Does Household Heterogeneity Matter for Monetary Policy? The Refinancing Multiplier*

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Abstract

This paper examines how heterogeneity among households influences the refinancing channel of monetary policy. We demonstrate that the correlation between two key factors—the probability of mortgage refinancing and the marginal propensity to consume—determines the strength of this transmission mechanism. Using novel survey data, we find a small but positive correlation, suggesting that the refinancing channel is more effective than previously recognized. However, this correlation conceals two opposing forces: financial sophistication, or the lack thereof, generates a negative relationship, while impatience and liquidity preferences drive a stronger, positive relationship. Furthermore, the aggregate correlation masks heterogeneity across the types of mortgage refinancing. Borrowers who take out cash-out refinances exhibit large immediate consumption responses, whereas those who refinance to take advantage of lower interest rates display more muted consumption responses. These mechanisms shape both time-dependent and state-dependent refinancing inaction, ultimately influencing the magnitude and speed of monetary policy pass-through. We find that this correlation results in 13% larger consumption responses to a simulated interest rate cut than a standard representative agent model would predict.

Keywords: Monetary Policy Transmission, Mortgage Refinancing, Consumer Spending

JEL classifications: E21, E52, G51, G53

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1 Introduction

Mortgage rates are one of the main channels, if not the primary direct channel, through which monetary policy influences household consumption (Campbell, 2023). Central banks seeking to stimulate demand have employed both conventional and unconventional tools to lower mortgage rates, encouraging households to refinance, extract equity, and increase current consumption (Bhutta and Keys, 2016; Di Maggio et al., 2020). However, since households differ in their propensity to refinance and their marginal propensity to consume, the distribution of these characteristics is a key driver of the refinancing channel of monetary policy (Di Maggio et al., 2017; Beraja et al., 2019).

In this paper, we argue that the correlation between these two critical parameters—the Likelihood of Refinancing a Mortgage (LRM) and the Marginal Propensity to Consume (MPC)—plays a decisive role in determining both the strength and speed of monetary policy's impact on aggregate demand. If, on the one hand, the correlation is positive, lower policy rates will translate into lower mortgage rates for households with high MPCs, resulting in large and swift effects on aggregate demand. On the other hand, if the correlation is negative, the households who refinance would predominantly be those with low MPCs, resulting in a slow and subdued effect. Theoretically, the correlation is ambiguous. On the one hand, impatient households with high marginal utility of liquidity could have both high refinancing rates and high MPCs, leading to a positive correlation. On the other hand, financially sophisticated households that refinance more might have low MPCs, resulting in a negative correlation. Consequently, it remains an empirical question.

We address this empirical question by surveying a representative sample of US homeowners and combining the survey evidence with estimates using microdata from the near universe of mortgage refinances. Our main result is a small but positive and significant correlation between refinancing rates and MPCs. We find evidence that the correlation is driven by two opposing economic mechanisms: financially sophisticated consumers have high refi likelihoods and low MPCs (generating a negative correlation), while impatient households with high marginal values of liquidity have high refi likelihoods and high MPCs (generating a positive correlation). The former results are consistent with the findings by Jørring (2024) on the relationship between financial sophistication and consumer spending, while the latter findings are consistent with the idea proposed in the theoretical work by Maxted et al. (2025) that present bias affects both mortgage refinancing and MPCs. Overall, our results offer a silver lining for the refinancing channel of monetary policy. Relative to models that impose no correlation, we find that lower policy rates (or quantitative easing targeted at bringing down mortgage rates) translate into larger and faster responses in aggregate demand.

We begin the paper by collecting novel survey data from a geographically representative sample of 1,027 U.S. homeowners via the Prolific platform. The survey elicits detailed information on financial behavior, mortgage history, and attitudes toward consumption. Following prior work, we measure MPCs using hypothetical windfall scenarios as in Fuster et al. (2020). Participants are asked how much they would adjust their spending, saving, and debt repayment in response to an unexpected one-time gain of $5,000 and a permanent decrease in mortgage payments of $250 per month. Their MPC is then defined as the fraction of additional income they report they would spend. To measure refinancing behavior, we ask homeowners whether they have refinanced their mortgage in the past 20 years, how frequently they have done so, and whether they engaged in cash-out refinancing. Additionally, we measure respondents' familiarity with refinancing and their financial literacy using the "Big Three" financial literacy questions from Lusardi and Mitchell (2023). We collect further financial and demographic characteristics, including credit scores, mortgage size, income, and a measure of present bias based on an impatience index from Aggarwal et al. (2022). To extend our analysis beyond the survey sample, we incorporate large-scale HMDA and GSE mortgage data, which allows us to observe actual refinancing behavior at a national level. We fit a quantitative model of refinancing behavior using this data which we then use to simulate refinancing and consumption responses to monetary policy for our population of subjects. This model also allows us to simulate consumption responses for counterfactual joint distributions of LRMs and MPCs, letting us quantify the magnitude of the effect of covariance of these two variables on policy outcomes.

Our survey results reveal a small but positive unconditional correlation between MPCs and refinancing propensity. Homeowners who have refinanced in the past tend to have higher MPCs than those who have not. We find that the average MPC from a $250 decrease in mortgage payments is 0.10 for individuals who have never refinanced, compared to 0.14 for those who have refinanced at least once. This result suggests that the refinancing channel of monetary policy is more effective than it would be if the two variables were uncorrelated. However, we also find that this relationship is shaped by two opposing forces. Our measure of impatience is positively correlated with both propensity to refinance and MPCs, driving a positive correlation between LRMs and MPCs. Mortgage size, mortgage term, and participation in government lending programs (VA, FHA, and rural housing) all further strengthen this positive correlation. On the other hand, credit scores and incomes are both positively correlated with refinancing but negatively correlated with MPCs. Therefore, wealth and financial sophistication dampen the overall correlation and weaken this channel of monetary policy. The combined facts that higher incomes are correlated with lower MPCs, higher mortgage sizes are correlated with higher MPCs, and both are correlated with increased

refinancing activity highlight the liquidity constraints imposed by debt burdens and suggest that mortgage relief policies may disproportionately impact higher-MPC households.

Beyond the correlation between MPCs and the likelihood of refinancing, we also find that MPCs are positively correlated with the probability that a borrower extracts equity from their home when they refinance, a "cash-out" refinancing. Conditional on having refinanced at all, borrowers who have done a cash-out refinance have an average MPC of 0.21 compared to a 0.11 average for those who have refinanced but not cash-out refinanced. This means that refinancing behavior and consumption patterns are positively related on the intensive margin as well as the extensive margin. Those who are more likely to spend additional cash on hand are more likely to refinance, and more likely to extract cash when doing so.

We extend our analysis by estimating a structural model of refinancing behavior using merged GSE mortgage performance and HMDA demographic data. We allow consumers' refinancing frictions to be determined by variables that are shared between these administrative datasets and our survey, namely loan size, credit score, loan age, loan term, and whether the loan is conventional or part of a government lending program (and thus guaranteed by Ginnie Mae). We then use our estimated model to predict how borrowers in our survey would respond to interest rate cuts. We use this predicted refinancing behavior alongside their reported MPCs to generate impulse responses in consumption. We compare these consumption responses to those predicted under counterfactual joint distributions of MPCs and LRMs. First, we compare our predictions to those in a model where MPCs and LRMs are uncorrelated (a representative agent model in which all agents have the mean MPC and mean refinancing behavior). We find that in the first five years following a 100bp mortgage rate cut, actual predicted consumption increases by 13% more than what a representative agent model would predict. However, we also compare our predictions to a model in which MPCs perfectly predict refinancing behavior. We find that our predictions lead to a 70% smaller increase in consumption than this perfect correlation benchmark, indicating that there is still room for better targeted policy.

Our findings have important implications for monetary policy. Since high-MPC borrowers are more responsive to mortgage rate reductions when they do refinance, policies aimed at increasing awareness and financial literacy could significantly amplify the effectiveness of the refinancing channel. Targeted outreach programs that help high-MPC households understand the benefits of refinancing could accelerate monetary policy transmission and enhance aggregate demand responses. Additionally, our results highlight the need for structural models of mortgage refinancing that incorporate behavioral heterogeneity. The dual effects of financial sophistication and liquidity constraints suggest that standard macroeconomic models may underestimate the role of frictions in the mortgage market.

Related literature

Our paper's main contribution is to study how heterogeneity across households impacts the refinancing channel of monetary policy. We build on the growing empirical literature studying mortgage refinancing and how it relates to the transmission of monetary policy. This literature has documented how the Fed can influence mortgage rates either conventionally by lowering its target rate, which lowers rates on 10-year Treasury rates (Nakamura and Steinsson, 2018) and in turn lowers 30-year fixed-rate mortgage rates (Gertler and Karadi, 2015; Gilchrist et al., 2015), or unconventionally through quantitative easing by buying mortgage-backed securities (MBS) (Gagnon et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011). Lower mortgage rates, in turn, encourage households to refinance to extract equity (Bhutta and Keys, 2016) and increase car purchases (Di Maggio et al., 2017, 2020). Critically, several papers find significant variation in the pass-through depending on both cross-sectional variation in home equity (Beraja et al., 2019) and the time-series path of interest rates (Berger et al., 2021; Eichenbaum et al., 2022). We contribute to this literature by providing empirical evidence on the correlation between two key determinants of the refinancing channel: mortgage refinancing and consumer spending.[1]

The literature on mortgage refinancing has documented significant variations across borrowers, emphasizing how many are often unsophisticated. Specifically, several studies have shown that borrowers fail to refinance optimally (Agarwal et al., 2016; Keys et al., 2016; Andersen et al., 2020). This lack of sophistication among mortgage borrowers extends to broker commissions (Woodward and Hall, 2012), mortgage points (Agarwal et al., 2017), non-salient fees (Liu, 2019), and interest-rate resets (Jørring, 2024).[2] Similarly to the literature on mortgage refinancing, the literature on consumer spending—going back to Friedman (1957) and Hall (1978)—documents vast differences in MPCs across households. A key result in the literature is that households with low levels of liquid savings (or equivalently, with high marginal utility of liquid wealth) have high MPCs, and this finding has been instrumental in the influential work analyzing how heterogeneity in MPCs affects monetary policy (Kaplan et al., 2018; Auclert, 2019).[3] We contribute jointly to the two literatures on

[1] See Amromin et al. (2020) for a recent review of the research on the effects of the refinancing channel of monetary policy.

[2] More broadly, our paper connects to a larger literature on financial literacy and the effect on financial decisions in general (Bernheim, 1995, 1998; Agarwal et al., 2009; Lusardi and Mitchell, 2011; Gathergood, 2012; Lusardi and Mitchell, 2014; Campbell, 2016).

[3] The empirical literature estimating heterogeneity in MPCs includes studies of Social Security tax withholdings (Parker, 1999), income taxes (Souleles, 1999; Johnson et al., 2006; Agarwal et al., 2007; Parker et al., 2013; Parker, 2017; Baugh et al., 2021), paycheck receipts (Stephens, 2006; Olafsson and Pagel, 2018), minimum wage increases (Aaronson et al., 2012), changes in income or unemployment benefits (Agarwal and Qian, 2014; Gelman et al., 2018; Baker and Yannelis, 2017; Baker, 2018), and decreases in loan payments (Stephens, 2008). See Jappelli and Pistaferri (2010) for a recent review.

the determinants of mortgage refinancing and MPCs, respectively, by providing empirical evidence on the joint distribution of mortgage refinancing and MPCs.

A related set of papers establishes that household heterogeneity affects aggregate transmission only through the covariance between MPCs and exposure to the shock in question: unhedged interest rate exposure in Auclert (2019), the cyclicality of individual earnings in Patterson (2023), and business-cycle exposure interacted with beliefs in Guerreiro (2023). Section 2 shows that the mortgage refinancing channel has the same structure, and our contribution to this literature is to measure the corresponding covariance for a margin on which exposure is not a fixed position but the outcome of a costly decision that many households never take. Where these papers estimate a single covariance, we further show that ours is a small net of two economically distinct forces of opposite sign, and we identify the household characteristics through which each operates.

