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## Refinancing Inertia in the Irish Mortgage Market

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## **Refinancing Inertia in the Irish Mortgage Market**

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#### Abstract

Mortgage refinancing is a key household financial decision, with those who fail to refinance losing out on substantial monetary savings. Using a loan level dataset of Irish mortgages, this paper estimates that approximately 67% per cent of unconstrained borrowers did not take up a cost free refinancing offer from their financial institution when it was optimal to do so. I estimate average borrower foregone savings to be  $\in$ 5,400 over the remaining term of the mortgage. This represents a significant household financial mistake, particularly for vulnerable cohorts. I explore the role of borrower and mortgage characteristics, with the presence of financial distress acting as a primary factor in the low levels of engagement.

JEL classification: D10, D14, G21.

Keywords: Mortgages, Refinancing, Household Finance

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## Non-Technical Summary

Mortgages are one of the main financial products used by households so any decision to materially change repayment levels can have long term implications on their finances. Refinancing a mortgage, which involves changing terms within an existing provider to take advantage of more favourable interest rates, is one such decision. The failure of households to refinance has been documented across countries, with widespread evidence that mortgage holders do not engage with their financial institutions when it is optimal to do so, or even when considerable monetary savings are available.

This paper provides unique evidence on mortgage refinancing inertia through the exploration of a letter offer issued by a financial institution. The marketing letter provided a cost-free opportunity for mortgage holders to avail of a lower interest rate at their current loan to value (LTV) ratio. Using a loan level dataset of 46,000 borrowers, I show that despite no financial cost, only 33% of eligible borrowers refinanced. For those who did not take up the offer, I calculate that the average borrower would have saved €490 in the first year, or €5,400 over the remaining term of their mortgage.

The likelihood of different cohorts taking up the offer is explored, expanding on previous literature to show that both borrower and mortgage characteristics are determining factors. I find single borrowers are less likely to take up the offer, while higher levels of income, larger outstanding balances and longer remaining term are linked with positive take up. There is evidence that borrowers react to the savings on offer, as higher savings and lower LTVs are linked to a greater probability of refinancing. Lastly, financial distress, measured by the presence of mortgage arrears, is linked with reduced levels of engagement. This indicates that an adverse experience can make households less likely to engage with their borrower on other mortgage decisions. However, the degree of financial distress is a factor. I find a larger negative impact for households in longer term arrears, with the cohort in minor arrears more likely to take up the offer in the short term.

There is clear evidence that levels of engagement can be influenced based on the manner in which a financial decision is presented as mortgage holders are limited in their ability to assess the risks, and benefits, of products. The use of a letter by the financial institution is examined, with the degree of administrative steps to be overcome identified as a contributing factor to the low levels of take up. The findings of this paper support the implementation of protections linked to mortgages, including disclosures to remove complexity and improve understanding around financial products.

## **1** Introduction

The selection, and management, of a mortgage product is one of the most important financial decisions for households. As housing assets represent the majority of their balance sheets, any decision to impact long-term repayment levels will have significant implications. Residential mortgages provide households with a number of options to react to the changing interest rate environment. Mortgage refinancing is one such decision. The primary reasons for which a household would want to refinance with their current borrower is to take advantage of lower interest rates, or adjust the size of their mortgage. This action often requires not only the decision to refinance but also the process of completing the refinance with a financial institution. During this process, households are forced to contemplate a range of complicated factors when determining the optimal time to refinance. As financial institutions rarely broadcast the availability of such offers, effort is required to identify the best choice and decipher complex financial documentation. Households may be required to pay deterring upfront financial costs. While there has been significant research to date outlining the factors associated with mortgage refinancing, a limited number of large scale empirical studies exist (Johnson et al., 2019; Keys et al., 2016; Bajo and Barbi, 2018; Andersen et al., 2015).

This paper provides unique evidence on refinancing inertia by a spectrum of distressed and non-distressed borrowers through the examination of a letter offer issued by a financial institution. The issuance of this marketing letter was undertaken of the institution's own volition and it provided a cost-free opportunity for customers to avail of a lower interest rate at their current loan to value (LTV) ratio. The analysis incorporates a loan level dataset of approximately 46,000 principal dwelling household (PDH) mortgages across a two-year time horizon. The data contain information about each mortgage, including LTV ratio, outstanding balance, interest rate and arrears status. Due to these attributes, I can obtain the scale of error through calculated foregone savings. Demographic attributes linked to age, marital status and income are also captured in the data. The analysis shows a take up rate of only 33% across eligible borrowers. For those who did not take up the offer, I calculate that the average borrower would have saved €490 in the first year, or €5,400 over the remaining term of the mortgage. In total, I quantify foregone lifetime savings of €166 million by those who did not refinance.

The empirical approach presents three core findings. Firstly, I replicate the results of previous studies showing borrower and mortgage characteristics matter. I show household income, the presence of a single borrower, loan term and mortgage amount outstanding all impact the decision. Secondly, there is evidence that borrowers react to the level of savings available, with higher savings and lower LTVs linked to a greater probability of refinancing. Finally, the presence of arrears, a proxy for financial distress, reduces likelihood of take up. This shows that a negative experience can reduce engagement with borrowers over other mortgage decisions. However, the degree of financial distress is a factor. I find a larger negative impact for households in longer term arrears, with the cohort in minor arrears more likely to take up the offer in the short term.

The remainder of this paper is structured as follows: Section 2 provides an overview of the literature. Section 3 describes the data and summary statistics. Section 4 explores the levels of savings and refinancing heterogeneity, while Section 5 presents the empirical approach and results. Section 6 outlines robustness checks and Section 7 concludes.

## 2 Literature

In recent years, interest rates charged on new mortgage lending for principle dwelling homes (PDH) in Ireland tended to be lower, on average, to the equivalent rates charged on the outstanding stock (Figure 1). Existing customers are often eligible to switch their mortgage to a lower interest rate by refinancing with their current provider, or by switching to another provider, once they meet certain criteria <sup>1</sup>. Across the same period, Irish retail interest rates were some of the highest in Europe (Figure 2). A number of factors contributed to this, including the structure of the Irish economy, relatively limited competition in retail lending and the legacy of the 2008 financial crisis.<sup>2</sup> This provided households with a clear incentive to seek out the best available rates on their mortgage to minimise the repayment burden.



The failure of households to refinance is well documented across international literature. Based on administrative data from over 800,000 offers, Johnson et al. (2019) show that more than 50% of US customers do not refinance even when pre-approved, with no upfront monetary costs, and the potential to reduce average monthly payments by up to 30% of a household's annual income. A further example is shown by Keys et al. (2016), who estimate that approximately 20% of unconstrained households for whom refinancing was optimal had not done so. The median household would have saved approximately \$11,000 over the remaining life of their mortgage. Bajo and Barbi (2018) investigate an Italian mortgage market reform that allowed borrowers to refinance at no cost and find a minor uptake of only 13%. Agarwal et al. (2015) break refinancing

<sup>&</sup>lt;sup>1</sup>A clean time series of internal refinancing activity for all PDH borrowers in Ireland did not exist at the time of writing.

