The Last Mile of Monetary Policy: Consumer Inattention, Disclosures, and the Refinancing Channel*

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Abstract

Despite mandatory disclosures of attractive refinancing opportunities, under-refinancing costs mortgage holders in many countries a significant fraction of income annually. To test for the role of consumer inattention in explaining sluggish refinancing, we partner with a large Irish bank to analyze a field experiment testing disclosure designs sent to 12,000 households. While we find only small effects of disclosure design improvements, a simple reminder letter increases refinancing by 80% from 9% to 16%. To interpret this reminder effect, we extend and estimate a mixture model of inattentive mortgage refinancing to allow for disclosure treatment effects. We find that a reminder decreases the likelihood mortgage holders are inattentive by 15 percentage points from 76% to 61%. A back-of-the-envelope calculation implies that each reminder letter generated an average of €64 of consumption (average of €913 for refinancing households). Our results suggest that reminders could have larger effects on household refinancing than a large rate cut and that reminders could strengthen the refinancing channel and stimulate local consumption even when policy rates are at the zero-lower bound or set in a monetary union.

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1 Introduction

Across many countries, researchers have documented a widespread "failure to refinance," where substantial savings available to mortgage holders through the refinancing channel remain unclaimed.[1] From a macroeconomic perspective, suboptimal refinancing may significantly limit the power of the refinancing channel of monetary policy transmission (Greenwald, 2018; Di Maggio et al., 2020; Cloyne et al., 2020). From a microeconomic perspective, suboptimal refinancing implies many households are overpaying mortgage interest and foregoing current or future consumption as a result (FCA, 2019).

In this paper, we analyze results of a field experiment conducted by a large retail bank in Ireland. The experiment tests whether design changes to the presentation of mandatory consumer disclosures prompt borrowers into greater take-up of beneficial internal refinancing opportunities. Our redesign treatments are constructed to more saliently highlight advantageous internal refinancing options by addressing biases which may intrude upon the household financial decision process and inhibit engagement with refinancing opportunities (e.g., inattention, status quo bias, and present bias). We see modest improvements from most disclosure design enhancements, consistent with overall inattention to disclosure (Adams et al., 2021). However, we also show that a reminder follow-up letter increases the probability of internal mortgage refinancing by 80%, from 8.6% to 15.5%. We find no evidence of an impact on an unintended but plausible secondary channel – external switching across mortgage providers.

This effort is the first mortgage refinancing field experiment outside of the United States, and the first large-scale refinancing experiment not targeted at distressed or low-income mortgage borrowers but instead at the wider population of outstanding mortgage holders. To our knowledge, only two previous papers undertake field experiments in the domain of mortgage refinancing. Johnson et al. (2019) carry out a series of field experiments to encourage uptake of preapproved refinance mortgages under the US Home Affordable Refinance Program, a 2009 federal program to help underwater and near-underwater homeowners refinance their mortgages. The second is Keys et al. (2016) who, among other things, test for effects of mailed notices to 193 borrowers from lower-income communities in Chicago. Among these peer efforts, our trial is the first to show statistically and economically meaningful impact from experimental treatment arms.

We interpret our treatment effects through the lens of the Andersen et al. (2020) behavioral model of inattentive refinancing, which itself builds on the optimal refinancing model

[1] See evidence of mortgage borrowers' low take-up of seemingly advantageous refinancing opportunities in the U.S. (Campbell, 2006; Keys et al., 2016; Johnson et al., 2019), Italy (Bajo & Barbi, 2018), Denmark (Andersen et al., 2020), the UK (FCA, 2019), and Australia (ACCC, 2018).

of Agarwal et al. (2016, ADL hereafter) that models fully attentive refinancing as an optimal options exercise problem. We then use Maximum Likelihood estimates of the model to measure the relative effectiveness of cutting interest rates versus sending a reminder. For the mortgage sector, we find that when the average incentive to refinance is roughly zero, mortgage interest rates would have to fall by 200 bp to generate the same amount of refinancing as the reminder letters. This exercise is particularly policy relevant when monetary policy rates are de facto constrained by a lower bound, complicating efforts to decrease interest rates through conventional monetary policy.

The failure to refinance puzzle continues to attract considerable academic and policy attention for a variety of reasons. First, the refinancing channel of monetary policy transmission has been shown to be quite significant and so frictions that impede refinancing have first-order implications for effective monetary stimulus—see Amromin et al. (2020) for a review. Altavilla et al. (2020) document the subdued monetary and credit dynamics in the Euro area, where the impact of standard ECB policy rate changes produced median instantaneous pass-through of 0.25 and the median medium-run pass through of about 0.65, much lower than what was estimated prior to the financial crisis. Our results highlight the power of non-monetary interventions in the hands all central banks, including national central banks in a currency union, to stimulate the refinancing channel. A back-of-the-envelope calculation suggests that our reminder treatment generates €128 of consumption for every €1 spent on disclosure reminders, highlighting the potential of what might be termed the last mile of monetary policy.

Second, there are financial stability implications which potentially arise from low mortgage switching rates. When borrowers stand to make substantial savings on mortgage repayments from switching (within or between providers) but fail to do so, they carry an elevated debt service ratio above what would be carried in a scenario where switching was more frequent. In carrying an elevated debt service ratio, the borrower is rendered more vulnerable to mortgage distress arising from more modest income shocks (see for instance Giordana and Ziegelmeyer (2019).[2] Market-wide, this would imply that the resilience of the household sector is undermined by the failure of borrowers collectively to demonstrate mortgage mobility (see also European Commission, 2015 and 2019).

Third, an observably low propensity of customers to switch mortgage providers could both diminish the incentive for providers to compete on the basis of price and send a discouraging signal to potential entrants who might bring competition to the market (Farrell and Klemperer, 2006).[3] Potential entrants may be discouraged from the observation that

[2]The empirical relationship between ability to repay and mortgage default (as distinct from strategic default arising from negative equity) has been demonstrated by Gerardi et al. (2016).

[3]Industrial organization theory has treated in detail the topic of switching costs as a barrier to potential

mortgage holders are insensitive to competitive price offerings when weighing market entry. In this way, the failure of consumers to encourage competition by demonstrably rewarding and punishing institutions by voting with their feet serves to diminish the prospects for price competition and competitive market entry.

Appendix Figure A1 reports mortgage provider switching rates across 28 European Union countries in 2016. Low switching percentages are not necessarily a cause for concern themselves, as they could indicate a market where price competition is such as to eliminate the need to switch providers. However, rates of mortgage switching and refinancing have, however, persistently preoccupied regulatory and academic attention when viewed against a backdrop of widespread opportunities for financial savings. In this context, analysts have focused on the range of costs that may act to inhibit mortgage switching and refinancing including administrative, financial, time, cognitive, and behavioral obstacles.

In the U.S., Keys et al. (2016) find that 20 per cent of households for whom refinancing was optimal had not done so, with median forgone saving of $160 per month or $11,500 over the life of the loan in present-discounted terms. In the Italian mortgage market, Bajo and Barbi (2015) found that only 4.2% of fixed rate borrowers took advantage of a legislative change which gave rise to potential refinancing gain of about 8 percent of the average principal balance (or €8,500). Even in a setting where borrowers receive a pre-approved refinancing offer under a government program with no upfront monetary costs that offer reductions in monthly payments of $204 on average (or $26,000, equivalent to about 30 per cent of a household's reported annual income), over half chose not to take-up the opportunity (Johnson et al., 2019).

There are several reasons why not switching or refinancing a mortgage might be a perfectly rational financial decision for mortgage holders even if they stand to save money by switching or refinancing. First, mortgage holders might deem the available savings insufficient to justify actual or psychological switching costs. Second, mortgage holders might be ineligible to switch as a consequence of their loan-to-value positions or their repayment history. Third, if they intend to move in the near-term, they might decide not to switch or refinance because they will not be in the home long enough to recoup the fixed costs of switching or refinancing (although Irish mortgages are generally portable across properties within Ireland). However, given the sizable fraction of consumers with sufficient equity and good credit who stand to realize substantial interest savings, it seems plausible that behavioral factors are systematically inhibiting borrowers from optimally navigating the mortgage market and obtaining the best available debt contract.

entry. Aghion and Bolton (1987) show how firms may use contracts with customers to create switching costs which act as a deterrent to new market entry.

The paper proceeds as follows. In Section 2, we review relevant literature. Section 3 provides relevant Irish mortgage market background, including a description of the relevant regulation. Section 4 presents our experimental design and data. Section 5 reports treatment effects. In Section 6, we extend the inattentive refinancing model of Andersen et al. (2020) to allow for disclosure effects, estimate treatment effects on attention, and conduct several counterfactual exercises. Section 7 concludes.

2 Literature

We first summarize the literature on interest rate pass-through before discussing the supply-side and demand-side barriers to mortgage refinancing. Our main point is that the backdrop of imperfect pass-through of monetary policy to the household sector heightens the importance of studies such as ours that document policy interventions that strengthen monetary policy transmission. The literature section concludes with a discussion on the effects of central bank communication and how behavioral frictions contribute to incomplete interest rate pass-through in the household sector.

2.1 Incomplete Interest Rate Pass-through

The degree to which monetary policy decisions transmit to tangible interest rate changes for households has been explored in detail over recent decades. Such dissemination has been a key issue for central banks, as a faster pass-through of interest rates to retail bank interest rates strengthens monetary policy transmission. In general, the literature documents sluggish and heterogeneous bank interest rate pass-through across financial products as well as cross country variation, motivating research into policies that can successfully improve pass-through.

Early research by De Bondt (2002) for the Euro area suggest that the proportion of the pass-through of changes in market interest rates are sticky in the short term and typically around 30% in the first month. The interest rate pass-through is higher in the long term, closer to 100%. The average speed for retail bank interest rates to fully adjust to market interest rate changes is typically between 3 and 10 months, with rates on loans to businesses converging faster than lending to households. Sørensen and Werner (2006) find similar conclusions on the sluggish and incomplete adjustment, shwoing that interest rates react significantly to misalignments with market rates by adjusting towards their long-run equilibrium. They attribute the significant heterogeneity across Euro area countries to a degree of fragmentation and lack of integration of retail banking sectors, identifying the level

of competition in countries as a core contributing factor. Finally, Darracq Pariès et al. (2014) demonstrate that periods of economic uncertainty and volatility also inhibit the transmission of low ECB interest rates to bank lending rates in several countries.

Altavilla et al. (2020) investigate why the interest rate channel of monetary policy in the Euro area has reduced over the last decade, outlining how nonstandard measures may have helped to mend the link between monetary policy and real activity. This focused on the targeted longer-term refinancing operations (TLTROs) introduced by the ECB in 2014 to enhance the transmission of monetary policy in light of the subdued monetary and credit dynamics. Also included were the quantitative easing asset purchase program to further ease monetary policy given that the policy rate had hit the zero lower bound. They show that these non-standard measures contributed to normalising the dynamics of lending rates to households. Despite a smaller effect compared with corporations, lending rates to households fell in response to non-standard measures and banks with a high level of non-performing loans and a low level of capital responded most. While the impact of standard measures produced median instantaneous pass-through of 0.25 and the median medium-run pass through of about 0.65, this was much lower than what was estimated prior to the financial crisis. A finding the authors state implies the interest rate channel of monetary policy has weakened. Non-standard measures lowered lending rates with a median reduction of about 40 basis points. This reduction was larger for banks operating in stressed countries (50 basis points) vs. banks in non-stressed countries (30 basis points).

Andries and Billon (2016) provide an analysis of the retail bank interest rate pass-through in euro zone countries over the past thirty years. While the periods of focus, and econometric techniques vary, the results show an incomplete short-run pass-through and a heterogeneous adjustment of interest rates across bank products and euro zone countries. The paper also examines if monetary policy transmission has been impaired in the wake of the financial crisis, with evidence that the effectiveness of monetary policy was hindered by financial fragmentation. Irish retail interest rates remain some of the highest in Europe. Factors such as limited competition in retail lending and high levels of financial difficulty in the wake of the crisis are provided as reasons why monetary policy changes may not be fully passed through to Irish borrowers relative to other member states .[4]

2.2 Barriers to Refinancing

On the supply-side, DeFusco and Mondragon (2020) document how underwriting requirements of verified employment and savings inhibit refinancing during recessions. Beraja et

[4] https://www.centralbank.ie/news/article/blog-monetary-policy-and-interest-rates-in-ireland

al. (2020) show how LTV-based underwriting and pricing inhibit refinancing after negative home price shocks leave existing mortgage holders with little or negative equity. Di Maggio et al. (2020) demonstrate that market segmentation during a recession can lead monetary stimulus to open credit access for certain borrowers and not others.

Demand-side barriers most commonly cited to explain slow refinancing relate to the actual or perceived cost which a mortgage holder confronts in refinancing, including financial and time, and the extent to which these costs exceed the benefit of reduced debt repayments. This relationship may create an inaction range within which it makes sense for a household to forego refinancing opportunities until such time as the interest rate differential exceeds an optimal threshold which justifies the effort of refinancing (ADL, 2013).

The Australian Competition and Consumer Commission (ACCC, 2018) reported that less than one in five borrowers would switch lender for an interest rate saving of 39 basis points, equivalent to $1000 savings in the first year and $10,800 in present-discounted terms over the remaining term for an average mortgage. While below 20 percent of borrowers indicate an intention to refinance or switch over the coming year, an even smaller percentage appear to follow through, with less than 4 percent of borrowers switching lender during the 12 month period of review to June 2018, suggesting a role for procrastination, and for deterrence by "opaque pricing practices and unnecessary steps." The ACCC finds that such borrower disengagement enables banks to charge substantially different interest rates to new and existing borrowers, with existing borrowers losing out to the tune of 32 basis points on average when compared against new borrowers in June 2018. This penalty translates to up to $850 a year in additional interest payments, and up to tens of thousands of dollars over the full term of the mortgage.