Our paper is most closely related to the empirical work on the relationship between financial sophistication, MPCs, and mortgage refinancing by Jørring (2024), and the theoretical work on the effect of present bias on mortgage refinancing and MPCs by Maxted et al. (2025). Jørring (2024) studies a sample of HELOC borrowers and finds that unsophisticated consumers have higher MPCs out of anticipated changes in mortgage payments and also show a failure to refinance their mortgage optimally, while Maxted et al. (2025) calibrate a theoretical model where present bias increases individuals' MPCs leading them to cash-out refinance (although this present bias can also induce procrastination in refinancing). Our main innovation relative to these studies is to document empirically how the two proposed mechanisms—financial sophistication and present bias—lead to opposing effects on the correlation between mortgage refinancing and MPCs. Consistent with Jørring (2024), we find that when sorting on financial sophistication (e.g., when sorting on credit score or financial literacy), we find a negative correlation, and consistent with Maxted et al. (2025), we find that when sorting on measures of present bias (e.g., using the impatience index from Aggarwal et al. 2022), we find a positive correlation. While the two previous studies have posited a single economic mechanism generating either a strong negative or positive correlation, respectively, in our paper, we show that both effects are present in the data.

2 Conceptual Framework

The effectiveness of the mortgage refinancing channel of monetary policy depends not on the average marginal propensity to consume and the average likelihood of refinancing separately, but on their joint distribution. In this section, we make that statement precise. We derive a single statistic, which we call *correlated refinancing*, that measures how much the aggregate

consumption response to a rate cut exceeds or falls short of the response a representative agent model would predict. We then show that the sign of this statistic is theoretically ambiguous and suggest two competing hypotheses that would push it in opposite directions.

2.1 Decomposition of the effectiveness of the refinancing channel

We are ultimately interested in the effect of a cut in interest rates on aggregate consumption. Consider a marginal, unexpected, and permanent reduction in the mortgage rate r, and let $\mathcal{C} \equiv -dC/dr$ denote the resulting increase in aggregate consumption per unit reduction in the rate. We refer to $\mathcal{C}$ as the strength of the refinancing channel. Indexing individuals by i, it is the sum of the responses of all individuals in the economy, $\mathcal{C} = -\int (dc_i/dr)\, di$. We work with a marginal change in the rate so that the decomposition below is an exact application of the chain rule rather than an approximation.[4]

For each individual, we can break this response into three components. First, the rate cut only changes the resources of a fixed-rate borrower if that borrower refinances. We denote the responsiveness of individual i's refinancing to a rate cut by

$$LRM_i \equiv -\frac{d\,\text{refi}_i}{dr}, \tag{1}$$

which is positive because a lower market rate makes refinancing more attractive.

Second, conditional on refinancing, we need to know how much the individual's resources change. We denote this

$$MR_i \equiv \frac{dw_i}{d\,\text{refi}_i}, \tag{2}$$

which captures both the reduction in the mortgage payment and, for cash-out refinancers, any equity extracted. Third, we need to know how much the individual increases consumption in response to a change in resources. This is the marginal propensity to consume,

$$MPC_i \equiv \frac{dc_i}{dw_i}. \tag{3}$$

We denote the cross-sectional averages of these three objects by $\mu_{MPC} \equiv \int MPC_i\, di$, $\mu_{MR} \equiv \int MR_i\, di$, and $\mu_{LRM} \equiv \int LRM_i\, di$.

[4]For a discrete rate cut of size Δr, the induced change in aggregate consumption is $\mathcal{C}\,\Delta r$ to first order. This is exact if the three objects defined below are constant in r over the relevant range, and an approximation otherwise. The structural model of Section 5 allows the refinancing probability to be a nonlinear function of the rate incentive and therefore does not impose this. Because the statistic we derive below is a ratio, it is unaffected by the distinction.

The total effect is the product of the three, integrated across individuals:

$$\mathcal{C} = -\int \frac{dc_i}{dr}\, di = \int \underbrace{\frac{dc_i}{dw_i}}_{MPC_i} \underbrace{\frac{dw_i}{d\,\mathrm{refi}_i}}_{MR_i} \underbrace{\left(-\frac{d\,\mathrm{refi}_i}{dr}\right)}_{LRM_i} di. \tag{4}$$

Equation (4) is an accounting identity: it is the chain rule applied individual by individual and then integrated across the population. It holds regardless of what generates the three objects, and in particular it does not depend on the specific model of refinancing behavior estimated below. What differs across models is only how each object is determined.

2.2 Correlated refinancing

To isolate the role of the joint distribution, we first combine the two refinancing terms. Define individual i's *refinancing exposure* as the expected resource gain received per unit reduction in the rate,

$$RE_i \equiv LRM_i \times MR_i, \tag{5}$$

with cross-sectional average $\mu_{RE} \equiv \int RE_i\, di$. Refinancing exposure combines the extensive margin, whether the individual refinances at all, and the intensive margin, how much is gained when they do. It is the mortgage-market analogue of the unhedged interest rate exposure of Auclert (2019), with the difference that RE_i depends on a costly and frequently forgone household decision rather than on a mechanical balance-sheet position.

Substituting (5) into (4) and applying the covariance identity gives our central expression:

$$\boxed{\mathcal{C} \;=\; \underbrace{\mu_{MPC} \cdot \mu_{RE}}_{\text{representative agent}} \times \big(1 + CR\big),} \tag{6}$$

where the *correlated refinancing* statistic is

$$CR \;\equiv\; \frac{\mathrm{Cov}(MPC_i,\, RE_i)}{\mu_{MPC} \cdot \mu_{RE}}. \tag{7}$$

The term $\mu_{MPC} \cdot \mu_{RE}$ in (6) is the response that would obtain in an economy of identical individuals, each holding the average MPC and the average refinancing exposure. This is what a representative agent model delivers. All of the contribution of heterogeneity is captured by the single term CR, and because CR is a covariance normalized by the product of means, it reads directly as a percentage: $CR = 0.15$ means the refinancing channel is 15 percent more powerful than a representative agent model would predict. If $CR = 0$, the two models coincide. If $CR > 0$, the individuals who refinance, and who gain most when they

do, are disproportionately those who spend, and the channel is amplified. If $CR < 0$, the gains from the rate cut accrue to the individuals least likely to spend them, and the channel is dampened. The central bank cannot choose who refinances, so CR measures how well the mortgage market happens to target monetary stimulus.

The structure of (6) is shared by a set of results in which heterogeneity affects aggregate transmission only through a covariance between MPCs and exposure to the shock. Auclert (2019) shows that the redistributive effect of an interest rate change is summarized by the covariance between MPCs and unhedged interest rate exposure. Patterson (2023) shows that the amplification of aggregate shocks through the labor market is summarized by the covariance between MPCs and the elasticity of individual earnings to output, and estimates that this covariance raises the aggregate MPC by roughly 20 percent over an equal-exposure benchmark. Guerreiro (2023) derives a statistic he calls correlated disagreement, the covariance between household beliefs and individual business-cycle exposure, and shows that the aggregate effect of belief disagreement is the product of means scaled by one plus that covariance. Our CR is the analogue of these statistics for the mortgage refinancing margin.[5] Our setting differs from these in one respect. In each of the papers above, exposure is a position: a balance sheet, a job, or a belief. Here exposure is the outcome of a costly decision that many households do not take.

2.3 Two margins of correlated refinancing

Refinancing exposure combines two distinct behaviors: whether a borrower refinances at all, and how much they gain when they do. High-MPC borrowers could be over-represented on either margin, or on both, and our survey speaks to each separately. We therefore decompose CR along these two margins. Expanding (4) and collecting terms gives

$$CR = \frac{\overbrace{CR_{MPC,LRM}}^{\text{extensive margin}} + \overbrace{CR_{MPC,MR}}^{\text{intensive margin}} + \tau}{1 + CR_{MR,LRM}}, \tag{8}$$

where τ is the third-order joint central moment under the same normalization.[6]

The denominator of (8) is a rescaling rather than a mechanism: $CR_{MR,LRM}$ asks whether

[5] The magnitudes are analogous rather than directly comparable, since the normalizations differ: Patterson (2023) measures a static increase in the aggregate MPC, whereas CR scales a cumulative consumption response to a specific rate cut.

[6] Expanding (4) about the three means gives $\mathcal{C} = \mu_{MPC}\mu_{MR}\mu_{LRM} + \mu_{MPC}\,\mathrm{Cov}(MR_i, LRM_i) + \mu_{MR}\,\mathrm{Cov}(MPC_i, LRM_i) + \mu_{LRM}\,\mathrm{Cov}(MPC_i, MR_i) + \mu^{(c)}$, with $\mu^{(c)} \equiv \int (MPC_i - \mu_{MPC})(MR_i - \mu_{MR})(LRM_i - \mu_{LRM})\,di$ and $\tau \equiv \mu^{(c)}/(\mu_{MPC}\mu_{MR}\mu_{LRM})$. Dividing through by $\mu_{MPC}\mu_{MR}\mu_{LRM}$, using $\mu_{RE} = \mu_{LRM}\mu_{MR}(1 + CR_{MR,LRM})$, and comparing to (6) yields (8).

borrowers who refinance often also gain more per refinance, which would arise if sophisticated borrowers both refinance frequently and hold larger mortgages. The economics is in the numerator, and each of the two terms corresponds to a comparison we can make directly in the survey.

The extensive margin, $CR_{MPC,LRM}$. Do high-MPC borrowers refinance more often? We measure this by comparing MPCs across borrowers who have and have not refinanced. Section 4 shows that homeowners who have never refinanced report an average MPC of 0.101, against 0.139 for those who have. As we show there, however, this gap is generated entirely by refinancers who extract equity, so it reflects the intensive margin below rather than a tendency for high-MPC households to refinance more often.

The intensive margin, $CR_{MPC,MR}$. Conditional on refinancing, do high-MPC borrowers extract more? The largest source of variation in MR_i is whether the borrower takes cash out, since equity extraction delivers a lump sum while a rate refinance delivers only a reduced payment. Comparing MPCs within the set of borrowers who have refinanced, Section 4 shows that cash-out refinancers report an average MPC of 0.21 against 0.11 for those who refinanced without extracting equity, which suggests this term is positive.

Finally, (8) disciplines the counterfactual exercises we run below. Because $\mathcal{C}$ is multilinear in (MPC_i, MR_i, LRM_i), replacing any one of the three with its cross-sectional mean sets every normalized covariance involving it to zero. A counterfactual that shuts down MPC heterogeneity alone, or refinancing heterogeneity alone, should therefore reproduce the representative agent benchmark almost exactly, and any residual deviation must come from the remaining covariance or from nonlinearity in the accumulation of refinancing over time. We use this as a check on our simulations.

2.4 Competing hypotheses relating MPCs and LRMs

Given the importance of CR, what should we expect the joint distribution of MPCs and LRMs to look like? We suggest two plausible but opposing hypotheses. Both hypotheses operate primarily on the extensive-margin term $CR_{MPC,LRM}$ in (8), and each identifies observable characteristics through which we can test it. Because they push in opposite directions, the net extensive margin can be small even when both forces are strong.

2.4.1 Positive correlation: heterogeneous marginal value of liquidity

If individuals value additional liquid wealth differently, this could induce a positive correlation between MPCs and LRMs. Some individuals have a high marginal utility from an additional liquid dollar. These individuals want additional liquidity to fuel high marginal

utility consumption. They could have limited ability to adjust the intensive margin of labor and limited access to credit. They are therefore in need of a channel through which they can increase their liquidity and consumption. Mortgage refinancing, especially cash-out refinancing, could be one such channel. These individuals would be more likely to pay the non-monetary effort costs involved in refinancing a mortgage, and would therefore have a high LRM. This connection between the strong desire to increase present consumption and the ability to increase present wealth by refinancing would induce a positive correlation between MPCs and LRMs.

Maxted et al. (2025) models potentially present biased individuals who use cash-out refinances as an injection of liquidity in order to increase their current consumption. This suggests that some measure of present bias or impatience could mediate this sort of positive relationship between MPCs and LRMs driven by heterogeneity in the marginal value of liquidity. It also suggests that the relationship should be concentrated in cash-out refinancing, so that the mechanism raises the intensive-margin term $CR_{MPC,MR}$ in (8) alongside the extensive-margin term $CR_{MPC,LRM}$.

