Mortgage Refinancing and the Marginal Propensity to Consume

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Abstract

This paper investigates the role of mortgage refinancing in shaping the estimates of marginal propensity to consume (MPC) and its implications for fiscal policy. Using U.S. household data, we find that MPCs decrease during the year of mortgage refinancing and stabilize afterwards, particularly among households with lower liquid assets, higher debt-to-income ratios, and valuable illiquid assets. The empirical evidence suggests that refinancing provides extra liquidity, reducing MPCs. We leverage on a partial equilibrium model to quantitatively assess these effects and to explore the role of home-equity extractions for fiscal policy. Our findings highlight a new dimension for the efficacy of cash transfers: targeted programs that consider higher MPCs of no-refinancers generate savings between 4 and 12% compared to non-targeted programs. These estimates imply approximately $30 billions in potential savings under the CARES Act of March 2020.

JEL Codes: E21, E62, G21, G51, H31

Keywords: Mortgage Refinance, Households Heterogeneity, Marginal Propensity to Consume, Fiscal Transfers, Housing, Fiscal Policy.

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1 Introduction

A growing body of research highlights the importance of household balance sheet composition for the transmission of macroeconomic policies. Within the framework of heterogeneous agent models, differences in asset holdings across liquidity categories generate substantial dispersion in the marginal propensity to consume (MPC) across households (Kaplan et al., 2018; Auclert et al., 2024), shaping the effectiveness of both monetary and fiscal policies. In the United States, mortgage debt and housing equity account for approximately 80% of homeowners' wealth, while two-thirds of U.S. households own a home (Survey Consumer Finances 2001). The illiquid nature of home equity may limit households' ability to utilize their wealth for consumption smoothing in response to income fluctuations. However, mortgage refinancing allows homeowners to convert a portion of their home equity into liquid assets, potentially mitigating liquidity constraints. Empirical evidence suggests that this mechanism plays a significant role in household consumption behavior: Hurst and Stafford (2004) estimate that approximately two-thirds of every dollar extracted through refinancing was allocated to current consumption among liquidity-constrained households in the early 1990s, while Chen et al. (2020) document a countercyclical pattern in home equity extraction, consistent with increased liquidity demand during economic downturns.

This paper investigates how mortgage refinancing affects the MPC and explores its implications for fiscal policy, particularly in the context of cash transfers. While previous studies have focused on cross-sectional variation in MPCs, the dynamic effects of mortgage refinancing on the MPC distribution remain under-explored. Understanding these changes is crucial for evaluating the efficiency of fiscal policy, especially given that fiscal transfers are often deployed during recessions—periods characterized by heightened refinancing activity.

We make two key contributions. Empirically, we leverage on U.S. household-level data from the Panel Study of Income Dynamics (PSID) and apply the methodology developed by Blundell et al. (2008) to estimate MPCs conditional on refinancing timing. Our results reveal a significant reduction in the MPC in the year of refinancing, which remains stable at lower level in subsequent years. Refinancing households are distinct in several ways: they hold a lower proportion of liquid assets relative to total wealth, exhibit higher debt-to-income ratios, and own higher-value illiquid assets. These characteristics align with the "wealthy hand-to-mouth" (W-HtM) classification of Kaplan et al. (2014), suggesting that refinancing provides an alternative liquidity channel for consumption smoothing. While prior studies argue that liquidity-constrained households exhibit high MPCs, our findings suggest a more nuanced interpretation: W-HtM households face liquidity constraints but have access to additional liquidity via home equity extraction, unlike poor hand-to-mouth households. The anticipated liquidity injection from refinancing relaxes budget constraints, thereby reducing MPCs[1]. These findings remain robust across specifications that condition on liquid wealth distribution, large expenditure needs (e.g., medical or educational expenses), expected labor income growth, and household hand-to-mouth status.

Motivated by these findings, we develop a partial equilibrium life-cycle model based on Boar et al. (2022), incorporating uninsurable idiosyncratic income risk, housing, and mortgage choices. The model quantitatively evaluates the role of mortgage refinancing in fiscal policy transmission. Our analysis demonstrates that MPCs out of cash transfers vary significantly depending on refinancing timing, consistent with our empirical evidence. We also examine the implications of the COVID-19 pandemic, which featured both a surge in refinancing activity and the implementation of large-scale fiscal transfers (Figure A.4). Simulating scenarios with income and interest rate shocks, we estimate an aggregate MPC of approximately 24%, in line with Parker et al. (2022), while refinancers exhibit a lower MPC of around 15%. Excluding refinancing as an option in our model leads to a lower aggregate MPC of 16%, underscoring the importance of refinancing activity in models featuring housing and mortgages. Finally, we show that targeting fiscal transfers toward non-refinancing households could improve policy efficiency, generating potential savings between 4% and 12% of untargeted fiscal programs. Based on our estimates, fiscal targeting could have saved approximately $30 billion from the economic stimulus payments under the CARES Act in March 2020.

Related Literature Our paper contributes to three strands of literature. First, several works have focused on the role of monetary policy in shaping incentives for households to refinance and smooth consumption. For example, Wong (2021) finds that younger households that refinance or enter new loans display large consumption response to monetary policy shocks. Along similar lines, Berger et al. (2021) and Eichenbaum et al. (2022) show that the impact of monetary policy is state-dependent: on the previous interest rate path for the former, and on the distribution of savings from refinancing for the lat-

[1] A recent study by Chetty et al. (2020) argues that the recent fiscal stimulus might have been ineffective, for many households only spent a small fraction of the stimulus checks.

ter. Di Maggio et al. (2017) find that reductions in mortgage payments driven by resets of adjustable-rates increases households' consumption, with poor homeowners having higher MPCs. Our paper contributes to these works by providing evidence of changes in MPCs due to refinancing activity, which determines the response of consumption to monetary policy and to fiscal policy, which is the focus of this paper.

Second, our paper relates to the extensive recent literature on heterogenous agents and the role of incomplete markets in determining the distribution of MPCs, mainly attributed to the category of hand-to-mouth households that display low liquid assets holdings and thus high consumption sensitivity to income changes. Several recent studies have highlighted the transmission mechanism of monetary policy (Kaplan et al., 2018), fiscal policy (Kaplan and Violante, 2014; Auclert et al., 2024) and estimates of intertemporal MPC (Fagereng et al., 2021; Auclert et al., 2024). Furthermore, Kaplan and Violante (2022) demonstrate the importance of assuming two types of assets (liquid and illiquid) in order to generate realistic level of aggregate wealth. Strictly related to this frontier, Boar et al. (2022) quantify the degree of liquidity constraints in the U.S. using a life-cycle model with home-equity extraction via refinance. The authors find that four-fifths of U.S. homeowners are liquidity constrained, a share which is significantly higher than hand-to-mouth households. Furthermore, Chen et al. (2020) show that households demand liquidity via home equity extractions during downturns. They estimate a structural model that quantitatively accounts for the evolution of households' balance sheets and consumption. Our paper sheds light into the mechanism through which "wealthy" hand-to-mouth households gain access to extra liquidity by utilizing home-equity extractions when confronted with income shortfalls.

Lastly, our paper is closely related to the extensive body of literature on how changes in house prices influence aggregate consumption (Mian and Sufi, 2009, 2011; Mian et al., 2013). An upswing in house prices motivates households to pursue more frequent refinancing, given the elevated valuation of their homes, which serves as collateral for borrowing. Berger et al. (2018) show that an incomplete markets model with income and house price uncertainty is able to reconcile the empirical evidence of large consumption responses to house price movements. They approximate the consumption response via a "rule-of-thumb" formula with MPC out of temporary income times the value of housing. However, their analysis does not tackle endogenous changes in households' MPCs driven by refinancing activity. Our empirical results show that the micro MPC out of transitory income (the first element of the rule-of-thumb) is conditional on having refinanced the mortgage.

Our paper contributes to these works by accounting for the dynamic effects of mortgage refinancing in shaping the consumption response of liquidity constrained households in the short-run. Lastly, we show that fiscal transfers might not be a one stop solution for all liquidity constrained households.

The remainder of the paper is organized as follows. Section 2 provides information on the data, empirical methodology and presents the main results. Section 3 presents evidence of counter-cyclical mortgage refinancing, providing a link to fiscal policy. Section 4 describes the theoretical model and discusses the results from the quantitative exercises. Section 5 concludes.

2 Empirical Analysis

Recent studies suggest that the strength of the refinancing channel of monetary policy is state-dependent and follows an interest rate cycle that spans several years (e.g., Berger et al., 2021; Eichenbaum et al., 2022). In this paper, we contribute to the literature by providing evidence on how mortgage refinancing influences MPCs, independent of the phase of the interest rate cycle in which refinancing occurs. This finding has important implications for the interaction between monetary and fiscal policy. Since interest rate incentives shape refinancing decisions—both through reductions in borrowing costs and through access to credit via payment-to-income constraints—these decisions, in turn, influence the effectiveness of fiscal policy by altering MPCs.

2.1 Data

We use data from the Panel Study of Income Dynamics (PSID) to analyze the impact and short-run dynamics of mortgage refinancing on the MPC of U.S. households. The PSID is a longitudinal survey that began in 1968 and tracks households and their offspring over time. The survey was conducted annually until 1999, when it transitioned to a biennial format. A key advantage of the PSID is its panel structure, which allows us to control for household-specific effects while also providing a rich set of variables. In particular, since 1999, the survey includes detailed information on consumption, as well as assets and balance sheet components.[2,3]

Our baseline sample spans the years 1999–2021, and we closely follow Kaplan et al. (2014) for data cleaning and sample selection. We use total family income and obtain federal and state income tax data from the NBER's TAXSIM model to compute disposable income. Additional details on the construction of consumption measures and classifications of liquid and illiquid assets are provided in Appendix A.1.

Following the literature on mortgages and housing (e.g., Chen et al., 2020; Boar et al., 2022), we define a refinancing event as occurring when a household's total mortgage balance increases by more than 5% from period $t-1$ to period t. Additionally, the household must be a homeowner, must have an active mortgage in period $t-1$, and must not have changed residence. The latter condition ensures that refinancing events are not confounded with relocations due to professional opportunities. These criteria allow us to isolate changes in mortgage balances that stem purely from home equity extraction for liquidity purposes. Our sample includes 4,305 observations of mortgage refinancing pooled across years. Appendix A.1 provides additional details on refinancing shares, mortgage rates, and changes in overall mortgage balances.

Table 1 presents summary statistics for refinancers and homeowners in 2001. Home-equity extractors do not appear wealthier than other homeowners in terms of disposable income or home values, suggesting that the decision to refinance is not primarily driven by house price appreciation or idiosyncratic income processes. However, refinancers exhibit significantly higher levels of indebtedness, as reflected in their average mortgage balances, debt-to-income ratios, and limited holdings of liquid assets. Notably, the share of "wealthy" hand-to-mouth households[4] is substantial, representing approximately 45% to 50% of both refinancers and homeowners.

[2]The PSID now covers more than 70% of all consumption items included in the Consumer Expenditure Surveys (CEX).

[3]Compared to other widely used household datasets, the PSID uniquely combines the information necessary for our research questions. To the best of our knowledge, no other publicly available U.S. household panel dataset includes consumption, income, and wealth composition.

[4]Kaplan et al. (2014) define a household as "wealthy" hand-to-mouth if it holds positive balances of illiquid assets but maintains liquid assets equivalent to less than two weeks' worth of disposable income, on average.

Table 1: Summary Statistics

	Refinancers	Homeowners
Disposable Income ($)	75,149	68,634
	(35,712)	(35,594)
Net Liquid Assets ($)	20,477	25,771
	(50,653)	(58,743)
Mortgage Balance ($)	107,587	77,092
	(69,879)	(78,199)
Home Value ($)	219,786	195,937
	(210,631)	(209,237)
Net Liquid Assets over Income	0.23	0.43
	(0.68)	(1.27)
Debt-to-Income Ratio	1.54	1.04
	(1.06)	(1.04)
N	321	2319

Notes: Values are means, with standard deviations in parentheses. Reference year is 2001. Data are deflated by the CPI deflator (2006 base year) where applicable.

Against this background, our analysis seeks to identify dynamic changes in MPCs among home-equity extractors, who may, in principle, exhibit two opposing patterns. First, they may display a high MPC out of transitory income due to their limited holdings of liquid assets, which could, in turn, incentivize them to refinance their mortgage. Second, given the substantial cash-out from home equity—funds that can be used to smooth consumption or cover large expenditures such as medical or educational costs—their MPC out of transitory income is expected to decline following refinancing. We formally test this hypothesis in our empirical exercises.