A notable exception to widespread failure to refinance is in response to interest rate roll-overs. Financial Conduct Authority (2019) finds that over three quarters of UK mortgage borrowers switch within 6 months of rolling onto a reversion rate following the expiry of a more attractive introductory rate. Still, the study estimates that about 800,000 consumers would benefit from switching but do not, forgoing estimated average savings of £1,000 per year in the first two years and £100 per year thereafter for the remaining life of the loan.

While available financial savings will naturally be an important determinant in a household's refinancing decisions, research has also focused upon some of the socio-economic drivers of refinancing behavior. For instance, Bajo and Barbi (2015) investigate the effect of the 2007 reform of the Italian mortgage market that has allowed borrowers to refinance their loans at no cost, documenting that only a minority of households avail of the savings opportunity, and illustrating how the propensity to refinance correlates with key mortgage and socio-demographic characteristics. Perhaps unsurprisingly, with greater savings to claim,

they find that larger loans and loans with a longer time to maturity are more likely to be refinanced. Those borrowers experienced with financial products, and those with an educational background in finance or economics are more likely to refinance. Men, and the more highly educated are more likely to avail of refinancing opportunities, while immigrants are less likely to do so. Similarly, older and wealthier borrowers are less inclined to refinance. Notably, those with lower recorded financial literacy are less likely to avail of beneficial refinancing opportunities.[5]

Similarly, Andersen et al. (2020) show that older households in Denmark with lower education, income, housing wealth, and financial wealth are less likely to consider refinancing, irrespective of the financial incentive to do so. These results point to the potential interaction between pre-existing sources of financial vulnerability and the additionally costly failure to avail of the opportunity which refinancing presents. More broadly, financial literacy has been shown to be closely associated with saving, retirement planning, the likelihood of stock ownership, and household wealth (Lusardi and Mitchell, 2007; van Rooij et al., 2012).

2.2.1 Psychological Barriers

The pattern of inertia and disengagement echoes those found in numerous other essential product markets. For instance energy, current account, telephone, and internet broadband markets are regularly cited as having similarly subdued levels of consumer switching against a market backdrop of meaningful price dispersion. See for instance Harold et al. (2019) for a review of switching activity in 14 retail markets across Europe; Yang (2014) for a review of switching in the Danish electricity market; Yin and Matthews (2014) for a review of switching costs in Chinese banking; Hartfree et al. (2016) on checking account switching; Lunn and Lyons (2018) on telecoms switching; and Shcherbakov (2016) on consumer switching in the market for paid television services.

This paper also contributes to the literature on consumer inattention. Evidence suggests that consumers fail to weigh non-salient information such as shipping fees (Brown et al., 2010; Einav et al., 2014) and demonstrate inattention to taxes not included in the posted prices (Chetty et al., 2009; Finkelstein, 2009). For mortgages, King and Singh (2018) find evidence that consumers who demonstrate limited attention bias choose more expensive cashback mortgages that are financially equivalent at the point of drawdown. In our experiment, our interventions address failure to appreciate or notice the potential savings in the moment, while the reminder deals with inattention due to absentmindedness (Schactar, 1999). While

[5]This is also in line with the work of Gerardi et al. (2013) illustrating that individuals with limited numerical ability default on their mortgage due to behavior unrelated to the initial choice of their mortgage, namely spending and savings patterns or sub-optimal investments made with respect to other financial contracts that impact borrowers' ability to repay their mortgages.

we find small effects of disclosure design improvements, the strong effects of a simple reminder letter suggests that inattention in the form of absentmindedness or procrastination is a more binding constraint on mortgage refinancing than inattention in the moment.

Andersen et al. (2020) document widespread failure to refinance even when the ADL threshold is exceeded. Inaction beyond the threshold suggested by the stylized optimal refinancing model must be justified by additional barriers relating to the 'psychological costs of refinancing' and behavioral present bias, which discourages households from incurring time costs today for benefits, realized in the future.

More recently, attention has shifted to understanding the role played by psychological factors and behavioral biases in blocking optimal mortgage refinancing. For instance, Johnson et al. (2019) document how traditionally cited factors such as numerical ability are less important in driving refinancing decisions, but instead outline the role played by a borrower's time preferences and feelings of suspicion. They show that those borrowers who are more suspicious of the motives of financial institutions are less likely to engage in refinancing, and that more attractive offers are required to motivate present biased borrowers to apply. McCarthy (2011), for instance, shows that behavioral factors such as self-control and patience may have a stronger impact on the incidence of household financial distress than education or financial literacy. Keys et al. (2016) similarly report that behavioral explanations such as procrastination and inattention as possible reasons why households neglect to take-up refinancing opportunities in their financial best interest. While in an experimental setting, the UK Financial Conduct Authority has demonstrated the significant effect that the issuance of reminders can play in prompting consequential financial actions, pointing to the role of procrastination and inattention in shaping the course of our financial lives. See for instance Adams and Hunt (2013), Adams et al. (2016), and Adams et al. (2015).

Inattention can explain a wide range of behavioural biases such as inattention to the future (hyperbolic discounting), inattention to the true probability (prospect theory) and inattention to true ability (overconfidence) (Gabaix, 2019). There is growing evidence on the role played by inattention in consumer decision making. Evidence suggests that consumers fail to weigh non-salient information such as eBay shipping fees (Brown et al., 2010; Einav et al., 2014) and demonstrate inattention to taxes not included in the posted prices (Chetty et al., 2009). For mortgages, King and Singh (2018) find evidence that consumers who demonstrate limited attention bias choose more expensive cashback mortgages that are financially equivalent at the point of drawdown. In our setting, inattention to potential mortgage savings can take a number of forms. First, inattention in a moment may be considered rational for the stressed consumer unable to process all available information. Second, a consumer may simply overlook the potential savings in the moment they receive the infor-

mation. Third, following an appreciation of the contents of the letter, inattention may occur as absent-mindedness, described by Schactar (1999) as shallow processing contributing to weak memories of key information and a related to do action. Related to this third form of inattention is procrastination. Procrastination involves a postponing, delaying, or putting off a task or a decision in a way that is problematic rather than strategic.[6]

In our experiment, we consider our behaviourally informed treatments as addressing the second type of inattention â failure to appreciate or notice the potential savings in the moment, while the reminder deals with the third type â absentmindedness. Related to the concept of procrastination, there may be numerous reasons for subsequent absentmindedness to occur such as i) absence of a deadline and a self-regulating time-management strategy that allows working under pressure and meeting deadlines successfully, also known as active procrastination (Steel and Konig, 2006, Chu and Choi, 2005), ii) underestimation of future self-control problems (OâDonoghue and Rabin, 2001) and iii) the scale of the decision leading to inaction (OâDonoghue and Rabin, 2001). In this paper, we do not differentiate between these different forms, considering instead that our reminder treatment deals with the overarching issue of absentmindedness/procrastination.

2.3 Central Bank Communications

Central Bank communications have for long been the primary barometer through which the expectations on interest rate fluctuations were set for both industry experts and the general public. From the Federal Open Market Committee meetings to European Central Bank monetary policy announcements, the impact on both financial markets and consumer lending rates has been assumed to be a powerful one. However, recent research has explored not only the strength of this guidance but also how these communications ultimately feed through to the general public.

McKay et al. (2016) show that, in contrast to standard models, the power of forward guidance is highly sensitive. If borrowers face income risk and borrowing constraints, a precautionary savings effect can reduce their responses to fluctuations in interest rates. Therefore, forward guidance may have substantially less power to stimulate action in borrowers. Blinder et al. (2008) provide an excellent overview on the growing literature linked to how this communication has formed an increasingly important element of monetary policy. From shrouds of secrecy and mumbling with great incoherence to structured predictability and transparency, evidence shows differing communication methods can be a core part of a cen-

[6]Studies suggest that procrastination chronically affects 15-20% of adults, and that approximately 25% of adults consider procrastination to be a defining personality trait for them (Steel, 2007; Nguyen et al., 2013).

tral bank's arsenal. Two aims are identified in 'reducing noise' and 'creating news'. The first increases the predictability of central bank actions, which should in turn reduce volatility in financial markets. The second covers how central bank announcements influence expectations and, therefore, move market prices and rates. They state that the optimal means on how to deliver on these aims has yet to be established with distinct differences in communication strategies across institutions.

Haldane and McMahon (2018) outline how central banks have not made their main communications accessible to a sufficiently wide audience. One reasons for this is linguistic complexity, with typical central bank publications have reading grade levels equivalent to college-level. This makes them inaccessible to large cohorts of the population when compared against levels of literacy. A monetary policy knowledge index is constructed by the authors based on survey data and shows understanding of monetary policy to have been largely unreached by to central bank communication changes. There are also differences across cohorts, with young, less well-educated and poor individuals being less knowledgeable. Lamla and Vinogradov (2019) expand on this by exploring the impact of consumers perceptions and expectations on interest rates based on FOMC announcements. They find announcements have little impact on consumers' perceptions and expectations of either inflation or interest rates but do identify an increase in the proportion of people who have heard monetary policy news. They find no evidence beliefs and confidence of consumers who receive news differ from the uninformed cohort. On average only 35% of consumers in their data are aware of the FOMC announcement during the announcement week, which grows by 10% after the announcement.

Recent work by the Central Bank of Ireland has explored the views on monetary policy communication, challenges and the road ahead by former members of Governing Council of the European Central Bank (Ehrmann et al., 2021). Respondents showed a general consensus across topics, with the view enhancing credibility and trust as the most important objective of central bank communication. A priority was placed on communication with financial markets and experts, which was deemed to be at an adequate level. However, less importance was placed on communication with the general public. A substantial room for improvement was identified, with the need for clear and targeted communications flagged as being key to reaching a wider audience in the future. One of the potential suggestions for change include an increased presence on social media.

There is a responsibility on policymakers and their institutions to guide the public to better comprehend a view of future economic movements, to minimalise uncertainty and make informed decisions on their long term financial products. As part of a recent monetary policy strategy review, the European Central Bank has acknowledged the need for credibility,

clarity and consistency in it's communications[7]. Within this review, it has been stated that by effectively letting markets know, in less technical and more understandable terms, where to expect interest rates to be in the future, they can bring about a change in the price of borrowing for consumers.

2.4 Consumer Disclosures and Reminders

2.4.1 Behaviourally Informed Disclosures

This paper is also part of a growing body of evidence on behavioral market failures (Sunstein, 2012), arguing that behaviorally-informed policy responses can deliver meaningful impacts on various public policy challenges (see Adams and Hunt, 2013; Duke et al., 2014; Adams et al., 2015; FCA, 2016; Adams et al., 2021). In many settings, the policy response to potentially suboptimal consumer choice has been to provide additional information, leading to a proliferation in mandatory disclosures (Ben-Shahar and Schneider, 2014; Kell, 2016). We additionally contribute to work demonstrating the potential of behaviorally informed, modernized mandatory financial disclosures (e.g., Lee and Hogarth, 2000; Bar-Gill, 2012).

For example, recent quasi-experimental work by Wang and Burke (2022) shows that behaviorally motivated payday disclosures had a significant effect on loan volumes in Texas. Adams et al. (2021) find that prominent front-page information about higher available rates led to an increase in switching from a baseline of 3% to 6% of consumers, while non-front-page disclosures had no effect. In the insurance market, Adams et al. (2015) estimate that putting last yearâs premium on renewal notices led to between 11% and 18% more consumers to switch or negotiate their home insurance policy.

2.4.2 Reminders

Using a theory of how limited memory and procrastination affects task completion, Ericson (2016) argues that for time-consistent and present-biased individuals, unanticipated reminders always increases the likelihood the task will be completed, whereas anticipated reminders may have ambiguous effects on the probability the task will be completed. It seems there is near universal view that reminder letters have a small positive impact on the outcome of interest. However, questions remain over who the reminder works for and, why in most cases, the vast majority of recipients remain reluctant to engage.

Reminder letters have a long history in health sciences, with evidence that such letters increase vaccination take up and cancer check-up rates (Hirani, 2021, Mayer et al, 2000). In

[7] https://www.ecb.europa.eu/home/search/review/html/monpol-communication.en.html

financial markets, research on reminder letters from the FCA found that well-timed reminder letters boosted switching rates by 8% when bonus interest rate periods expired in the cash savings market (Adams, Hunt, Vale Zaliauskas, 2015). Furthermore, Adams and Hunt (2013) in an experiment to encourage customers to avail of a redress scheme, found that when reminder letters produced higher results when significantly sent at the three week point, while middle-aged consumers are the least likely to respond to redress letters. A UK study on pawnbrokers found that a behaviourally designed reminder letter, delivered to customers 2 weeks after incurring a surplus due to their item being sold, almost doubled surplus collection rates within 30 days (Adams et al, 2021).

3 Context

3.1 Irish mortgage market

There are three primary types of mortgages in Ireland: fixed-rate mortgages, variable-rate mortgages, and tracker mortgages with each type accounting for approximately 55%, 20%, and 25% of current outstanding balances, respectively. Fixed-rate mortgages are similar to UK fixed-rate mortgages and US adjustable-rate mortgages; they are fixed for an initial term of 1-5 years and then convert to a variable-rate mortgage thereafter. There is generally a prepayment penalty of approximately 2% of the outstanding balance if a borrower prepays their mortgage during the fixed-rate period. However, mortgages are portable in Ireland in the sense that borrowers are usually permitted to change the property that the mortgage secures without penalty such that if they move withing Ireland, they take their mortgage with them. Variable-rate mortgages adjust periodically at the sole discretion of the lender (as opposed to floating debt elsewhere that is usually indexed to an interest-rate benchmark). There is no penalty for prepayment and refinancing internally is allowed without fee, unless the borrower wishes to pay for an appraisal to justify a lower loan-to-value ratio bracket. Refinancing in Ireland generally maintains the original maturity at origination and does not extend a mortgage's term. Tracker mortgages in Ireland generally track the ECB refinancing rate plus a spread of approximately 100 basis points. However, Irish lenders stopped originating new tracker mortgages in 2008.