<sup>&</sup>lt;sup>2</sup>https://www.centralbank.ie/news/article/ blog-monetary-policy-and-interest-rates-in-ireland

mistakes down further by highlighting that not only do 52% of their sample make errors of commission (choosing the wrong rate) but 17% make errors of omission (waiting too long to refinance) and 10% commit both errors. These failures to refinance sit in in line with other financial mistakes made by households across a range of products such as pensions, insurance, payday loans and credit cards (Van Rooij et al., 2011; Choi et al., 2011; Agarwal et al., 2009; Sydnor, 2010).

A notable cohort of work has focused on the optimal time for when refinancing should occur (Stanton, 1995; Zheng et al., 2012; Hurst and Stafford, 2004; Kalotay et al., 2008; Chen and Ling, 1989). In theory, this should be when the present value of the interest saved exceeds the sum of refinancing costs. However, in the real world this requires complex calculations to identify so households may adopt simple flags to spur on the act of refinancing, such as a percentage fall in available interest rates. If a household refinances too soon and rates continue to fall then they won't reap the full reward, while if they wait too long savings are foregone as a higher interest rate is paid for an extended period. Theoretical models have been constructed to represent this, including an option-pricing model by Bennett et al. (2001) and a closed form solution by Agarwal et al. (2013). The latter has acted as a baseline for authors to define a failure to optimally refinance (Andersen et al., 2015; Gianinazzi, 2019; Keys et al., 2016).

The role of borrower demographics and financial characteristics have been shown to impact refinancing behaviours (Johnson et al., 2019; LaCour-Little, 1999; Bennett et al., 2001; Archer et al., 1997). LaCour-Little (1999) shows that the inclusion of demographic characteristics such as geographic location, household income and age in explanatory models unambiguously increases the explanatory power. Findings by Bennett et al. (2001) confirm that credit ratings have significant effects on refinancing probability, with structural change in the mortgage market increasing the propensity to refinance. Bajo and Barbi (2018) illustrate how the likelihood to refinance correlates with key mortgage and income characteristics. Unsurprisingly, they find those with greater savings to realise, larger loans and loans with a longer maturity are more likely to refinance. However, wealthier borrowers were less likely to refinance. In the Danish mortgage market, Andersen et al. (2015) highlights a widespread failure to refinance even when the potential savings are sizeable. The authors show that older households, those with lower education, income and wealth are less likely to consider refinancing.

Households in forms of financial distress, such as mortgage arrears or negative equity, tend not to refinance. This can be linked to a reluctance for lenders to renegotiate due to the risks associated with redefaulters (Adelino et al., 2013), as well as restrictive requirements around employment and liquidity constraints (DeFusco and Mondragon, 2020). However, it appears there is more at play than just neoclassical transaction costs or restrictions. Past financial experiences and trust in institutions can act as contributing factors. In Johnson et al. (2019), the authors document that traditionally cited barriers to refinancing are less important in driving refinancing decisions relative to behavioural factors such as trust in financial institutions. They show that those borrowers who are suspicious of the motives of financial institutions are less likely to engage in refinancing. Distress caused by the financial crisis had a negative impact on the relationship between mortgage holders and financial institutions in Ireland. Prominent events such as the tracker mortgage examination, in which customers were charged incorrect interest rates

and properties lost as a result of lenders failings (Central Bank of Ireland, 2019), had contributed to low levels of trust in the banking industry.<sup>3</sup>

The methods through which financial institutions communicate the availability of financial products has been explored in recent years. In particular, a focus has been placed on the psychological limitations and biases that prevent households from deciphering information relating to such products (Bakos et al., 2009; Gabaix and Laibson, 2006; Bar-Gill, 2003). Such constraints provide sellers with no incentive to promote transparency as the inefficient selection of products by households often results in higher profits or fees. The acquiring, absorption and processing of large volumes of complex information requires often unachievable time and effort so households infrequently update their perspective on products (Reis, 2006). This rationality at irregular intervals limits their ability to make time sensitive decisions during periods of inattention. Ericson (2017) outlines how present bias and limited memory can also help explain why individuals procrastinate instead of taking action by deadlines. He explains how the issuance of reminders can have both positive and negative effects on this behaviour subject to timing and anticipation.

Letters remain a primary method through which financial institutions present information on mortgages and communicate alternative products. Their structure, design and content can be adjusted by researchers to achieve different goals and test different effects (Johnson et al., 2019; Keys et al., 2016; Bertrand et al., 2010; Karlan and Zinman, 2009; Adams et al., 2015; Karlan et al., 2016). There is clear evidence that demand can be influenced through these different methods, whether it be to take up a personal loan, increase savings or refinance a mortgage. The use of framing, reminders and personalisation can all be used to encourage take up of products. However, financial institutions are also aware of letter design when targeting consumers. Ru and Schoar (2016) outline how institutions take the sophistication of their customers into account in the US credit card industry. They find that credit card terms offered to more sophisticated customers differ significantly in their format from those offered to unsophisticated customers. A degree of administrative burden can be employed by financial institutions to promote, or discourage, certain behaviours by customers through the framing of information.

This study focuses on a period in which interest rates were cut across Irish financial institutions. While a number of blanket rate cuts were provided to customers, one lender issued a product offer letter to an eligible cohort. This event is worthy of note as the letter simplified the refinancing process by eliminating financial costs and provided households with the opportunity to make significant monetary savings. Unlike other restrictive refinancing conditions, it also allowed participation by borrowers in financial distress, such as negative equity or arrears. Yet, despite this, I show that only a small portion of borrowers took up the offer.

<sup>&</sup>lt;sup>3</sup>https://eyfinancialservicesthoughtgallery.ie/consumer-banking-survey-2014/

## 3 Data

During the reference period in question, a financial institution issued a refinancing offer letter to a cohort of mortgage holders.<sup>4</sup> This offer was a one-time only opportunity for eligible customers to move from a standard variable interest rate to lower interest rates linked to current LTV ratios.<sup>5</sup> It applied to both standard variable rate and fixed rate customers who drew down their mortgage prior to a set date. The offer was only available to primary dwelling household properties. Buy-to-Let, Commercial and Tracker mortgages were all excluded. A noteworthy element was that, contrary to some traditional refinancing scenarios, mortgage holders in arrears and negative equity were also eligible to take up the offer. All eligible customers received an information booklet, which contained an application form, valuation voucher, repayment examples and terms and conditions of the offer. Customers were required to apply to move to the new rates and organise a valuation of their home using the voucher. A reminder letter was issued within nine months for those who did not avail of the initial offer. Much like Johnson et al. (2019), this refinancing decision is a simplified version of those previously stated in the literature due to the provision of the letter that pre-approved individuals with minimal upfront monetary costs. There was no need for mortgage holders to individually identify the optimal time to refinance and proactively contact the financial institution. The upfront search effort and financial costs were minimised and, therefore, the complexity of the decision was reduced.