2.2 Empirical Approach

To examine how mortgage refinancing affects MPCs out of transitory income, we follow the seminal methodology of Blundell et al. (2008) (henceforth, BPP), which we briefly outline. We begin by defining a standard income process with orthogonal transitory and permanent components:

$$\Delta y_{i,t} = \underbrace{\eta_{i,t}}_{\text{Permanent}} + \underbrace{\Delta\varepsilon_{i,t}}_{\text{Transitory}} \tag{1}$$

The BPP approach is a two-stage procedure. In the first stage, we regress log income and log consumption expenditures on year and cohort dummies, education, race, family structure, employment status, geographic variables, and their interactions with year dummies:

$$y_{i,t} = \alpha^y + \beta_y' \mathbf{X}_{i,t} + \varepsilon_{i,t}^y \tag{2}$$

$$c_{i,t} = \alpha^c + \beta_c' \mathbf{X}_{i,t} + \varepsilon_{i,t}^c \tag{3}$$

This procedure isolates the permanent component of both income and consumption, while the residuals serve as proxies for their transitory components. We then construct first-differenced residuals for both log consumption, $\Delta\hat{\varepsilon}_{i,t}^c$, and log income, $\Delta\hat{\varepsilon}_{i,t}^y$. In the second stage, BPP estimate the MPC as the coefficient on transitory income shocks in an instrumental variables (IV) regression of $\Delta\hat{\varepsilon}_{i,t}^c$ on $\Delta\hat{\varepsilon}_{i,t}^y$, using $\Delta\hat{\varepsilon}_{i,t+1}^y$ as an instrument:

$$\widehat{\text{MPC}}_t = \frac{\text{Cov}(\Delta\hat{\varepsilon}_{i,t}^c, \Delta\hat{\varepsilon}_{i,t+1}^y)}{\text{Cov}(\Delta\hat{\varepsilon}_{i,t}^y, \Delta\hat{\varepsilon}_{i,t+1}^y)} \tag{4}$$

The true marginal propensity to consume out of a transitory shock is defined as:

$$\text{MPC}_t = \frac{\text{Cov}(\Delta\hat{\varepsilon}_{i,t}^c, \varepsilon_{i,t})}{\text{Var}(\varepsilon_{i,t})} \tag{5}$$

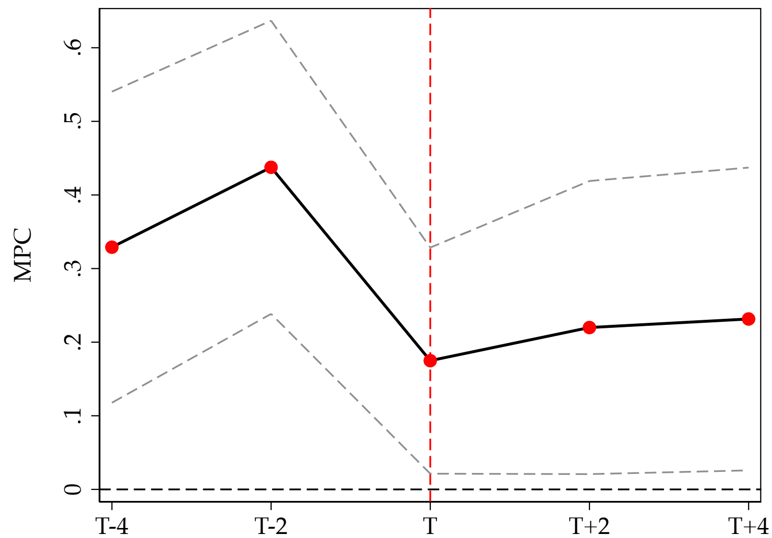
The estimator $\widehat{\text{MPC}}_t$ is consistent for the true MPC under the assumption that households do not possess foresight or advance information about future shocks:

$$\text{cov}(\Delta\hat{\varepsilon}_{i,t}^c, \eta_{i,t+1}) = \text{cov}(\Delta\hat{\varepsilon}_{i,t}^c, \varepsilon_{i,t+1}) = 0 \tag{6}$$

Given our interest in estimating dynamic MPCs, we augment the estimation procedure by incorporating a symmetric indicator for the timing of refinancing ($\text{Ref}_{i,t}$), spanning from four years before refinancing to four years after. Figure 1 presents the baseline estimates of MPCs.

$$\widehat{\text{MPC}}_t(\text{Ref}_t) = \frac{\text{Cov}(\Delta\hat{\varepsilon}^c_{i,t}, \Delta\hat{\varepsilon}^y_{i,t+1})}{\text{Cov}(\Delta\hat{\varepsilon}^y_{i,t}, \Delta\hat{\varepsilon}^y_{i,t+1})} \cdot \text{Ref}_{i,t} \tag{7}$$

Figure 1: (Biennial) MPCs Estimates over Home-Equity Extraction



Notes: time T refers to the year of home-equity extraction. Grey dashed lines represents 95% confidence intervals with bootstrapped standard errors based on 250 replications. H_0: MPC (Before) = MPC (After), p-value= 0.03.

It is important to note that the BPP methodology, when applied to biennial PSID data, captures the consumption response over the first two years following a transitory income shock. The period preceding mortgage refinancing is characterized by relatively high MPCs. Consistent with our hypothesis, these estimates suggest that households extracting equity from their home face tight borrowing constraints and a strong demand for liquidity. At the time of refinancing and in the years thereafter, MPCs stabilize at significantly lower levels—approximately half of their pre-refinancing values.

Our findings shed light on the dynamic effects of household financial decisions on balance sheets and, consequently, on MPCs. In particular, our estimates emphasize the extent of heterogeneity in MPCs over time, a dimension that is masked in cross-sectional estimates for specific household subgroups.[5]

[5]Notably, the average MPC before refinancing (approximately 0.40) is substantially higher than the estimated MPC for "wealthy" hand-to-mouth households (0.26). See the later section on the intratemporal dimension of MPCs.

2.3 Robustness Checks

2.3.1 Liquidity constraints

We conduct several robustness checks by analyzing subgroups of households to validate our hypothesis that home-equity extractions are primarily driven by liquidity needs. Specifically, we consider the following groups:

- "Wealthy" hand-to-mouth households, as defined by Kaplan et al. (2014).
- Households that experienced an increase in medical or educational expenditures in the year preceding mortgage refinancing.
- Liquidity-constrained households, based on the criteria proposed by Cooper (2013): *i)* households below the median of the liquid assets-to-income ratio distribution; *ii)* households above the median of the debt-service ratio,[6] which measures the burden of existing financial obligations.

The results, reported in Appendix A.2, confirm that households facing medical or educational expenses prior to refinancing experience a substantial decline in MPCs, as do those classified as liquidity constrained based on their liquid wealth-to-income ratios. However, we do not observe a similar pattern for households with high debt-service ratios. These findings highlight the importance of refinancing as a mechanism to address unexpected expenses and liquidity constraints rather than anticipated future expenditures.

In Table A.2, we report the average change in MPCs before and after mortgage refinancing. Across all specifications, we find a large and statistically significant drop in MPCs, ranging between 0.20 and 0.26. Additionally, we confirm that our key empirical result is robust to a range of alternative specifications, including controls for unemployment, household head selection, cash-on-hand, and total consumption (see Appendix A.2).

2.3.2 Interest rate incentives

Our sample includes periods of historically low mortgage interest rates, particularly during the zero-lower-bound era of monetary policy. This environment may have influenced

[6] The debt-service ratio is defined as the ratio of total debt payments—including mortgages, home equity loans, auto loans, and credit card payments—to disposable income.

the subset of households that chose to refinance, with some refinancing not necessarily due to liquidity needs but rather to reduce the net present value of their debt obligations. Indeed, interest rate incentives—measured as the differential between an existing mortgage contract rate and prevailing market rates for new mortgages—are a well-established driver of refinancing activity (Berger et al., 2021; Eichenbaum et al., 2022). To address this concern, we test the robustness of our main finding by restricting the sample to households that increased their mortgage balance but did not report a decline in their mortgage interest rate. This specification is particularly stringent, as it likely excludes households that obtained a lower interest rate even when their refinancing was motivated by liquidity needs. Table A.3 shows that the decline in MPCs following refinancing is -0.28, a larger drop than the -0.20 observed in our baseline estimates. This result further strengthens our argument that home-equity extraction lowers MPCs primarily for households facing liquidity constraints—a specific subset of all refinancers.

Finally, we conduct ad-hoc checks related to the BPP methodology and its core assumptions, reported in Appendix A.3. A critical assumption in estimating structural MPCs is the presence of unanticipated income shocks. This assumption is particularly relevant in the context of mortgage refinancing, as households may anticipate their refinancing decisions well in advance. We address this concern in greater detail in the next section.

2.4 Validity of Identification

2.4.1 No-foresight assumption

It is crucial to assess the validity of the no-foresight assumption in the context of mortgage refinancing timing. This assumption pertains to potential adjustments in consumption today in anticipation of future income shocks, whether permanent or transitory. In the case of mortgage refinancing, we assume that at $t-1$ (two years before home-equity extraction), households do not systematically adjust their consumption levels. An alternative scenario would involve agents anticipating a (potentially negative) income shock, leading to a correlation between expected income shocks and the decision to refinance. We argue that such a scenario is implausible, supporting the validity of the BPP no-foresight assumption.[7]

[7]The literature on household finance and mortgage contracts suggests that many households fail to refinance even when it is financially optimal to do so (e.g., for interest rate benefits) and that behavioral

To empirically test this argument, we implement a staggered event-study research design, following Freyaldenhoven et al. (2022), and specify the following linear panel model with dynamic policy effects:

$$c_{i,t} = \alpha_i + \gamma_t + q_{i,t}'\psi + \sum_{m=-G}^{M} \beta_m z_{i,t-m} + C_{i,t} + \varepsilon_{i,t} \tag{8}$$

where α_i represents household fixed effects, γ_t denotes time fixed effects, and $q_{i,t}$ is a vector of control variables. The scalar $C_{i,t}$ captures confounding factors that may correlate with refinancing decisions, while $\varepsilon_{i,t}$ represents an unobserved shock uncorrelated with the policy. The dependent variable $c_{i,t}$ is the log of consumption, and the dynamic effects of refinancing (home-equity extractions) are captured by $\sum_{m=-G}^{M} \beta_m z_{i,t-m}$, where the indicator $z_{i,t-m}$ equals 0 in all periods prior to refinancing and 1 afterward.

To facilitate interpretation, we modify (8) following Freyaldenhoven et al. (2022) by expressing the model in terms of changes in the policy $z_{i,t}$ and estimating cumulative treatment effects:

$$\begin{aligned} c_{i,t} = \alpha_i + \gamma_t + \sum_{k=-G-L_G}^{M+L_M-1} \delta_k \Delta z_{i,t-k} + \delta_{M+L_M} z_{i,t-M-L_M} \\ + \delta_{-G-l_G-1}(1 - z_{i,t+G+L_G}) + q_{i,t}'\psi + C_{i,t} + \varepsilon_{i,t} \end{aligned} \tag{9}$$

Here, $z_{i,t-M-L_M}$ is an adoption indicator equal to 1 if household i refinanced at least $M + L_M$ periods before period t, while $(1 - z_{i,t+G+L_G})$ indicates whether household i will refinance more than $G + L_G$ periods in the future. The parameters $\{\delta_k\}_{k=-G-L_G-1}^{k=M+L_M}$ capture cumulative policy effects over different horizons and are linked to (8) as follows:

$$\delta_k = \begin{cases} 0 & \text{for } k < -G, \\ \sum_{m=-G}^{k} \beta_m & \text{for } -G < k \leq M, \\ \sum_{m=-G}^{M} \beta_m & \text{for } k > M \end{cases} \tag{10}$$

Following the literature, we normalize $\delta_{-1} = 0$, meaning that the event-study coefficients can be interpreted as effects relative to the period immediately preceding refinanc-

and non-monetary frictions often delay refinancing decisions. These arguments reinforce the validity of the BPP assumption and our results.

ing. In a separate specification, we account for cohort-specific adoption effects, as proposed by Sun and Abraham (2021). Under staggered treatment adoption, the estimator β_m represents a weighted average of policy effects across event times and cohorts. However, Sun and Abraham (2021) show that these weights can be nonzero (for event times $m \neq 0$) and, in some cases, negative across cohorts. We implement a cohort-adjusted specification that allows for distinct policy effect profiles for first-treated and never-treated cohorts. Moreover, we include lagged dependent variables and household characteristics in $q'_{i,t}$ to control for pre-existing trends.[8]

To mitigate endogeneity concerns—specifically, liquidity-constrained households are more likely to refinance—we control for potential confounders by including the liquid assets-to-income ratio in $C_{i,t}$. If liquidity needs drive home-equity extractions that facilitate consumption smoothing, this specification should estimate the true dynamic effects of refinancing on consumption.

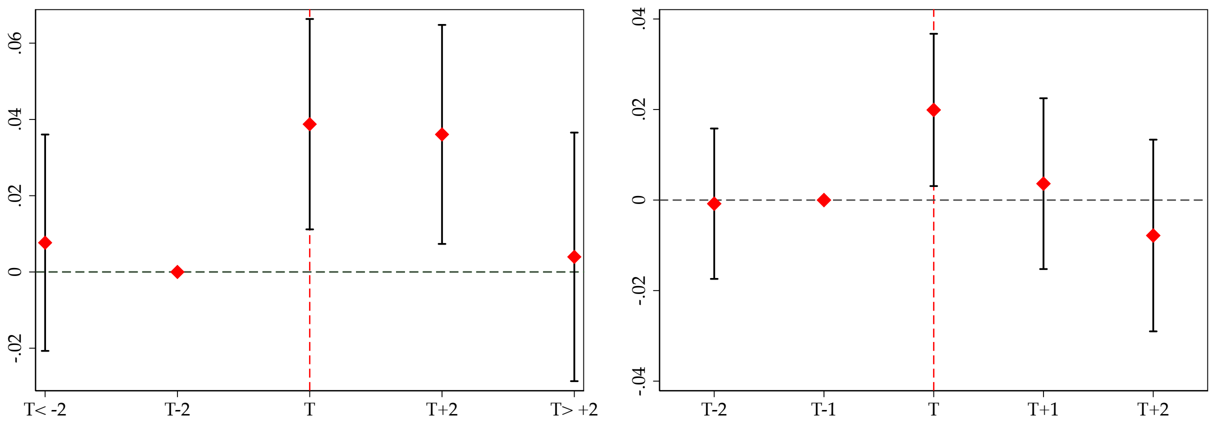
Figure 2 presents the estimated δ_k coefficients for **(a)** a homogeneous treatment effect specification that accounts for confounding factors and **(b)** a heterogeneous treatment effect specification following Sun and Abraham (2021). At the time of refinancing, households increase non-durable expenditures by approximately 2–3%, depending on the specification. Most importantly, all pre-refinancing point estimates are statistically insignificant, indicating no anticipatory effects or pre-trends in consumption that could systematically drive refinancing decisions. Although the coefficient just before refinancing is normalized to zero by construction, the coefficient δ_{-2} is also not significantly different from zero, ruling out systematic trends in consumption in the years leading up to refinancing.

These results confirm that the decline in MPCs observed after refinancing is not driven by anticipatory changes in consumption linked to expected income shocks, thereby reinforcing the validity of our findings.

In Appendix A.3.3, we test whether anticipatory consumption effects differ by cohort. Our estimates indicate that only two cohorts (2012 and 2020) exhibit significant pre-trends in consumption before refinancing. However, the change in MPCs remains robust even when we exclude these households from our sample.

[8] We use the same control variables and interaction terms as in the BPP estimation.

Figure 2: Dynamic Effects on Log Consumption



(a) Confound **(b)** Heterogeneous Treatment Effect

Notes: time T refers to the year of home-equity extraction. Red diamonds indicate the point estimates, while grey bars indicate 95% confidence intervals.