Refinancing activity in the Irish mortgage market is notably subdued when seen against a backdrop of widespread and substantial opportunities for financial savings from refinancing available in the Irish market. Just over one in four Irish households has an outstanding mortgage on their main residence (CSO, 2018). Among these households, mortgage debt is significant, accounting for 71.6 per cent of total debt outstanding. Recent studies show

that, after signing their mortgage contract, very few Irish households refinance or switch their mortgage type. For example, Byrne et al. (2020) report that three in every five eligible mortgages could save over €1,000 within the first year if they switch and more than €10,000 over their remaining term but that just 2.9 per cent of mortgages switched provider during H2 2019.

A survey of Irish mortgage holders undertaken by the Central Bank of Ireland in 2016 suggests that many consumers believe that the mortgage switching or refinancing process would be too complex to engage in or that the process would be too costly in terms of time and effort (CBI, 2017). However, over half of consumers agreed that they would consider switching their mortgage for an interest rate saving. Despite this, approximately 52 per cent of surveyed consumers said that they were uncertain about the amount of money that could be saved by switching their mortgage.

Provision 6.5(g) of the Central Bank's Consumer Protection Code requires that regulated entities provide variable-rate mortgage holders, at least annually, with a summary of other mortgage products that could provide them with savings on their mortgage at that point in time. As such, whether a mortgage was originated as a variable-rate mortgage or originated as a fixed-rate mortgage and then automatically converted to variable rate after its fixed-rate period ended, many borrowers will receive these disclosures. It does not currently stipulate how such information should be presented. It is this mandatory annual disclosure document which forms the starting point for our experimental treatments.

3.2 Regulatory

Significant regulatory attention has been brought to bear on the topic of consumer inertia in the mortgage market. In tackling the detriment that accrues for consumers and to the financial system more broadly, regulators in recent years have shifted attention from informational remedies based on traditional disclosure requirements to more behaviorally-informed approaches to the design of policy responses. The Australian Securities and Investments Commission, for instance, has advocated a more diverse regulatory toolkit which turns to behavioral economics to help to understand persistent and systemic market problems such as this, tempering the heavy reliance that had been placed on formalistic disclosure requirements to fix market problems. This traditional disclosure approach, they argued, meant "much of the responsibility for avoiding harm is placed with consumers themselves in the first instance", where "individual consumers are assumed to be fully rational agents who make decisions relying on all the information available to maximise their outcomes" (Kell, 2016).

Similarly, the UK Financial Conduct Authority has flagged its intention to move away

from 'ineffective countermeasures' such as traditional unadjusted disclosure requirements deployed against entrenched market problems which arise from suboptimal consumer financial decisions. The FCA has argued that in order to move things forward in areas such as consumer inertia, policy design must incorporate insights offered by behavioral economics, which is seen as a "game changer" in this domain. By expanding the regulatory toolkit and the set of remedies available to policymakers, behavioral economics can have a "profound impact on many of the most serious challenges facing policy makers today" (Wheatley, 2014; Bailey, 2019).

In Ireland, regulatory steps have been taken which seek to understand and tackle the obstacles which consumers may face as they consider the possibility of mortgage switching. Notably the, the July 2016 introduction of transparency measures for variable rate mortgage holders, and the enactment of enhanced measures in for mortgage transparency and switching. Notwithstanding these regulatory initiatives and energetic commercial switching campaigns, the rate of mortgage switching and refinancing remains notably subdued in the Irish market. With this field trial, we sought to harness insights from behavioral economics and adopt the experimental method to empower consumers to make better choices for themselves.

4 Experimental Design

We partnered with a major retail bank in the Irish mortgage market to test a series of behaviorally enhanced versions of an existing mandatory financial disclosures delivered by mail among a representative subset of 12,050 variable rate mortgage holders in January 2020. Trial subjects were tracked in terms of their subsequent propensity to refinance in two data snapshots provided by the partnering institution at three months and six months after the distribution.

To avoid potential for observer effects that would jeopardize the integrity of our experimental design, trial participants were not made aware that the version of the mandatory disclosure they received formed part of a behavioral field trial. As such, it was essential that all versions were rigorously evaluated to ensure that they were at least in keeping with the baseline informational requirement stipulated by the Consumer Protection Code (e.g., no key information was removed, which might lead to a mortgage holder having less information available than they would under the baseline scenario). Further, our trial was subject to rigorous legal and data protection assessment to ensure it was in keeping with these standards, and was overseen by a robust internal governance framework within the Central Bank.

Tracking data recorded detailed loan characteristics such as the interest rate prevailing

on the loan, interest rate type, loan balance, current monthly repayment, available savings with respect to the best available alternative product option, along with indicators for those loans that had reached maturity, switched externally, otherwise exited the book, and most importantly, refinanced internally. This data allow us to assess the differential impact of our treatments brought to bear on borrowers' mortgage management.

Our research design is informed by power analysis which allowed us to determine the number of customers required to participate in the experiment. We estimate the minimum effect size (i.e., the minimum increase in mortgage refinancing) that is likely to be detected for a given number of customers under examination. With a sample of 12,000 and six treatments, our power analysis indicated that we would have statistical power to detect treatment effects as small as a 1.56 percentage point improvement over the baseline rate of refinancing, equivalent to an increase of 13 per cent.

A total trial sample of 12,050 were randomly drawn from the population of variable rate mortgage customers with the partnering institution and randomly allocated into one of seven treatment cells (the control group plus six treatment arms). This procedure results in a split of approximately 1,700 customers per cell. As a further experimental manipulation, within each treatment arm, the sample was randomly divided in half, with one half receiving an additional follow-up reminder notification by post 4-6 weeks after the original communication.

The literature on mortgage and non-mortgage field trials designed to encourage household financial engagement finds a broad range of factors may act to inhibit the take-up of mortgage refinancing opportunities – including informational, procedural, financial, and behavioral obstacles. In this paper, we are target five such potential obstacles: process complexity, inattention, incomprehension of the price differential, procrastination, and present bias. Within the parameters of the baseline mortgage refinancing disclosure we are working with, we test a series of corresponding appropriate refinements that have shown promise in the encouragement of consumer engagement in other settings.

Simplification: Each treatment communication included a box on the front page of the letter with key points highlighted, including the current interest rate and monthly repayment that was payable on the customer's mortgage, in addition to the lowest alternative interest rate and associated monthly repayment available to the customer. The box was designed to engage customers and to ensure that key information could be accessed quickly. Simplification is an experimental technique that can be used to target customer inattention and information overload, both of which have been found to affect the ability of consumers to make informed choices (e.g., Lunn et al., 2016; Adams and Hunt, 2013). A key insight from behavioral economics concerns consumer's bounded capacity to process large volumes

of complex information and distill key actionable messages.

Personalized Savings: The retail bank's standard communication (the control) included a table that noted the interest rate associated with each alternative product option available to the customer, but there was no translation of the associated monthly repayment amounts. In each of the treatments, we supplemented the table with the monthly repayment amount associated with each option, and the savings (where available) relative to the current monthly repayment. This technique targets ambiguity aversion and present bias, whereby individuals who place more weight on the present over the future would forego long-run payoffs in order to avoid short-run administrative burdens. Oxera (2016) use the setting of the UK annuities market to illustrate link between the presentation of personalized savings and the extent of customer shopping around.

Prominent Subject Line: The subject line in the control letter stated, *"You may be able to save money on your mortgage"*. To increase the likelihood that customers would perceive the letter to be important, we trialled the use of color, increased font size and emboldened the text in three of our interventions. In a similar vein, BIT (2015) report that printing the call to action prominently on official communication significantly increased payment rates across a range of fines, debts and taxes.

Framing: A central insight from behavioral economics relates to the potential for choices to be influenced by the way in which they are framed for the decision maker (Kahneman and Tversky, 1979). The presentation of financial savings in a loss frame would aim to counteract loss aversion, which is the tendency for people to prefer avoiding losses to acquiring equivalent gains. This is a central proposition of Prospect Theory, which is a theory of consumer choice developed as a behavioral alternative to the more traditional Expected Utility Theory. The theory predicts that since the disutility associated with losses exceeds the utility associated with equivalent gains, people are more willing to take risks to avoid incurring the loss. In the current context, refinancing represents the risky prospect as against the known status quo. Genakos et al. (2015) and Adams et al. (2015) provide evidence for the relative efficacy of loss-framing in the presentation of financial savings to nudge consumer behavior.

We trialled presenting the refinancing opportunity with a gain frame and separately with a loss frame. We changed the language to read either *"With a different rate, you could save up to €X a year on your mortgage"* or *"You could be missing out on savings of up to €X a year by not choosing a lower mortgage interest rate"*. To complete the comparison, other letters adopted a more neutral tone.

Color: The use of color can help to draw attention to salient information. Treatment group 1 received the same communication as treatment group 2, but the former employed color at key junctures in the letter. The UK Cabinet Office Behavioural Insights Team

(BIT, 2015) proposes the use of color as a means of making communications attractive to consumers, in the context of their EAST framework for the application of behavioral insights to encourage action (make it Easy, Attractive, Social, and Timely).

Next Steps Clarified: A core lesson from behavioral economics is that the removal of even the smallest frictions to a process can have a large impact in prompting action (BIT, 2015). Ambiguity aversion can cause an avoidance of uncertain prospects in favor of known prospects, even when the known prospect may not be particularly favorable. In an effort to mitigate these potential influences, we added for treatment group 6 a clarified process box, which clearly delineated the steps required for a mortgage holder to take action and move onto a lower cost interest rate option.

Reminder: Reminders target customer inattention, procrastination, and forgetfulness. We hypothesize that one of the important obstacles to optimal household financial decision-making is procrastination, which may be the result of time-poverty. Time-constrained households may queue financial tasks which are subsequently forgotten, or simply delayed so that opportunities are missed. In an experimental setting, Adams et al. (2015) find that reminders increase the rate of switching in savings accounts in the U.K. by at least 8 per cent.

4.1 Descriptive statistics

Table 2 reports summary statistics for several mortgage and borrower characteristics in our data across trials. In order to attribute any observed difference in refinancing rates across customer groups to the impact of our intervention, it was essential that we randomly allocated our customer sample into each of the different groups (i.e., to receive the existing standard disclosure – the control group – or to receive one of the enhanced alternative versions – the treatment groups). To test that this randomization exercise was effective, and to be confident that other factors are not driving the any impact we observe at the evaluation stage, we must check that our groups are in fact well-balanced in terms of key covariates at the outset.

Following McKenzie (2015), Table 3 shows a pairwise regression of treatment status (control vs. each of our treatment groups) on a vector of covariates which may be correlated with our outcome variable of interest, to ascertain whether these factors differ systematically and help to predict treatment status. We find a high degree of statistical balance. However, where we observe any evidence of statistical difference, such as in the years to maturity variable, we run supplementary regression analysis in our evaluation of treatment effects to control for any potential imbalance and ensure our treatment effects are robust to this.

Our trial sample of loans consists of a random subsample of outstanding variable rate mortgages held by the partnering institution. Our sample is restricted to variable rate mortgages as this is the cohort that is eligible for receipt of the mandatory disclosure from which we build our experimental treatment arms. Our total sample of 12,050 reduces to an estimation sample of 11,720 following the attrition of 330 observations which exited the loan book or reached maturity during the trial period. Of our estimation sample, 1,354 go on to refinance internally, and 379 switch externally. Estimating potential 1-year savings (calculated with reference to the lowest applicable interest rate available internally to the mortgage holder) among our trial sample with respect to the prevailing interest rate and the outstanding balance at the individual loan level, we notice two patterns. First, we observe a weakly positive relationship between potential savings and the borrower's current interest rate. Second, we see a much more strongly positive association with the current outstanding balance, suggesting that the loan balance is a more important feature than the point in time interest rate gap in influencing the relative attractiveness of a refinancing opportunity.

5 Results

In this section, we outline the impact that our alternative treatment arms had on the observed rate of mortgage refinancing, compared against the baseline standard which is represented by our 'Control' group. Our impact analysis is based on data reported in June 2020 (+3 months after the distribution of disclosure letters).

Before turning to a stepwise sequential analysis of our pre-specified research questions, we find at an aggregate level that all of the treatment arms produced higher refinancing rates than the existing standard, with these differences all being statistically significant at the 1 per cent level (see Table 4 for regression output and Figure 1 for equivalent graphical representation). We see in Figure 1 that of those customers who received the existing standard disclosure, 8.6 per cent went on to take up a refinancing offer, whereas between 11.9 per cent and 12.6 per cent of customers who received one of the enhanced disclosures went on to refinance. This represents an increase in mortgage refinancing of 46 per cent with the strongest alternative (Version 4). Table 4 equivalently reports these same treatment effects obtained alternatively from ordinary least squares regression of refinancing probability on treatment status, compared against the base category which is the Control group. Our results compare favorably against those found in two preceding mortgage refinancing experiments. Keys et al. (2016) found no statistical differences in take-up within three treatment arms which, inter alia, drew attention to the amount of savings that mortgage holders could achieve.[8]

[8]However, a much smaller small sample sizes (N=193) (fewer than 10 households refinanced in each

Similarly, Johnson et al. (2019) found that none of the experimental interventions had a positive impact on refinancing take-up rates.

Our regression estimation shows that our main treatment effects are robust to the addition of select controls added to address observed statistical imbalances reported previously in Table 3.

To evaluate whether personalized savings estimates will increase take-up of refinancing opportunities, we consider the evidence of treatment effects but strip out any potential reminder effect by concentrating on those customers that received only the enhanced notifications but no further reminder in Figure 2. Version 1 represents the smallest amendment to the existing standard, with the addition of personalized savings estimates but none of the additional refinements incorporated in subsequent versions. As such, we can attribute this pairwise comparison to the pure treatment effect of the personalized savings estimates, but no such statistical difference is found.