2.4.2 Negative correlation: heterogeneous financial sophistication

An alternative hypothesis is that differences in the financial sophistication of homeowners could generate a negative correlation between MPCs and LRMs. Jørring (2024) shows that financially unsophisticated individuals have larger spending responses to changes in income. These individuals are also less likely to follow financial markets and know about the opportunity to refinance. They could therefore have high MPCs and low LRMs, relative to financially sophisticated homeowners. This would suggest a negative relationship between the variables, and a negative contribution to CR.

Such a model would suggest that direct measures of financial sophistication such as the "Big Three" questions from Lusardi and Mitchell (2023) or questions about familiarity with the concept of mortgage refinancing could be related to both MPCs and LRMs. Furthermore, certain financial characteristics such as income and credit scores that are known to correlate with financial literacy could mediate such a negative correlation. Because this mechanism operates on who acts on a refinancing opportunity rather than on how much they extract when they do, it bears most directly on the extensive-margin term $CR_{MPC,LRM}$.

2.4.3 Taking the ambiguity to the data

The two hypotheses are not mutually exclusive. Both mechanisms can operate in the same population, and they push CR in opposite directions. The sign of the unconditional correla-

tion between MPCs and LRMs is therefore ambiguous, and its magnitude alone is uninformative about the strength of either force. A small measured CR is as consistent with two strong and offsetting mechanisms as with two weak ones.

This shapes our empirical strategy. It is not enough to estimate the unconditional correlation. We must also decompose it, by sorting on observable characteristics that theory associates with each mechanism and by separating cash-out from rate refinancing, in order to recover the separate contributions. We do this in Section 4 and then quantify what the resulting joint distribution implies for monetary policy pass-through.

3 Methods and Data

In this paper we seek to estimate the relationship between two latent characteristics of homeowners: their marginal propensities to consume (MPCs) and their likelihood of mortgage refinancing (LRM). In addition we seek to measure a wide array of demographic covariates, their relationship with these two concepts of interest, and their role in intermediating the relationship between LRMs and MPCs. As the primary intent of this study is the novel estimation of the *relationship* between these variables, we attempted to measure these constructs using well established methods. Where possible, we closely replicate the existing literature, which has the added bonus of providing additional data in each of these domains.

The goal of our empirical work is not generally to establish causal relationships between MPCs and LRMs (or the other covariates). Instead, we hope to shed light on the conditional and unconditional distributions of these variables which play an important role in intermediating the causal relationship between monetary policy and aggregate demand.

3.1 Primary Survey

To collect our primary data, we designed and ran a survey of over 1,000 US homeowners, who are geographically representative of the US population, via the online platform Prolific. Participants took the survey on January 16, 2025. All study materials were administered via Qualtrics.[7]

To measure MPCs, we closely follow the hypothetical scenario method utilized in Fuster et al. (2020). As in their paper, we ask each participant how they would adjust their spending, saving, and debt payment following a wealth increase. Fuster et al. (2020) find that a hypothetical gain of $5,000 induced the most participants to state that they would increase

[7]Relevant study materials can be found in Appendix B.

spending (and thus have a positive MPC), thus inducing meaningful variation between subjects. We therefore present our homeowner subjects with the following.

> Now consider a hypothetical situation where you unexpectedly receive a one-time payment of $5,000 today. We would like to know whether this extra income would cause you to change your spending behavior in any way over the next 3 months.

Subjects are then asked to select one of the following

- Over the next 3 months, I would **spend/donate** more than if I hadn't received the $5,000
- Over the next 3 months, I would **spend/donate** the same as if I hadn't received the $5,000
- Over the next 3 months, I would **spend/donate** less than if I hadn't received the $5,000

They are then asked similar questions about **paying off debt** and **saving**. As in Fuster et al. (2020), subjects who respond that they would spend more than if they hadn't received the payment are asked, "How much more would you spend/donate than if you hadn't received the $5,000?" We then define their MPC in response to this scenario as their response to this question divided by 5,000 or 0 if they had answered that they would spend the same or less. For all measures of MPC, we censor at an MPC of 1, to reduce the potential for misunderstanding or mis-entry.

In order to capture MPCs relevant to the setting of refinancing one's mortgage, we also ask about the following new scenario.

> Now consider a hypothetical situation where your monthly mortgage payments (or monthly bills if you do not currently have a mortgage) unexpectedly decrease by $250 per month, starting today and lasting for 10 years. We would like to know whether this extra income would cause you to change your spending behavior in any way over the next 3 months.

Subjects are then asked very similar questions to the one-time $5,000 gain scenario. Subjects who indicate that they would spend more are then asked, "How much more (per month) would you spend/donate than if you hadn't received this decrease?" Again, we define their MPC as their response to this question divided by 250 or 0 if they had answered that they would spend the same or less. The two hypothetical scenarios are presented in a random order in order to reduce potential ordering effects.

These scenarios give us two related measures of MPCs. In order to reduce measurement error, we also combine the two into a single variable using factor analysis. This generates a weighted average MPC variable equal to 0.81 times the MPC out of the one time payment and 0.19 times the MPC out of the decreasing monthly payment. Throughout our analysis, qualitatively similar results are found when we use a simple average or either of the individual measures.

Previous studies have found a strong relationship between MPCs elicited from similar hypothetical questions and MPCs estimated from responses to exogenous income shocks (Parker and Souleles, 2019). We therefore expect our elicited MPCs to be a reasonable proxy for actual MPCs.

To measure propensity to refinance one's mortgage, we use two main approaches. First and foremost, we ask each homeowner "How many times have you refinanced your mortgage in the last 20 years?" Our primary measure of refinancing is a binary variable equal to 1 if they have refinanced in the last 20 years and 0 otherwise. We follow-up by asking for the timing of each of these refinances, their prior rate, and whether the refinancing was a cash-out refinancing.

Our second approach is to learn about the homeowners' financial literacy and familiarity with the mortgage refinancing process. Before any questions related to mortgages are asked, we ask all subjects, "Are you familiar with what it means to refinance a mortgage?" We create a binary variable titled "familiar with refinancing" for which we assign those who respond "Extremely familiar" or "Very familiar" a value of 1 and 0 to those who respond otherwise. If subjects were not familiar with the concept of refinancing, we redirected them to a page explaining the topic before continuing with the survey. We also ask the "Big 3" questions on financial literacy from Lusardi and Mitchell (2023). We use whether they answered all three questions correctly as a measure of financial sophistication.

In addition we collect a number of characteristics about the subject and their mortgage contract. For mortgage characteristics we collected purchase year, loan origination year, original loan size, original term, interest rate, and whether the loan is associated with any government programs. For homeowner characteristics, we collected credit score, income, zip code, race/ethnicity, gender, education, age, and household structure. We also want to test the possibility that MPCs and propensities to refinance are connected through borrowers' present bias as in the model of Maxted et al. (2025). To proxy for homeowners' degree of present bias (β), we use the index of impatience used by Aggarwal et al. (2022), which uses questions from the psychology literature (Tuckman, 1991; Lay, 1986) that have been found to predict real behaviors such as procrastination.

3.2 Linking Survey Data to Mortgage Performance Data

Collecting the MPCs of individual homeowners is a challenging exercise and is limited by budget and sample recruitment. Estimating propensities to refinance, on the other hand, is far less limited. Data on the prepayment performance of all US mortgage loans guaranteed by the three government sponsored entities (GSEs) is publicly available.

We take two approaches to utilizing this additional data. First, we use our survey data on MPCs to calibrate a prediction model that takes variables available in the GSE data and provides a predicted MPC. We then sort loans in the GSE data by their predicted MPCs and study the difference in refinancing behavior for high predicted MPC individuals vs. low predicted MPC individuals. This exercise allows us to study the relationship between *actual refinancing behavior* and *predicted MPCs*.

We also link the data in the opposite direction. We estimate a model of refinancing behavior similar to that of Andersen et al. (2020), allowing for heterogeneity in both time-dependent and state-dependent frictions. We use the GSE data to estimate the relationship between these refinancing model parameters and variables that are available in our survey. We can then use this relationship to predict the refinancing behavior of our survey participants and compare MPCs for subjects with different predicted refinancing parameters. As noted by Fuster et al. (2020) and Lewis et al. (2024), predicting MPCs based on observable characteristics is difficult due to large latent heterogeneity. We therefore prefer this latter method which allows us to study the relationship between *predicted refinancing behavior* and *actual MPCs*.

4 Results

4.1 Primary Survey Results

Below, we present reduced form results from the data collected in our survey. We document a small positive unconditional correlation between MPCs and refinancing activity, and we show that it implies a correlated refinancing statistic of at least 0.15, so that the refinancing channel is at least 15 percent more effective than the representative agent benchmark of Section 2.2. We then unpack this correlation and show that this appears to be the product of (a) a large positive relationship between MPCs and cash-out refinancing, driven by impatience, mortgage size, mortgage term, and participation in government lending programs, with no comparable relationship for refinances that do not extract equity; (b) a smaller negative relationship generated by credit scores and income; and (c) a latent positive correlation between MPCs and refinancing behavior.

4.1.1 Summary Statistics

Our primary survey collected data from 1,027 homeowners who are geographically representative of the United States at the state level. Measuring MPCs for homeowners, specifically, is a useful exercise for policy-makers. We find that the average MPC out of a $5,000 lump sum payment was 0.099 (s.e. of 0.006) in our sample of homeowners. This is close to, if slightly below, estimates from Fuster et al. (2020), who find an analogous MPC of 0.12 among the general US public[8]. We find that 31.3% of participants had a positive MPC, which is also consistent with the 36% found by Fuster et al. (2020). We estimate that the average MPC out of a $250 per month decrease in mortgage payments (or bills) is 0.120 (s.e. of 0.009). 20.5% of participants had a positive MPC by this measure. The two measures of MPCs are significantly positively correlated. Figure 1 plots the distributions of these two measures of MPCs.

[8]Our survey collects MPCs specifically for homeowners while Fuster et al. (2020) collects them for the overall US population. It seems reasonable to expect that homeowners might have lower MPCs on average than the general population given the negative correlation between income and MPCs.

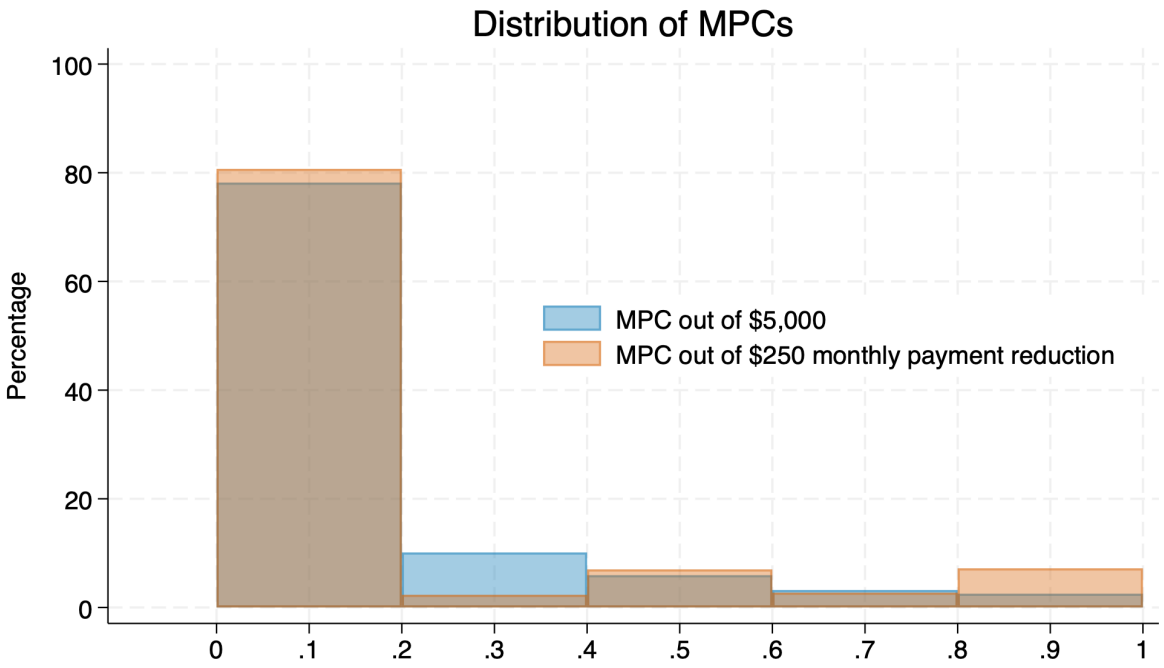


Figure 1: Homeowners' reported MPCs out of a hypothetical $5,000 payment and a $250 reduction in monthly mortgage payments (or bills). Histogram of both measures of MPC. Participants who report that they would not increase their spending following the change in wealth are assumed to have an MPC of 0. Participants who indicated that they would increase their spending are asked by how much they would increase their spending. Their MPC is then their response divided by the hypothetical change in wealth. We censor MPCs from above at 1.