2.4.2 Endogeneity of refinancing on consumption

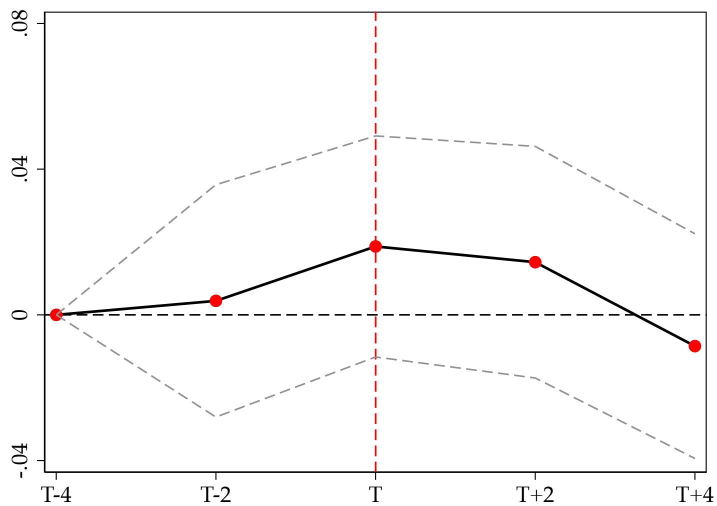
The decision to refinance has a direct impact on household consumption, as a portion of the extracted home equity is allocated to nondurable expenditures. This effect extends beyond the responsiveness of consumption to income shocks, as documented in the previous section. Specifically, the change in consumption, $\Delta\hat{\varepsilon}^c_{i,t}$, in equation (5), is directly influenced by mortgage refinancing. To address the potential endogeneity arising from this channel, we control for the timing of refinancing, $Ref_{i,t}$, in the BPP estimation. This approach allows us to disentangle the effect of refinancing from that of income shocks. Formally, we estimate the following specification:

$$\Delta\hat{\varepsilon}^c_{i,t} = \alpha + \sum_{t=T-4}^{T+4} \delta_t \Delta\hat{\varepsilon}^y_{i,t} \cdot Ref_{i,t} + \sum_{t=T-4}^{T+4} \gamma_t Ref_{i,t} + \varepsilon_{i,t} \tag{11}$$

where $\Delta\hat{\varepsilon}^y_{i,t}$ represents the change in income at time t, instrumented by its change at $t+1$. The coefficient δ_t captures the marginal propensity to consume (MPC) out of income shocks for refinancing households—our baseline MPC estimate—while γ_t identifies the direct effect of refinancing on consumption.

Figure 3 presents the estimates for γ_t, showing that they are not statistically significant. This result suggests that the endogenous effect of refinancing on consumption does not bias the main MPC estimates (see Appendix A.3.5).

Figure 3: (Biennial) Estimates of Effect of Refinancing on Consumption



Notes: time T refers to the year of home-equity extraction. Grey dashed lines represents 95% confidence intervals with bootstrapped standard errors based on 250 replications.

2.5 Intratemporal dimension

In the previous section, we highlighted the intertemporal dimension of mortgage refinancing and its role in shaping household MPCs. We now turn to the intratemporal aspect, examining cross-sectional differences in MPCs by estimating them for distinct household types within our dataset. This approach provides cross-sectional estimates for each category, offering insights into heterogeneity across groups.

Table 2 shows that households engaging in mortgage refinancing exhibit higher MPCs, particularly relative to homeowners and non-refinancers. However, the MPC of refinancing households remains lower than that of “wealthy” hand-to-mouth (W-HtM) households, consistent with the notion that some refinancers face liquidity constraints similar to W-HtM households. Nonetheless, refinancing households alleviate these constraints through home-equity extraction.

The cross-sectional estimate for refinancers, however, masks the impact of home-equity extraction across different positions in the liquid wealth distribution. To address this, we apply the BPP estimator to a sample split of mortgage refinancers, stratifying them based on their liquid wealth-to-income ratio relative to the median value in the sample. Table

3 reveals a substantial divergence in MPCs, indicating that refinancers at the lower end of the liquid wealth distribution exhibit significantly higher MPCs. This result reinforces the notion that a substantial share of refinancers pursue mortgage refinancing primarily due to liquidity constraints.

The intertemporal and cross-sectional results remain robust when using an alternative liquidity measure—cash-on-hand—as shown in Appendix A.2.5. Our findings suggest that cross-sectional estimates of MPCs may obscure the effects of endogenous choices affecting household balance sheets. Specifically, over a four-year period, we show that mortgage refinancing plays a key role in shaping the cross-sectional estimates for homeowners and liquidity-constrained households.

Table 2: (Biennial) MPCs over Households Category

	Refinancers	No-Refinancers	W-HtM	Homeowners	Sample
MPC	0.22***	0.17***	0.26***	0.18***	0.19***
	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)
N	9,000	11,544	7,952	14,803	20,544

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. W-HtM refers to "wealthy" hand-to-mouth.

Table 3: (Biennial) Refinancers MPCs over Liquid Wealth

	Refinancers Liquid Wealth $<$ Median (1)	Refinancers Liquid Wealth $>$ Median (2)
MPC	0.24***	0.16**
	(0.04)	(0.07)
N	7,059	1,945

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (1) $>$ MPC (2), p-value: 0.86

3 Counter-cyclical Mortgage Refinancing

In this section, we demonstrate that refinancing activity is particularly pronounced during economic downturns and recessions. We replicate the empirical findings of Chen et al. (2020), who show that home-equity extraction exhibits countercyclical behavior, consistent with an increased demand for liquidity.

This evidence underscores the potential role of fiscal policy, particularly in the design of targeted cash transfers, which are influenced by heterogeneous MPCs shaped by refinancing behavior.

3.1 Data

We use data on mortgages originated quarterly in the United States from the Fannie Mae Single-Family Loan-Level dataset to replicate the empirical findings of Chen et al. (2020), who employ data from the Mortgage Bankers Association. Our exercise serves as a robustness check of their results. The dataset tracks each loan monthly from origination until it is either voluntarily prepaid or involuntarily terminated through foreclosure.

For our purposes, we do not distinguish between loans and borrowers, as each loan has a unique identification number. Thus, we assume that each loan corresponds to a new borrower. Our sample spans from January 2000 to November 2021, and we restrict our analysis to 30-year fixed-rate mortgages, the most common mortgage contract in the United States. To mitigate computational burden, we randomly select a 10 percent sample of loans originated in each quarter during our sample period.

We define refinanced mortgages as those that are voluntarily prepaid before maturity, focusing on total refinancing activity. While our dataset does not allow us to precisely distinguish refinancing motives, we argue that this limitation does not materially affect our main conclusions, in line with Chen et al. (2020). However, the Fannie Mae dataset provides information on the purpose of the mortgage at origination—home purchase, interest rate refinance, or cash-out. In Appendix A.6, we confirm that our results remain robust when we restrict our analysis to the share of new cash-out mortgages per quarter.

Since our analysis focuses on the time-series properties of refinancing activity, we construct our refinancing index as the share of prepaid mortgages (N_t^{ref}) over the total number of active mortgages (N_t) in a given month t: $\text{REFI}_t = N_t^{\text{ref}}/N_t$. We use the logarithm of this variable in our analysis. Additionally, we incorporate macroeconomic controls from the FRED database, including the Industrial Production Index (IP_t), the Case-Shiller House Price Index (HPI_t), and the year-over-year change in the 30-year fixed mortgage rate (ΔRM30_t). As additional controls ($\mathbf{X}_t$), we include the 1-year Treasury rate in levels and year-over-year changes, as well as the 30-year fixed mortgage rate. Interest rates enter the specification in percentage terms, while index variables enter in logarithms.

3.2 Empirical Evidence

We follow Chen et al. (2020) and regress our monthly (log) index of mortgage refinancing on macroeconomic and financial variables as follows:

$$\log\left(\text{REFI}_t\right) = \alpha + \beta_1 \log\left(\text{IP}_t\right) + \beta_2 \log\left(\text{HPI}_t\right) + \beta_3 \Delta\text{RM30}_t + \mathbf{X}_t'\beta_4 + \epsilon_t. \tag{12}$$

Table 4 presents the results. Changes in interest rates and house prices align with aggregate refinancing activity: households take advantage of lower interest rates to refinance their mortgages, while rising house prices enable increased borrowing through higher-valued collateral. However, industrial production negatively correlates with refinancing activity, indicating that households refinance marginally more during economic downturns, even after controlling for interest rate and house price incentives, consistent with Chen et al. (2020).[9]

We argue that this countercyclical pattern of mortgage refinancing induces *aggregate* changes in MPCs, which we assess through a partial equilibrium model in the next section.

Table 4: Aggregate Refinancing and Economic Activity

Dependent variable: $\log(\text{REFI}_t)$	(1)	(2)	(3)
$\log\left(\text{IP}_t\right)$	-3.40***	-3.01***	-2.73***
	(0.56)	(0.72)	(0.72)
$\log\left(\text{HPI}_t\right)$		0.69***	0.53**
		(0.17)	(0.25)
ΔRM30_t		-0.46***	-0.46***
		(0.05)	(0.07)
Controls	✗	✗	✓
N	262	262	262
R^2	0.10	0.40	0.48

Notes: Robust standard errors in parentheses. $^{*}\ p < 0.10$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$.

[9] In Appendix A.6, we conduct a robustness analysis by splitting the sample around the Great Financial Crisis and examining the share of cash-out mortgages relative to newly originated mortgages per quarter.

4 Model

4.1 Environment

Motivated by the empirical evidence on the relationship between MPCs and home equity extraction, we build on an overlapping generations model following Boar et al. (2022) to examine the role of mortgage refinancing in fiscal policy. Individuals in the model have finite lifespans, experience random income fluctuations and housing maintenance shocks, derive utility from consumption and housing, and incur disutility from home production. They can save either through short-term liquid assets or by investing in residential property.

The analysis is conducted in partial equilibrium, treating interest rates and housing prices as exogenous variables. Individuals choose between renting and homeownership, where selling a property entails a fixed transaction cost. Additionally, liquidity can be accessed through mortgage borrowing, subject to both a fixed monetary origination cost and a stochastic utility cost that captures non-financial barriers to borrowing.

Preferences. Agents derive lifetime utility over T periods (each period representing a quarter) by choosing consumption c, housing services h, time spent on home production n, and terminal wealth w:

$$\mathbb{E}\sum_{t=1}^{T}\beta^{t-1}\left(\frac{c_t^{1-\sigma}}{1-\sigma}+\alpha\frac{h_t^{1-\sigma}}{1-\sigma}-\frac{n_t^{1+\gamma}}{1+\gamma}-\xi_t\right)+\beta^T B\frac{(1+w_{T+1})^{1-\sigma}}{1-\sigma}$$

To obtain a new mortgage (including the option to refinance an existing one), agents incur a random utility cost ξ. The utility function includes the discount factor β, relative risk aversion σ, elasticity of home production $1/\gamma$, weight of housing in preferences α, and strength of the bequest motive B.

Income. Each period, an agent receives income:

$$y_{i,t}=\lambda_t z_{i,t} e_{i,t}$$
$$\log(z_{i,t+1})=\rho_z \log(z_{i,t})+\sigma_z\varepsilon_{i,t+1}$$

where λ_t represents the deterministic life-cycle income component, $z_{i,t}$ the persistent component, and $e_{i,t}$ the transitory component. The persistent component follows an AR(1) process with innovation volatility σ_z and persistence ρ_z, while $e_{i,t}$ is i.i.d., drawn from a normal distribution with volatility σ_e.

Home production. The supply of hours in home production generates ϕn units of output, allowing households to smooth consumption by providing services to family members.

Liquid assets. Households can save using a standard one-period risk-free asset a with interest rate $r_l(a)$ and borrowing limit $\underline{a} < 0$. The interest rate depends on liquid asset holdings, capturing heterogeneity in returns across the wealth distribution, as in Benhabib et al. (2019).

Housing. Agents adjusting their housing stock h to h' incur proportional transaction costs $f_s ph$ and must finance $p(h' - h)$ units of output. Homeowners face maintenance shocks $\delta_t = \bar{\delta}$ with probability π_δ, and zero otherwise.

Renting. Households that do not own a home can rent h units of housing services at rental rate R. Renting eliminates adjustment costs.

Mortgages. Agents can borrow through mortgages. For each amount borrowed b, the required minimum payment $\bar{m}$ follows a no-arbitrage condition:

$$\bar{m} = \frac{r_m}{1 - (1 + r_m)^{-D}} \cdot b$$

where D denotes the mortgage maturity (assumed to be 30 years, in line with U.S. mortgage markets) and r_m the mortgage interest rate. However, agents may repay an amount exceeding the required minimum ($m \geq \bar{m}$) without prepayment penalties. The mortgage balance evolves according to:

$$b' = (1 + r_m)b - m$$

Mortgage refinancing. Homeowners who do not sell their property can extract home equity through refinancing. Refinancing incurs fixed costs $f_{0,m}$ and proportional costs $f_{1,m}b'$, applicable whether refinancing an existing mortgage or financing a new home purchase. Additionally, as modeled in agent preferences, non-monetary costs (ξ) associated with mortgage origination are drawn from an exponential distribution with mean ν, capturing behavioral and informational frictions that reduce refinancing likelihood.

At mortgage origination, agents must satisfy both a loan-to-value (LTV) constraint and a payment-to-income (PTI) constraint:

$$b' \leq \theta_m ph \quad \text{(LTV)}$$
$$\frac{r_m}{1-(1+r_m)^{-D}} b' \leq \theta_y y \quad \text{(PTI)}$$

Refinancing costs are rolled into debt, so agents do not face out-of-pocket expenses, and their mortgage balance updates to:

$$\hat{b}' = f_{0,m} + (1 + f_{1,m})b'$$

Budget constraints. Each period, agents make one of five discrete choices that determine their budget constraint.