The issuance of this letter provided an opportunity to evaluate uptake of the refinancing offer amongst both distressed and non-distressed mortgages. It facilitated exploring the role of borrower and mortgage heterogeneity to determine the degree to which households make incorrect financial decisions and forego significant monetary savings. It also allowed for a review of the financial institution's approach, which subjected mortgage holders to administrative burden rather than issuing a blanket rate adjustment in line with LTV ratios. I limit the analysis period from the beginning of the letter issuance to one year following the reminder letter. This provides sufficient time for completion of the offer take-up process, while minimising the impact of other factors that may have influenced levels of refinancing.

#### 3.1 Overview of Dataset

The paper utilises a panel of loan level data from the Central Bank of Ireland. Kennedy et al. (2011) provide a detailed description of the dataset. The data covers one of the major institutions, representing a significant portion of the Irish mortgage market. The panel runs bi-annually across a two-year period from the first issuance of the offer to one year post the issuance of the reminder letter. The dataset provides approximately 185,000 observations, containing information on 46,000 borrowers and their mortgages. The data include date of origination, loan-to-value ratio, outstanding balance, interest rate,

<sup>&</sup>lt;sup>4</sup> A generic example of this letter can be found in the Appendix.

<sup>&</sup>lt;sup>5</sup>The take up, or non-take up, of this refinancing offer had no impact on a borrower's ability to switch their mortgage to another provider.

first time buyer and arrears status. Origination attributes linked to each borrower are also provided, including age, employment status, marital status and income.<sup>6</sup>

## 3.2 Descriptive Statistics

Table 1 shows overall summary statistics for both borrower and mortgage characteristics broken down across those that refinanced and those that did not. The first column (1) shows the mean values across key demographic, financial and mortgage variables for those who refinanced and column (2) reports the same figures for those who did not. The third column provides  $\beta$  values for the t-test difference between the two cohorts, the statistical significance and standard errors. I observe distinct differences across the two cohorts for the majority of variables. Homeowner heterogeneity is clear for demographic characteristics, with a higher proportion of refinancers being married and employed. In terms of financial characteristics, I find that those who took up the letter offer were those who stood to gain the most in terms of savings. Refinancers are also proportionally more likely to be in the top quintiles of the income distribution. Structural differences in mortgage characteristics are also evident, with a clear link between offer qualifying criteria and take-up. As stated in the offer, it was most advantageous for those on lower LTV bands to refinance. This is reflected in the greater proportion of refinancers at the lowest LTV band. The average size of outstanding balances indicates refinancers have larger monetary amounts still to be repaid. This would act as a further motivation for action to reduce interest rates as they would stand to save the most.

First time buyers account for almost a third of both groups of mortgage holders. As is to be expected, the average interest rate is lower for those who refinanced at 3.94%, compared with 4.53% for those did not. Variables associated with financial distress, such as the presence of arrears, is significantly higher for those who did not refinance. This is despite the fact that they still qualify under the terms of the offer. Leinster (ex. Dublin) accounted for the largest proportion of primary mortgages in the sample, at 36% for non-refinancers and 32% for those who took up the offer. Building upon previous literature, characteristics predicted to influence the outcome variable were included as covariates in the analysis.

Across the timeline in question, there were notable differences in the distribution of interest rates for the sample. As can be seen in Figure 3, these varied across LTV bands, between a minimum of 3.4% and a maximum of 7.25%, with a mean of 4.3%. However, these interest rates varied by period, with the predominant rate of the cohort at approximately 4.48% prior to the offer in Period 1. A clear drop can be seen following the implementation in Period 2, with further reductions evident as additional households refinanced until the average rate fell to 4.26% in the final period (Figure 4). The data also provides an overview of LTV ratios and arrears duration across the cohort (Figure 5 & Figure 6). Over half of the mortgages (50.6%) fall within the LTV up to 50% cohort and approximately 11% have an LTV ratio over 100%. The measure of financial distress, arrears, impacts 15% of the cohort. Of this group, 29% are in short term arrears of less

<sup>&</sup>lt;sup>6</sup>Further information on variable generation is available in the Appendix. For the purposes of this paper, mortgages under  $\in$  10,000 outstanding balance, two years of term remaining or monthly instalment below  $\in$  100 were excluded.

than 30 days and 46% are in long term arrears of over 1 year. The next section will take an in-depth look at the level of refinancing activity, reviewing the degrees of heterogeneity across the cohorts.

	(1)	(2)	(3	3)
	Refinance	No Refinance	T-te	est
Demographics	Mean	Mean	$\beta$	t
Age: 25-34	0.04	0.04	-0.01***	(-6.53)
Age: 35-44	0.30	0.31	0.00*	(2.04)
Age: 45-54	0.40	0.42	0.02***	(8.01)
Age: Over 54	0.25	0.23	-0.02***	(-8.34)
Male	0.63	0.64	0.01***	(3.77)
Single	0.29	0.33	0.04***	(19.59)
Employed	0.80	0.76	-0.04***	(-17.41)
Self Employed	0.09	0.11	0.02***	(10.69)
Unemployed	0.06	0.08	0.02***	(16.81)
<b>Financial Characteristics</b>				
Income Quintile 1	0.18	0.21	0.03***	(12.86)
Income Quintile 2	0.19	0.20	0.01***	(5.27)
Income Quintile 3	0.19	0.20	0.01***	(4.50)
Income Quintile 4	0.21	0.20	-0.01***	(-5.58)
Income Quintile 5	0.22	0.19	-0.03***	(-16.43)
Savings Quintile 1	0.15	0.22	0.07***	(18.10)
Savings Quintile 2	0.18	0.21	0.02***	(5.89)
Savings Quintile 3	0.20	0.20	-0.00	(-0.64)
Savings Quintile 4	0.22	0.19	-0.02***	(-5.86)
Savings Quintile 5	0.24	0.18	-0.07***	(-15.80)
Mortgage Characteristics				
LTV up to 50%	0.57	0.47	-0.10***	(-39.22)
LTV 50% to 60%	0.11	0.10	-0.01***	(-9.17)
LTV 60% to 70%	0.09	0.09	-0.00	(-1.18)
LTV 70% to 80%	0.07	0.08	0.01***	(5.77)
LTV 80% to 90%	0.05	0.07	0.02***	(17.00)
LTV over 90%	0.10	0.19	0.09***	(51.14)
Loan Term Remaining	15.22	15.29	0.07	(1.85)
Current Balance	98,503	93,031	-5,472***	(-15.02)
Current Interest Rate	3.94	4.53	0.59***	(383.94)
First Time Buyer	0.31	0.32	0.01***	(5.77)
Arrears	0.06	0.19	0.13***	(88.21)
Observations	61,472	122,180	183,652	
Borrowers	15,368	30,545	45,913	