We also collect data on the refinancing history for each homeowner. We find that 50.9% of our sample has refinanced at some point in the last 20 years for an average of 0.739 total refinancings.

We also measure the consumers' financial literacy and find that 62% of homeowners are familiar with the concept of refinancing. We also ask each participant the "Big 3" financial literacy questions from Lusardi and Mitchell (2023) and find that 69.5% answer all three correctly. This is higher than the 43.3% of the general US population that answer all three correctly, according to Lusardi and Mitchell (2023)[9]. These two measures of financial literacy are significantly positively correlated.

Finally, we collect additional mortgage characteristics and demographic variables that we use in our analysis including the index of impatience from Aggarwal et al. (2022), home

[9]Again, our survey population is exclusively homeowners while Lusardi and Mitchell (2023) reports data from the overall US population. Higher financial literacy among homeowners than the general public seems reasonable.

purchase year, original mortgage amount, credit scores, income, race, and gender. Summary statistics of all variables used can be found in the Appendix in Table 4.

	(1) MPC	(2) MPC
Impatience index (std)	0.038***	
	(0.009)	
Big Three financial literacy all correct	-0.042**	
	(0.020)	
FICO score (std)		-0.029***
		(0.010)
Original loan amount (std)		0.021*
		(0.012)
Income (std)		-0.024**
		(0.010)
30 Year Term		-0.043**
		(0.020)
Conventional		-0.045**
		(0.020)
Constant	0.150***	0.180***
	(0.017)	(0.023)
Observations	1,027	1,013
R^2	0.027	0.068

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 1: Explaining MPCs. Both columns report regressions of MPCs out of a $250 reduction in monthly mortgage payments (or bills) on other measured covariates. The first column reports a regression of MPCs on the index of impatience from Aggarwal et al. (2022) and whether the subject correctly answered all three of the "Big Three" questions from Lusardi and Mitchell (2023). The second column regresses MPCs on borrower and mortgage contract characteristics that are observable both in our survey and the GSE-HMDA mortgage data. All variables labeled (std) have been standardized. Their coefficients can be interpreted as the change in MPC associated with a 1 std. dev. change in the variable. Robust standard errors are reported in parentheses below the point estimates.

Table 1 reports simple linear relationships between measured MPCs out of a $250 reduc-

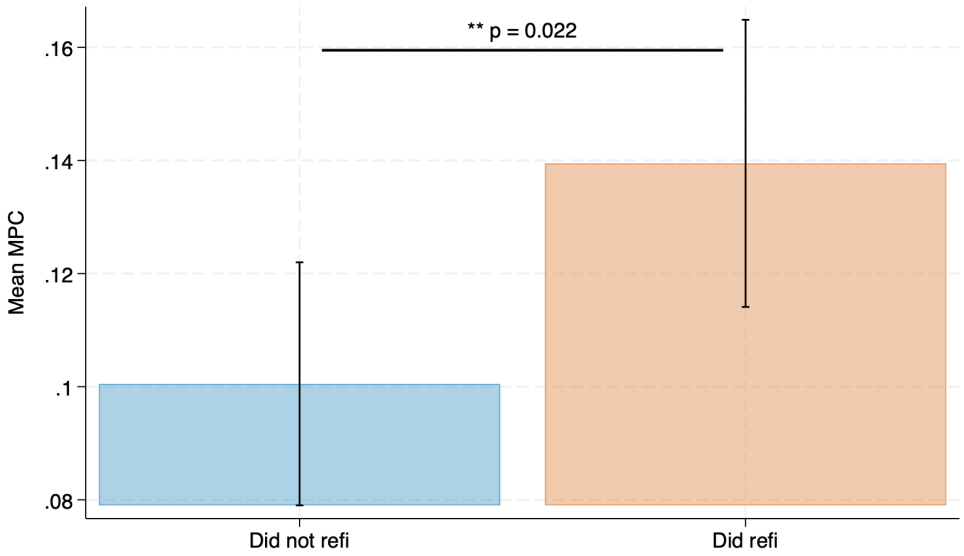
tion in monthly mortgage payments (or bills) and these other measured covariates. These relationships are in line with what theory and previous empirical work would predict. The first column documents the relationship between MPCs and two latent individual characteristics, impatience and financial literacy. As predicted by the hypotheses in Section 2, we find a positive relationship between MPCs and impatience and a negative one between MPCs and financial literacy. The second column regresses MPCs on observable borrower characteristics. We find that MPCs are negatively correlated with credit scores and income but positively correlated with loan size (conditional on income). This is likely due to income and loan size having opposing effects on liquidity. All else being equal, wealthy borrowers have more liquid wealth and lower MPCs. However, larger mortgages, and thus larger mortgage payments, eat into this liquid wealth and increase MPCs. While, at first glance, many of these coefficients may seem small in magnitude, they should be compared to the mean MPC of 0.12.

4.1.2 Relationship between MPCs and Refinancing

A key finding of our primary survey is that the unconditional correlation between MPCs and LRMs is positive. Figure 2 compares MPCs out of monthly payment reductions for homeowners who have refinanced in the past to those who have not. The average MPC for individuals who have never refinanced in the past is 0.101 (s.e. of 0.011) compared to 0.139 (s.e. of 0.013) for those who have. This positive relationship between the two variables implies that, on the whole, the mortgage refinancing channel of monetary policy is more effective than it would be if the two were uncorrelated.

This comparison is enough to compute the correlated refinancing statistic defined in Section 2.2. Normalizing the covariance between MPCs and refinancing by the product of their means gives $CR = 0.155$, so the refinancing channel is roughly 15 percent more powerful than a representative agent model would predict.[10]

[10]Because refinancing is binary, the covariance can be computed directly from the group means as $p(1-p)(\bar{c}_1 - \bar{c}_0)$, where $p = 0.509$ is the share of the sample that has refinanced and $\bar{c}_1 = 0.139$ and $\bar{c}_0 = 0.101$ are mean MPCs among refinancers and non-refinancers. The statistic then simplifies to $(1-p)(\bar{c}_1 - \bar{c}_0)/\mu_{MPC}$.



(a) Mean MPC out of a $250 reduction in monthly mortgage payments (or bills) by previous refinancing activity

Figure 2: Main results. Figures report mean MPCs for borrowers who have and have not refinanced in the last 20 years. Black bars report the 95% confidence intervals for each estimate. P-values for comparison of means (proportions) tests are also reported.

This positive relationship holds when we control for a number of covariates, though it is not significant, indicating a smaller positive latent relationship between MPCs and refinancing activity. Table 2 columns 1 and 2 report regressions of whether or not the homeowner has refinanced on MPC out of $250 reduction in monthly mortgage payments (or bills) and measured covariates. Coefficients are reported with robust standard errors. Columns 3 and 4 report the same regressions but with MPC as the dependent variable and refinancing as an independent variable.

We find that even after controlling for purchase year, familiarity with refinancing, impatience, credit scores, loan amounts, race, and gender, a positive and significant relationship remains. We get a point estimate that implies a 0.1 increase in MPCs is associated with a 1.1 percentage point increase in the probability of having refinanced. This implies that some of the latent component of refinancing behavior is positively related to MPCs.

Comparing the regressions with refinancing as the dependent variable to those with MPC as the dependent variable begins to reveal a few interesting patterns. First, the R^2 values for refinancing are generally higher, meaning we are able to explain more of refinancing behavior than we can MPCs. Next, we can use the signs of the coefficients to study how covariates moderate the correlation between MPCs and refinancing. For a given covariate, if the sign of the coefficients in the "Has Refi" regression and "MPC" regression have the same signs,

then this covariate generates positive covariance between MPCs and LRMs (and negative covariance for opposing signs). Figure 3 plots the coefficients for two regressions: one of "Has Refi" on covariates and another of "MPC" on the same covariates. The signs reported above each variable indicate which effect the variable has on the correlation between MPCs and LRMs. We note that the relationship between refinancing and impatience is positive as is the relationship between MPCs and impatience. Therefore impatience may be a driver of the overall positive relationship between MPCs and refinancing. On the other hand, credit scores and income appear to go in the opposite directions for MPCs vs refinancing activity. These variables may all be weakening the relationship between MPCs and refinancing.

	(1) Has Refi	(2) Has Refi	(3) MPC	(4) MPC
MPC out of $250 monthly	0.131**	0.085		
	(0.056)	(0.055)		
Has refinanced			0.039**	0.030
			(0.017)	(0.020)
Impatience index (std)		0.053***		0.036***
		(0.015)		(0.009)
FICO score (std)		0.032**		-0.022**
		(0.015)		(0.010)
Original loan amount (std)		0.035**		0.019
		(0.016)		(0.012)
Income (std)		0.066***		-0.023**
		(0.017)		(0.010)
30 Year Term		-0.072**		-0.042**
		(0.032)		(0.020)
Conventional		-0.139***		-0.044**
		(0.032)		(0.020)
Constant	0.494***	0.642***	0.101***	0.164***
	(0.017)	(0.033)	(0.011)	(0.024)
Observations	1,027	1,013	1,027	1,013
R^2	0.005	0.219	0.005	0.088

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 2: Relationship between refinancing and MPCs. Columns 1-2 report regressions of whether the homeowner has refinanced in the last 20 years on covariates. Columns 3-4 report similar regressions with MPCs out of $250 reduction in monthly mortgage payments as the dependent variable. Columns 1 and 3 report the unconditional relationship between MPCs and LRMs. Columns 2 and 4 report the relationship between MPCs and LRMs controlling linearly for a variety of observable homeowner and mortgage characteristics. All variables labeled (std) have been standardized. Their coefficients can be interpreted as the change in MPC associated with a 1 std. dev. change in the variable. Robust standard errors are reported in parentheses below the point estimates.

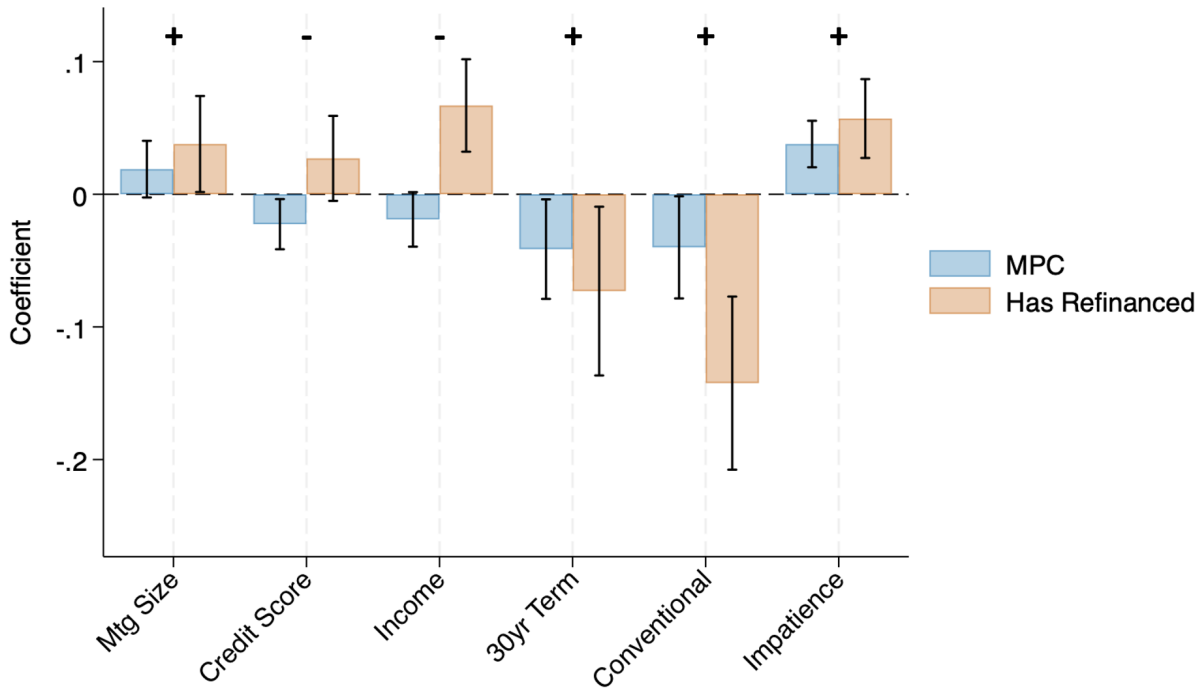


Figure 3: Figures report coefficients for regressions of mean MPCs out of $250 reduction in monthly mortgage payments and proportions of homeowners who have refinanced on all of the covariates listed in the x-axis (each continuous variable is standardized). Black bars report the 95% confidence intervals for each coefficient estimate. Positive and negative signs indicate whether the coefficients across the two regressions share the same sign or not, and thus whether the covariate induces a positive or negative correlation between MPCs and refinancing.