To examine whether targeted behavioral refinements over and above the presentation of personalized savings will have an additional impact on refinancing probability, we incorporate these additional refinements in all versions subsequent to Version 1, and include the use of color, a loss frame, a gain frame, a more prominent subject line, and clarified next action steps. We do not find evidence of any additional treatment effect brought about by these refinements, over and above what is delivered by the first enhancement in the presentation of personalized savings. We cannot reject that the treatment effects are statistically different from each other, even though they are each individually statistically significant relative to the control group.

We find strong evidence from the results above that reminders are consequential, most clearly evident in Figures 3 and 4, which report the differential treatment effect between the treated customers who additionally received a reminder, and those who only received a single enhanced notification. On average across treatment versions, we observe a statistically significant reminder bonus of an additional 32 per cent increase in refinancing probability over and above the average refinancing probability following an enhanced original notification. Figure 4 disaggregates this differential treatment effect within each treatment group.

In Figure 5 we report the refinancing rate for each treatment group, conditioning on receipt of a reminder. We observe refinancing rates of between 12.8 per cent and 15 per cent, an increase of 74 per cent in the strongest combination.

Figure 2 reports the impact when we restrict our focus to compare the outcomes of customers who received the existing standard against those groups who received an enhanced disclosure, but did not additionally receive a reminder communication. In several cases, we

group), meant that the authors were unable to reject the possibility of economically meaningful results.

do still observe statistically significant increases in refinancing rates, but these are comparatively modest to what we report above. In the strongest version, we observe a statistically significant 36 per cent increase in the rate of refinancing as against the group who received the existing standard (that is, an increase in the probability that the recipient actually refinanced from 8.6 per cent to 11.7 per cent).

Figure 6 reports the aggregate treatment effect for the treated groups considered together but distinguished by reminder status as against the control. We find a statistically significant increase in refinancing probability of 21 per cent and 59 per cent respectively.

Next, we test whether the strength of observed treatment effects varies along relevant loan and borrower dimensions – the volume of debt outstanding, the amount of savings available, borrower type (i.e., First Time vs. Second and Subsequent Buyers), and take-up of Covid-19 mortgage repayment breaks. We can hypothesize that borrowers with greater amounts of debt outstanding and larger interest rate gaps to the best available rate (implying higher potential savings) will be more responsive to enhanced notifications which draw greater attention to lower cost mortgage options. More theoretically ambiguous is the differential treatment effect for FTB and SSBs. On the one hand, we might expect that FTBs being on average younger and with expected higher levels of digital literacy, should be more responsive to treatment. On the other, SSBs being by definition more experienced in financial decision making and mortgage origination and management, should be less intimidated by renegotiation and therefore more responsive to our enhanced notifications.[9] For the relationship with Covid-19 repayment breaks, we might suppose that selection of a repayment break serves as an indicator of household financial pressure, or alternatively evidence of active attention and engagement with advantageous household financial options under crisis conditions, both of which may render a borrower more responsive to lower cost mortgage refinancing opportunities.

Table 5 tests whether interaction effects can be observed where all treatment types are pooled and compared against the control group. We find evidence of statistically significant interaction effects in just two settings: between borrower type treatment status in the no-reminder group, and between the level of outstanding debt and treatment status in the reminder group. These indicate respectively that FTBs and those with higher levels of outstanding mortgage debt respond more strongly to treatment.

While we do not observe other statistically significant interaction effects, we do observe some notable level differences in the probability of refinancing. Those with higher potential

[9] Andersen et al. (2020) find that older households are less likely to consider switching or refinancing. Bajo and Barbi (2018) who report a relationship between financial product experience and refinancing take-up.

savings are significantly more likely to take up a refinancing opportunity irrespective of their treatment status, while FTBs and those who have availed of the Covid-19 repayment break are also statistically more likely to have refinanced in our estimation period. While loan balances are a significant component of first-year savings, the level of loan balance is not statistically significant conditional on the first-year savings, suggesting that the effect of debt levels on refinancing behavior operates mostly through the amount of savings.

Intuitively, and echoing a result found in Keys et al. (2016) and Bajo and Barbi (2018), we observe that those with 'high' savings potential are more likely to refinance than those with 'low' savings potential by 12 per cent, and those with 'high' outstanding debt are 11-12% more likely to refinance than those with 'low' outstanding debt. We observe that first time buyers are 3-5% more likely than second and subsequent buyers to refinance. We also find that borrowers who have availed of a Covid-19 mortgage repayment holiday are 4 per cent more likely to take up a refinance opportunity than those who did not avail of such repayment forbearance. One potential explanation for such a pattern is an attention and engagement effect, whereby certain borrowers are more tuned in to potentially advantageous financial opportunities which create breathing space in their household finances.

To examine whether enhanced disclosures drawing greater attention to internal refinancing opportunities may additionally impact upon the probability of external switching across providers, we evaluate whether any treatment effect can be observed in terms of this unintended but plausible secondary channel – external switching across mortgage providers in Table 6. In a series of regression specifications to mirror our main regression analysis in Table 4. We find no consistent evidence for this effect, notwithstanding a small but statistically significant effect recorded for Version 2, an effect which we treat as incidental in view of the absence of any consistent pattern in direction or significance across other similar versions.

5.1 Financial impact of the observed treatment effects

In our most impactful treatment combination, the refinancing rate increased by 74 per cent (from the baseline refinancing rate of 8.6 per cent to 15 per cent in Treatment Group 1 - Figure 3). We estimate the potential impact of this trial on the broader market as follows: the latest loan-level dataset collected by the Central Bank and covering the five main retail banks in Ireland shows approximately 240,000 outstanding variable rate mortgage loans at end-June 2020. If we assume that the baseline refinancing rate on foot of the existing standard notification of 8.6 per cent applies market-wide, an increase in refinancing of the magnitude we achieve in our best trial would imply that an additional 15,360 mortgages would realize mortgage repayment savings on foot of this enhanced annual notification. In

this context, we note that the average 12-month savings realized on mortgages that did refinance in our trial was €1,206, albeit the equivalent market-wide figure could differ given alternative product offerings at other institutions.

6 Inattention Estimates

In this section, we interpret our treatment effects through the lens of the Andersen et al. (2020) model of inattentive refinancing. The baseline model builds on the optimal refinancing model of Agarwal et al. (2016), which assumes that households are fully attentive to the task of refinancing and refinance their mortgages if the net benefits of refinancing are positive. There are two components to the net benefits of refinancing: their incentive to refinance $I(x_i, \varphi)$ in interest-rate points that potentially depends on certain observable mortgage characteristics x_i through parameter vector φ and an idiosyncratic random shock to the net benefit of refinancing ϵ_i. The incentive to refinance $I(x_i, \varphi)$ is a function capturing a household's incentive to refinance in interest-rate points

$$I(x_i, \varphi) = \left(r_i^{old} - r_i^{new}\right) - O_i(x_i, \varphi)$$

where r^{old} is the household's current mortgage rate, r^{new} is the household's current prevailing mortgage rate, and O_i is the household's optimal refinancing threshold, calculated using the Agarwal et al. (2016) solution to optimal refinancing option exercise, which in turn depend on certain current mortgage terms x_i. Each household thus has a minimum decrease in interest rates (O_i) they require to be willing to refinance, and $I(\cdot, \cdot)$ measures how far above that threshold they are currently. In the baseline, full attention model, the household refinances if

$$e^{\beta} I(x_i, \varphi) + \epsilon_i > 0$$

where β measures the household's responsiveness to the incentive.

For estimation, ϵ is assumed to be distributed logistic, in which case the probability a mortgage borrower refinances is

$$\begin{aligned} \Pr(refinancing_i = 1 | x_i; \beta, \varphi) &= \Pr\left(e^{\beta} I(x_i, \varphi) + \epsilon_i > 0\right) \\ &= \Lambda(e^{\beta} I(x_i, \varphi)) \end{aligned}$$

where $\Lambda(\cdot)$ is the inverse logistic function $\Lambda(x) = e^x/(1+e^x)$. We can then estimate β and φ by maximum likelihood, finding the parameters β and φ that maximize the likelihood that we would observe the vector of refinancing decisions in the data.

6.1 Inattention Model

To allow for the possibility that a household is inattentive and thus not paying any attention to their refinancing incentive or refinancing shock, Andersen et al. (2020) use a mixture model with each household inattentive in a given period with some probability. Inattentive households do not refinance ever. Households are inattentive if $\delta' x_i + \eta_i > 0$ where η is a random shock to a household's attention each period. If η is also distributed logistic, then the probability that a given household is inattentive in any given period can be written as

$$w_i(x_i, \delta) = \Pr(\delta' x_i + \delta_1 Treatment_i + \delta_2 Reminder_i + \eta_i > 0) = \frac{\exp(\delta' x_i)}{1 + \exp(\delta' x_i)}. \quad (1)$$

To refinance, households need to both be attentive (probability $1 - w_i$) and have positive net benefits of refinancing (probability $\Lambda(e^\beta I(x_i, \varphi))$). The likelihood that a household refinances at time t is then $(1 - w_i)\Lambda(e^\beta I(x_i, \varphi))$.

Households that didn't refinance were either inattentive or attentive but didn't have sufficient incentive to refinance. The likelihood that a household doesn't refinance at time t is then $(1 - w_i)(1 - \Lambda(e^\beta I(x_i, \varphi)) + w_i$. The overall likelihood of observing a sample of refinancing given covariates x is then the product of the relevant probabilities for the refinancers and the non-refinancers.

$$\mathcal{L}(\beta, \delta, \varphi | x_i) = \left(\prod_{refi_i=1} (1 - w_i)\Lambda(e^\beta I(x_i, \varphi)) \right) \left(\prod_{refi_i=0} w_i + (1 - w_i)\Lambda(-e^\beta I(x_i, \varphi)) \right)$$

To estimate the model, we first calibrate certain parameters following Andersen et al. (2020) and estimate several parameters likely to be different in the Irish context. See Table 7 for details. The maximum likelihood estimates $\left(\hat{\beta}, \hat{\delta}, \hat{\varphi}\right)$ maximize the log of this likelihood function. These parameters estimate the importance β of the refinancing incentive, the importance δ of the covariates in shifting attention, and the importance φ of the covariates in determining private refinancing costs. Estimating this model in our setting with exogenous treatment variables corresponding to the reminder arm allows us to characterize how valuable a given treatment is at cueing consumer attention versus changing their refinancing threshold.

Table 8 reports estimates of this model using Maximum Likelihood along with robust standard errors. In column 1, we essentially constrain the model to follow only the ADL model of refinancing without any fixed cost of refinancing or possibility of borrower inattention. In this specification, we estimate a very low β such that the coefficient $\exp(\beta)$ is approximately 0 such that without allowing for fixed costs of refinancing or inattention, it appears as though borrowers are completely insensitive to the incentive to refinance. Start-

ing in column 2, we allow for there to be a fixed cost of refinancing γ_0 such that borrowers refinance when their expected gain from refinancing (including their logit private shock to refinancing costs) exceeds this threshold. Once we allow for these unobserved refinancing costs with γ_0, estimates of β increase significantly. The estimates of β in columns 2-5 imply that a 10 bp decrease in rates increases refinancing conditional on being attentive by approximately 50 bp.

The implied estimate of fixed costs in column 2, which does not allow for attention effects, the implied estimate of the fixed cost of refinancing is implausibly high ($\exp(\gamma_0) \approx$ €514,000). Even allowing for the interpretation of this fixed cost to include the psychological, time, and hassle costs of refinancing, the large estimates are perhaps more consistent with mortgage borrower inattention, which the specification in column 2 is constrained to attribute to borrowers being insensitive to the incentive to refinance as them behaving as if their costs of refinancing were incredibly high. When we allow for attention effects in column 2, the fixed cost parameter is reduced substantially, from 13.2 to 6.4, demonstrating how allowing for a certain fraction of mortgage borrowers to be inattentive to refinancing improves the model's fit of the data. The estimate of γ_0 in column 2 implies a cost of refinancing of approximately €620.

The estimate of the probability of being inattentive is $\Lambda(\delta_0) \approx 78\%$ in column 3. Although consistent with a substantial likelihood of being inattentive, this estimate pools the control group and the treatment group. Columns 4 and 5 allow mortgage borrowers who received disclosure letters with design improvements and those that additionally received follow-up reminder letters 4-6 weeks later to have different levels of attention. The estimates in column 4 imply that the treatment letters decreased inattention by 6 percentage points and the reminder letters decreased inattention by an additional 10 percentage points. The fixed cost estimate increases when we allow for treatment effects on inattention, with the estimate of γ_0 in column 4 implying a €6,000 cost of refinancing. This higher cost of refinancing in column 4 than column 3 suggests that the specification in column 3 was misattributing some of the more responsive refinancing of the treatment groups to having a lower cost of refinancing. Once allowing for the treatment groups to have lower inattention in column 5, it is clear that the control group still behaves as if they have high costs of refinancing, consistent with overall pessimistic beliefs about the time and effort required to refinance a mortgage (CBI, 2017). Column 5 adds controls that allow for heterogeneity in refinancing costs along observable dimensions to test whether certain groups have stronger inertia. The estimates of the treatment effects on attention and the fixed cost estimates are similar to column 4, with refinancing inertia in age, first-time homebuyer status, and decreasing in Covid-19 forbearance. Overall, the redesigned disclosure treatment and subsequent follow-

up reminder decrease the probability of being inattentive by 20 percentage points from 76% to 56%.

The estimates are consistent with the reminders having a large effect on refinancing by increasing the probability that a given borrower is attentive. Reconciling the nontrivial effects of the treatments without reminders on inattention in Table 8 with the more modest effects in Figure 2, recall that the total effect of the treatment on refinancing is the increase in the probability of attending to the task of refinancing times the probability of refinancing for a given refinancing incentive conditional on paying attention. Because this second term is low, the total effect of improving attention by a few percentage points is still somewhat muted, consistent with the modest implied fixed cost of refinancing γ_0 in columns 2-4.