#### TABLE 1. Summary Statistics by Group

**FIGURE 3. Distribution of Interest Rates** 













#### Who Refinanced? 3.3

In line with previous literature (Johnson et al., 2019; Keys et al., 2016; Bajo and Barbi, 2018; Agarwal et al., 2015), I find evidence of mortgage refinancing inertia. Table 2 outlines the number of borrowers who refinanced. Across four periods, a total of 15,368 mortgages took up the offer, representing 33% of eligible borrowers. The majority of these occurred in Period 1 with the initial issuance of the letter. This was followed by two additional periods of comparable numbers, the lack of fall off in Period 3 can be associated with issuance of the reminder letter to borrowers who hadn't taken up the offer. The final period showed the lowest number of refinances and captures those who may have been delayed in completing the administrative steps required in the process.

Refinanced Mortgage	Period 1	Period 2	Period 3	Period 4	Total
Didn't Refinance	35,127	43,879	44,040	45,238	168,284
Refinanced	10,786	2,034	1,873	675	15,368
Total	45,913	45,913	45,913	45,913	183,652
Didn't Refinance Refinanced Total	35,127 10,786 45,913	43,879 2,034 45,913	44,040 1,873 45,913	45,238 675 45,913	168,284 15,368 183,652

TABLE 2. Number of Refinances by Period

Figure 7 provides colour on levels of refinancing at a county level. At basic count, there is significant heterogeneity with Dublin having the most refinances at approximately 26% and Leitrim the least with less than 1%. However, if we weight the number of refinances as a proportion of total mortgage population per county the numbers are much closer with variation between 38% and 23%. Cork and Dublin have the highest proportion, with Leitrim the lowest.

FIGURE 7. Weighted Proportion of Refinancing by County

A degree of administrative burden had to be overcome to benefit from the offer and, as a result, an opportunity for substantial savings appears to have been missed by borrowers. These barriers are comparable to those linked to mortgage product management as noted by Central Bank of Ireland (2016). This research showed many customers were concerned that mortgage switching would be too complex to engage with and were uncertain of their ability to save money. Despite a simplified refinancing process, such barriers may have also hindered decision making in this case. The letter referenced in this paper incorporates barriers to active engagement. There is little saliency on how much borrowers would stand to benefit so many could be unsure of how their current LTV ratio and a small percentage change in interest rates would translate into tangible savings. The letter also requires engagement with a valuation professional and includes an ambiguous statement related to fees, stating that all outside the valuation must be covered by the customer. Borrowers who were uncertain of available savings may have been put off by such a statement. However, an aspect of the offer that appears to have promoted uptake was inclusion of a reminder, which could be linked to levels of refinancing in later periods. Much like previous research (Karlan et al., 2016; Ericson, 2017; Adams et al., 2015), it appears the reminder may have improved engagement by reducing the role of inattention.

## 4 Savings & Refinancing Heterogeneity

### 4.1 Realised & Hypothetical Savings

The paper now takes a closer look at the savings that were achieved by those who refinanced and the amounts foregone by those who did not. As the offer included a voucher for valuation, the external financial costs are minimal. Unlike the mortgage switching process, legal fees are not considered as such services are not required to complete the process. The savings and hypothetical savings available are explored in Figure 8, illustrating the distribution of realised and hypothetical savings in a euro amount in the first year and over the lifetime of the loan. At the annual level, the bulk of estimated savings are concentrated between  $\in 100$  and  $\in 1,000$ , with 86% of mortgages falling within this range. Given that there are time and administrative costs associated with taking up refinancing, some of these customers might conclude that the savings available in the short-term (over a 1-year horizon) are not sufficiently large to justify refinancing (assuming they could calculate the net benefit).

Table 3 provides further breakdown on the levels of savings. It shows 80% of the sample could have saved over  $\in$ 200 in the 12 months following a refinance and 37% of mortgages had potential savings above  $\in$ 500 over this period. In other words, there is a substantial cohort of PDH borrowers who could save by taking up the refinancing offer. Expressed differently, I find that the number of mortgages whose potential savings exceed 5% of their total repayment cost for the year is 56%, with 11% of eligible mortgages standing to save over 10%. In terms of comparing realised savings with the generated hypothetical figures, I see those who refinanced holding, on average, higher levels of savings across all measures. The most pronounced differences being for gains of over  $\in$ 500 (42% for refinancers vs. 35% for non-refinancers) and 5% of annual cost (59% for refinancers vs. 54% for non-refinancers).

#### **FIGURE 8. Savings**



Source: Central Bank of Ireland Loan Level Data & Author's Workings

Aggregating the realised and hypothetical savings of these mortgages, I estimate potential one-year cumulative savings among eligible mortgages amounting to  $\in$ 23 million. However, only  $\in$ 8 million was actually realised. This means that approximately  $\in$ 15 million of potential savings were forgone by those who did not take up the offer in the first year alone.

To estimate potential lifetime savings, the paper uses a standard annuity formula to calculate the total cost of credit under the current and hypothetical repayment scenarios, with the difference representing the estimated lifetime saving. I assume that the alternative interest rate remains constant over the horizon. This assumption is in keeping with the approach of Devine et al. (2015) & Byrne et al. (2020). Over the time-horizon of mortgages, the majority of estimated undiscounted savings are concentrated between €1,000 and €15,000, with 74% falling within this range. 39% of borrowers have potential savings above €5,000 over the life of their mortgage and 14% of these could save more than €10,000. Again, those who refinanced hold, on average, higher levels of savings across both measures with gains of over €5000 achievable for 42% for refinancers vs. 38% for non-refinancers. Aggregating the realised and hypothetical savings of these mortgages, I estimate cumulative total savings for eligible mortgages amount to €257 million. However, only €90 million was actually realised, with €166 million of potential savings forgone by those who did not take up the offer.