A renter receives the net proceeds from selling a home (if applicable) after covering maintenance costs and repaying outstanding mortgage debt:

$$c + a' + Rh' = y + \phi n + (1 + r_l(a))a - (1 + r_m)b + (1 - f_s)ph - \delta h$$

A homebuyer incurs the purchase price of a new home and, if borrowing, the new mortgage balance, subject to fixed and proportional costs, as well as the LTV and PTI constraints:

$$c + a' + ph' - b' = y + \phi n + (1 + r_l(a))a - (1 + r_m)b + (1 - f_s)ph - \delta h$$

Inactive agents simply make the required mortgage payment:

$$c + a' = y + \phi n + (1 + r_l(a))a - m - \delta h, \quad m \geq \bar{m}$$

Refinancing agents repay the original mortgage and take a new mortgage, subject to the LTV and PTI constraints:

$$c + a' - b' = y + \phi n + (1 + r_l(a))a - (1 + r_m)b - \delta h$$

Recursive formulation. Each period, agents maximize the value function over five discrete choices (1. rent, 2. purchase without a mortgage, 3. purchase with a mortgage, 4. refinance, 5. remain inactive), without yet considering the mortgage utility cost. Defining the state vector as $s = (t, a, b, \bar{m}, h, z, e, \delta)$, we express the value function envelope as:

$$\bar{V}(s) = \int \max\left(V^1(s), V^2(s), V^3(s) - \xi, V^4(s) - \xi, V^5(s)\right) dF(\xi)$$
$$F(\xi) = 1 - \exp\left(-\frac{\xi}{\nu}\right)$$

Calibration. We follow the benchmark calibration in Boar et al. (2022), replicating key moments of household portfolio composition, particularly for refinancers. The calibration generates an annual refinancing rate of 8%, consistent with PSID waves from 1999 and 2001, as well as Bhutta and Keys (2016), who use a large consumer credit panel. Table 5 reports externally and internally calibrated parameters. To assess the dynamic response of MPCs among homeowners who refinance, we recalibrate the model—Table 6—for a separate version that deliberately excludes the refinancing option.

Table 5: Baseline Calibration - Boar et al. (2022)

Assigned	Value	Parameter	Calibrated	Value	Parameter
T	61	Number of years	β	0.985	Discount factor
σ	2	Relative risk aversion	α	0.687	Preference weight on housing
γ	1	Home production elasticity	ϕ	0.939	Efficiency home production
D	30	Mortgage maturity	B	10.26	Bequest motive
r_m	0.025	Mortgage interest rate	R	0.011	Rental rate of housing
θ_m	0.85	Maximum LTV	$f_{0,m}$	$1,330$	Fixed cost mortgage, 2016 USD
θ_y	0.21	Maximum PTI	τ_0	0.358	Slope liquid int. rate schedule
$f_{1,m}$	0.025	Proportional cost mortgage	τ_1	10.33	Location liquid int. rate schedule
ν	1/3	Mean utility cost mortgage	r_h	0.016	Upper bound liquid int. rate
f_s	0.06	Cost of selling home	ρ_z	0.964	AR(1) persistent income comp.
π_δ	0.10	Prob. maintenance shock	σ_z	0.15	Volatility persistent income comp.
$\bar{\delta}$	0.063	Size maintenance shock	σ_e	0.327	Volatility transitory income comp.
r_l	-0.028	Lower bound liquid int. rate			

Table 6: Alternative Calibration - No Refinance

Calibrated	Value	Parameter
β	0.987	Discount factor
α	0.706	Preference weight on housing
ϕ	0.957	Efficiency home production
B	9.919	Bequest motive
R	0.011	Rental rate of housing
$f_{0,m}$	964.18	Fixed cost mortgage, 2016 USD
τ_0	0.335	Slope liquid int. rate schedule
τ_1	10.93	Location liquid int. rate schedule
r_h	0.0032	Upper bound liquid int. rate

4.2 MPCs of Refinancers

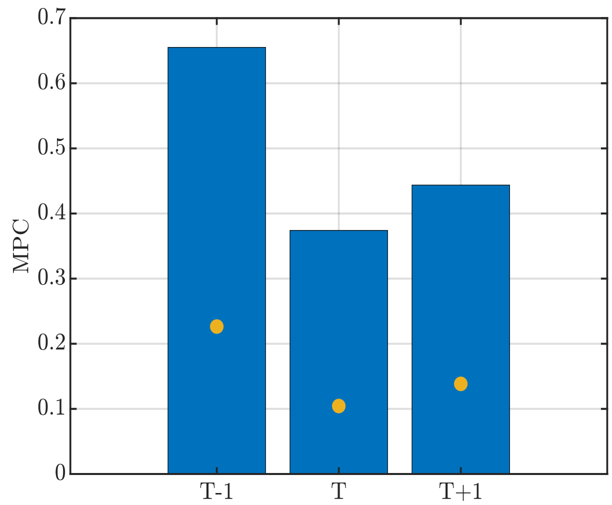
We first simulate the model over multiple periods using the benchmark calibration. This simulated economy serves as a baseline for assessing the impact of various scenarios considered in this section. As a first experiment, we implement an unanticipated one-time \$500 cash transfer to agents who have refinanced at different points in time and compute their (annual and quarterly) marginal propensity to consume relative to the baseline economy:

$$\text{MPC}_{i,t} = \frac{\tilde{C}_{i,t} - C_{i,t}}{\tau}, \quad i = \{\underbrace{\text{Ref} = t-4}_{T+1}, \ \underbrace{\text{Ref} = t}_{T}, \ \underbrace{\text{Ref} = t+4}_{T-1}\}$$

where C and $\tilde{C}$ represent household consumption levels in the absence and presence of the fiscal transfer, respectively. This specification allows us to compute the MPC for individuals who refinanced one year prior to receiving the cash transfer (denoted as $t-4$), corresponding to the MPC one year after ($T+1$) the refinancing event. Additionally, we estimate the MPCs for individuals who either refinance at the same time as the transfer or will refinance one year later, based on the simulated economy without fiscal transfers. Importantly, the actual refinancing decision remains largely unchanged in response to the additional cash transfer, with the increase in refinancing activity amounting to only 0.2%. Figure 4 presents the average MPCs as a function of the timing of home equity extraction.

Consistent with the empirical findings from the PSID, the annual MPC is significantly higher before the refinancing event and subsequently declines and stabilizes following home equity extraction. These results highlight two key insights: *i)* households that refinance are likely facing liquidity constraints, as they lack sufficient liquid assets to sustain and smooth consumption, prompting their decision to refinance; *ii)* the effectiveness of cash transfers in stimulating consumption depends on the extent of refinancing activity in the economy, given its role in shaping micro-level MPCs.

Figure 4: MPCs Conditional on Home-Equity Extraction Timing



Notes: time T refers to the year of mortgage refinance. For instance, T-1 refers to the MPC of agents one year before they will refinance. Yellow dots display the first quarter MPCs, and the blue bars the annual MPCs.

To further support this argument, we next examine how quarterly MPCs vary in the short run depending on the timing of the refinancing event. The time dimension allows us to disentangle the cumulative effect presented in Figure 4, enabling a direct comparison of the impact of cash transfers over time. These estimates correspond to intertemporal MPCs (iMPCs), as defined by Auclert et al. (2024), in response to a contemporaneous change in disposable income, a concept we discuss in detail in Section 4.4.

4.3 Scenarios Analysis

How does the option to refinance a mortgage affect the efficacy of fiscal transfers during economic downturns? To address this question and to link the model to our empirical findings, we simulate distinct exogenous scenarios that approximate recessionary conditions.

First, we use the baseline simulation from the previous section to compute the aggregate quarterly MPC as a benchmark. Second, we simulate a permanent reduction in the pre-tax mortgage interest rate (r_m) of 1.75 percentage points. This lower interest rate facilitates refinancing by relaxing the PTI constraint and incentivizes refinancing by reducing mortgage costs. This scenario isolates the effects on MPCs stemming solely from interest rate incentives, in line with the literature on the transmission of monetary policy through the refinancing channel (Berger et al., 2021; Eichenbaum et al., 2022).

Third, we simulate a scenario in which, in a given quarter, all households receive a negative shock to either the persistent component ($z_{i,t}$) or the transitory component ($e_{i,t}$) of their income. These shocks aim to replicate declines in disposable income and increased unemployment risk, thereby capturing the liquidity needs of households attempting to smooth consumption while facing income losses. Although home-equity extraction offers a potential liquidity source, access is constrained by the PTI requirement, meaning that only households with sufficiently high post-shock income can successfully refinance.

Finally, we simulate a scenario combining both interest rate and income shocks, replicating as closely as possible, within the model's structure, the economic conditions of a recession—such as those experienced during the COVID-19 pandemic.

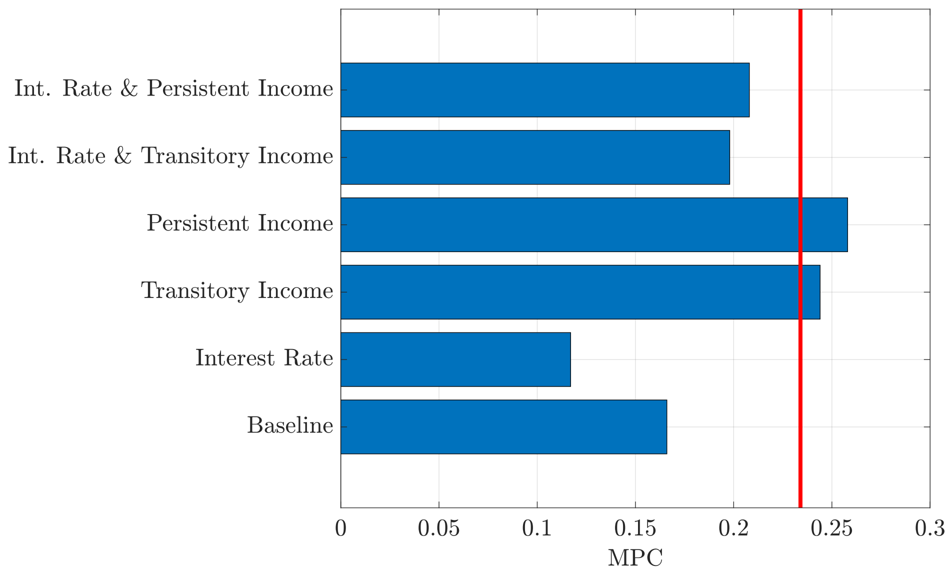
Figure 5 presents the aggregate quarterly MPCs under all scenarios. The baseline MPC averages 0.17, consistent with the original estimate in Boar et al. (2022). Under the interest rate reduction scenario, the MPC declines to 0.12. This is because lower interest rates permanently reduce total mortgage costs, allowing households to increase their permanent consumption, thereby reducing their responsiveness to transitory cash transfers. Additionally, lower rates relax PTI constraints for both new homebuyers and refinancing households, further decreasing the effectiveness of transitory fiscal transfers compared to periods of higher interest rates.

By contrast, income loss scenarios generate higher MPCs than the baseline, with estimates of 0.26 and 0.24 for shocks to the persistent and transitory income components, respectively. As refinancing opportunities decline while consumption falls, fiscal transfers become more effective: households spend a larger fraction of the additional cash in the first quarter, producing an MPC increase that aligns with the empirical literature. In particular, our estimates closely match those of Parker et al. (2022), who report an MPC of 0.23 based on CEX data following the fiscal stimulus measures enacted in response to the COVID-19 pandemic.

Finally, when combining both interest rate and income shocks, the resulting MPCs reflect a linear combination of the independent scenarios, yielding estimates of 0.21 and

0.20 for persistent and transitory income shocks, respectively.

Figure 5: Aggregate MPCs - Simulated Scenarios

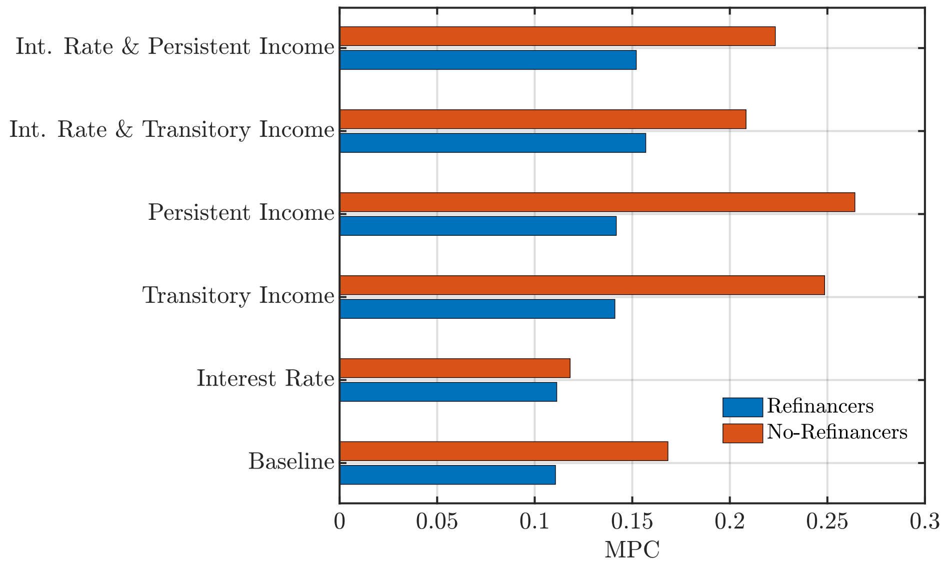


Notes: Quarterly MPCs for each simulated scenarios. The vertical red line represents the average estimate of fiscal transfers from Parker et al. (2022) for all consumption expenditure goods based on the CEX. See the main text for more details.

The results indicate that the nature of the shock plays a crucial role in determining the size of MPCs. In particular, our scenario analysis underscores the significance of aggregate income shocks—typically observed during recessions—in generating MPCs that closely align with empirical estimates from micro-data.

However, the refinancing decision introduces substantial heterogeneity in the economy's MPCs. Figure 6 compares the average MPCs of households that refinanced within the preceding year to those that did not refinance. The disparity becomes particularly pronounced in simulations that incorporate income shocks, highlighting the greater sensitivity of consumption responses between the two groups.

Figure 6: Average MPCs - Simulated Scenarios - Refinancers and No-Refinancers



Notes: Quarterly MPCs for each simulated scenarios.