The positive unconditional correlation seems to indicate that homeowners' marginal utility from additional liquid wealth could be an important link between MPCs and refinancing behavior. If this were the case, we should see high MPC borrowers extracting equity from their homes in the form of cash-out refinances. To test this, we compare MPCs for borrowers who have not refinanced at all, borrowers who have done a non-cash-out refinancing, and borrowers who have done a cash-out refinancing. Figure 4 shows that homeowners who have done a cash-out refinance have significantly higher MPCs than the other two groups. In fact, once we separate out the two types of refinancings, non-cash-out refinancers do not have significantly different MPCs from those who have not refinanced. It therefore appears that homeowners wishing to take cash out of their home equity in order to fuel high marginal utility spending are driving the positive correlation between MPCs and refinancing behavior.

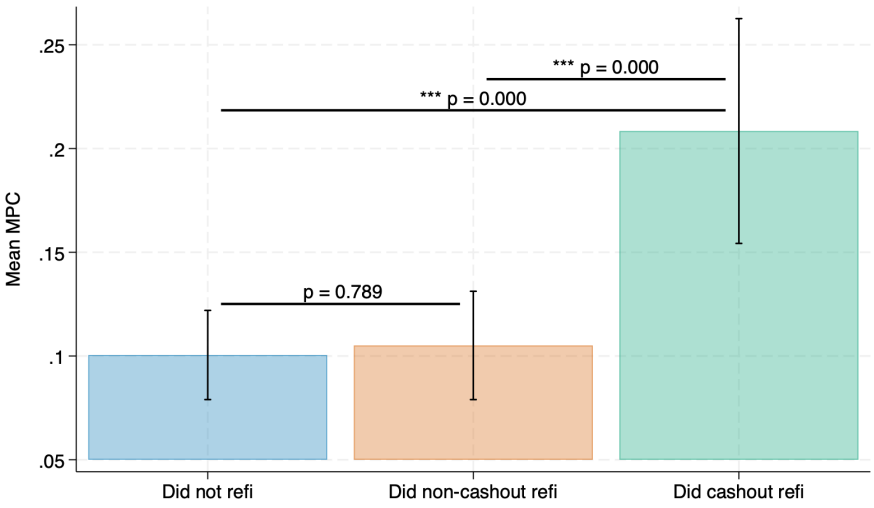


Figure 4: Mean MPCs out of a $250 reduction in monthly mortgage payments (or bills) by refinancing type. Black bars report the 95% confidence intervals for each estimate. P-values for comparison of means (proportions) tests are also reported.

This is the comparison that identifies the intensive margin of Section 2.3. It also sharpens the interpretation of the unconditional gap reported above: because refinancers who do not extract equity spend no differently out of a windfall than homeowners who have never refinanced, the positive relationship between MPCs and refinancing activity is not that high-MPC households refinance more often, but that they are more likely to extract equity when they do. What raises the aggregate consumption response is therefore the size of the resource gain flowing to high-MPC households rather than the frequency with which they act.

This also means the correlated refinancing statistic reported above is a lower bound. Computing it from the binary refinancing indicator weights every refinancer equally, whereas the statistic in Section 2.2 weights each household by the size of the resource gain it receives. The difference between the two is proportional to the covariance between MPCs and the resource gain among refinancers, which the comparison above indicates is positive. Accounting for the larger gains received by cash-out refinancers would therefore raise it.

Finally, we can do a covariance decomposition to study how much of the estimated covariance between refinancing activity and MPCs is driven by collected covariates, versus how much is unexplained/latent. The law of total covariance states that

$$\text{Cov}(\text{MPC}, \text{Refi}) = \text{E}[\text{Cov}(\text{MPC}, \text{Refi}|X)] + \text{Cov}(\text{E}[\text{MPC}|X], \text{E}[\text{Refi}|X]). \tag{9}$$

The first term is the covariance of residuals after regressing MPCs and refinancing on a set of covariates. This represents the latent part of the covariance between MPCs and

LRMs. The second term is the covariance of predicted MPC and predicted refinancing from the regression with the same set of covariates. This represents the explained part of the covariance between MPCs and LRMs. When we use the set of variables that are shared between our survey data and our mortgage administrative data (mortgage size, credit score, income, loan term, and conventional), we can explain 30% of the covariance between MPCs and refinancing. When we add our measure of impatience to this set of covariates, we can explain 51% of the covariance, indicating the importance of impatience to this mechanism.

5 Structural Estimation and Counterfactuals

In order to quantify and better understand the effects of our estimated correlation on consumption responses to monetary policy, we estimate a model of refinancing with state and time dependent frictions similar to that of Andersen et al. (2020). We allow for heterogeneity in these state and time dependent frictions based on the observable characteristics shared by our two data sets. We can then use this model to estimate the stimulus generated by different interest rate scenarios and compare these predictions to models in which refinancing and MPCs have counterfactual joint distributions (for example, a representative agent framework in which they are uncorrelated).

This improves upon the simple result with the correlated refinancing statistic in several ways. The statistic computed in Section 4 takes the household's refinancing history as a proxy for its response to a rate cut, holds the resource gain from refinancing fixed across households, and is static. The exercise in this section relaxes all three: refinancing responds to the rate incentive through an estimated model, the payment reduction is scaled by each borrower's own loan size and rate, and we trace the full path of the consumption response rather than its level.

5.1 Theoretical Framework

Our model features borrowers who choose whether or not to refinance by maximizing a utility function, conditional on paying attention. If borrower i attends to the decision as to whether or not to refinance in time t, they compare utility from refinancing

$$u_{1,i}(r_t) = \beta_i x_{i,t} + \epsilon_{1,i,t}, \tag{10}$$

to utility from not refinancing

$$u_{0,i}(r_t) = \epsilon_{0,i,t}. \tag{11}$$

The vector $x_{i,t}$ contains borrower characteristics, but most importantly, it contains the rate incentive the borrower faces in time t (the gap between the rate the borrower has and the current market rate). We allow β_i to vary across borrowers according to borrower characteristics. The ϵ terms are distributed iid Type I Extreme Value, giving us the familiar logit probability of refinancing, conditional on paying attention.

This utility function captures, in a reduced form, the costs and benefits of refinancing. It allows for heterogeneity in both the fixed costs of refinancing and the sensitivity to the incentive of refinancing. It abstracts from the dynamic problem of refinancing and is therefore unable to model borrowers' expectations of future interest rates and the related decision to wait to refinance in a later period. This part of the model captures state dependent frictions to refinancing.

The borrower faces this decision to refinance if and only if they are paying attention. We model whether the borrower pays attention similarly. Borrower i pays attention in time t if

$$\alpha z_i + \nu_{1,i,t} > \nu_{0,i,t}. \tag{12}$$

The vector z_i contains static borrower characteristics and **not** any time varying incentives to refinance. Both ν terms again are distributed iid Type I Extreme Value. Each borrower therefore has a constant probability of paying attention in any period, but this probability can vary across borrowers based on their characteristics. This part of the model captures time dependent frictions to refinancing.

The borrowers' probability of refinancing in a given period is then the product of the probability of paying attention and the probability of refinancing conditional on paying attention. Both of these probabilities can vary with borrower characteristics which may be correlated with MPCs. Therefore, this model allows us to study how MPCs and refinancing behavior might be related.

5.2 Estimating the Model

We estimate this model using mortgage data from the Government Sponsored Entities (GSEs) merged with the Home Mortgage Disclosure Act (HMDA) data. This data contains borrower characteristics and the monthly prepayment history of all loans guaranteed by the GSEs (a majority of the US mortgage market). We estimate the model using Maximum Likelihood Estimation.

We estimate heterogeneity in refinancing behavior using the borrower characteristics that are found in both the GSE/HMDA data and our survey data (mortgage size, credit score, income, loan term, and conventional) as the variables in $x_{i,t}$ and z_i. This allows us to estimate

the relationship between these characteristics and the state and time dependent frictions in refinancing. We can then use the estimated parameters of this model to predict the refinancing probability of any individual in our survey data given any incentives. This allows us to generate model predicted refinancing behavior to accompany self-reported MPCs.

5.3 Model Fit

We estimate the model on the GSE-HMDA data using Maximum Likelihood and evaluate fit by comparing the model-implied S-curves to the empirical refinancing probabilities in the data. Recall that the two pieces of our model, attention and choice, have a natural mapping to the shape of the S-curve. The peak of the S-curve, that is the maximum refinancing probability achieved at large rate incentives, is approximately equal to the probability of paying attention ($\Lambda(\alpha z_i)$), while the shape of the S-curve conditional on attention is governed by the state-dependent parameters β_i. Figure 5 plots the model-implied S-curves against the empirical S-curves for all borrowers. The model closely tracks the empirical S-curves in both peak and shape, suggesting the importance of capturing both time- and state-dependent refinancing frictions.

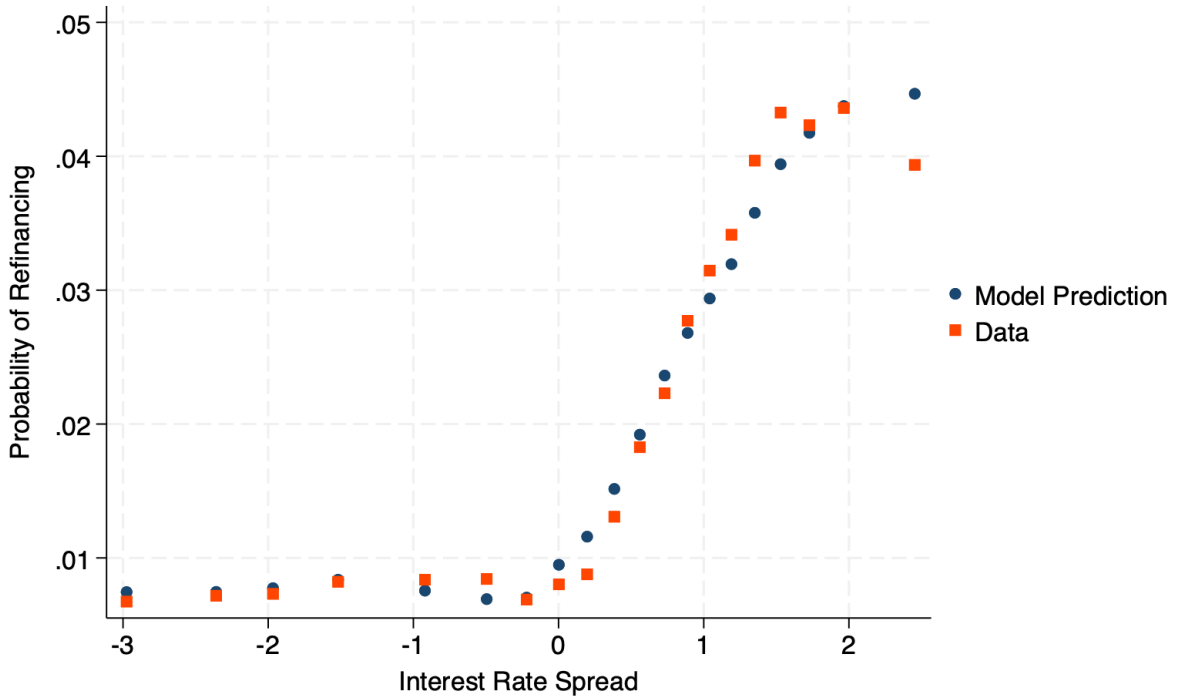


Figure 5: Model fit. Empirical S-curves (red) and model-implied S-curves (blue) for all borrowers. The empirical S-curves are simply bin scatter plots of whether a loan prepaid against the rate incentive to refinance. Model-implied S-curves are generated by simulating the estimated model at each rate spread.