	Refinanced	%	Didn't Refinance	%	Total	%
Number of Mortgages	15,368	100	30,545	100	45,913	100
Of which can save:						
Undiscounted						
>€100 in Year 1	14,469	94	28,838	94	43,307	94
>€200 in Year 1	12,648	82	23,904	78	36,588	80
>€500 in Year 1	6,528	42	10,672	35	17,200	37
>€1,000 in Year 1	1,611	10	2,508	8	4,119	9
>€5,000 over term	6,416	42	11,578	38	17,994	39
>€10,000 over term	2,560	17	3,978	13	6,538	14
> 5% of annual cost	9,135	59	16,374	54	25,509	56
> 10% of annual cost	1,752	11	3,097	10	4,849	11
> 1% of income	5,775	38	10,012	33	15,787	34
> 2% of income	1,523	10	2,807	9	4,330	9
Discounted (2% per annum)						
>€5,000 over term	5,449	35	9,434	31	14,883	32
>€10,000 over term	1,777	12	2,629	9	4,406	10
Discounted (10% per annum)						
>€5,000 over term	2,290	15	3,442	11	5,732	12
>€10,000 over term	317	2	680	2	997	2

TABLE 3. Breakdown of Savings

Similar to the approach used by Keys et al. (2016), I include discounted lifetime savings estimates using a 2% and a 10% per annum discount factor for illustrative purposes. At the 2% level, 14,883 mortgages would still save over  $\in$ 5,000, with 4,406 mortgages saving over  $\in$ 10,000. The numbers fall off significantly once a 10% discount is implemented, with only 5,732 still saving over  $\in$ 5,000 and 997 over  $\in$ 10,000. Again, the realised savings by refinancers were, on average, higher than the hypothetical.

## 4.2 Mortgage Refinancing Heterogeneity

A different perspective on refinancing is to analyse variation within the sample of mortgages across key variables. Much like Keys et al. (2016), Table 4 breaks down the mortgage sample from the analysis. Across all quintiles, I find significant failure to take up the offer. For household income, I see a smaller proportion of the lowest-income households took up the letter offer compared to the top earners. The levels of refinancing by LTV quintiles reflect the terms of the letter offer, with those in the second quintile showing the highest percentage. Borrowers in this cohort could not only avail of the lower interest rates on offer compared with those in higher quintiles but also would benefit from them for longer compared with the bottom quintile. The third set of rows focus on the remaining loan amount for each mortgage. As the savings from refinancing are based on interest rates charged on outstanding amounts, borrowers with larger outstanding amounts can benefit far more than borrowers with a smaller amount. This is reflected in the levels of refinancing (28% versus 35%) for those in the bottom quintile and households in the top quintile. However, the highest level of refinancing is in

#### the third quintile at 36%.

For age cohorts, I observe that the youngest and oldest borrowers have comparable level of refinancing despite the levels of savings being far higher for younger age cohorts. Counterintuitively, as borrowers get older (and potential savings fall), the levels of refinancing rise. Lastly, I explore variation across those in mortgage arrears. The in-arrears quintiles exhibit the lowest levels of refinancing across all variables. This indicates the presence of arrears to be a barrier to refinancing despite borrowers qualifying for the offer and significant savings to be made. Levels of engagement with the offer vary from 23% for those on the smallest arrears amounts ( $\in$ 449) to just 2% for the largest ( $\in$ 39,518).

	% Refinanced	Savings	Hypothetical Savings	Quintile Range
By income				
Lowest	31	4,872	4,663	<€37,309
Second quintile	32	5,377	5,187	>€37,194 & <€48,419
Third quintile	32	5,730	5,582	>€48,419 & <€59,871
Fourth quintile	35	6,359	5,813	>€59,871&<€77,091
Highest	37	7,792	6,242	>€77,092
By LTV				
Lowest	34	1,740	1,552	< 22.4
Second quintile	40	4,455	3,924	>22.4 & <40.4
Third quintile	39	7,805	6,710	>40.4 & <59.3
Fourth quintile	32	9,387	7,822	>59.3 & <83.5
Highest	22	6,276	6,434	>83.5
By loan amount				
Lowest	28	982	1,070	< €31,723
Second quintile	32	2,120	2,319	>€31,723&<€57,118
Third quintile	36	4,523	4,708	>€57,118 & <€95,957
Fourth quintile	35	7,944	7,727	>€95,957 & <€148,121
Highest	35	13,130	11,415	>€148,121
By age				
Youngest	34	9,904	8,209	<41
Second quintile	32	6,932	6,061	>41 & <46
Third quintile	32	5,540	5,007	>47 & <50
Fourth quintile	33	4,250	3,958	>51&<56
Oldest	35	3,004	3,053	>56
By arrears				
Lowest	23	4,046	3,968	<€449
Second quintile	22	6,338	5,846	>€450&<€1,854
Third quintile	14	5,816	5,402	>€1,855 & <€11,875
Fourth quintile	7	7,751	5,615	>€11,875 & <€39,518
Highest	2	6,487	7,597	>€39,518
-				

TABLE 4. Breakdown of Refinancing Levels & Savings By Quintiles

## 5 Empirical Approach & Results

Building upon the work of Keys et al. (2016); Bajo and Barbi (2018) & Johnson et al. (2019), this paper investigates the role of demographic, financial and mortgage characteristics in the decision to refinance for a cohort of distressed and non-distressed borrowers. A combination of binomial and multinomial logistic regressions are used to complete this analysis. Logistic regression analysis is implemented to investigate the relationship between binary or categorical response probability and explanatory variables.

I begin with a positive binary dependant variable if the borrower took up the refinancing offer across any of the eligible time periods. I then extend to a multinomial logit specification where the probability of take up in first period and the subsequent periods is compared to reference category of no refinance. Across each of the tables, there are three specifications utilised. The baseline is composed of the core mortgage and borrower characteristics to compare the findings with prior studies. Secondly, I add in a lifetime savings variable to capture monetary gain linked with a refinance. The final specifications, controls are added for the origination year of the mortgage.<sup>7</sup>

## 5.1 Results

Across the three specifications of Table 5, I find evidence to confirm initial insights from the previous sections. The baseline specification finds that borrower characteristics such as income levels, employment status and marital status do impact likelihood of refinancing. I find both self-employed and single borrowers are less likely to take up the offer. While in contrast to Bajo and Barbi (2018) & Andersen et al. (2015), and aligned with Johnson et al. (2019), higher levels of income are linked with positive take up. Mortgage characteristics also play a role, with refinancing propensity positively affected by larger outstanding balances and remaining term, much like Bajo and Barbi (2018). The role of LTV ratios is highlighted, with those in cohorts linked to lower interest rates having a greater likelihood to refinance. The largest positive coefficient is for the LTV up to 50% cohort who could avail of the lowest rate. In the second specification, the results show evidence that borrowers react to monetary benefits, with higher savings resulting in a greater probability of refinancing. Similar to Johnson et al. (2019), these findings validate the view that borrowers open letters, identify financial incentives and engage in line with the terms of the offer. The final specification focuses on financial distress, with a large, negative coefficient linked to the presence of arrears.

I expand on this initial arrears result through a series of interactions for the binomial model in Table 11 of the Appendix. There are consistent negative coefficients for the in-arrears cohort across savings, outstanding amounts, remaining term and for single borrowers. The savings result implies that a negative financial situation can limit the impact of positive gains from other financially beneficial decisions. While those in financial distress are already perceived as vulnerable, single borrowers in the arrears

<sup>&</sup>lt;sup>7</sup>An overview of the variables used across the specifications are available in Table 12 of the Appendix.

cohort, who often carry the repayment burden on their own, have a lower probability of refinancing when they could stand to marginally benefit the most from reduced instalments.

