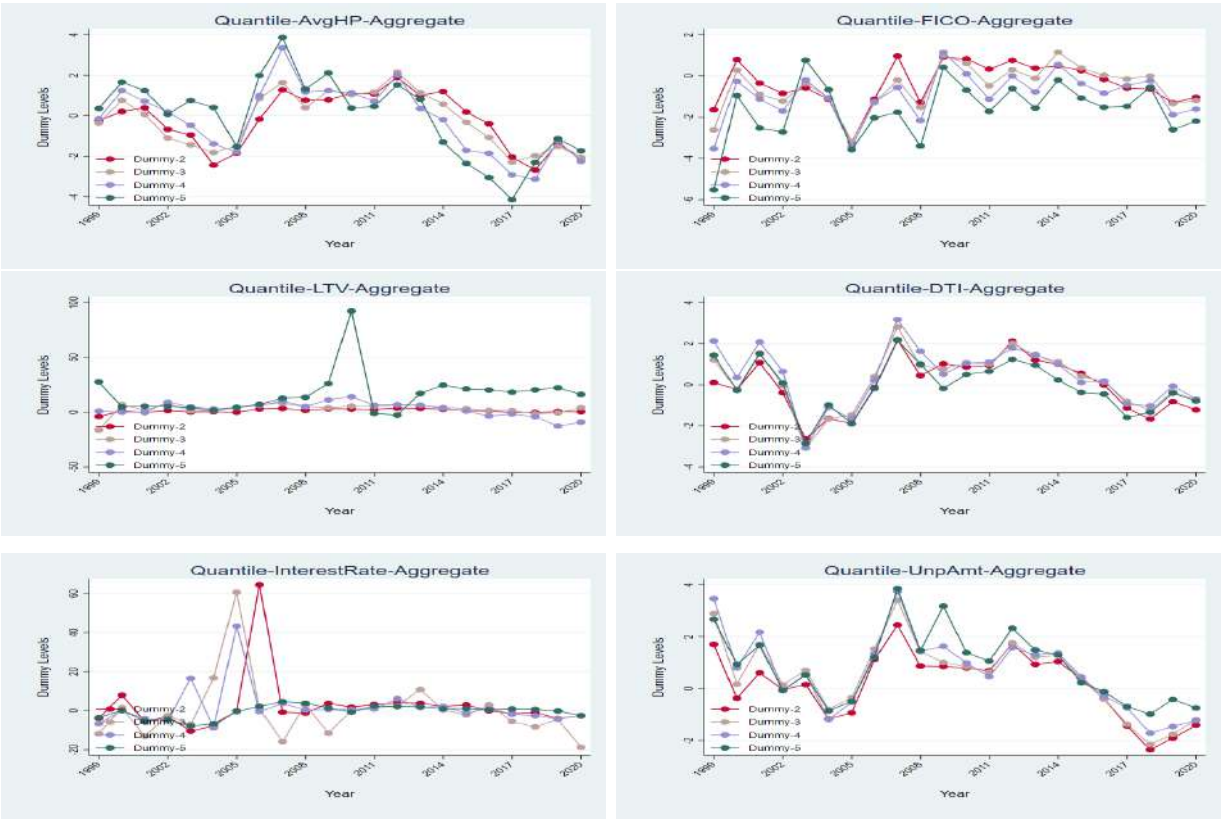


Figure B.11: Dummy values-5 quantiles

Figure B.12: 5 quantiles: Interaction Effects for quantile 2

Figure B.13: 5 quantiles: Interaction Effects for quantile 3

Figure B.14: 5 quantiles: Interaction Effects for quantile 4

Figure B.15: 5 quantiles: Interaction Effects for quantile 5

Figure B.16: Coefficient values with region dummies