As an additional check on the model's validity, Table 3 compares the signs of the model's estimated marginal effects on refinancing to the signs of the OLS coefficients from our survey regressions in Table 2. Although these are estimates from two separate data sources and identification strategies, the signs align across all six shared covariates, providing reassurance that the model captures the same underlying variation in refinancing behavior that we document in the survey.

Table 3: Comparison of model marginal effects and survey OLS coefficients. Each row reports the sign of the covariate's estimated effect on refinancing probability in the structural model (estimated on GSE-HMDA data) and in the OLS regression of having refinanced on borrower characteristics from our survey (Table 2, column 2).

	Model Marginal Effect	Survey OLS Coefficient
Loan size	+	+
FICO score	+	+
Loan age	+	+
Loan age^2	−	−
30-year term	−	−
Conventional	−	−

5.4 Calibrated Consumption Responses

We use the estimated model to simulate consumption responses to a 100 basis point rate cut, and compare these responses across counterfactual joint distributions of MPCs and refinancing behavior. This exercise allows us to quantify how much the observed correlation between MPCs and refinancing, documented in Section 4, matters for the aggregate demand response to monetary policy.

5.4.1 Setup

We simulate the 1,027 homeowners in our survey sample. Each borrower is given a loan with the current market interest rate and the opportunity to refinance following an immediate 100 basis point reduction. In each subsequent period, the model determines whether a borrower pays attention to the refinancing decision and, conditional on attention, whether they refinance. Once a borrower refinances, they receive a reduction in their monthly mortgage payment equal to the difference between the payment implied by their original rate and the payment implied by a rate 100 basis points lower, calculated for a mortgage of their actual loan size. Their consumption response in each period is then:

$$\Delta C_{i,t} = \text{MPC}_i \times \Delta m_i \times \mathbf{1}[\text{refinanced}_{i,t}], \tag{13}$$

where Δm_i is the reduction in monthly mortgage payment and $\mathbf{1}[\text{refinanced}_{i,t}]$ indicates that borrower i has refinanced by period t.

5.4.2 Counterfactual Joint Distributions

We run the above simulation for five scenarios that vary the joint distribution of MPCs and refinancing behavior:

1. *Full heterogeneity*: Each borrower's individual survey MPC is paired with their model-predicted refinancing behavior based on their individual characteristics. This is our baseline scenario, intended to reflect the actual joint distribution of types in the data.

2. *MPC heterogeneity only*: Each borrower retains their individual survey MPC, but refinancing behavior is replaced with the cross-sectional average (representative) refinancing probability. This isolates the role of MPC heterogeneity.

3. *Refinancing heterogeneity only*: Refinancing behavior is driven by individual characteristics as in the baseline, but each borrower is assigned the average MPC. This isolates the role of refinancing heterogeneity.

4. *Representative agent*: All borrowers are assigned the average MPC and the average refinancing probability. This corresponds to a standard representative agent model that ignores all heterogeneity.

5. *Perfect correlation*: MPCs perfectly predict refinancing likelihood, so that the covariance between MPCs and LRMs is maximized. This provides an upper bound on the consumption response achievable by the correlation channel.

5.4.3 Results

Figure 6 plots the average per-capita monthly consumption response over time for the first four of the five scenarios. The full heterogeneity scenario generates a cumulative consumption response approximately 13% larger than the representative agent benchmark, reflecting the positive correlation between MPCs and refinancing documented in Section 4.

Figure 7 shows the cumulative consumption response across all scenarios. While the gain from the observed correlation is economically meaningful, it amounts to roughly 30% of the gap between the representative agent and the perfect-correlation upper bound. Equivalently, actual borrowers consume approximately 70% less than they would under perfect correlation.

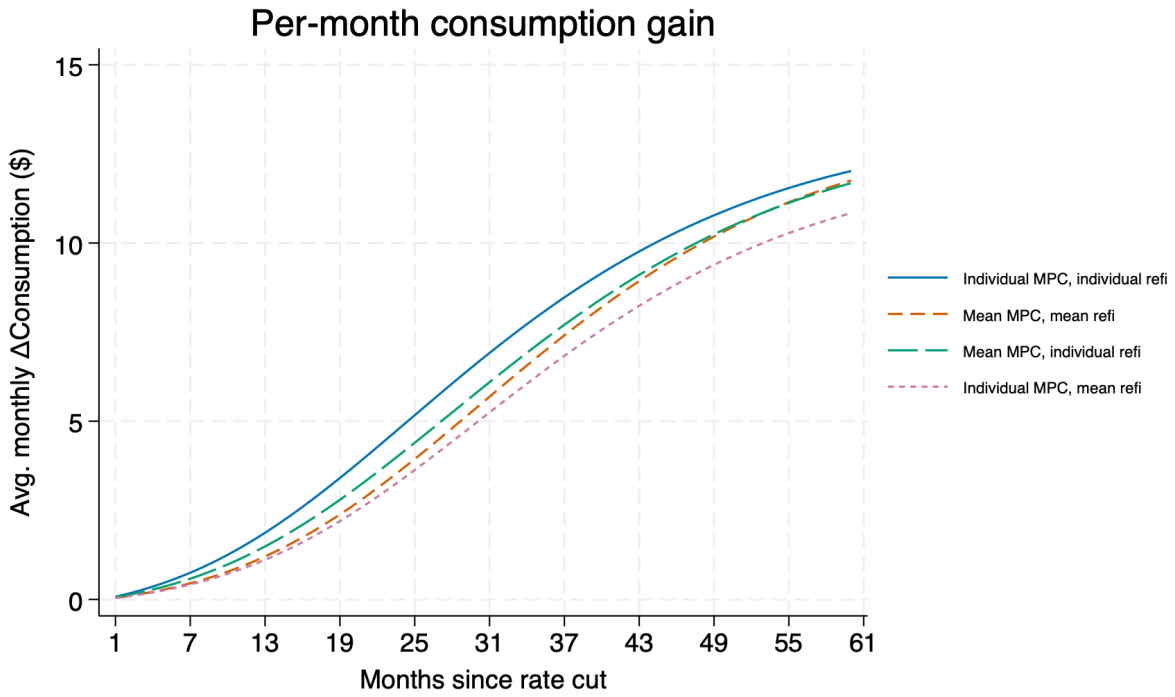


Figure 6: Average per-capita monthly consumption response to a 100 basis point rate cut (with all borrowers starting at the same rate), simulated for 1,027 survey homeowners under four counterfactual joint distributions of MPCs and refinancing behavior. The response in each period is $\text{MPC}_i \times \Delta m_i \times \mathbf{1}[\text{refinanced}_{i,t}]$, averaged across borrowers.

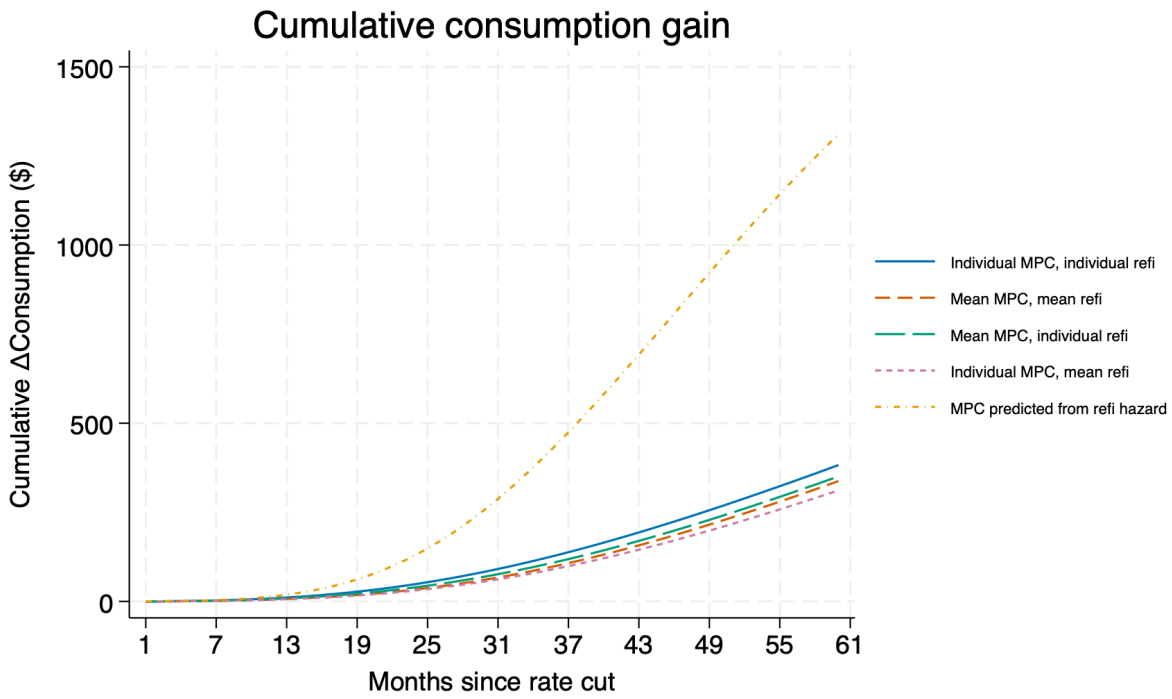


Figure 7: Cumulative per-capita consumption response to a 100 basis point rate cut across the five counterfactual scenarios.

Comparing scenarios (2) and (3) to the baseline reveals that both sources of heterogeneity contribute to some deviation from the representative agent model. However, the full heterogeneity scenario combines both effects, and creates a larger divergence from the representative agent benchmark than either source of heterogeneity in isolation combined. This highlights the role of the correlation between MPCs and refinancing in consumption responses.

We can also compare these results to a model in which all of our homeowners do not start with the same interest rate, but instead start with the market rate at the time they last refinanced (or took out their loan). This allows us to assess the effect of heterogeneity on the path dependence in interest rates. Figure 8 documents the consumption responses of each of our agent types under this scenario allowing for path dependence. Here we find that relative to our model where all borrowers start at the same interest rate, our fully heterogeneous borrowers increase consumption by 15% less while our representative agents increase consumption by 20% less. The fact that the representative agents see a larger relative decrease in consumption indicates that path dependence in rates plays a smaller role in the full heterogeneity model than it does in a representative agent model. Intuitively, actual high MPC borrowers are more likely to have refinanced in the past than low MPC

borrowers. Therefore they are likely to have smaller interest rate spreads following a rate cut, making them less likely to refinance again.