	Base	line	Savir	ngs	Arre	ars
<b>Borrower Characteristics</b>						
Age	0.000	(0.001)	0.000	(0.001)	0.000	(0.001)
Age Squared	-0.000	(0.000)	-0.000	(0.000)	-0.000	(0.000)
Male	-0.002**	(0.001)	-0.003**	(0.001)	-0.002*	(0.001)
Single	-0.010***	(0.001)	-0.010***	(0.001)	-0.010***	(0.001)
Self Employed	-0.010***	(0.002)	-0.010***	(0.002)	-0.007***	(0.002)
Unemployed	-0.033***	(0.002)	-0.032***	(0.002)	-0.030***	(0.002)
Retired/Education/Other	0.024***	(0.003)	0.023***	(0.003)	0.025***	(0.003)
Log(Income)	0.010***	(0.001)	0.010***	(0.001)	0.008***	(0.001)
Mortgage Characteristics						
LTV up to 50%	0.042***	(0.002)	0.041***	(0.002)	0.031***	(0.002)
LTV 50% to 60%	0.030***	(0.002)	0.029***	(0.002)	0.023***	(0.003)
LTV 60% to 70%	0.025***	(0.002)	0.024***	(0.002)	0.018***	(0.003)
LTV 70% to 80%	0.018***	(0.002)	0.018***	(0.002)	0.012***	(0.003)
LTV 80% to 90%	0.012***	(0.003)	0.004*	(0.003)	0.001	(0.003)
Loan Term Remaining	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
Amount over €200,000	0.009***	(0.002)	0.007***	(0.002)	0.011***	(0.002)
First Time Buyer	0.001	(0.001)	0.000	(0.001)	-0.001	(0.001)
Savings (€)			0.001***	(0.001)	0.001***	(0.000)
Arrears					-0.050***	(0.002)
Dummies for origin year	Yes		Yes		Yes	
Observations	181,424		180,463		180,463	
Borrowers	45,381		45,275		45,275	

#### TABLE 5. Logit Regression Results - Marginal Effects

Notes: Logit Regressions. Dependent variable: Borrower refinanced (=1) or not (=0) Marginal impact for level of savings is scaled up by 1000

Omitted categories for dummy variables are: Employed, LTV over 90%

Standard errors in parentheses

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

Transitioning to the multinomial model in Table 6, I compare the overall refinancing results with those of the two distinct cohorts who refinanced in different periods. The motivation behind this secondary approach is to compare the role of variables for those who refinance straight away, compared with those who completed the action in later periods, which included the issuance of a reminder letter. Reminders have been shown to improve engagement across financial products by offsetting the impact of inattention and procrastination, with the timing and anticipation of the reminders a key factor (Karlan et al., 2016; Ericson, 2017; Adams et al., 2015).

While my findings for income, LTV ratio and arrears are consistent across the two periods, I see key differences across the impact and significance of age, savings and first time buyer status. A positive association emerges for age in the first period, indicating older borrowers were more likely to uptake the offer straight away. In contrast to this, a negative link was found for first time buyer status. A possible interpretation of this would be that first time buyers who have recently taken out a mortgage might be less willing to re-engage with their lender if they had only done so recently. Older borrowers with more established relationships or experience with the lender are more likely to take up the offer, as more time may have passed since their last engagement and they are more familiar with the process. For the second outcome - refinanced in a later period, I find counterfactual results for borrower age and first time buyer status, with younger borrowers and first time buyers more likely to take up the offer in these periods. While these borrowers had initially deferred refinancing, potentially due to inattention or lack of motivation to re-engage with their lender, the passing of time and impact of the reminder may have motivated them to complete the process. Relative to other mortgage characteristics, the levels of monetary savings available did not result in a higher likelihood of refinancing in the first period. It may be the case that those who refinanced straight away based their ability to benefit on the criteria referenced in the letter, such as levels of LTV linked to lower rates. The coefficients for these variables are larger than the later period, indicating more of an influence on the decision. In contrast, savings have a positive and significant impact the likelihood of refinancing in later periods, which indicated that borrowers could identify the level of savings across the term with higher amounts acting as a greater incentive to refinance.

	Base	line	Savii	ngs	Arre	ars
Refinanced - Period 1						
Age	0.001***	(0.000)	0.002***	(0.000)	0.002***	(0.000)
Age Squared	-0.000***	(0.000)	-0.000***	(0.000)	-0.000***	(0.000)
Male	-0.002	(0.001)	-0.002*	(0.001)	-0.002	(0.001)
Single	-0.008***	(0.001)	-0.008***	(0.001)	-0.008***	(0.001)
Self Employed	-0.009***	(0.002)	-0.008***	(0.002)	-0.007***	(0.002)
Unemployed	-0.030***	(0.002)	-0.029***	(0.002)	-0.028***	(0.002)
Retired/Education/Other	0.026***	(0.003)	0.025***	(0.003)	0.026***	(0.003)
Log(Income)	0.005***	(0.001)	0.005***	(0.001)	0.004***	(0.001)
LTV up to 50%	0.025***	(0.002)	0.026***	(0.002)	0.019***	(0.002)
LTV 50% to 60%	0.018***	(0.002)	0.019***	(0.002)	0.015***	(0.002)
LTV 60% to 70%	0.015***	(0.002)	0.017***	(0.002)	0.013***	(0.002)
LTV 70% to 80%	0.008***	(0.002)	0.010***	(0.002)	0.006***	(0.002)
LTV 80% to 90%	0.010***	(0.002)	0.002	(0.002)	-0.000	(0.002)
Loan Term Remaining	0.001***	(0.000)	0.001***	(0.000)	0.001***	(0.000)
Amount over €200,000	0.004*	(0.002)	0.005**	(0.002)	0.007***	(0.002)
First Time Buyer	-0.004***	(0.001)	-0.004***	(0.001)	-0.005***	(0.001)
Savings (€)			-0.001*	(0.001)	-0.001	(0.001)
Arrears					-0.029***	(0.002)
<b>Refinanced - Later Period</b>						
Age	-0.001***	(0.000)	-0.001***	(0.000)	-0.001***	(0.000)
Age Squared	0.000***	(0.000)	0.000***	(0.000)	0.000***	(0.000)
Male	-0.001	(0.001)	-0.001	(0.001)	-0.000	(0.001)
Single	-0.002*	(0.001)	-0.002*	(0.001)	-0.002**	(0.001)
Self Employed	-0.001	(0.001)	-0.001	(0.001)	-0.000	(0.001)
Unemployed	-0.003**	(0.001)	-0.003*	(0.001)	-0.002	(0.001)
Retired/Education/Other	-0.002	(0.002)	-0.002	(0.002)	-0.002	(0.002)
Log(Income)	0.005***	(0.001)	0.005***	(0.001)	0.004***	(0.001)
LTV up to 50%	0.017***	(0.001)	0.016***	(0.001)	0.012***	(0.001)
LTV 50% to 60%	0.012***	(0.001)	0.010***	(0.001)	0.008***	(0.001)
LTV 60% to 70%	0.009***	(0.001)	0.008***	(0.001)	0.006***	(0.001)
LTV 70% to 80%	0.010***	(0.001)	0.008***	(0.001)	0.006***	(0.001)
LTV 80% to 90%	0.003*	(0.001)	0.003*	(0.001)	0.001	(0.002)
Loan Term Remaining	0.000	(0.000)	-0.000	(0.000)	-0.000**	(0.000)
Amount over €200,000	0.006***	(0.001)	0.003*	(0.001)	0.004***	(0.001)
First Time Buyer	0.004***	(0.001)	0.004***	(0.001)	0.004***	(0.001)
Savings (€)			0.001***	(0.001)	0.001***	(0.001)
Arrears					-0.022***	(0.002)
Dummies for origin year	Yes		Yes		Yes	
Observations	181,424		180,463		180,463	
Borrowers	45,381		45,275		45,275	