4.4 Intertemporal MPCs

The transmission channel of fiscal policy operates both contemporaneously and intertemporally through differing propensities to consume out of transfers, as discussed by Auclert et al. (2024). Within the framework of heterogeneous agent models, the authors demonstrate that, given the limited planning horizon over which households can smooth consumption, the effectiveness of fiscal policy is primarily governed by intertemporal MPCs (iMPCs). These iMPCs can be expressed in matrix form as the change in consumption at time t, conditional on a transfer occurring at time s:

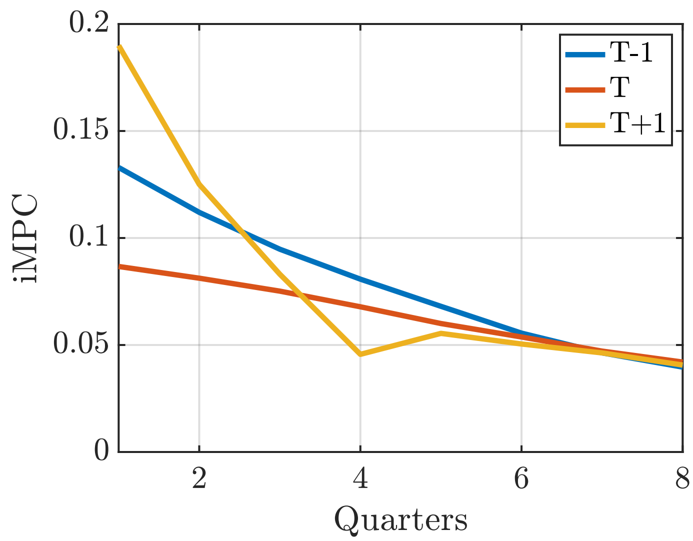
$$\mathbf{M} \equiv \begin{pmatrix} M_{0,0} & \cdots & M_{0,s} \\ \vdots & \ddots & \vdots \\ M_{t,0} & \cdots & M_{t,s} \end{pmatrix} \equiv \begin{pmatrix} \frac{\partial C_0}{\partial Z_0} & \cdots & \frac{\partial C_0}{\partial Z_s} \\ \vdots & \ddots & \vdots \\ \frac{\partial C_t}{\partial Z_0} & \cdots & \frac{\partial C_t}{\partial Z_s} \end{pmatrix} \tag{13}$$

where $\frac{\partial C_t}{\partial Z_s}$ represents the aggregate change in consumption C in response to a change in disposable income Z. The iMPCs matrix serves as a sufficient statistic for the response of macroeconomic variables to fiscal policy, providing a useful tool for estimating general equilibrium paths in heterogeneous agent models and fiscal multipliers.

In our analysis, we focus on the contemporaneous effect of fiscal transfers—the first column of the M matrix. The contrast in iMPCs between an individual who has recently refinanced and one who refinanced a year earlier is approximately 50% (0.08 to 0.13), as shown in Figure 7. Notably, the disparity is even more pronounced for an individual who will refinance in the following year, as their current quarterly MPC is around 0.20. In Appendix B.2, we show that substantial heterogeneity persists across different shock scenarios and household groups. Refinancers exhibit the smallest immediate consumption response, which gradually declines over time, whereas no-refinancers experience a larger initial consumption surge, followed by smaller increases in subsequent periods.

From a policymaker's perspective, and given the available data at the time of fiscal transfers, these findings provide insights into the potential for fiscal targeting based on the timing of mortgage refinancing, allowing for more effective allocation of transfers by leveraging variations in MPCs.

Figure 7: Quarterly iMPCs Conditional on Home-Equity Extraction Timing



Notes: The iMPCs represent the share of the fiscal transfer that is spent at each period. $T-1$ and $T+1$ refer to the timing of refinancing of agents: one year prior and post receiving the fiscal transfer, respectively.

4.5 Mortgage Refinancing Channel

To assess the impact of mortgage refinancing on fiscal policy, we replicate the simulations from the previous section using a version of the model in which households are unable to access home equity (labeled "No-Refinance"). This restriction limits their ability to obtain liquidity to maintain consumption levels when faced with adverse income shocks. We re-estimate the model using the simulated method of moments to ensure that it reproduces the same calibration targets as the original benchmark in Boar et al. (2022).

Figure 8 shows that MPCs are lower across nearly all simulated scenarios in the alternative re-calibrated version where mortgage refinancing is disallowed, with the largest differences arising when both income and interest rates decline simultaneously. The only scenario in which the "No-Refinance" model generates higher aggregate MPCs is when both the interest rate and the persistent income component decline, underscoring the potential benefits of home-equity extraction when current and expected income fall.

These results are partly driven by differences in the calibrated discount rate, which is higher in the "No-Refinance" model, making households more patient. Additionally, the share of hand-to-mouth households in the "No-Refinance" model is lower than in the data (37% and 41% at the aggregate level, 27% and 32% for homeowners), significantly impacting the model-generated MPCs. As a result, more households hold liquid assets, allowing them to better absorb negative shocks and smooth consumption. Nevertheless, the distribution of liquid assets remains closely matched to the data, as in the baseline calibration.

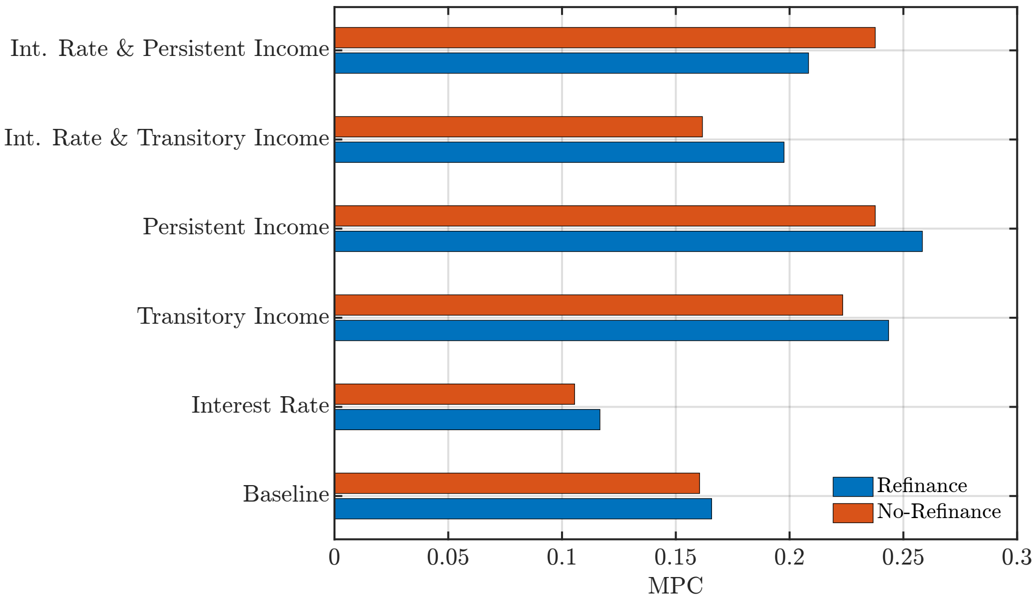
This exercise highlights the importance of incorporating mortgage refinancing in models of household behavior and its implications for aggregate MPCs. These dynamics are particularly relevant for studying monetary-fiscal policy interactions in heterogeneous agent models that feature both liquid and illiquid assets (e.g., housing), as in Kaplan and Violante (2014), Kaplan et al. (2018), and Auclert et al. (2024).

4.6 Savings from Targeted Cash Transfers

The results from the previous sections suggest a potential role for targeted fiscal programs in improving redistribution efficacy by directing transfers toward high-MPC households based on their observable status as non-refinancers in previous quarters. To quantify the potential savings from such targeting, we simulate the model—under each previously analyzed scenario—while restricting cash transfers only to households that did not refinance their mortgage in the past year (i.e., a targeted fiscal program).

The total cost of the original untargeted program (1), which includes all households in the economy (N), is given by $\text{TC}_1 = \tau \cdot N$, where $\tau = \$500$. This program generates a total increase in aggregate consumption of $\Delta C_1 = \overline{\text{MPC}}_1 \cdot \tau \cdot N$, where $\overline{\text{MPC}}_1$ represents

Figure 8: Aggregate MPCs - Refinancing Channel



Notes: Quarterly MPCs for each simulated scenarios in the re-calibrated version of the model without mortgage refinancing.

the average MPC in the economy.

We then compute the number of households required to achieve the same increase in consumption ΔC_1 when considering only the average MPC of non-refinancers ($\overline{\text{MPC}}_2$), given by

$$m' = \frac{\Delta C_1}{\overline{\text{MPC}}_2 \cdot \tau}$$

This allows us to determine the total cost of the targeted program (2) as $TC_2' = m' \cdot \tau$, and the corresponding (potential) savings as $S = TC_1 - TC_2'$.

Figure 9 presents the savings across all scenarios as a percentage of the untargeted benchmark program (1). These savings range from 4% in the baseline economy to approximately 12% in the scenario combining an interest rate drop and a persistent income decline. Under the assumption that the COVID-19 pandemic can be partially approximated by a scenario characterized by monetary easing (a drop in interest rates) alongside a temporary aggregate income loss,[10] we leverage the "Interest Rate & Transitory Income"

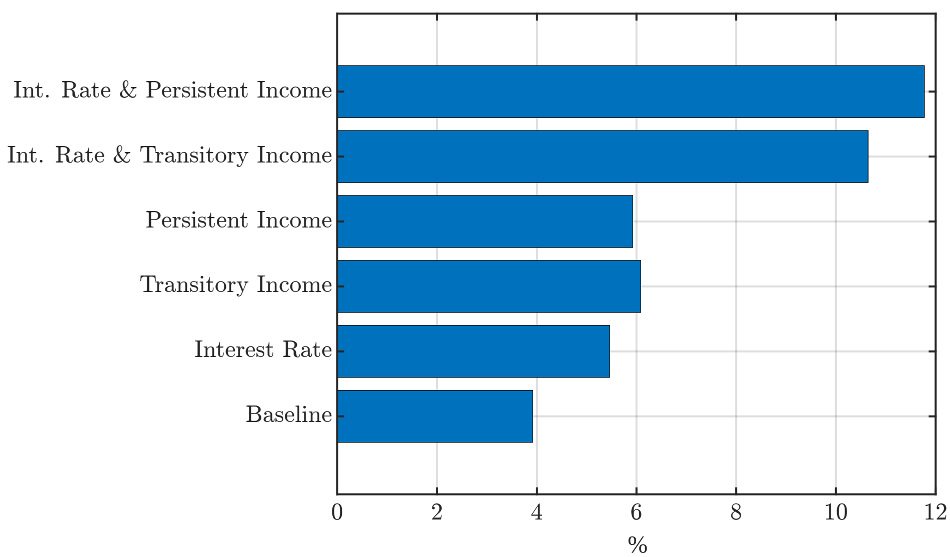
[10]The income losses during the COVID-19 pandemic were driven by multiple factors, including mass job losses due to business shutdowns, supply chain disruptions, and reduced consumer demand. Here, we do not aim to isolate these specific channels but rather use the scenario as a broad proxy for a severe economy-wide income shock.

scenario to impute potential monetary savings of approximately 10%. This translates to an estimated $30 billion in savings from the $300 billion in Economic Impact Payments authorized under the CARES (Coronavirus Aid, Relief, and Economic Security) Act by the U.S. Congress.

We acknowledge that targeting non-refinancers may be challenging to implement in a realistic policy setting. Nonetheless, our exercise provides a useful benchmark comparable to a targeting scheme based on income bracket, homeownership status, and overall indebtedness. As shown in Appendix Table A.1, homeowners with an income close to the mean ($65,000) and a debt-to-income ratio below 1 roughly capture the group of non-refinancers well suited for targeted cash-transfer programs.

Our findings align with and provide further insights into previous research highlighting the limited efficacy of fiscal transfers during the COVID-19 pandemic (Chetty et al., 2020). For instance, Koşar et al. (2023) argue that highly leveraged households are more likely to allocate fiscal transfers toward debt repayment rather than consumption, as they seek to avoid the burden of future borrowing costs. Similarly, Parker et al. (2022) report a minimal and statistically insignificant increase in spending during the third round of stimulus payments in March 2021. We view these studies as complementary to our analysis: not only do highly indebted households prioritize debt repayment over immediate consumption, but as they eventually refinance to access liquidity, their lower MPCs further reduce the effectiveness of fiscal transfers.

Figure 9: Savings from Fiscal Targeting



Notes: Savings are expressed in percentages of total costs under an untargeted program.

4.7 General Discussion

We acknowledge that discrepancies may exist between our empirical MPC estimates derived from consumption responses to identified transitory income shocks using the Blundell et al. (2008) method and the MPCs associated with one-time cash stimulus payments, as modeled in our policy experiment. Households may react differently to lump-sum transfers than to transitory income fluctuations. In particular, Johnson et al. (2006) and Parker et al. (2013) report relatively high MPC estimates compared to the broader MPC literature, suggesting that MPCs from cash transfer payments may appear larger than those from transitory income shocks. Similarly, Kueng (2018) highlights the role of policy framing and expectations in shaping consumption responses, which could further contribute to differences in estimated MPCs.

However, in most cases, a transitory income change, after controlling for all factors that might influence income, is fundamentally similar to a one-time cash payment. Both are unexpected, provide a liquidity injection, and temporarily relax the household's budget constraint without affecting long-term income expectations. If the households treat one-time cash stimulus as a purely transitory income change, their consumption response should be comparable to the MPC estimates from BPP. Since its introduction, the BPP estimation approach has been widely adopted in the MPC literature.

Several studies convincingly draw parallels between transitory income shocks and one-off cash stimulus payments. Kaplan et al. (2014) apply the BPP methodology and estimate the MPC for hand-to-mouth households to range between 24% and 30% using PSID data. Their preferred two-asset model delivers MPC estimates that align with empirical findings. Boar et al. (2022) conduct a $500 cash transfer experiment using the same partial equilibrium framework we rely on and produce MPC estimates similar to those observed in the data. Methodologically, Commault (2022) modifies the BPP estimator to allow for gradual consumption responses and finds a significantly higher MPC for transitory income shocks, which is more consistent with estimates from natural experiments.[11] Based on the above discussion, it is reasonable to assume that under similar conditions—such as framing, expectations, and frequency of occurrence—transitory income shocks and lump-sum transfers can generate comparable consumption responses.

Finally, our empirical analysis underscores the behavioral differences between refinancers and non-refinancers. If refinancers have already gained a liquidity boost from

[11] Based on our previous results and the discussion in Section 2.4, we believe the original BPP estimator remains the most suitable for our analysis.

refinancing, their MPCs will be lower, making them less likely to spend a stimulus check compared to non-refinancers. The variation in MPCs across these groups is not driven by the distinction between income fluctuations and lump-sum transfers. Rather, assuming that any differences in how these groups respond to transitory income shocks versus stimulus payments are comparable (holding all else constant), our empirical estimates remain an informative benchmark that closely aligns with our counterfactual exercises.