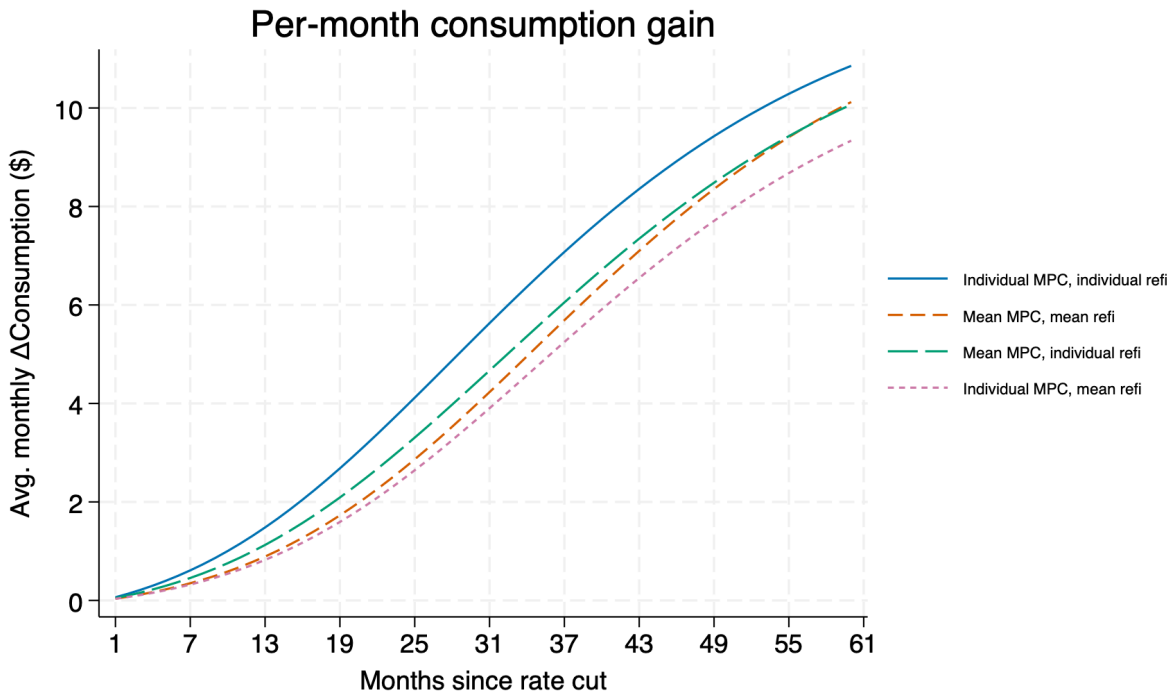


Figure 8: Average per-capita monthly consumption response to a 100 basis point rate cut (with all borrowers starting from the market rate at the time they last originated a loan), simulated for 1,027 survey homeowners under four counterfactual joint distributions of MPCs and refinancing behavior. The response in each period is $\text{MPC}_i \times \Delta m_i \times \mathbf{1}[\text{refinanced}_{i,t}]$, averaged across borrowers.

These results underscore the quantitative importance of this correlation for monetary policy transmission. A policymaker relying on a representative agent model would underestimate the consumption response to a rate cut by roughly 13% on average. At the same time, the large gap between actual and perfect-correlation outcomes suggests that frictions preventing high-MPC households from refinancing represent a significant drag on the effectiveness of the mortgage refinancing channel.

6 Quantitative model plan

The structural model of Section 5 takes MPCs as given and estimates refinancing behavior. It is well suited to measuring the correlation we care about, but it cannot tell us what produces that correlation, and it cannot say how the correlation would change under a different policy

or a different state of the economy. In this section, we describe a quantitative model that we are currently developing to answer those questions. The model generates all three objects of the framework in Section 2, namely the marginal propensity to consume, the likelihood of refinancing, and the resource gain from refinancing, from a single household optimization problem. Correlated refinancing is then an output of the model rather than an input to it, and we can ask how it responds to the environment. This section describes the model, how our data discipline it, and the experiments we intend to run. We report no quantitative results here.

6.1 Model features

The model is a heterogeneous-agent, incomplete-markets economy of the kind introduced by İmrohoroğlu (1989), Huggett (1993), and Aiyagari (1994), extended to include the long-term fixed-rate mortgage contract on which the refinancing channel depends. Among models of this class it is closest to Beraja et al. (2019) and Eichenbaum et al. (2022), both of which embed refinancing subject to a fixed cost. We depart from both by allowing households to differ permanently in their patience and in their cost of refinancing, which is what measuring the correlation requires and which neither model has. Households live forever, face persistent idiosyncratic income risk, cannot borrow without collateral, and derive utility from nondurable consumption and from housing services.[11] Each period a household chooses whether to stay, to refinance in place at a fixed cost, or to sell its house and buy a new one. [12] Both changing houses and refinancing are costly, so households make adjustments infrequently.

Households finance their houses with long-term, fixed-rate, amortizing mortgages. Amortization is geometric, as in Greenwald (2026), so a constant fraction of the outstanding balance is retired each period. The critical feature is that a household's payment is computed at the rate locked in at origination rather than at the current market rate. A change in the market rate therefore does nothing to the payments of households that do not act, which is the friction that makes the refinancing channel interesting in the first place. New mortgages, whether originated when a household moves or when it refinances in place, carry the current market rate and are capped by a loan-to-value limit.

Two features of the refinancing decision deserve emphasis, because they are what the reduced-form exercise cannot deliver. First, a household that refinances chooses its new balance freely up to the loan-to-value cap, so the cash-out amount is an optimal choice rather

[11] Utility is not separable across the two, so a household's house size affects its marginal utility of consumption and hence its MPC.

[12] These discrete choices are smoothed with a taste shock. The scale of the shock governs how much action occurs at unfavorable incentives and how much inaction occurs at favorable ones, both of which we observe in the data.

than an assumption. The model therefore endogenizes the resource gain from refinancing, which is the object we could only proxy in the survey. Second, because balances amortize while collateral values do not fall, households that have gone longer without refinancing have more available borrowing capacity. The model consequently generates a tenure gradient in cash-out behavior without our imposing one.

Finally, households differ permanently along two dimensions: their discount factor and their fixed cost of refinancing. Impatience generates dispersion in MPCs beyond what income risk alone delivers, and it raises the value of extracting equity. Refinancing costs generate dispersion in refinancing propensity conditional on the gain from acting. The joint distribution of these two characteristics is what produces correlated refinancing in the model, and it maps directly onto the two competing mechanisms of Section 2.4: an impatience force that makes the correlation positive, and a cost or sophistication force that makes it negative. We solve the model in partial equilibrium, taking the risk-free rate, the mortgage rate, the wage, and the house price as given, and we relax the last of these in Section 6.3.

6.2 Calibration and identification

We plan to set the mechanical parameters of the mortgage contract and the housing market externally, from the existing literature: the risk-free rate, the spread between the risk-free rate and the mortgage rate, the amortization rate chosen to match the duration of a thirty-year loan, the loan-to-value cap, the cost of moving, risk aversion, and the income process. None of these are controversial, and none is specific to our question.

The parameters that matter for our mechanism are calibrated internally, and this is where our data do the work. Our survey and the mortgage data discipline three distinct blocks.

The distribution of discount factors is disciplined by the liquid wealth distribution together with the level and dispersion of MPCs that we measure directly. Because our sample is homeowners rather than the general population, and because our MPCs are elicited from the same hypothetical scenarios used throughout the recent literature, they are the appropriate target for a model of homeowners.

The distribution of refinancing costs is disciplined by the refinancing hazard as a function of the rate incentive, which is the S-curve we estimate on the GSE-HMDA data in Section 5. The height of the hazard at large incentives identifies the mass of low-cost households, and the slope and peak of the curve identify the dispersion in costs. The hazard at small and negative incentives identifies the scale of the taste shocks, since a model without them predicts essentially no action there.

The joint distribution of the two characteristics, which is the object that determines cor-

related refinancing, is disciplined by the covariance moments that are the central contribution of this paper. Specifically, we target the gap in MPCs between homeowners who have and have not refinanced, the gap between those who have and have not extracted equity when refinancing, and the opposing sign pattern of the covariates: impatience raises both MPCs and refinancing propensity, while financial literacy, credit scores, and income lower MPCs but raise refinancing propensity. These are the extensive-margin and intensive-margin terms of Section 2.3, so the correlation we measure in the survey is what pins down the correlation in the model.

6.3 Counterfactual experiments

We plan two families of experiments, corresponding to shocks to the two prices that determine refinancing incentives.

The first is a shock to the mortgage rate, which is the model counterpart of the exercise in Section 5. Starting from the calibrated steady state, we impose an unanticipated and permanent rate cut, follow the distribution of households forward, and compute the aggregate consumption response. The advantage over the reduced-form exercise is that we can compute correlated refinancing directly from the model cross-section, using endogenous MPCs and endogenous resource gains rather than survey MPCs and mechanical payment reductions, and we can then re-run the experiment under counterfactual joint distributions of household types. Shutting down the correlation while preserving the marginal distributions gives the representative-agent benchmark of Section 2 in a setting where every object is internally consistent. The model also allows us to ask a question that the reduced-form exercise cannot answer: because the response depends on the distribution of locked-in rates, which is itself a function of the history of rates, the same cut has different effects at different points in the rate cycle (Berger et al., 2021; Eichenbaum et al., 2022). We can ask whether the correlation between MPCs and refinancing makes monetary policy more or less state dependent, not merely more or less powerful on average.

The second is a shock to the house price. A change in house prices moves collateral values and therefore the distribution of loan-to-value ratios, which determines both who is able to refinance and how much equity they can extract. This margin is distinct from the rate incentive and it operates on the intensive margin of our decomposition. Beraja et al. (2019) show that the regional distribution of home equity shaped the pass-through of monetary policy during the last recession, and our framework makes clear what determines whether that matters in aggregate: not the average level of equity, but whether the households locked out by low equity are the households with high MPCs. We will use the model to

ask whether a fall in house prices disproportionately excludes high-MPC borrowers, and hence whether correlated refinancing falls precisely when a stimulative rate cut would be most valuable. Combining the two shocks lets us characterize how the effectiveness of the refinancing channel depends jointly on the rate environment and the equity distribution.

7 Conclusion

In this paper we demonstrate that the correlation between the Likelihood of Refinancing a Mortgage (LRM) and the Marginal Propensity to Consume (MPC) determines the strength of the refinancing channel. We collect novel survey data on the LRMs and MPCs of over 1,000 US homeowners and reveal a small positive correlation, implying a more effective channel than previously accounted for. We find evidence for two opposing effects. Heterogeneity in financial sophistication generates a negative relationship and liquidity preferences generate a larger, positive one. We use a structural model of refinancing to estimate these effects and explore their implications on the size and speed of monetary policy pass-through.

We see two fruitful paths forward in this research agenda. First, one could use individual level financial account data to estimate this important relationship between LRMs and MPCs using a revealed preference approach to estimation rather than our hypothetical scenario approach. Second, one could incorporate our findings into a general equilibrium model of the economy, and explore the implications beyond our partial equilibrium approach.

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Appendix A Additional Analysis

	Mean	Std. Dev.	N
MPC out of $5000	0.099	0.208	1027
MPC out of $250 monthly	0.120	0.273	1027
Has refinanced in 20 years	0.509	0.500	1027
Count of refinancings in 20 years	0.739	0.906	1027
Is familiar with concept of refinancing	0.620	0.486	1027
Answered all Lusardi-Mitchell Big 3 correctly	0.695	0.461	1027
Count of correct Lusardi-Mitchell Big 3	2.593	0.687	1027
Impatience Index	3.140	1.154	1027
Home purchase year	2013.145	8.889	1027
Original mortgage size	267.969	179.522	1024
FICO score	758.257	69.666	1027
Income	101.255	49.070	1016
White	0.770	0.421	1027
Male	0.421	0.494	1027

Table 4: Summary Statistics

Appendix B Study Materials

Survey materials are attached below.

Brandeis
UNIVERSITY

Consent

Informed Consent Document

For the research study: **The Effect of Financial Sophistication on Monetary Policy**

This study is being conducted by Dr. Ryan Westphal of Brandeis University.

Please read this form carefully – it tells you about your rights in this study. Ask questions if you want more information about this form or the study.

If you decide to participate in this study you will check a box on this form – please make sure you understand it completely before doing so. Keep a copy of this form for your records – it has important information like whom to contact if you have questions later.

What is this study about?

People's financial decisions and how they influence optimal monetary policy.

Who are we asking to participate?

Anyone at least 18 years old who owns their primary residence.

What will you be asked to do?

We will ask you to complete a survey that will take you about 15 minutes.

Are there any possible risks to you?

While there are no questions that can directly identify you, your responses may be made public during the publication process. You can quit the study completely at any time.

Will you benefit from participation?

No – you will not.

Will it cost you anything to participate?

Just your time (15 minutes for the survey).

Will you receive anything for participating in the study?

You will be paid $5 for the survey upon completion.

What will happen with your answers after this study?

We will store your answers – without information that can identify you – indefinitely.