TABLE O. MUILINOMIAI LOGIL REGRESSION RESULTS - MARGINAI EFFECTS	TABLE 6. Multinomial	Logit Regress	ion Results -	Marginal	Effects
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Notes: Multinomial logit regression.

Base outcome: no refinance. Outcome 1: refinanced in first period.

Outcome 2: refinanced in later period.

Marginal impact for level of savings is scaled up by 1000

Omitted categories for dummy variables are: Employed, LTV over 90%

Standard errors in parentheses

\* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

## 5.2 Financial Distress

The legacy of the financial crisis remained evident in the Irish housing market during the period in question. Statistics from the Central Bank of Ireland show over 90,000 PDH mortgages were in arrears when the offer was issued<sup>8</sup>. This represents a primary form of financial distress experienced by a notable cohort of Irish households. In many scenarios, borrowers in arrears would not be eligible to refinance but the conditions of this offer included these distressed borrowers. However, it is worth noting that borrowers in extreme arrears may have ceased all engagement with financial institutions given the severity of financial distress and low perceived possibility for repayment. Therefore, they were not going to refinance regardless of the terms available.

Previous work has looked into the understanding of borrower behaviour and the determinants of arrears, with Lydon and McCarthy (2013) & Read et al. (2014) citing level of repayment burden and debt-servicing ratios as key factors. For those in arrears, refinancing opportunities to reduce their repayment burden would improve the likelihood of reducing levels of financial distress.

Arrears		
	0.005	(0,000)
Less than 1 month	0.005	(0.003)
1 to 3 months	-0.040***	(0.004)
3 to 6 months	-0.042***	(0.005)
6 to 12 months	-0.048***	(0.005)
> 1 year	-0.073***	(0.001)
Borrower and Mortgage Controls	Ye	S
Dummies for origin year	Ye	S
Observations	180,	463
Borrowers	45,2	275
Notes: Logit Regressions.		

TABLE 7. Logit Regression Results - Arrears Marginal Effects

Dependent variable: Borrower refinanced (=1) or not (=0) Standard errors in parentheses \* p < 0.10, \*\* p < 0.05, \*\*\* p < 0.01

In the previous section, a negative link between mortgage arrears and refinancing was established. However, this did not explore the impact of heterogeneous levels of arrears. I provide further insights on these cohorts by introducing a categorical variable to capture the different degrees of arrears. Arrears can be broken down from short term arrears valued at less than one month to arrears up to over one year. As can be seen in Table 7, there is no negative impact for those in short term arrears but as they develop past the single month mark, a clear and growing negative impact on probability of refinancing emerges.

<sup>&</sup>lt;sup>8</sup>https://www.centralbank.ie/statistics/data-and-analysis/ credit-and-banking-statistics/mortgage-arrears

Table 8 expands the arrears duration variable across a multinomial model. For those who refinanced in first period, low levels of arrears actually led to a higher probability of refinancing. These borrowers in minor arrears still took on beneficial opportunities to engage, seeking to make savings. This is potentially as they have not experienced the negative effects of larger degrees of financial distress that deter engaging with their financial institution. Across the remaining arrears cohorts, I find the same negative and increasing impact for both outcomes but with larger coefficients for first period.

Refinanced - Period 1		
Less than 1 month	0.016***	(0.003)
1 to 3 months	-0.027***	(0.003)
3 to 6 months	-0.028***	(0.004)
6 to 12 months	-0.037***	(0.004)
> 1 year	-0.052***	(0.001)
Refinanced - Later Period		
Less than 1 month	-0.012***	(0.001)
1 to 3 months	-0.013***	(0.002)
3 to 6 months	-0.014***	(0.003)
6 to 12 months	-0.011***	(0.003)
> 1 year	-0.021***	(0.001)
Borrower and Mortgage Controls	Ye	s
Dummies for origin year	Ye	S
Observations	180,4	163
Borrowers	45,2	75
Notes: Multinomial logit regression	n.	
Base outcome: no refinance.		
Outcome 1: refinanced in first perio	od.	
Outcome 2: refinanced in later per	iod.	
Standard errors in parentheses		
* $p < 0.10$ , ** $p < 0.05$ , *** $p < 0.01$		

**TABLE 8. Multinomial Logit Regression - Arrears Marginal Effects** 

While some borrowers may have missed out on significant savings due to the administrative burden of the letter offer, research by Tracy and Wright (2012) shows that the institution itself could have suffered as a result. They highlight that following a repayment burden reduction from refinancing, the five-year default rate on performing adjustable-rate mortgages with loan-to-value ratios above 80% declines by 3.8 percentage points. This lower default risk implies a notable expected reduction in future credit losses by issuing lenders.

## 6 Robustness Checks

One possible explanation for the levels of refinancing inertia within this cohort is that households were preparing for a switch to a different lender. Recent work from Byrne et al. (2020) in Figure 9 has shown that there was an increase in switching activity among PDH borrowers during the period in question. Switching, when taken as a percentage

of outstanding amount of mortgages, grew from 1.3% across 2015 to 5.4% in 2019. Despite this increase, mortgage customers in Ireland did not engage to any large extent with the option to switch their mortgage over the reference period. This would validate the position that the cohort of non-refinancers were not waiting to switch to another provider.



FIGURE 9. Levels of Switching in Irish Market

Another potential impact on levels of refinancing is that mortgage holders may have already received temporary forbearances or modifications from the financial institution. Such modifications could be better for liquidity and reduce the incentive for refinancing. However, from reviewing the data I can see that only a small number (less than 2%) of the mortgages in the sample received forbearances linked to reduced instalments. In relation to longer term modifications, I find that while a higher proportion of those without modifications refinanced (35% compared with 21%), mortgages with changes such as capitalisation (23%), split mortgages (15%) and term extensions (36%) were still eligible and active in the refinancing process.