5 Conclusions

The composition of households' balance sheets plays a critical role in determining their ability to smooth consumption in response to adverse shocks, which in turn influences their marginal propensity to consume and the efficacy of stabilization policies. In this paper, we examine the dynamic effects of home-equity extraction on MPCs, focusing on the role of mortgage refinancing in allowing households to borrow against their housing assets.

Using the methodology of Blundell et al. (2008), we document a substantial reduction in MPCs—approximately 50%—following refinancing. This result is robust across different proxies for liquidity-constrained households. Building on this finding, we assess the implications of mortgage refinancing for fiscal policy, based on the presence of a countercyclical component in home-equity extractions. We employ a partial equilibrium life-cycle model developed by Boar et al. (2022), in which households choose between renting and homeownership, with associated mortgage and refinancing decisions. We use the model to evaluate its ability to replicate our micro-estimates of MPCs over the timing of refinance, and to examine the aggregate impact of MPC heterogeneity across household categories. Conditioning on exogenous income and interest rate shocks, we show that MPCs out of fiscal transfers align closely with empirical estimates from the literature. The observed heterogeneity in MPCs based on refinancing status suggests a potential role for fiscal targeting, which we explore using simulated data. Our estimates indicate that targeted fiscal programs could yield savings of 4–12% relative to untargeted programs, as no-refinancers exhibit higher MPCs on average. For instance, our estimated savings from fiscal transfers under the CARES Act of March 2020 amount to approximately $30 billion.

One key implication of our work for heterogeneous agent models with housing and asset choices is the importance of allowing households to "liquidate" part of their home equity through refinancing. This channel is particularly relevant during recessions, when monetary and fiscal policy interactions become paramount. We illustrate this point by analyzing an alternative version of the model in which households lack the option to refinance. In this setting, MPCs decline across all scenarios we consider.

While our findings are derived from a partial equilibrium framework, they underscore the need for future research to explore the general equilibrium effects of mortgage refinancing. This includes studying both the optimal decision-making processes involved in exercising refinancing options and the subsequent changes in MPCs. Further investigation will enhance our understanding of the broader macroeconomic implications of both monetary and fiscal policies.

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Appendix

A Empirical Appendix

This section of the Appendix provides details on the household-level data used in the empirical analysis, along with additional robustness checks. Section A.1 describes the construction and cleaning of the main household series from the PSID. Section A.2 presents robustness checks for the baseline results. Section A.3 addresses methodological concerns related to the estimation strategy of Blundell et al. (2008) and provides additional robustness tests. Additionally, Sections A.4 and A.5 outline the data sources used for the countercyclicality analysis in Section 3.

A.1 Dataset Construction - PSID

We construct household-level variables in the PSID database following standard practices. In line with Kaplan et al. (2014), we define consumption expenditure as the sum of spending on food at home and away from home, utilities, gasoline, car maintenance, public transportation, childcare, health expenditures, and education. Household income consists of labor earnings and government transfers, with federal and state taxes computed using the NBER's TAXSIM software to obtain a measure of after-tax income.

Total wealth is the sum of liquid and illiquid assets. Liquid assets include checking and savings accounts, money market funds, certificates of deposit, savings bonds, Treasury bills, and directly held shares of stock in publicly traded corporations, mutual funds, or investment trusts. Illiquid assets comprise the value of housing, residential and nonresidential real estate (net of mortgages and home equity loans), private retirement accounts (e.g., 401(k)s, IRAs, thrift accounts, and future pensions), and the cash value of life insurance policies. Net liquid and illiquid assets account for liquid debts (e.g., credit card balances) and mortgage balances, respectively.

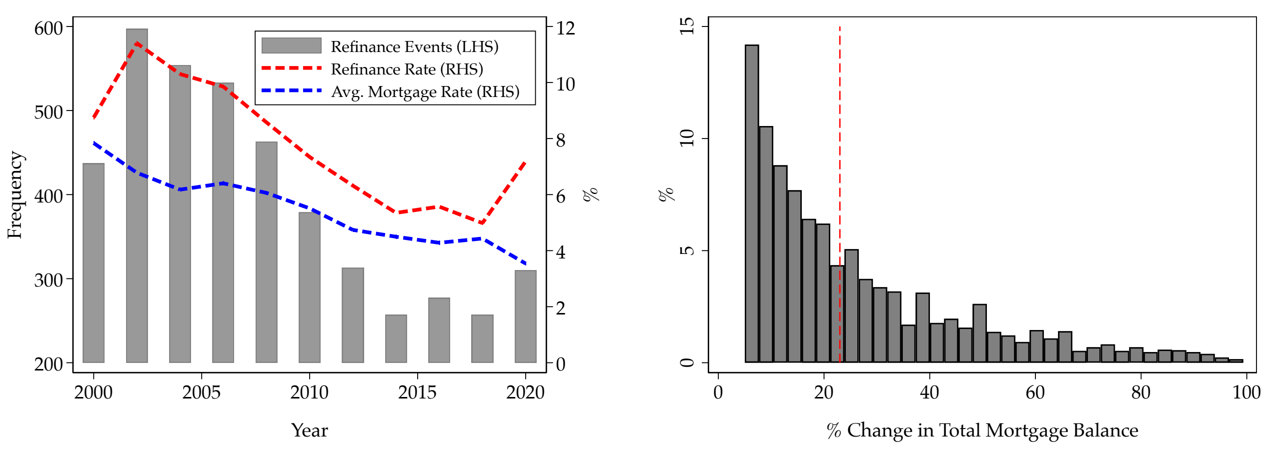
We exclude households with missing information on education, state of residence, or race, as well as those with extreme income changes—specifically, income growth exceeding 500%, income drops greater than 80%, or income below $100. We also drop top-coded observations on income or consumption and restrict our sample to households whose heads are between the ages of 25 and 75. The final sample consists of 42,351 observations pooled over the twelve survey years from 1999 to 2021.

Following the literature, a household is classified as hand-to-mouth (HtM) if its net liquid assets are less than two weeks' worth of disposable income, assuming a credit limit equal to one month of income. We further distinguish between "poor" and "wealthy" HtM households: the former do not hold any illiquid assets, while the latter have positive net holdings. In our sample, 35% of households are classified as "wealthy" HtM, while 25% are "poor" HtM.

Consistent with Chen et al. (2020) and Boar et al. (2022), we define a household as having refinanced its mortgage if the total mortgage balance increases by more than 5% between two consecutive PSID waves. Figure A.1 presents trends in refinancing activity and its impact on total mortgage balances over time. In particular, Panel (a) is comparable in both magnitude and dynamics to its counterpart from the Fannie Mae Single-Family Loan-Level dataset (Figure A.4).

Table A.1 provides additional demographic and financial information for a sample split between households that extracted home equity in 2001 and their non-refinancing counterparts, along with the overall average. These summary statistics offer a meaningful snapshot of household characteristics, accounting for the dynamic effects of refinancing on household balance sheets.

Figure A.1: Refinancing Activity - PSID



(a) Frequency and Rate **(b)** Distribution

Notes: panel (a) plots the frequency (lef-hand-side axis) of refinancing events for each year, the annualized rate of aggregate refinancing over the total mortgages and the average mortgage rate (right-hand-side axis) for each survey wave. Panel (b) plots the distribution of the percentage changes in total mortgage balance, conditioning on refinancing. The dashed red line indicates the median value change.

Table A.1: Summary Statistics

	Refinancers		Non-Refinancers		Sample	
Age	46.7	(9.5)	47.4	(12.2)	47.3	(11.9)
College Education (%)	63.2	(48.3)	61.6	(48.6)	61.8	(48.6)
Employed (%)	87.9	(32.7)	81.7	(38.7)	82.5	(38.0)
Unemployed (%)	2.2	(14.6)	1.75	(13.1)	1.8	(13.3)
Retired (%)	7.5	(26.3)	13.6	(34.3)	12.8	(33.4)
Family Size	3.2	(1.3)	2.9	(1.4)	2.9	(1.4)
Number of Children	1.0	(1.0)	0.9	(1.1)	0.9	(1.1)
Support Children Outside Family (%)	13.4	(34.1)	14.9	(35.6)	14.7	(35.4)
Disposable Income ($)	75,149	(35,712)	67,565	(35,471)	68,634	(35,594)
Net Liquid Assets ($)	20,477	(50,653)	26,639	(59,935)	25,771	(58,743)
Net Illiquid Assets ($)	99,951	(106,126)	124,849	(136,627)	121,342	(133,013)
Net Liquid Assets over Income	0.23	(0.68)	0.46	(1.34)	0.42	(1.27)
Debt-to-Income Ratio	1.54	(1.06)	0.96	(1.01)	1.04	(1.04)
N	321		1998		2319	

Notes: Values are means, with standard deviations in parentheses. Reference year is 2001. Data are deflated by the CPI deflator (2006 base year) where applicable.

A.2 Refinancing MPCs - Robustness checks

A.2.1 Liquidity Constrained

In this section, we conduct several robustness checks for our main result on MPCs conditional on a refinancing event. We examine various factors that may have incentivized households to refinance in order to access liquidity. These include instances where medical or educational expenditures increased in conjunction with refinancing (i.e., if a household refinanced its mortgage at time t, the change in expenditure between $t-1$ and t is positive). Additionally, we consider proxies for liquidity constraints, such as the "wealthy" HtM indicator, as well as households with a liquid wealth-to-income ratio below the median and a debt-service-to-income ratio above the median (Cooper, 2013).

Compared to the benchmark results, we leverage the average MPCs before and after refinancing, as we focus on smaller subgroups of the sample. The results, reported in Table A.2, indicate significant changes in MPCs, ranging from 18% to 26%, in line with our main findings. The only case in which the decline in MPCs is not statistically significant is for households with high debt-service-to-income ratios. This result is likely due to pre-committed expenditures over the short to medium run, which may not be directly related to the liquidity needs that drive refinancing decisions. The smaller number of observations in this category further supports this interpretation.

Table A.2: Change in MPCs upon Refinancing

	Baseline	W-HtM	Medical	Educational	Liq. Wealth/Income	Debt-Service
ΔMPC	-0.20**	-0.25**	-0.24**	-0.25**	-0.18	-0.19
	(2.13)	(2.13)	(2.14)	(2.27)	(1.64)	(0.96)
N	5,092	3,321	3,656	4,181	4,007	2,044

Notes: t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.2.2 Interest Rate Incentives

The recent literature on the mortgage refinancing channel of monetary policy has emphasized the role of interest rate incentives as the primary mechanism through which changes in the policy rate influence consumption and the broader economy (Wong, 2021; Berger et al., 2021; Eichenbaum et al., 2022). We confirm that our main findings are not driven by the interest rate benefits that households may obtain when refinancing.

Table A.3 reports the average MPC before and after refinancing for a subset of households that did not experience a change in their mortgage rate. Even in this restricted sample, the decline in MPC remains sizable (0.32) and statistically significant, further reinforcing the liquidity channel as the primary mechanism underlying our results.

Table A.3: (Biennial) MPCs Estimates over Refinancers - No Interest Rate Incentives

	Before Refinance (1)	After Refinance (2)
MPC	0.47***	0.15*
	(0.11)	(0.08)
N	3,434	3,434

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (1) = MPC (2), p-value: 0.02

A.2.3 Unemployment

A major source of income volatility affecting consumption growth is the risk of unemployment. Here, we test whether our results are driven by refinancers who lost their job, either at the time of refinancing (t) or two years prior ($t - 1$).[12]

The sample of unemployed households who refinance is extremely small, and the estimated MPCs for this group are not statistically significant. Moreover, constraints such as the PTI limit the likelihood that unemployed individuals can secure new mortgage contracts, reinforcing the idea that households opt for cash-out refinancing primarily due to liquidity needs rather than large and severe income shocks.

Table A.4: (Biennial) MPCs Estimates over Refinancers - Unemployment

	Before Refinance (1)	After Refinance (2)
MPC	0.16	0.00
	(0.26)	(0.13)
N	724	724

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

[12] We control for both the contemporaneous refinancing event and unemployment status. The results remain unchanged when considering unemployment in the two years preceding refinancing. Results are available upon request.

A.2.4 Male Household Head

We further control for low workforce engagement by restricting our sample to households with male heads. Table A.5 shows that our results remains robust to this specification.

Table A.5: (Biennial) MPCs Estimates over Refinancers - Male Households' Heads

	Before Refinance	After Refinance
	(1)	(2)
MPC	0.44***	0.19***
	(0.08)	(0.06)
N	4,640	4,640

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (1) = MPC (2), p-value: 0.01.

A.2.5 Cash-on-hand

Table A.6 presents MPC estimates across different levels of cash-on-hand, a widely used measure of liquidity that combines monthly labor income with available liquid assets (Jappelli and Pistaferri, 2020). The decline in MPCs upon refinancing for households below the median of the cash-on-hand distribution confirms a sizable reduction in MPCs for potentially liquidity-constrained households, consistent with the findings in Table A.2.

At the same time, the average MPC of refinancers below the median cash-on-hand value remains higher than that of households in the upper half of the distribution, in line with the results reported in Table 3.

Table A.6: MPC over Refinancers Households - Cash-on-hand

	Change	Average	Average
	Cash-on-hand < Median	Cash-on-hand < Median	Cash-on-hand > Median
	(1)	(2)	(3)
ΔMPC/MPC	-0.21**	0.23***	0.18***
	(0.11)	(0.04)	(0.06)
N	3,678	6,494	2,506

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (2) > MPC (3), p-value: 0.79.

A.2.6 Total Consumption

Our baseline results are based on changes in non-durable consumption. To assess the robustness of our findings, we extend the analysis to include durable goods (vehicles and household furnishings and equipment) in the measure of consumption. The change in MPCs remains robust when considering total consumption, while expenditures on durable goods do not produce qualitatively significant differences.

These results suggest that non-durable goods expenditures primarily drive the baseline findings, reinforcing the notion that refinancing relaxes liquidity constraints for immediate consumption needs, thereby lowering MPCs.

Table A.7: Change in MPCs upon Refinancing - Total Consumption and Durable Goods

	Total Consumption	Durable Goods
ΔMPC	-0.21**	-0.25
	(1.89)	(0.92)
N	5,129	4,913

Notes: t-statistics in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.3 Blundell et al. (2008) - Robustness checks

In this section we perform several robustness checks that relate to the methodology by Blundell et al. (2008), in particular the exogeneity assumption of no advance information which could be violated in the setting of mortgage refinancing.