We use our estimates of the model to measure the relative effectiveness of cutting interest rates (which increases the refinancing incentive I by lowering r^{new}) versus sending a reminder as effective as our field experiment reminders that increased w_i. This exercise is particularly policy relevant when monetary policy is de facto constrained by a Zero Lower Bound, complicating efforts to decrease interest rates through conventional monetary policy. Counterfactual estimates suggest that there is significant scope for direct-to-household communication from the central bank in the form of reminder notices to provide monetary stimulus by spurring refinancing. When the average incentive to refinance is approximately 0, reminders increase refinancing by 7 percentage points. However, reminders and lower interest rates are complementary. When the average incentive to refinance is 100 bp, reminders increase refinancing by 8-12 percentage points.

We can further use the model to estimate the size of the decrease in mortgage interest rates needed to induce the same amount of refinancing as a reminder letter. When the average incentive to refinance is roughly zero, mortgage interest rates would have to fall by 200 bp to generate the same amount of refinancing. Furthermore, we note that decreasing *mortgage* rates by 200 bp is more challenging than decreasing monetary policy rates by a set amount, especially given the limited pass-through from ECB policy rates to mortgage interest rates in Ireland and the apparent lower bounds on nominal policy rates.

7 Conclusion

In this paper we report encouraging results that illustrate the potential to deliver significant and meaningful impacts on consumer engagement by way of small changes to an existing financial disclosure. We find that our enhanced package of disclosure measures are successful in prompting engagement among mortgage customers. Decomposing the mechanisms of greatest impact, we find that a follow-up reminder communication is especially worthwhile:

those who additionally received a reminder after the initial communication engaged with the beneficial refinancing opportunities in greater numbers. Our best combination of treatments yielded a 74 per cent increase in the probability that a borrower refinanced to a lower available interest rate. On a standalone basis without the complementary boost of a reminder notification, we find that gain-framed personalized savings deliver the strongest impact on refinancing probability, an increase of 36 per cent. Future work could explore whether professional marketing experts could improve upon the simple design enhancements we tested here.

Our estimates show that average 12-month savings realized on mortgages that did take up a refinancing option was €1,217, and that if our results were replicated in wider population of outstanding variable rate mortgages in Ireland, it would yield an additional 15,360 refinanced mortgages in the year, resulting in millions of euros of reduced debt repayment burdens for mortgage holders. Using the MPC out of interest savings identified among U.S. mortgage borrowers by Di Maggio et al. (2017) of 0.75, we estimate that refinancing households increased their consumption by €913. Averaged across all households receiving a reminder letter, this suggests that the redesigned disclosure letter and accompanying reminder increase consumption by an expected €64 per household. Conservatively assuming that the redesigned disclosure and reminder letter cost €0.50 to produce and deliver, this implies a cost-effectiveness measure of €128 for every €1 spent on communication to households about the opportunity to refinance.

Preliminary estimates of the Andersen et al. (2020) model of inattentive refinancing suggest that the reminder disclosures had large effects precisely because they increased the probability that a given consumer was attentive to the task of refinancing. Using our model estimates to simulate counterfactuals, we find that central bank communication to consumers reminding them of refinancing opportunities has significant potential to be an effective monetary policy tool to complement or substitute for lowering rates.

Several caveats apply to our estimates. Repeated reminders may be more or less effective than the one-shot reminder we studied here. Repeated reminders may lose their salience if households learn to rely on them instead of proactively acquiring their own information on refinancing activities, and as the households with the largest incentive to refinance or the lowest cost of attention to refinancing attrit from the sample of mortgage borrowers with large refinancing incentives, the effect of an additional reminder may decrease. However, it's also possible that as consumers become attuned to reminder letters, they trust them more and their refinancing spills over through peer effects and social learning. We also note that reminders are more effective when rates have fallen and may not be as successful in a rising rate environment. However, generally speaking, policymakers are generally not keen

to stimulate refinancing in such an environment anyway. The treatment effects we study here are likely to be more effective when the status-quo disclosure letter is less transparent to begin with. Streamlining, personalizing, simplifying, and highlighting are more valuable in the context of confusing, onerous, and overly detailed disclosures. The success of the communication also depends on the trust households place in the discloser. It may be advantageous for the communication to be sent directly by a government agency or central bank than from a for-profit bank, although emphasizing that the letter itself is mandated could help. Finally, it's possible that the need for reminders would decrease in equilibrium if more attentive refinancing led banks to decrease the spread between their offered variable rates and policy rates in the first place.

Overall, our results can be read in the context of a growing body of evidence that demonstrates the value of behaviorally informed approaches in delivering effective consumer protection in essential product markets. However, they are the first of their kind to demonstrate statistically and economically meaningful improvements in the stubbornly persistent puzzle of low take up of advantageous mortgage refinancing opportunities.

References

Adams, Paul, Stefan Hunt, Christopher Palmer, and Redis Zaliauskas, "Testing the effectiveness of consumer financial disclosure: Experimental evidence from savings accounts," *Journal of Financial Economics*, 2021, *141* (1), 122–147.

_ , _ , Laura Smart, and Redis Zaliauskas, "Stimulating interest: Reminding savers to act when rates decrease," *FCA Occasional Paper*, 2015, (7).

Agarwal, Sumit, John C Driscoll, and David I Laibson, "Optimal mortgage refinancing: a closed-form solution," *Journal of Money, Credit and Banking*, 2013, *45* (4), 591–622.

Aghion, Philippe and Patrick Bolton, "Contracts as a Barrier to Entry," *The American economic review*, 1987, pp. 388–401.

Altavilla, Carlo, Fabio Canova, and Matteo Ciccarelli, "Mending the broken link: Heterogeneous bank lending rates and monetary policy pass-through," *Journal of Monetary Economics*, 2020, *110*, 81–98.

Amromin, Gene, Neil Bhutta, and Benjamin J. Keys, "Refinancing, Monetary Policy, and the Credit Cycle," *Annual Review of Financial Economics*, 2020, *12* (1), 67–93.

Andersen, Steffen, John Y Campbell, Kasper Meisner Nielsen, and Tarun Ramadorai, "Sources of inaction in household finance: Evidence from the Danish mortgage market," *American Economic Review*, 2020, *110* (10), 3184–3230.

Andrews, Peter, "Did life and pensions ldisclosuremwork as expected," *Occasional Paper Series*, 2009, (32).

Andries, Natalia and Steve Billon, "Retail bank interest rate pass-through in the euro area: An empirical survey," *Economic Systems*, 2016, *40* (1), 170–194.

Australian Competition and Consumer Commission, "Residential mortgage price inquiry," 2018.

Bailey, Andrew John, "The future of financial conduct regulation," *Address given at Bloomberg London*, 2019.

Bajo, Emanuele and Massimiliano Barbi, "Financial illiteracy and mortgage refinancing decisions," *Journal of Banking & Finance*, 2018, *94*, 279–296.

Banerjee, Abhijit Vinayak, Esther Duflo, Rachel Glennerster, and Dhruva Kothari, "Improving immunisation coverage in rural India: clustered randomised controlled evaluation of immunisation campaigns with and without incentives," *British Medical Journal*, 2010, *340.*

Bar-Gill, Oren, *Seduction by contract: Law, economics, and psychology in consumer markets*, Oxford University Press, 2012.

Ben-Shahar, Omri and Carl E Schneider, *More than you wanted to know*, Princeton University Press, 2014.

Blinder, Alan S, Michael Ehrmann, Marcel Fratzscher, Jakob De Haan, and David-Jan Jansen, "Central bank communication and monetary policy: A survey of theory and evidence," *Journal of economic literature*, 2008, *46* (4), 910–45.

Bondt, Gabe De, "Retail bank interest rate pass-through: new evidence at the euro area level," *Available at SSRN 357380*, 2002.

Campbell, John Y, "Household finance," *The Journal of Finance*, 2006, *61* (4), 1553–1604.

Central Bank of Ireland, "Addendum to the Consumer Protection Code 2012," Technical Report July 2016.

_ , "Addendum to the Consumer Protection Code 2012," Technical Report July 2017.

_ , "Addendum to the Consumer Protection Code 2012," Technical Report December 2017.

_ , "Mortgage Switching Research," Technical Report April 2017.

Central Statistics Office, "Household Finance and Consumption Survey 2018," Technical Report 2020.

Cloyne, James, Clodomiro Ferreira, and Paolo Surico, "Monetary policy when households have debt: new evidence on the transmission mechanism," *The Review of Economic Studies*, 2020, *87* (1), 102–129.

Dell'Ariccia, Giovanni, Pau Rabanal, and Damiano Sandri, "Unconventional monetary policies in the euro area, Japan, and the United Kingdom," *Journal of Economic Perspectives*, 2018, *32* (4), 147–72.

Devine, Kenneth, Sarah Frost, Rory McElligott et al., "Switch and save in the Irish mortgage market," Technical Report, Central Bank of Ireland 2015.

Di Maggio, Marco, Amir Kermani, and Christopher J Palmer, "How quantitative easing works: Evidence on the refinancing channel," *The Review of Economic Studies*, 2020, *87* (3), 1498–1528.

Duke, Charlotte, Steffen Huck, Zanna Iscenko, and Brian Wallace, "How Does Selling Insurance As an Add-On Affect Consumer Decisions? A Practical Application of Behavioural Experiments in Financial Regulation," *FCA Occasional Paper*, 2014, (3).

Ehrmann, Michael, Sarah Holton, Danielle Kedan, and Gillian Phelan, "Monetary policy communication: perspectives from former policy makers at the ECB," 2021.

Eurobarometer, "Retail Financial Services," Technical Report 373, Special Eurobarometer Report 2012.

Eurobarometer, "Financial Products and Services," Technical Report 446, Special Eurobarometer Report 2016.

European Commission, "Green paper on retail financial services: Better products, more choice, and greater opportunities for consumers and businesses," Technical Report 2015.

_ , "Study on switching of financial services and products – Final Report," Technical Report, Directorate-General for Financial Stability, Financial Services and Capital Markets Union 2019.

Farrell, Joseph and Paul Klemperer, "Coordination and lock-in: Competition with switching costs and network effects," *Handbook of industrial organization*, 2007, *3*, 1967–2072.

Financial Conduct Authority, "Increasing consumer engagement in the annuities market: can prompts raise shopping around?," Technical Report 2016.

_ , "Mortgages market study: Final report," Technical Report 2019.

Finkelstein, Amy, "E-ztax: Tax salience and tax rates," *The Quarterly Journal of Economics*, 2009, *124* (3), 969–1010.

Gabaix, Xavier and David Laibson, "Shrouded attributes, consumer myopia, and information suppression in competitive markets," *The Quarterly Journal of Economics*, 2006, *121* (2), 505–540.

Genakos, Christos, Costas Roumanias, and Tommaso Valletti, "Loss aversion on the phone," 2015.

Gennaioli, Nicola, Andrei Shleifer, and Robert Vishny, "Neglected risks, financial innovation, and financial fragility," *Journal of Financial Economics*, 2012, *104* (3), 452–468.

Gerardi, Kristopher, Lorenz Goette, and Stephan Meier, "Numerical ability predicts mortgage default," *Proceedings of the National Academy of Sciences*, 2013, *110* (28), 11267–11271.

Giordana, Gastón and Michael Ziegelmeyer, "Stress testing household balance sheets in Luxembourg," *The Quarterly Review of Economics and Finance*, 2020, *76*, 115–138.

Glennerster, Rachel and Kudzai Takavarasha, *Running randomized evaluations*, Princeton University Press, 2013.

Greenwald, Daniel L., "The Mortgage Credit Channel of Macroeconomic Transmission," 2018. MIT Sloan Research Paper No. 5184-16.

Haldane, Andrew and Michael McMahon, "Central bank communications and the general public," in "AEA papers and proceedings," Vol. 108 2018, pp. 578–83.

Harold, Jason, John Cullinan, Seán Lyons et al., "Stick or switch? Consumer switching in 14 retail markets across Europe," Technical Report 2019.

Johnson, Eric J, Stephan Meier, and Olivier Toubia, "What's the catch? Suspicion of bank motives and sluggish refinancing," *The Review of Financial Studies*, 2019, *32* (2), 467–495.

Kell, Peter, "ASIC and behavioural economics: Regulating for real people," 2016. Address given at The Impacts of Behavioural Economics on Financial Markets and Regulations Symposium.

Kennedy, Sean, "Survey of SME Taxpayers 2013," Technical Report, Irish Government Economic and Evaluation Service 2013.

_ , Gerry McGuinness, and Martina Shirran, "Survey of PAYE Taxpayers 2015," Technical Report, Irish Government Economic and Evaluation Service 2015.

Keys, Benjamin J, Devin G Pope, and Jaren C Pope, "Failure to refinance," *Journal of Financial Economics*, 2016, *122* (3), 482–499.

Kobayashi, Teruyoshi, "Incomplete interest rate pass-through and optimal monetary policy," *Fourteenth issue (September 2008) of the International Journal of Central Banking*, 2018.

Lamla, M. and D. Vinogradov, "Central bank announcement :Big news for little people?," *Journal of Monetary Economics*, 2019, *108*, 21–38.

Lee, Jinkook and Jeanne M Hogarth, "Consumer information search for home mortgages: who, what, how much, and what else?," *Financial Services Review*, 2000, *9* (3), 277–293.

Lunn, Pete, Marek Bohacek, Jason Somerville, Aine Ni Choisdealbha, Feidhlim McGowan et al., "Price Lab: An investigation of consumers' capabilities with complex products," *Economic and Social Research Institute (ESRI) Research Series*, 2016.

Lunn, Peter D and Sean Lyons, "Consumer switching intentions for telecoms services: evidence from Ireland," *Heliyon*, 2018, *4* (5), e00618.

Lusardi, Annamaria and Olivia S Mitchell, "Financial literacy and retirement planning: New evidence from the Rand American Life Panel," *Michigan Retirement Research Center Research Paper No. WP*, 2007, *157*.

Madrian, Brigitte C and Dennis F Shea, "The power of suggestion: Inertia in 401 (k) participation and savings behavior," *The Quarterly journal of economics*, 2001, *116* (4), 1149–1187.