If you agree, we would like to store your de-identified answers in a place where we can share them with other researchers (called a digital repository). This allows other researchers to use this information in their own future research.

What if you don't want to participate or change your mind partway through?

Participating in this study is completely voluntary. You can refuse to participate or quit at any time.

Who can you contact if you have more questions?

If you have any questions about the research or your participation in the study, feel free to contact Dr. Westphal at westphal@brandeis.edu.

This research was approved by an office/committee that oversees the ethics of human subjects research at Brandeis University. If you have any questions about your rights or concerns about the study, you may contact them at 781-736-8133 or hrpp@brandeis.edu.

Subject Consent

I have read this consent form completely. I have been encouraged to ask questions, and have received helpful answers. I understand that:

- My participation is voluntary
- I may quit at any time without penalty

☐ By checking this box, I voluntarily agree to take part in this study.

Mortgage

Do you own the primary residence that you live in?

- ○ No
- ○ Yes

Do you currently or have you in the past had a mortgage on the primary residence that you live in?

- ○ Yes, I currently have a mortgage on my home
- ○ Yes, I did have a mortgage on my home, but I have paid it off in full
- ○ No, I never had a mortgage on my home

Are you the primary financial decision maker in your household?

- ○ No, someone else is

- Yes, I am
- I am equally responsible for financial decisions along with someone else in my household

Lusardi-Mitchell

Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow?

- More than $102
- Exactly $102
- Less than $102
- Do not know
- Refuse to answer

Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, how much would you be able to buy with the money in this account?

- More than today
- Exactly the same
- Less than today

- Do not know
- Refuse to answer

Please tell me whether this statement is true or false. "Buying a single company's stock usually provides a safer return than a stock mutual fund."

- True
- False
- Do not know
- Refuse to answer

KnowRefi

Are you familiar with what it means to refinance a mortgage?

- Not familiar at all
- Slightly familiar
- Moderately familiar
- Very familiar
- Extremely familiar

NoKnowRefi

What Does It Mean To Refinance A Mortgage?

"Refinancing the mortgage on your house means you're essentially trading in your current mortgage for a newer one – often with a new principal and a different interest rate. Your lender then uses the newer mortgage to pay off the old one, so you're left with just one loan and one monthly payment.

There are a few pros and cons of refinancing. You can use a refinance to make use of your home's equity, get a better interest rate and/or lower monthly payment. A refinance could also allow you to remove another person from or add them to the mortgage.

But the upfront costs required for refinancing may mean the lower monthly payment isn't worth your while. That's why it's important to understand the refinancing process and make sure it's the right move for you."

- Victoria Araj at Rocket Mortgage

Mortgage

When did you purchase your (primary) home?

1990 1993 1997 2000 2004 2007 2010 2014 2017 2021 2024

I purchased it in (please select 1990 if you purchased earlier than 1990)

When did your current home mortgage begin? (If you have refinanced your mortgage, choose the year in which you most recently refinanced.)

1990 1993 1997 2000 2004 2007 2010 2014 2017 2021 2024

It began in

What was the original size of your mortgage?

- $0 - 99,999
- $100,000 - 199,999
- $200,000 - 299,999
- $300,000 - 399,999
- $400,000 - 499,999
- $500,000 - 599,999
- $600,000 - 699,999
- $700,000 - 799,999

- $800,000 or greater
- I don't know

What was the original term of your (primary) home mortgage?

- 30 years
- 20 years
- 15 years
- 10 years
- Other
- I don't know

Is your (primary) home mortgage a fixed or adjustable rate mortgage?

- Fixed
- Adjustable (includes hybrid loans that are fixed and become adjustable rate)
- I don't know

Is your (primary) home mortgage associated with any of the following government programs?

- FHA
- VA
- USDA (Rural)
- None

To the best of your knowledge, which of the following ranges of credit scores do you fall into?

- 300 to 579: Poor
- 580 to 669: Fair
- 670 to 739: Good
- 740 to 799: Very Good
- 800 to 850: Excellent
- Do not know
- Refuse to answer

Current Rate

What is the current monthly payment (in dollars) that you are paying on your (primary) home mortgage? If you do not know, please put your best guess.

What is the current interest rate that you are paying on your (primary) home mortgage? Please enter your rate as a number (e.g. if your interest rate is 5.5%, please enter 5.5). If you do not know, please put your best guess.

How confident are you that your interest rate is ${q://QID13/ChoiceTextEntryValue}%?

Not very confident Very Confident

0 1 2 3 4 5 6 7

Confidence

CurMarketRate

Without checking, what do you think is the average 30 year mortgage rate being offered to refinancing borrowers today? Please enter the rate as a number (e.g. if you think

the average mortgage rate is 5.5%, please enter 5.5). If you do not know, please put your best guess.

How confident are you that the market refinancing rate is ${q://QID14/ChoiceTextEntryValue}%?

Not very confident Very Confident

0 1 2 3 4 5 6 7

Confidence

Refinancing History 1

How many times have you refinanced your mortgage in the last 20 years?

- Never
- Once
- Twice
- Three times
- Four or more times

Refi1

When is the most recent time that you refinanced the mortgage on your primary residence?

	Month	Year
Month/Year		

What was the interest rate on your mortgage before you refinanced? Please enter your rate as a number (e.g. if your interest rate was 5.5%, please enter 5.5).

Was this a "cash-out" refinancing?

- Yes
- No
- I don't know

Refi2

When is the second most recent time that you refinanced the mortgage on your primary residence?

	Month	Year
Month/Year		

What was the interest rate on your mortgage before you refinanced? Please enter your rate as a number (e.g. if your interest rate was 5.5%, please enter 5.5).

Was this a "cash-out" refinancing?

- Yes
- No
- I don't know

Refi3

When is the next most recent time that you refinanced the

mortgage on your primary residence?

	Month	Year
Month/Year		

What was the interest rate on your mortgage before you refinanced? Please enter your rate as a number (e.g. if your interest rate was 5.5%, please enter 5.5).

Was this a "cash-out" refinancing?

- Yes
- No
- I don't know

MPC1

Now consider a hypothetical situation where you unexpectedly receive a one-time payment of $5,000 today. We would like to know whether this extra income would

cause you to change your spending behavior in any way over the next 3 months.

Please select only one

- Over the next 3 months, I would **spend/donate** more than if I hadn't received the $5,000
- Over the next 3 months, I would **spend/donate** the same as if I hadn't received the $5,000
- Over the next 3 months, I would **spend/donate** less than if I hadn't received the $5,000

Please select only one

- Over the next 3 months, I would **pay off more debt (or borrow less)** than if I hadn't received the $5,000
- Over the next 3 months, I would **pay off the same amount of debt** as if I hadn't received the $5,000
- Over the next 3 months, I would **pay off less debt (or borrow more)** less than if I hadn't received the $5,000

Please select only one

- Over the next 3 months, I would **save** more than if I hadn't received the $5,000

- ○ Over the next 3 months, I would **save** the same as if I hadn't received the $5,000
- ○ Over the next 3 months, I would **save** less than if I hadn't received the $5,000

SpendMoreAmount

You indicated that you would increase your spending/donations over the next 3 months following the receipt of the $5,000 payment. How much more would you spend/donate than if you hadn't received the $5,000?

SpendMoreFollowup

You indicated that you would increase your spending/donations over the next 3 months by $${q://QID54/ChoiceTextEntryValue} following the receipt of the $5,000 payment. How would your spending change over time? I would increase my spending in...
(Please note: The numbers need to add up to ${q://QID54/ChoiceTextEntryValue}.)

the next 2 weeks by $	0
the 2 weeks after that by $	0
the second month by $	0
the third month by $	0
Total	0

MPCmonthly

Now consider a hypothetical situation where your monthly mortgage payments (or monthly bills if you do not currently have a mortgage) unexpectedly decrease by $250 per month, starting today and lasting for 10 years. We would like to know whether this extra income would cause you to change your spending behavior in any way over the next 3 months.

Please select only one

- Over the next 3 months, I would **spend/donate** more than if I hadn't received the $250 per month
- Over the next 3 months, I would **spend/donate** the same as if I hadn't received the $250 per month

- Over the next 3 months, I would **spend/donate** less than if I hadn't received the $250 per month

Please select only one

- Over the next 3 months, I would **pay off more debt (or borrow less)** than if I hadn't received the $250 per month
- Over the next 3 months, I would **pay off the same amount of debt** as if I hadn't received the $250 per month
- Over the next 3 months, I would **pay off less debt (or borrow more)** less than if I hadn't received the $250 per month

Please select only one

- Over the next 3 months, I would **save** more than if I hadn't received the $250 per month
- Over the next 3 months, I would **save** the same as if I hadn't received the $250 per month
- Over the next 3 months, I would **save** less than if I hadn't received the $250 per month

SpendMoreAmount Monthly

You indicated that you would increase your spending/donations over the next 3 months following your

mortgage payment decreasing by $250 per month. How much more (per month) would you spend/donate than if you hadn't received this decrease?

SpendMoreFollowup Monthly

You indicated that you would increase your spending/donations over the next 3 months by $${q://QID65/ChoiceTextEntryValue} following the receipt of the $250 monthly payments. How would your spending change over time? I would increase my spending in... (Please note: The numbers need to add up to ${q://QID65/ChoiceTextEntryValue}.)

the next 2 weeks by $	0
the 2 weeks after that by $	0
Total	0

Fiftybpdrop

Earlier you indicated that your current mortgage rate is ${q://QID13/ChoiceTextEntryValue}%. Now consider a hypothetical situation where the mortgage rate being offered by lenders has fallen to - 0.5 }%. How likely would you be to refinance your current mortgage?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

Hundredbpdrop

Earlier you indicated that your current mortgage rate is ${q://QID13/ChoiceTextEntryValue}%. Now consider a hypothetical situation where the mortgage rate being offered by lenders has fallen to - 1 }%. How likely would you be to refinance your current mortgage?

- Extremely unlikely
- Somewhat unlikely
- Neither likely nor unlikely
- Somewhat likely
- Extremely likely

reficutoff

Earlier you indicated that your current mortgage rate is ${q://QID13/ChoiceTextEntryValue}%. What is the highest mortgage rate being offered by lenders at which you would definitely refinance your mortgage? If you would never consider refinancing your mortgage, please enter 0.

Impatience Index

To what extent do you agree with the following statements?

	Strongly disagree	Diagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I'm always saying: I'll do it tomorrow.	○	○	○	○	○	○	○
I usually accomplish all the things I plan to do in a day.	○	○	○	○	○	○	○

	Strongly disagree	Diagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
I postpone starting on things I dislike to do.	○	○	○	○	○	○	○
I'm on time for appointments.	○	○	○	○	○	○	○
I often start things at the last minute and find it difficult to complete them on time.	○	○	○	○	○	○	○

Demographics

What is your US Zip Code?

Are you of Spanish, Hispanic, or Latino origin?

- ○ Yes
- ○ No

Choose one or more races that you consider yourself to be

- [ ] White or Caucasian
- [ ] Black or African American
- [ ] American Indian/Native American or Alaska Native
- [ ] Asian
- [ ] Native Hawaiian or Other Pacific Islander
- [ ] Other
- [ ] Prefer not to say

What is the highest level of education you have completed?

- ○ Some high school or less
- ○ High school diploma or GED
- ○ Some college, but no degree
- ○ Associates or technical degree
- ○ Bachelor's degree
- ○ Graduate or professional degree (MA, MS, MBA, PhD, JD, MD, DDS etc.)
- ○ Prefer not to say

What was your total household income before taxes during the past 12 months?

- Less than $25,000
- $25,000-$49,999
- $50,000-$74,999
- $75,000-$99,999
- $100,000-$149,999
- $150,000 or more
- Prefer not to say

How old are you?

- Under 18
- 18-24 years old
- 25-34 years old
- 35-44 years old
- 45-54 years old
- 55-64 years old
- 65+ years old

How do you describe yourself?

- Male
- Female

- ○ Non-binary / third gender
- ○ [ ] Prefer to self-describe
- ○ Prefer not to say

How many children under 18 live with you?

[ ]

What is your current marital status?

- ○ Married
- ○ Living with a partner
- ○ Widowed
- ○ Divorced/Separated
- ○ Never been married

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