A.3.1 Variance-Covariance Matrix of Income and Consumption Growth

We begin by estimating the variance-covariance matrix of current income and consumption growth with future income growth, conditioning on refinancing-relevant periods, as in our main specification ($t \in [\text{Refi} - 2, \text{Refi} + 2]$). Table A.8 provides insights into the possible length of anticipation effects.

In short, transitory shocks appear to be short-lived, as the average auto-covariance of detrended income growth remains statistically significant only up to $t + 1$. This suggests that transitory shocks follow a MA(0) process. Similarly, the covariance of detrended consumption growth is significant up to $t + 1$, indicating a departure from a random walk.

These findings allow us to estimate a robust version of the BPP estimator that relaxes the random walk assumption on log consumption, following Commault (2022). When transitory shocks are short-lived, a single future value of detrended income growth serves as a valid instrument that satisfies the requirements of the robust estimator. We currently adopt this same instrument in the second stage of our baseline BPP estimation.

Table A.8: Variance-Covariance Matrix of Income And Consumption Growth

	cov($\Delta\hat{\varepsilon}^{y}_{i,t}$, .)	p-value	cov($\Delta\hat{\varepsilon}^{c}_{i,t}$, .)	p-value
$\Delta\hat{\varepsilon}^{y}_{i,t}$	0.102	0.000	0.113	0.000
$\Delta\hat{\varepsilon}^{y}_{i,t+1}$	-0.037	0.000	-0.013	0.000
$\Delta\hat{\varepsilon}^{y}_{i,t+2}$	-0.002	0.159	0.001	0.280
$\Delta\hat{\varepsilon}^{y}_{i,t+3}$	-0.004	0.033	-0.001	0.912

Notes: First differenced residuals of both log consumption and log income were estimated based on equation (7). For the first entry of the first column, we test for if the variance of $\Delta\hat{\varepsilon}^{y}_{i,t}$ is larger than 0.0001 for completeness. Other p-values reflect two-tailed t-tests where we test the hypothesis $cov(\Delta\hat{\varepsilon}^{y}_{i,t}, \Delta\hat{\varepsilon}^{y/c}_{i,t+h})/var(\Delta\hat{\varepsilon}^{y}_{i,t})$ is different from 0. We perform a two-tailed t-test here due to the fact that we cannot assume the sign of the covariance. If consumption or income growth follows a random walk, the covariances could be positive or negative, hence we perform two-tailed t-tests.

A.3.2 Measurement Errors

The BPP methodology is subject to several biases in its estimation process, primarily due to the biennial structure of the dataset. These biases stem from factors such as the correlation between past shocks and individual-specific borrowing conditions, which negatively affects the estimated relationship between income and consumption growth. Additionally, while the timing of shocks initially influences consumption growth, this effect diminishes over time, leading to downward-biased estimates.

Against this background, we assume that the measurement error variance is large, approximately equal to the variance of transitory income shocks within a single survey wave.[13] Table A.9 confirms that our baseline results remain robust under this adjustment.

[13] In practice, we re-estimate MPCs using the BPP method by scaling the first-stage regressor as $\Delta\hat{\varepsilon}^{y}_{i,t}/2$.

Table A.9: (Biennial) MPCs Estimates over Refinancers - Measurement Errors

	Before Refinance	After Refinance
	(1)	(2)
MPC	0.80^{***}	0.41^{***}
	(0.15)	(0.11)
N	5,092	5,092

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (1) = MPC (2), p-value: 0.05.

A.3.3 Anticipations

One of the key assumptions of the BPP method is that households do not have advance information about future income shocks. In our context, a violation of this assumption would imply that households anticipate the refinancing event up to two years in advance.

First, based on unconditional data, we find that the correlation between the de-trended income shocks ($\Delta y_{i,t}$) and our lagged refinancing indicator ($\text{Ref}_{i,t-1}$) is positive but extremely small (0.01). This suggests that households do not systematically experience large income shocks in the two years preceding home equity extraction, providing reassurance that our estimates are not biased by systematic anticipation effects.

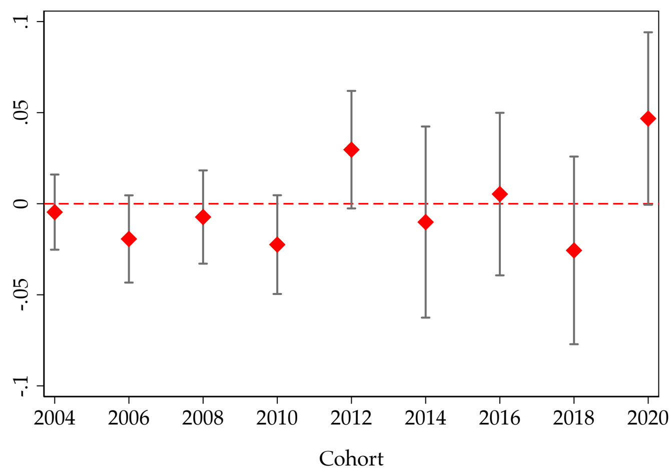
Second, we explicitly test for anticipatory effects on log consumption across refinancing cohorts, accounting for the underlying assumptions in the staggered event-study of Section 2.4.1. To this end, we estimate the following specification:

$$\log c_{i,t} = \alpha_i + \alpha_t + \sum_{s=1}^{T} \sum_{r=1}^{R} \beta_{s,r} T_{i,s} \cdot C_{r,t} + \mathbf{X}'_{i,t}\gamma + \varepsilon_{i,t}$$

where α_i and α_t are household and time fixed effects, respectively, and $\mathbf{X}_{i,t}$ is a standard set of demographic controls. The interaction term $T_{i,s} \cdot C_{r,t}$ consists of two dummy variables: $T_{i,s}$ denotes year s for household i, while $C_{r,t}$ identifies refinancing cohort r at time t. Intuitively, the coefficient $\beta_{s,r}$ captures both anticipatory and post-treatment effects on consumption growth for each cohort of refinancers.

Figure A.2 plots the average estimates for each refinancing cohort r over all periods t preceding the refinancing event. The only cohorts exhibiting statistically significant anticipatory effects are those that refinanced in 2012 and 2020. To ensure that our baseline results are not driven by this subset of households, we re-estimate our baseline specification excluding these cohorts. As shown in Table A.10, the results remain robust, confirming that our findings are not biased by anticipatory effects.

Figure A.2: Average Anticipatory Effect by Refinancing Cohort



Notes: average anticipatory effect estimates by cohort in red diamonds, while grey bars indicate 95% confidence intervals. Each estimate is the average of all $\beta_{s,r}$ for a given cohort r and for all $s < r$.

Table A.10: (Biennial) MPCs Estimates over Refinancers - Exclude 2012/2020 Cohorts

	Before Refinance	After Refinance
	(1)	(2)
MPC	0.44***	0.19***
	(0.10)	(0.06)
N	3,655	3,655

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. H_0 : MPC (1) = MPC (2), p-value: 0.05.

A.3.4 AR(1) Persistent Component

The BPP approach assumes that income shocks are either permanent or transitory. We test our baseline result in the case in which shocks are persistent, following an AR(1) process:

$$p_{i,t} = \rho \cdot p_{i,t} + \eta_{i,t}$$

We estimate MPCs over refinancing assuming that the difference in income is now given by $\Delta\tilde{y}_{i,t} = y_{i,t} - \rho \cdot y_{i,t-1}$, following Kaplan and Violante (2010). Table confirms our baseline result under several cases we consider for the value of the persistent parameter.

Table A.11: MPC over Refinancers Households - AR(1) Persistent Component

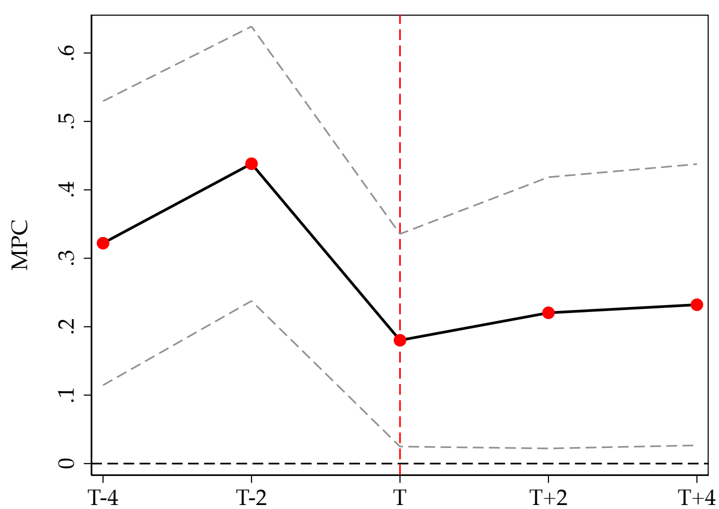
	$\rho = 0.80$	$\rho = 0.90$	$\rho = 0.95$
ΔMPC	-0.31**	-0.23**	-0.21**
	(0.15)	(0.11)	(0.11)
N	5,092	5,092	5,092

Notes: Bootstrapped standard errors based on 250 replications in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

A.3.5 Endogeneity of refinancing on consumption

Figure A.3 plots the MPCs estimates γ from equation 11, showing that the baseline results is robust to the inclusion of the refinancing indicator.

Figure A.3: (Biennial) MPCs Estimates over Home-Equity Extraction



Notes: time T refers to the year of home-equity extraction. Grey dashed lines represents 95% confidence intervals with bootstrapped standard errors based on 250 replications.

A.4 Fannie Mae Data

We use loan-level data for the U.S. from the Fannie Mae Single-Family Loan-Level historical dataset.[14] Fannie Mae is one of the largest government-sponsored enterprises (GSEs) in the agency mortgage-backed securities (MBS) market, alongside Freddie Mac and Ginnie Mae. By the end of 2022, agency MBS accounted for 67.8% ($8.9 trillion) of total outstanding mortgage debt, while by March 2023, outstanding securities in the agency market totaled $8.8 trillion, with Fannie Mae comprising 41.1% ($3.6 trillion) of that amount (Goodman et al., 2023).

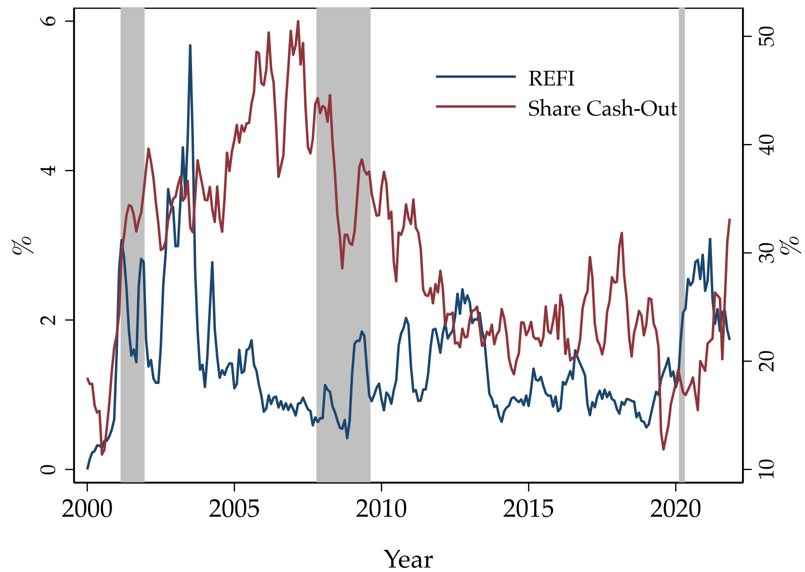
The dataset provides loan-level panel data, including detailed information on loan characteristics at origination for fixed-rate mortgages. However, we do not utilize these additional characteristics, as our study does not focus on the heterogeneity among refinancers. Each loan in the dataset is uniquely identified at origination with an identification number, which does not allow tracking of the same borrower across multiple mortgage contracts. Consequently, we treat each loan as if it belongs to a new borrower.

The sample spans from January 2000 to November 2021. We restrict the dataset to fixed-rate mortgage contracts and, to reduce computational burden, randomly select 10% of newly originated loans per quarter. We define a mortgage as refinanced if it is voluntarily prepaid before maturity, and we focus on total refinancing. To measure refinancing activity, we construct an aggregate index (REFI_t) as the share of prepaid mortgages over the total number of active mortgages in our sample for a given month.

Figure A.4 plots the REFI_t index, along with the share of cash-out loans used as a robustness check (see Section A.6). Refinancing activity was particularly high during the housing boom leading up to the Great Financial Crisis and experienced a sharp increase following the COVID-19 pandemic, driven by a combination of liquidity needs and historically low mortgage rates.

[14] Data available at Fannie Mae Single-Family Loan-Level website.