McCarthy, Yvonne, "Behavioural characteristics and financial distress," *European Central Bank*, 2011.

McKay, A., E. Nakamura, and J. Steinsson, "The power of forward guidance revisited," *American Economic Review*, 2016, *106* (10), 3133–58.

Miranda-Agrippino, Silvia and Giovanni Ricco, "The transmission of monetary policy shocks," *American Economic Journal: Macroeconomics*, 2021, *13* (3), 74–107.

Oxera, "Increasing consumer engagement in the annuities market: can prompts raise shopping around?," Technical Report 2016.

Pariès, Matthieu Darracq, Diego Moccero, Elizaveta Krylova, and Claudia Marchini, "The retail bank interest rate pass-through: The case of the euro area during the financial and sovereign debt crisis," *ECB Occasional Paper*, 2014, (155).

Rooij, Maarten CJ Van, Annamaria Lusardi, and Rob JM Alessie, "Financial literacy, retirement planning and household wealth," *The Economic Journal*, 2012, *122* (560), 449–478.

Shcherbakov, Oleksandr, "Measuring consumer switching costs in the television industry," *The RAND Journal of Economics*, 2016, *47* (2), 366–393.

Sørensen, Christoffer Kok and Thomas Werner, "Bank interest rate pass-through in the euro area: a cross country comparison," Technical Report, ECB working paper 2006.

Sunstein, Cass R, "The storrs lectures: behavioral economics and paternalism," *Yale LJ*, 2012, *122*, 1826.

Team, Behavioural Insights, "EAST: Four Simple Ways to Apply Behavioural Insights," 2014.

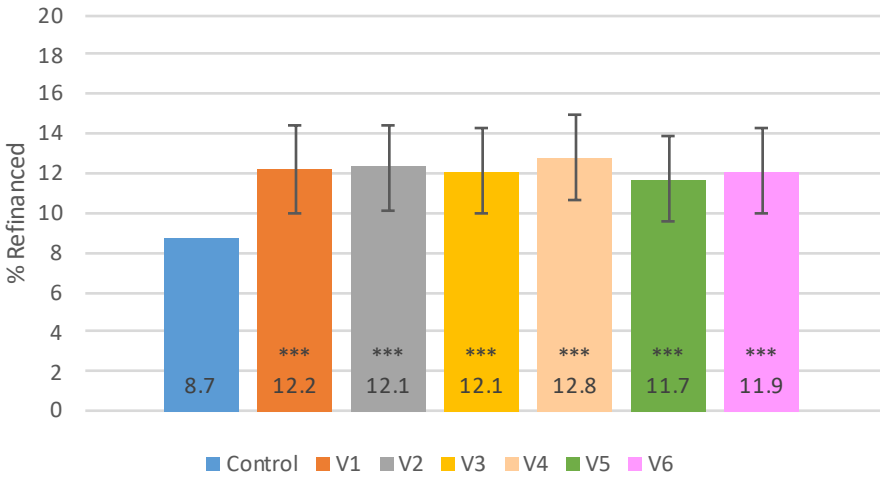
Wang, Jialan and Kathleen Burke, "The effects of disclosure and enforcement on payday lending in Texas," *Journal of Financial Economics*, 2022, *145* (2, Part B), 489–507.

Wheatley, Martin, "Making competition king–the rise of behavioural economics at the FCA," *Address given at the Australian Securities and Investments Commission*, 2014.

Yang, Yingkui, "Understanding household switching behavior in the retail electricity market," *Energy policy*, 2014, *69*, 406–414.

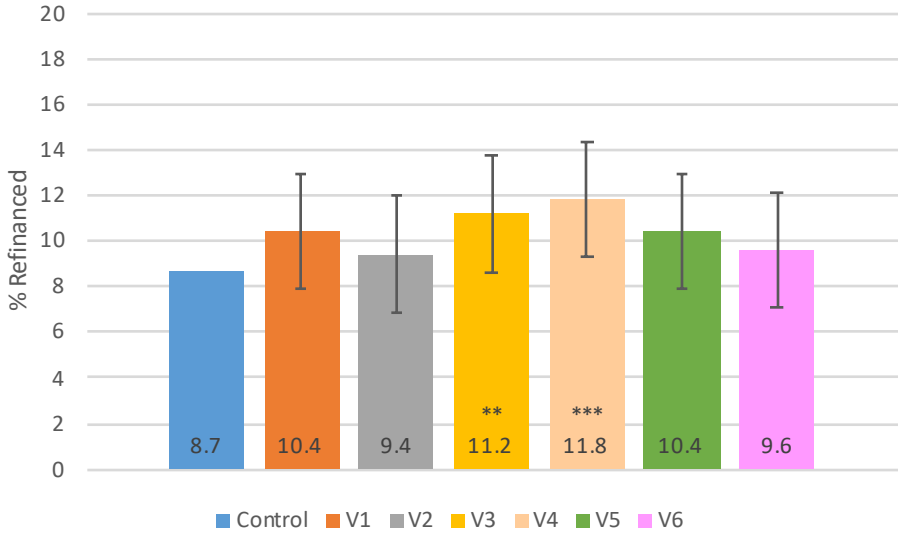
Yin, Wei and Kent Matthews, "The determinants and profitability of switching costs in Chinese banking," *Applied economics*, 2016, *48* (43), 4156–4166.

Figure 1: Refinancing Rates by Treatment Arm



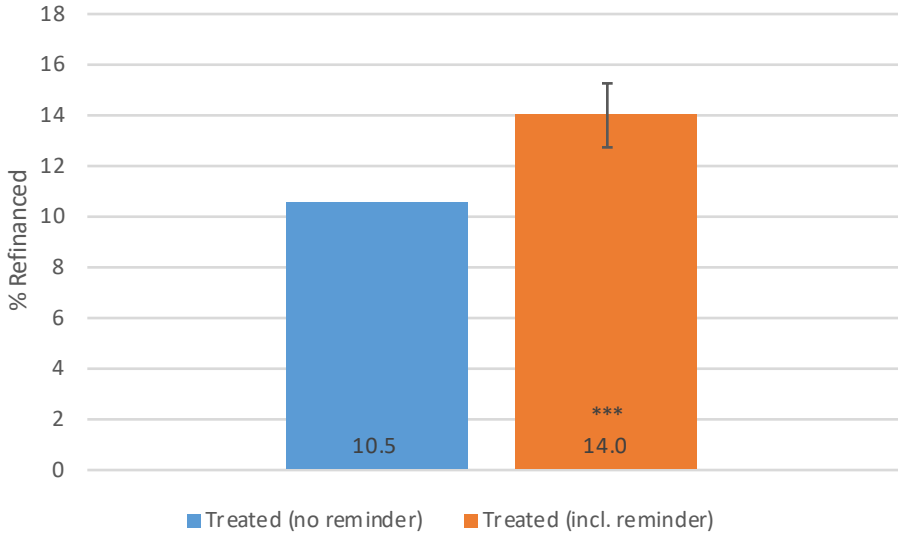
Notes: Figure plots refinancing rates by treatment arm, unconditional on whether a borrower received a reminder. Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that a given treatment group's refinancing rate was equal to the control-group refinancing rate. *** p<0.01, ** p<0.05, * p<0.1.

Figure 2: Refinancing Rates by Treatment Arm: No Reminder Sample



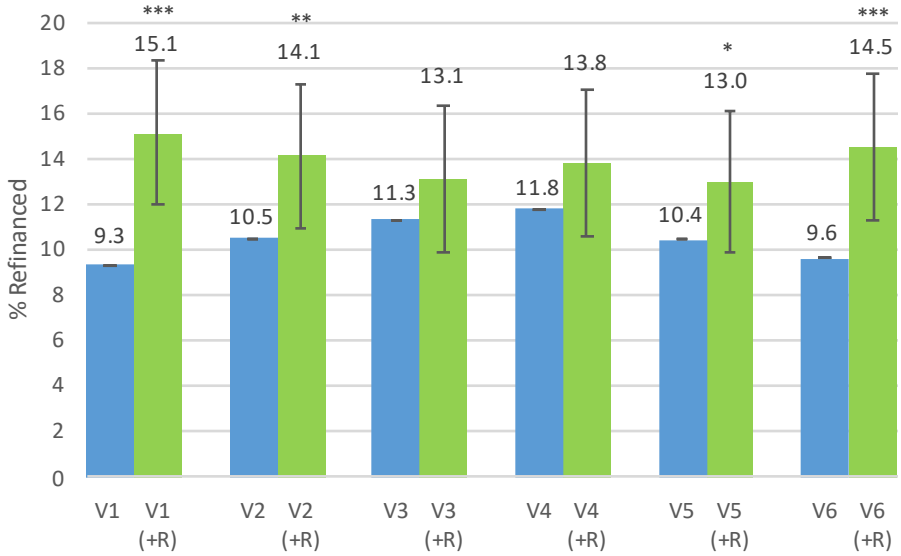
Notes: Figure plots refinancing rates by treatment arm for the subset of the sample that did not receive a reminder letter. Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that a given treatment group's refinancing rate was equal to the control-group refinancing rate. *** p<0.01, ** p<0.05, * p<0.1.

Figure 3: Average Treated Refinancing Rates by Reminder Status



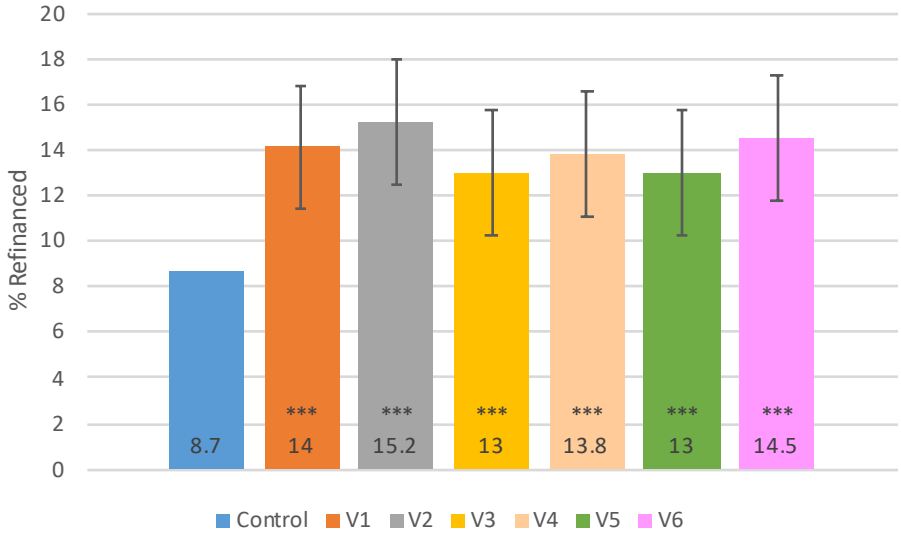
Notes: Figure plots average refinancing rates for treated borrowers who did not (left-hand bar) and did (right-hand bar) receive a follow-up reminder letter. Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that the average treated borrower with a reminder letter was more likely than the average treated borrower without a reminder letter to refinance. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 4: Refinancing Rates by Treatment Arm and Reminder Status



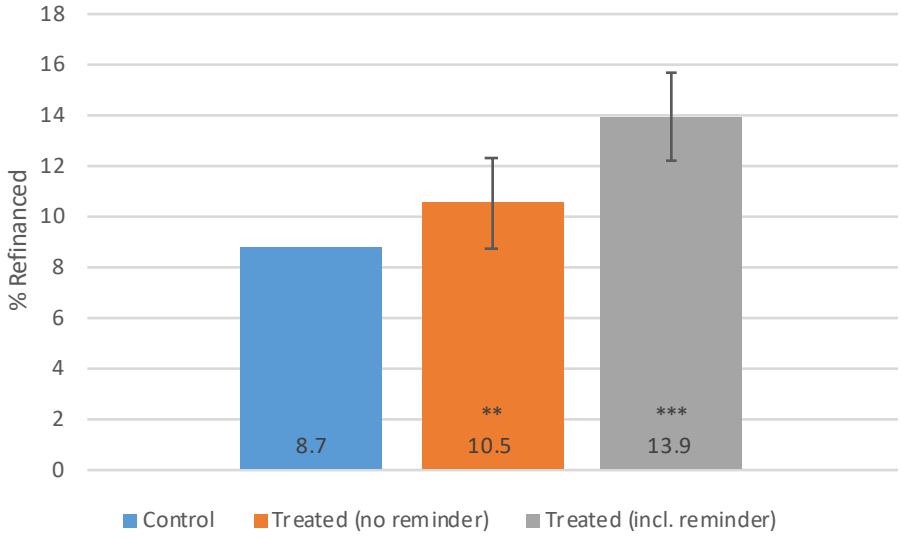
Notes: Figure plots average refinancing rates for treated borrowers by treatment group and by reminder status. Green bars plot treatment effects for borrowers receiving the given treatment arm and a follow-up reminder letter. Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that the refinancing rate for a given treatment group's average borrower was equal for the reminder and non-reminder group. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Figure 5: Refinancing Rates by Treatment Arm: Reminder Sample



Notes: Figure plots refinancing rates by treatment arm for the subset of the sample that did receive a reminder letter. Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that a given treatment group's refinancing rate was equal to the control-group refinancing rate. *** p<0.01, ** p<0.05, * p<0.1.

Figure 6: Average Refinancing Rates by Treatment Status and Reminder Status



Notes: Figure plots average refinancing rates for control-group borrowers (blue), treated borrowers who did not receive a follow-up reminder letter (orange), treated borrowers who did receive a follow-up reminder letter (gray). Brackets denote 95% confidence intervals. Asterisks correspond to p-values for a test that the average treated borrower with the indicated reminder status was more likely than the average control-group borrower to refinance. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 1: Treatment arms overview

Versions	Design format	Reference code
Control	Existing standard	C
Version 1	Neutral-framed personalized savings estimates (quiet salutation)	V1 (Pers)
Version 2	Neutral-framed personalized savings estimates (quiet salutation) in Color	V2 (Pers-Col)
Version 3	Neutral-framed personalized savings estimates and prominent subject line (PSL)	V3 (Pers-Prom)
Version 4	Gain-framed personalized savings estimates with PSL	V4 (Pers-Gain)
Version 5	Loss-framed personalized savings estimates with PSL	V5 (Pers-Loss)
Version 6	Loss-framed personalized savings estimates with clarified process box with PSL	V6 (Pers-Loss-Box)
Reminder	50 per cent of all groups above (excl. Control) additionally receive a reminder communication at +4-6 weeks	R

Table 3: Test of Covariate Balance by Treatment

Treatment group	V1	V2	V3	V4	V5	V6
Dublin	0.011	-0.004	-0.014	0.018	-0.011	-0.020
	(0.023)	(0.023)	(0.023)	(0.022)	(0.023)	(0.023)
Borrower age	0.000	-0.002	-0.000	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
First Time Buyer	0.009	0.002	0.004	0.009	-0.017	-0.002
	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)	(0.020)
Mortgage balance	-0.000*	-0.000	0.000	-0.000	0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Interest rate (outset)	-6.917	-0.561	2.169	0.409	2.665	-3.390
	(4.912)	(4.871)	(4.807)	(4.902)	(4.490)	(4.931)
Years to maturity	-0.003**	-0.004***	-0.003*	-0.002	-0.004**	-0.003**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.001)	(0.002)
1-Year savings	0.066**	0.016	-0.002	0.017	0.004	0.032
	(0.030)	(0.030)	(0.027)	(0.030)	(0.024)	(0.031)
Arrears	-0.034	-0.015	-0.094	0.020	0.068	0.035
	(0.055)	(0.054)	(0.058)	(0.052)	(0.050)	(0.052)
Covid-19 forbearance	-0.054*	-0.015	-0.064**	0.003	0.007	-0.011
	(0.032)	(0.031)	(0.032)	(0.031)	(0.031)	(0.031)
Constant	0.809***	0.683***	0.458**	0.496**	0.503**	0.713***
	(0.219)	(0.221)	(0.217)	(0.220)	(0.206)	(0.222)
Observations	3,287	3,320	3,293	3,340	3,306	3,281
R-squared	0.004	0.003	0.003	0.002	0.003	0.002

Notes: Table shows regression results of a pairwise regression of treatment status (control vs. each of our treatment groups) on a vector of covariates. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 2: Descriptive statistics across treatment cells

Group	Control	V1	V2	V3	V4	V5	V6	Treated (no reminder)	Treated (with reminder)	Market (variable rate)	Market (excl. tracker)	Market (all)
Dublin	0.20	0.20	0.19	0.19	0.21	0.19	0.19	0.19	0.20	0.27	0.30	0.28
	(0.40)	(0.40)	(0.39)	(0.39)	(0.41)	(0.39)	(0.39)	(0.39)	(0.40)	(0.44)	(0.46)	(0.45)
Borrower age	49.83	50.31	49.88	50.12	50.25	50.10	50.01	50.17	50.05	49.14	46.86	48.32
	(9.23)	(9.38)	(9.20)	(9.27)	(9.62)	(9.25)	(9.37)	(9.41)	(9.29)	(9.89)	(9.90)	(9.64)
First Time Buyer	0.41	0.40	0.40	0.40	0.40	0.39	0.40	0.41	0.39	0.39	0.44	0.38
	(0.49)	(0.49)	(0.49)	(0. .49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.49)	(0.50)	(0.49)
Mortgage balance	84,212	82,612	81,356	82,566	82,557	83,662	84,607	82,185	83,587	104,224	134,125	130,693
	(84,141)	(91,266)	(81,633)	(91,561)	(92,633)	(100,995)	(90,319)	(89,348)	(93,700)	(96,368)	(113,355)	(116,096)
Interest rate (outset)	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.042	0.037	0.034	0.026
	(0.003)	(0.002)	(0.002)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)	(0.002)	(0.007)	(0.007)	(0.01)
Years to maturity	13.82	13.16	13.13	13.25	13.28	13.13	13.34	13.18	13.25	14.65	17.21	15.97
	(8.53)	(8.52)	(8.46)	(8.45)	(8.49)	(8.42)	(8.44)	(8.45)	(8.47)	(8.80)	(9.11)	(8.61)
1-Year savings	1,057	1,056	1,028	1,037	1,046	1,056	1,069	1,044	1,054	1,033.51	841	-58.83
	(1,014)	(1,181)	(1,014)	(1,148)	(1,122)	(1,225)	(1,112)	(1,144)	(1,126)	(1,176.82)	(1,041)	(1,983)
Arrears	0.03	0.03	0.03	0.02	0.03	0.04	0.03	0.03	0.03	0.05	0.03	0.04
	(0.16)	(0.16)	(0.16)	(0 .14)	(0. 17)	(0.19)	(0.18)	(0.16)	(0.17)	(0.22)	(0.17)	(0.19)
Covid-19 forbearance	0.09	0.07	0.08	0.07	0.09	0.09	0.09	0.08	0.08	0.12^	0.12^	0.13^
	(0.28)	(0.26)	(0.28)	(0.26)	(0.29)	(0.29)	(0.28)	(0.27)	(0.28)	(0.32)	(0.33)	(0.34)
Observations	1,659	1,628	1,661	1,634	1,681	1,647	1,622	4,931	4,942	220,299	359,829	572,189

Notes: The table reports means and standard deviations in parentheses of mortgage borrower characteristics in each treatment and control group. Dublin is an indicator for whether the mortgaged property is located in Dublin. Borrower age of the oldest borrower on the mortgage. First-time buyer indicates whether the borrower is a first time-buyer. Mortgage balance is amount outstanding on loan at the time of experiment in euros. Interest rate is the interest rate applicable on the loan at the outset of the experiment. 1-year savings is the amount in euros of savings available to the borrower in the first year after refinancing to the best available rate. Covid forbearance indicates whether the borrower was using Covid-19 payment break (introduced in Ireland in March 2020 to alleviate short-term liquidity constraints faced by borrowers experiencing financial difficulties due to the impact of the pandemic). Arrears is an indicator for whether the mortgage is 90 days past due at the outset of the experiment. ∧ Covid-19 forbearance shares for the 'market' comparisons are measured from loan-level data collected by the Central Bank of Ireland as at June 2021, while all other variables are measured at the outset of the field trial.

Table 4: Main regression results (unconditional on reminder status)

	(1)	(2)	(3)
V1 (Pers)	0.035***	0.040***	0.039***
	(0.011)	(0.011)	(0.011)
V2 (Pers-Col)	0.036***	0.040***	0.040***
	(0.011)	(0.011)	(0.011)
V3(Pers-Prom)	0.034***	0.038***	0.037***
	(0.011)	(0.011)	(0.011)
V4 (Pers-Gain)	0.041***	0.044***	0.044***
	(0.011)	(0.011)	(0.011)
V5 (Pers-Loss)	0.030***	0.034***	0.034***
	(0.011)	(0.011)	(0.011)
V6 (Pers-Loss-Box)	0.034***	0.036***	0.036***
	(0.011)	(0.011)	(0.011)
Years to maturity		0.006***	0.005***
		(0.000)	(0.000)
Covid-19 forbearance			0.036***
			(0.011)
Borrower age			0.000
			(0.000)
Payment type			0.007
			(0.026)
Arrears			-0.106***
			(0.018)
1-Year savings (€000s)			0.021***
			(0.003)
Constant	0.087***	0.001	-0.042
	(0.008)	(0.009)	(0.060)
Treatment effect equality p-value	0.007	0.001	0.001
Observations	11,538	11,559	11,538
R-squared	0.002	0.029	0.036

Notes: Treatment effects are measured relative to a base category which is the Control group. Column 1 evaluates treatment effects without any additional controls, while columns 2 and 3 add controls where we find minor evidence of statistical difference in our balance analysis from Table 3. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 5: Treatment Effect Heterogeneity

Treatment Group	V1	V2	V3	V4	V5	V6
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment Indicator	-0.001	0.002	0.022	0.021	0.018	0.011
	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)	(0.018)
Treatment ×						
First Time Buyer	0.028	0.034	0.008	0.051**	0.018	0.005
	(0.023)	(0.022)	(0.023)	(0.023)	(0.022)	(0.022)
Loan Balance (€50,000-100,000)	0.049	0.068	0.065	0.043	0.057	-0.013
	(0.045)	(0.045)	(0.047)	(0.046)	(0.045)	(0.046)
Loan Balance (>€100,000)	0.004	0.094*	0.074	0.014	0.063	-0.030
	(0.056)	(0.056)	(0.058)	(0.057)	(0.055)	(0.056)
1-Year Savings (€500-1000)	0.012	0.000	-0.006	-0.027	-0.038	0.027
	(0.041)	(0.041)	(0.042)	(0.041)	(0.041)	(0.041)
1-Year Savings (>€1000)	0.025	-0.063	-0.067	-0.023	-0.038	0.075
	(0.056)	(0.056)	(0.058)	(0.058)	(0.056)	(0.056)
Covid-19 Forbearance	0.025	0.025	0.034	0.026	-0.014	-0.017
	(0.039)	(0.038)	(0.039)	(0.037)	(0.037)	(0.037)
First Time Buyer	-0.007	-0.007	-0.007	-0.007	-0.007	-0.007
	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)	(0.016)
Loan Balance (€50,000-100,000)	-0.031	-0.031	-0.031	-0.031	-0.031	-0.031
	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)	(0.032)
Loan Balance (>€100,000)	-0.012	-0.012	-0.012	-0.012	-0.012	-0.012
	(0.039)	(0.039)	(0.039)	(0.039)	(0.038)	(0.039)
1-Year Savings (€500-1000)	0.041	0.041	0.041	0.041	0.041	0.041
	(0.029)	(0.030)	(0.029)	(0.029)	(0.029)	(0.029)
1-Year savings (>€1000)	0.114***	0.114***	0.114***	0.114***	0.114***	0.114***
	(0.039)	(0.039)	(0.039)	(0.040)	(0.039)	(0.039)
Covid-19 Forbearance	0.023	0. 023	0. 023	0. 023	0. 023	0. 023
	(0.026)	(0.026)	(0.026)	(0.027)	(0.026)	(0.026)
Constant	0.044***	0.044***	0.044***	0.044***	0.044***	0.044***
	(0.013)	(0. 013)	(0. 013)	(0. 013)	(0. 013)	(0. 013)
Treatment effect equality p-value	0.843	0.701	0.647	0.470	0.821	0.777
Observations	3,291	3,322	3,296	3,342	3,309	3,283
R-squared	0.038	0.035	0.028	0.031	0.032	0.039

Notes: First Time Buyer interaction term is measured relative to a base category which is Second and Subsequent Buyers. Balance interaction terms are measures relative to a base category which is <€50,000. Savings interaction terms are measured relative to a base category which is <€500. P-values test whether all treatment-control interactions are jointly zero. Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 6: Treatment effects on external switching

	(1)	(2)	(3)
V1 (Pers)	0.001	0.001	0.000
	(0.006)	(0.006)	(0.006)
V2 (Pers-Col)	-0.017***	-0.017***	-0.018***
	(0.006)	(0.006)	(0.006)
V3(Pers-Prom)	0.001	0.001	-0.000
	(0.006)	(0.006)	(0.006)
V4 (Pers-Gain)	-0.007	-0.007	-0.007
	(0.006)	(0.006)	(0.006)
V5 (Pers-Loss)	0.002	0.002	0.002
	(0.006)	(0.006)	(0.006)
V6 (Pers-Loss-Box)	-0.005	-0.005	-0.005
	(0.006)	(0.006)	(0.006)
Years to maturity		0.000	-0.000
		(0.000)	(0.000)
Covid-19 forbearance			-0.028***
			(0.006)
Borrower age			-0.000*
			(0.000)
Payment type			0.006
			(0.015)
Arrears			-0.035***
			(0.010)
1-Year savings (€000s)			0.003*
			(0.002)
Constant	0.036***	0.034***	0.052
	(0.004)	(0.005)	(0.033)
Treatment effect equality p-value	0.019	0.019	0.018
Observations	11,538	11,538	11,538
R-squared	0.001	0.001	0.005

Notes: Table reports treatment effects on external switching. See notes to Table 4 for further details. *** p<0.01, ** p<0.05, * p<0.1

Table 7: Parameter Values Used in ADL Model of Optimal Refinancing.

Parameter	Name	Value	Source
Inflation	π	0.02	Average IE inflation
Real discount rate	ρ	0.05	Standard
Nominal interest rate volatility	σ	0.002	CBI monthly interest rate series
Marginal tax rate for interest deduction	τ	0	Eliminated in Ireland in 2019
Exogenous Pr(termination)	μ	0.11	Microdata from partner bank
Perceived fixed costs of refinancing (€)	κ	100	Usual cost is zero

Notes: Table reports parameter values used in the Agarwal et al. (2013) model of optimal refinancing discussed in Section 6 adapted to the Irish mortgage market context.