Figure A.4: Fannie Mae Refinance Indices

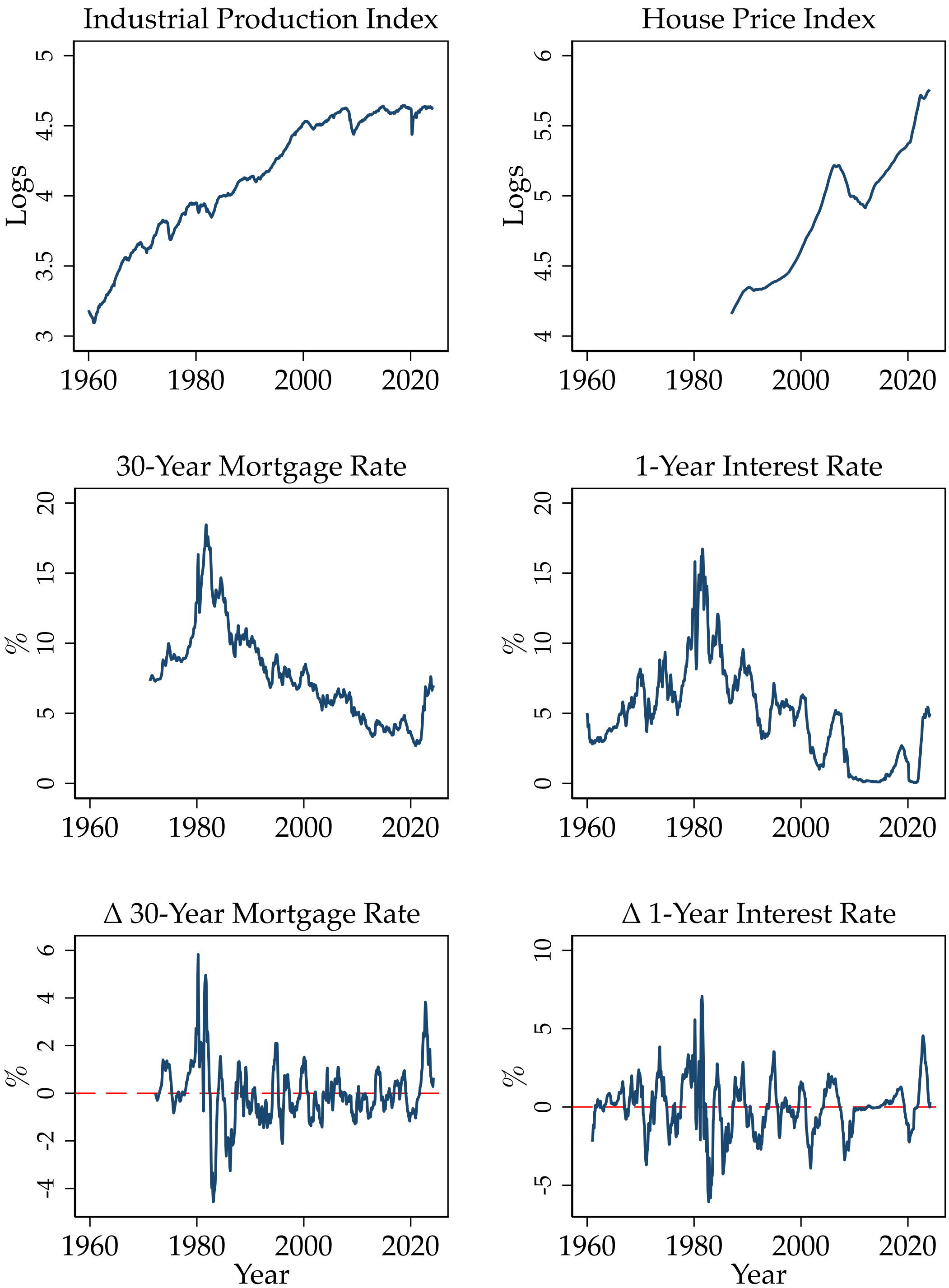


Notes: The gray shaded areas show the U.S. recessions according to the NBER. See main text for the construction of the refinance index and the share of cash-out loans.

A.5 Macroeconomic Data

We retrieve macroeconomic time series from the Federal Reserve Economic Data (FRED) Database managed by the Federal Reserve Bank of St. Louis. We use the Industrial Production: Total Index (INDPRO), the S&P CoreLogic Case-Shiller U.S. National Home Price Index (CSUSHPISA), the 30-Year Fixed Rate Mortgage Average in the U.S. (MORTGAGE30US), and the Market Yield on U.S. Treasury Securities at 1-Year Constant Maturity (GS1). We apply the logarithm function to indices, while rates (in level and change) are in percentages.

Figure A.5: Macroeconomic Data



A.6 Counter-cyclical Mortgage Refinancing

We confirm that the counter-cyclical feature of mortgage refinancing is robust to a sample split based on the Great Financial Crisis (Table A.12), representing a structural break in the housing market and on the interest rates path.

Table A.12: Aggregate Refinancing and Economic Activity - GFC Sample Split

	Before GFC			After GFC		
Dependent variable: log($REFI_t$)	(1)	(2)	(3)	(1)	(2)	(3)
log (IP_t)	-7.25***	-18.51***	-12.36***	-2.77***	-1.83**	-3.62***
	(0.96)	(1.50)	(1.86)	(0.75)	(0.77)	(0.60)
log (HPI_t)		3.77***	2.85**		0.47***	-0.63***
		(0.30)	(0.78)		(0.17)	(0.17)
$\Delta RM30_t$		-0.54***	-0.51***		-0.34***	-0.01
		(0.06)	(0.14)		(0.05)	(0.05)
Controls	✗	✗	✓	✗	✗	✓
N	94	94	94	148	148	148
R^2	0.19	0.81	0.83	0.09	0.33	0.74

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

To further validate our assumption that prepaid mortgages in the Fannie Mae dataset serve as a reliable proxy for mortgage refinancing, we utilize information on the stated purpose of newly originated loans each quarter. Specifically, we compute the share of cash-out mortgages as the ratio of loans labeled as "Cash-Out Refinance" to the total number of new loans entering the dataset in a given quarter.

This measure differs from our baseline approach, which considers only refinanced mortgages among the most recent loans. In contrast, the $REFI_t$ indicator captures the ratio of prepaid loans to the total stock of existing loans within a given quarter.

Table A.13 presents the estimates under this alternative definition, confirming the countercyclicality of cash-out refinancing in specifications that exclude additional controls.

Table A.13: Aggregate Share of Cash-Out and Economic Activity

Dependent variable: log(Cash-Out Share$_t$)	(1)	(2)	(3)
log (IP$_t$)	-1.31***	-2.10***	0.48
	(0.34)	(0.69)	(0.45)
log (HPI$_t$)		0.24	1.48**
		(0.18)	(0.15)
ΔRM30$_t$		0.03	-0.26***
		(0.04)	(0.03)
Controls	✗	✗	✓
N	254	254	254
R^2	0.05	0.06	0.50

Notes: Robust standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

B Model Appendix

This section of the Appendix reports additional information about the simulations from the model used in the main text. For further details on the model itself, see Boar et al. (2022).

B.1 Simulations

Each scenario described in Section 4.3 is based on a baseline simulated economy consisting of 25,000 households over 244 quarters (61 years of the life cycle). Against this baseline economy (denoted as M^b), we introduce an exogenous shock to a parameter x and generate an alternative simulated version (denoted as M^x).

When computing MPCs in the model, we retrieve the simulated economy and introduce an exogenous, fully unanticipated transfer that enters the agents' budget constraint in a given period. The MPCs for each scenario are then calculated as follows:

$$MPC_{i,t}^{x} = \frac{\tilde{C}_{i,t}^{x} - C_{i,t}^{x}}{\tau}$$

where $\tilde{C}_{i,t}^{x}$ represents the level of consumption when households receive the fiscal transfer.

We compute MPCs by averaging over households i within specific groups (refinancers, non-refinancers) as well as at the aggregate level. In scenarios where two parameters are shocked, we first generate a simulated economy with the initial shock (M^{x_1}) and subsequently introduce the second shock on top of it (M^{x_1,x_2}).

For our fiscal experiments, we identify agents as non-refinancers in the shocked scenarios and compare targeted fiscal transfers directed to them against an untargeted fiscal program. Specifically, in the untargeted case, agents who are not refinancing their mortgage continue to retain their status as non-refinancers upon receiving the transfer.

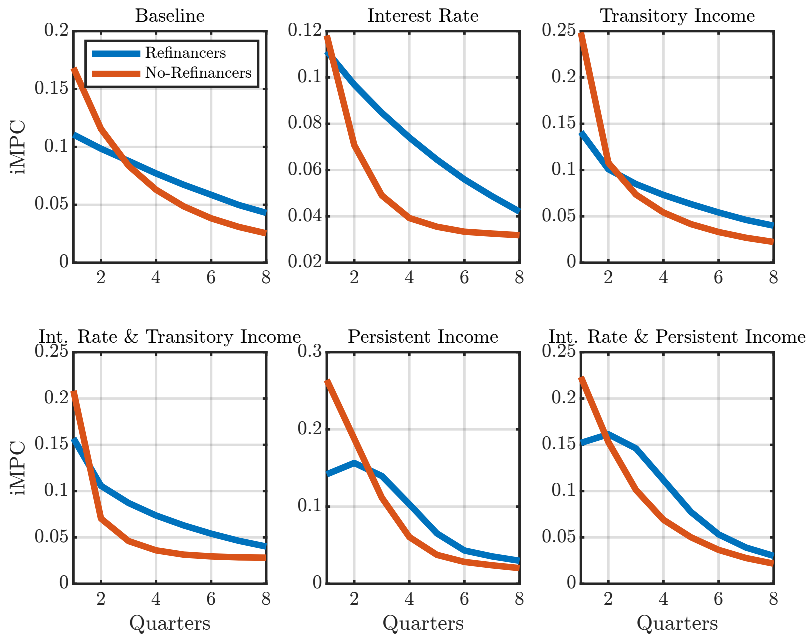
B.2 Intertemporal MPCs

In our analysis, fiscal transfer simulations allow us to examine how different household groups adjust their consumption in response to an exogenous increase in disposable income. We focus exclusively on fully unanticipated transfers, as opposed to income changes that households expect to occur in future periods. In our iMPCs framework, we consider only the first column, $M_{t,0}$.

Figure B.1 presents the average iMPCs for refinancers and non-refinancers under each simulated shock. Households that refinanced within the year preceding the transfer exhibit, on average, a lower propensity to consume than non-refinancers. The latter group experiences a larger immediate consumption response, consistent with a shorter planning horizon and a greater immediate benefit from consumption relative to smoothing over time.

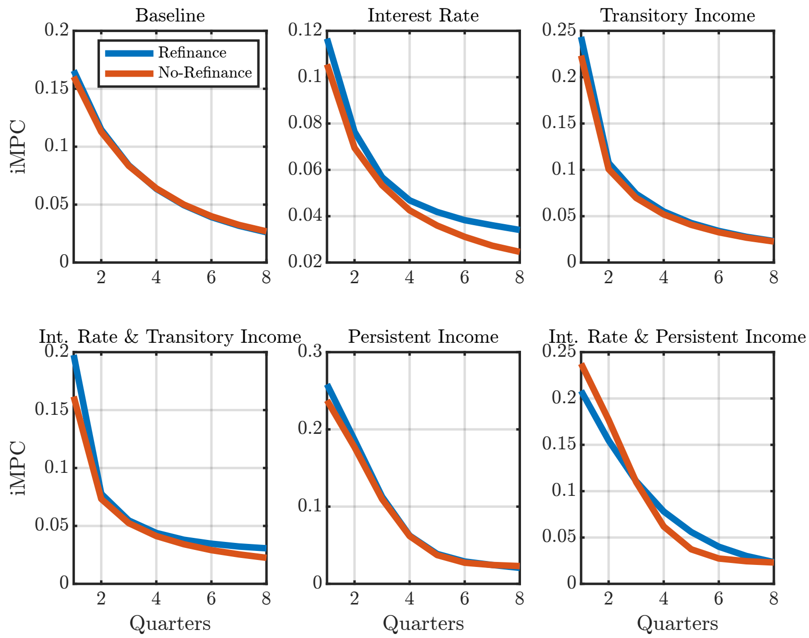
Figure B.2 compares the aggregate iMPCs between the baseline model and an alternative specification in which households do not have the option to refinance mortgages. The observed differences are minimal and primarily affect the immediate response (as discussed in Section 4.5 of the main text). These findings suggest that, while refinancing has a limited aggregate effect on the efficacy of fiscal policy, it serves as a mechanism for certain households to smooth consumption in response to adverse shocks.

Figure B.1: Quarterly iMPCs - Simulated Scenarios - Refinancers and No-Refinancers



Notes: Quarterly iMPCs for each simulated scenarios across households groups. The iMPCs represent the share of the fiscal transfer that is spent at each period.

Figure B.2: Quarterly iMPCs - Simulated Scenarios - Refinancing Channel



Notes: Quarterly iMPCs for each simulated scenarios in the re-calibrated version of the model without mortgage refinancing. The iMPCs represent the share of the fiscal transfer that is spent at each period.

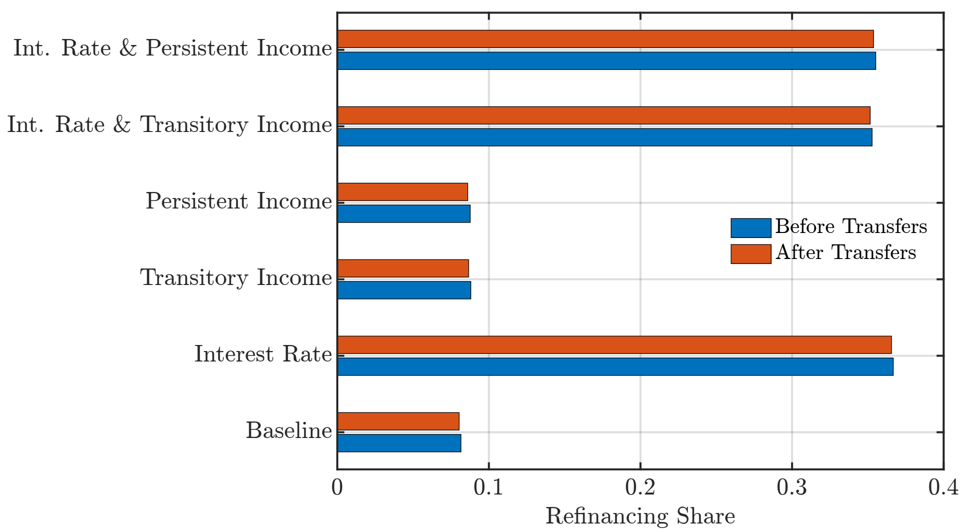
B.3 Share of Refinancers

For each simulated shock scenario, we calculate the overall share of refinancers in the economy and compare it before households receive fiscal transfers with the ex-post simulated economy that includes these transfers. This approach enables us to identify the primary drivers of refinancing activity and assess whether households can marginally access home equity upon receiving additional—albeit modest—funds.

Figure B.3 shows that mortgage rates are the dominant factor influencing refinancing behavior. The share of refinancers increases from an average of 8% in the baseline scenario to approximately 35% in cases involving a drop in interest rates. Furthermore, fiscal policy has minimal impact on aggregate refinancing activity, as the differences between scenarios with and without transfers are negligible.

These findings reinforce the notion that during recessions or economic downturns, when monetary easing incentivizes some households to extract home equity, targeted fiscal programs can enhance policy efficacy, as discussed in the main text.

Figure B.3: Refinancing Shares - Simulated Scenarios



Notes: The refinancing shares are calculated as the ratio of the number of refinancers to the total number of homeowners with an active mortgage at a given time t. This same period t serves as the reference point for when fiscal transfers are distributed.