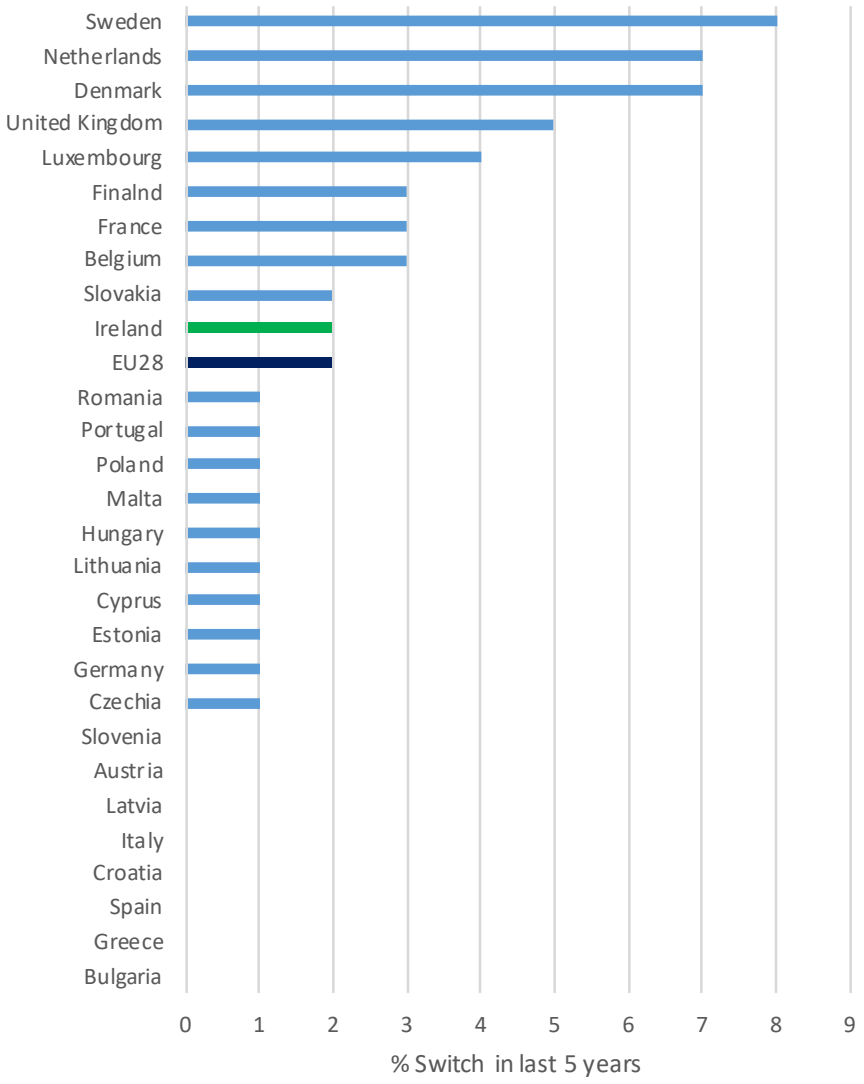
Table 8: Mixture Model Maximum Likelihood Estimates

Parameter	(1)	(2)	(3)	(4)	(5)
Incentive Sensitivity (β)	-125.48***	-1.61***	-0.23	-1.58***	-1.65***
	(1.12)	(0.01)	(0.51)	(0.05)	(0.05)
Fixed Cost of Refinancing (γ_0)		13.15***	6.43***	8.71***	8.71***
		(0.70)	(0.49)	(0.03)	(0.20)
Non-Dublin Indicator (γ_1)					0.25
					(0.18)
Age (γ_2)					0.02***
					(0.01)
First-time Homebuyer (γ_3)					0.48***
					(0.14)
Covid-19 Forbearance (γ_4)					-0.57**
					(0.25)
Inattention Constant (δ_0)			1.28***	1.13***	1.02***
			(0.19)	(0.11)	(0.12)
Treatment on Inattention (δ_1)				-0.31**	-0.33**
				(0.12)	(0.13)
Reminder on Inattention (δ_2)				-0.43***	-0.44***
				(0.08)	(0.09)
Observations	11,200	11,200	11,200	11,200	11,200

Notes: Table reports maximum likelihood estimates of the mixture model of inattentive refinancing described in the text. Incentive Sensitivity is the coefficient on the ADL refinancing incentive described in Section 6 using the parameters defined by Table 7, with coefficient $\exp(\beta)$. The fixed cost of refinancing constant γ_0 estimates an average fixed cost term to rationalize observed refinancing variable. The fixed-cost controls (γ_1-γ_4) allow for differences across groups in the estimated fixed cost of refinancing. The inattention constant δ_0 allows the inattention index in (1) to have a constant term. The inattention treatment effects allow borrowers who treated with redesigned disclosures (δ_1) and disclosure reminders (δ_2) to have different levels of attention. Age is demeaned. Covid-19 indicates whether the borrower was approved for mortgage-payment forbearance with a Covid hardship. Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

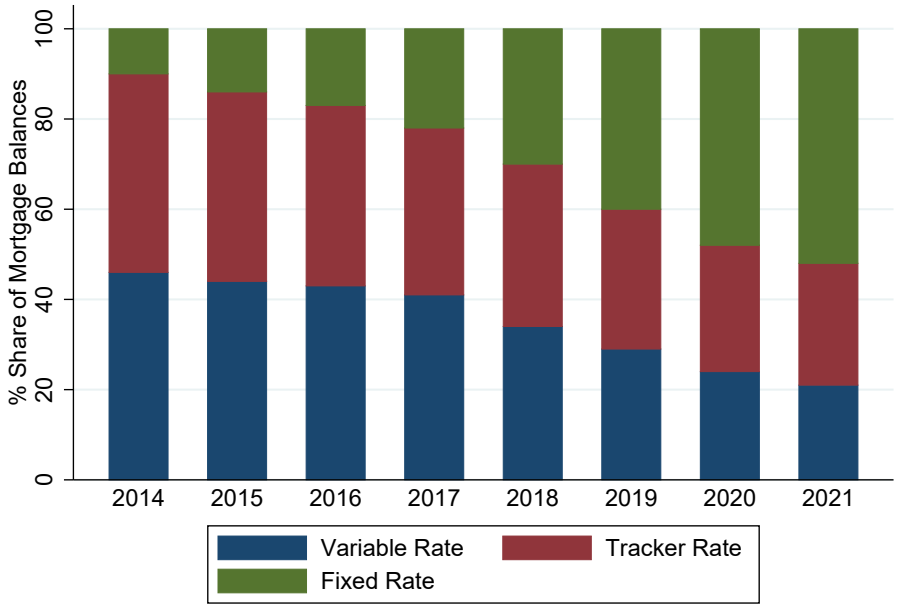
Appendix

Figure A1: In the last 5 years have you changed mortgage loan provider?



Source: Special Eurobarometer 446 (2016).

Figure A2: Mortgage Breakdown by Type



Source: Central Bank of Ireland Retail Interest Rate Statistics

Figure A3: Levels of Switching

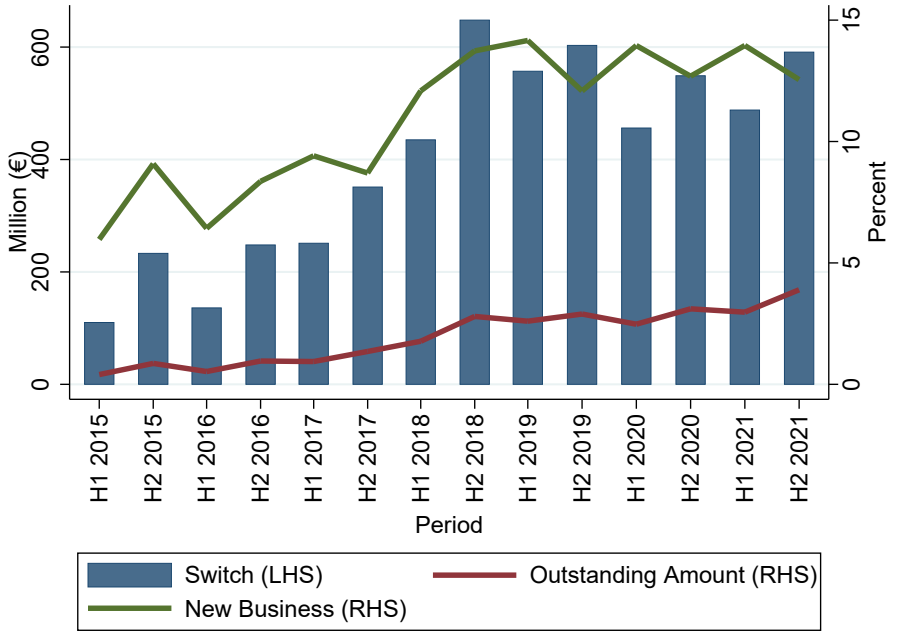


Figure A4: Example Control-Group Disclosure Letter

5 Bank Street
Monetary Road
Ireland

Phone: 01 111 1111

Mr. Joe Bloggs
123 Customer Street
Ireland

23 March 2022

Mortgage Account Number 123456789

You may be able to save money on your mortgage

Dear Joe

This letter supplements the information we sent with your annual mortgage loan statement in the leaflet called "***Information about your mortgage (You may be able to save money on your mortgage)***".

The standard variable interest rate we currently charge you on your mortgage loan is 5%.
However, we want to make sure you are getting the best deal and we may have a mortgage for you at a lower interest rate.

What rates are available?
The lowest interest rate currently available to you is a one-year fixed rate of 4%. We also offer fixed rates for periods of two, three, and five years. We explain Loan to Value at the end of this letter.

Explaining the table below
This table shows you the interest rates along with the Annual Percentage Rate of Charge (APRC). We explain APRC at the end of this letter.

Fixed interest rates

Fixed interest rate mortgages	**Loan to Value Up to 60%**	**Loan to Value 61-80%**	**Loan to Value over 80%**
1-year	4% (5% APRC)	4% (5.3% APRC)	4% (5.5% APRC)
2-year	4% (4.9% APRC)	4% (5.1% APRC)	4% (5.4% APRC)
3-year	4.1% (4.8% APRC)	4.1% (5% APRC)	4.1% (5.2% APRC)
5-year	4.1% (4.7% APRC)	4.1% (4.8% APRC)	4.1% (5% APRC)

About standard variable rates
Standard variable rates are interest rates that change based on decisions we make. They may go up,

down or stay the same. You can read our Variable Mortgage Interest Rate Policy Statement (produced by us under Provision 4.28a of the Central Bank of Ireland's Consumer Protection Code) on our website at financialinstitution.com /mortgages.

Keep checking to see if you can save money
You should keep your mortgage arrangements under review as there may be other options that could provide you with savings. You can find out more about switching your mortgage from the Competition and Consumer Protection Commission website at consumerhelp.ie/switching-mortgage.

What will it cost to move to a new rate?
You are on a standard variable rate mortgage. That means, if you are eligible, you can generally move to a new rate at no extra cost. However, sometimes we may ask you to have your home valued to show you are eligible for a lower loan-to-value interest rate where this applies. The cost to you of this valuation is about €150 but this can vary.

What to do now
You can find out more and request a new rate online at financialinstitution.com/mymortgage or by calling us on 01 111 1111.

Yours sincerely,

John Bank
Head of Mortgages

Rates quoted are effective from 20 March 2022 and are subject to change.

What does Loan to Value (LTV) mean?
Loan to Value is the amount you owe under your mortgage divided by the current value of your property and expressed as a percentage. To give you an example, if you owe €100,000 on your mortgage loan and your property is valued at €200,000, your LTV is 50%.

What is the Annual Percentage Rate of Charge (APRC)?
Annual Percentage Rate of Charge (APRC) works out the overall cost of a mortgage loan and shows it as an annual rate. It takes into account all the costs involved over the term of the loan (it assumes that you will roll onto one of our standard variable rates at the end of your fixed period). We calculate it to a standard set out in consumer protection legislation. APRC calculations are based on the cost per month on a €100,000 mortgage over 20 years. APRC includes €150 valuation fee and mortgage charge of €175 paid to the Property Registration Authority. For Buy to Let, APRC includes a fee for the Banks solicitor of €950 plus VAT at 23% plus outlay of up to €350.

WARNING: YOUR HOME IS AT RISK IF YOU DO NOT KEEP UP PAYMENTS ON A MORTGAGE OR ANY OTHER LOAN SECURED ON IT. THE PAYMENT RATES ON THIS HOUSING LOAN MAY BE ADJUSTED BY THE LENDER FROM TIME TO TIME.

Figure A5: Example Treatment-Group Disclosure Letter

Mortgage Account Number: 1234567

You may be able to save money on your mortgage

Dear John,

Your current mortgage interest rate is a standard variable rate of 4.34%. We want to make sure you are getting the best deal and we may have a lower interest rate for your mortgage.

Current monthly repayment at 4.34%:	€700
Potential monthly repayment at 2.9% fixed:	€670
Estimated difference in monthly repayments	-€30
Potential difference over the year:	-€360

- We have a range of interest rates that could save you money.
- Our lowest rate is a fixed rate of 2.9%, which could result in an immediate monthly saving to you of about €30. Over the course of a full year, that's approximately €360 in savings.
- Below, we outline the full range of interest rate options currently available, along with the next steps to take if you wish to choose one of these alternative options.

Explaining the tables below

These tables show you the interest rates along with the Annual Percentage Rate of Charge (APRC). We explain APRC at the end of this letter. The rates may vary by Loan to Value (LTV) ratio. We also explain LTV at the end of this letter.

Fixed interest rates

Fixed interest rate options	Loan to Value Up to 60%	Loan to Value 61-80%	Loan to Value over 80%	Difference in monthly repayments	Difference over the year
1-year	2.9% (3.9% APRC)	2.9% (4.2% APRC)	2.9% (4.4% APRC)	-€30	-€360
2-year	2.9% (3.8% APRC)	2.9% (4.0% APRC)	2.9% (4.3% APRC)	-€30	-€360
3-year	3% (3.7% APRC)	3% (3.9% APRC)	3% (4.1% APRC)	-€25	-€300
5-year	3.2% (3.7% APRC)	3.2% (3.8% APRC)	3.2% (4.0% APRC)	-€20	-€240
10-year	3.5% (3.7% APRC)	3.5% (3.8% APRC)		-€15	-€180
10-year			3.7% (4.0% APRC)	-€12	-€144

Figure A6: Example Reminder Letter

Mortgage Account Number: 1234567

REMINDER: You may be able to save money on your mortgage

Dear X,

We recently wrote to you about the availability of lower mortgage interest rate options and the potential for savings on your monthly mortgage repayments.

This is a reminder to take action to avail of one of these options.

If you wish to take up a lower interest rate for which you are eligible, you can go online at websiteaddress.com/mortgages, call us on 01 XXX XXXX, or visit a branch.

Yours sincerely,

Firstname Secondname
Head of Mortgages