## 7 Conclusion

Mortgages are a primary financial product held by consumers, with any decision linked to reducing their repayment burden having a considerable impact on household finances. This paper investigates one such decision, providing evidence of suboptimal levels of refinancing across a cohort of distressed and non-distressed borrowers. A loan level dataset was used to explore the impact of a letter offer that facilitated borrowers moving to lower interest rates linked to their LTV ratios. The offer had no monetary costs yet gave borrowers the opportunity to make significant financial savings. Despite this, I find only 33% of eligible mortgages had refinanced, foregoing an average of  $\in$ 5,400 over the remainder of their terms. A focus is placed on distressed borrowers, with these already vulnerable households missing out on savings that could reduce the risk of default. This letter offer, and level of engagement required, appears to have contributed towards a

costly mistake by a large number of borrowers.

There is clear evidence that levels of consumer engagement can be encouraged, or discouraged, based on choice architecture. The manner in which a financial decision is presented can lead to mistakes as consumers are limited in their ability to assess products. A series of studies have identified obstacles associated with this poor decision making such as complexity, inattention and procrastination. In response to this evidence, a movement emerged incorporating behavioural insights to improve consumer understanding (Barr et al. (2009);Bar-Gill and Warren (2008); Campbell et al. (2011); Bubb and Pildes (2013)). A common recommendation is the introduction of smart, simplified and personalised information disclosures to de-bias prospective consumers. Examples of this include the CARD Act and Dodd-Frank Act, which provide improvements in plain language disclosures and requirements for financial products. Institutions such as the Financial Conduct Authority have completed a number of studies showing the positive impact of such improvements (Adams and Hunt, 2013; Authority, 2016).

The Central Bank of Ireland has been active in the area of consumer protections linked to mortgage products and disclosures since the period in which the refinancing There have been two key amendments to the Consumer offer took place. Protection Code published in an effort to improve transparency and remove complexity around understanding the mortgage products available to borrowers<sup>9</sup>. Under these amendments, financial providers must give information on their alternative product options, provide a reason for a rate change and flag if a different approach is used to set interest rates for different borrowers. These institutions must also provide a guide to the steps required for mortgage switching and a comparison of the total interest payable over the remaining term of the mortgage. The Central Bank of Ireland has also established a small team, dedicated to the uses of behavioural economic insights and techniques to better understand how and why people make financial choices, with a clear focus on the role of behavioural factors (Byrne et al., 2022). While this paper has focused on the failure to refinance prior to the implementation of these amendments, future work should aim to analyse the impact of these changes to see if communications from financial institutions informed by behavioural insights can be used to improve levels of refinancing.

<sup>&</sup>lt;sup>9</sup>https://www.centralbank.ie/regulation/consumer-protection/ consumer-protection-codes-regulations

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## Appendix

## **Creation of Additional Variables**

The loan level dataset provides a substantial cohort of the variables required to analyse the refinancing offer. However, some additional variables had to be calculated from underlying data. The variables in question are explained below.

#### **Identifier Variable**

The core outcome variable in this analysis is the identification of borrowers who availed of the refinancing offer. This was generated as a binary variable, with a value of 1 indicating positive take up. A mortgage holder was deemed to have undertaken a refinance if, following the date of first issuance of the letter, the data showed their interest rate fall in line with their LTV ratio and pricing criteria outlined by the financial institution (Table 9). A number of separate interest rate drops were identified across the period. However, they were excluded as they exceeded the advertised interest rates. This includes those on fixed rates who rolled onto new fixed rates or variable rate mortgages originating at the end of a fixation period. Those who moved from fixed to a new fixed or variable at a higher level appears to signal the end of a fixation period.

Loan to Value Ratio (LTV)	Variable Rate
Less than or equal to 50% LTV	A%
Greater than 50% and less than or equal to 60% LTV	B%
Greater than 60% and less than or equal to 70% LTV	C%
Greater than 70% and less than or equal to 80% LTV	D%
Greater than 80% and less than or equal to 90% LTV	E%
Greater than 90% LTV	F%

TABLE 9. Loan to value Ratio & Interest Rate

To validate the identifier variable is accurately capturing mortgages meeting the set criteria of the offer, Table 10 provides a breakdown of interest rates to LTV ratios of refinancers. Over half of refinanced mortgages fall under the LTV up to 50% category, which avails of the lowest rate of A%. The second highest number represent those in the LTV over 90% category, who would capture all those in both the early stages of their mortgage, or those who have fallen into negative equity. Overall, this table acts as a justification for the outcome variable due to the high degree of matching between identified refinancer mortgage characteristics and the letter criteria. The small numbers, 5% of total, of refinancers in categories either side of the letter offer terms have been maintained as they may include borderline cases and still represent valid reductions in interest rates roughly in line with the terms.

Rate %	LTV up to 50%	LTV 50% - 60%	LTV 60% - 70%	LTV 70% - 80%	LTV 80% - 90%	LTV over 90%	Total
A	8,080	33	0	0	0	0	8,113
В	159	1,481	22	0	0	0	1,662
С	0	172	1,342	33	0	0	1,547
D	0	0	148	1,050	65	0	1,263
E	0	0	0	130	721	36	887
F	0	0	0	0	81	1,811	1,892
Total	8,240	1,686	1,512	1,216	867	1,847	15,368

TABLE 10. Refinance Alignment with Letter Criteria

#### Savings

This paper employs the methodology of Devine et al. (2015) & Byrne et al. (2020) to calculate the realised and hypothetical savings available to borrowers if they were to take up the refinancing offer. For realised savings, I take the lower interest rate received following a refinance and compare it with the pre-refinance rate. The difference between the pre and post instalment is our measure of savings. This is calculated as a total level over a period of one year. For hypothetical savings, I apply the interest rates outlined in the refinance offer to those who did not avail. The difference between the existing and hypothetical instalment is the measure of hypothetical savings. Again, this is calculated as a total level over a period of one year.

To estimate potential lifetime savings, this paper applies the same approach but uses a standard annuity formula to estimate the total cost of credit under the current and hypothetical repayment scenarios, with the difference representing the estimated lifetime saving. It assumes that the alternative interest rate remains constant over the horizon of investigation.

			=				2	
Refinanced								
Age	0.006	(0.007)	0.006	(0.007)	0.007	(0.007)	0.006	(0.007)
Age Squared	-0.001	(0.001)	-0.001	(0.001)	-0.001	(0.001)	-0.001	(0.001)
Single	-0.138***	(0.018)	-0.118***	(0.018)	-0.138***	(0.018)	-0.137***	(0.018)
Loan Term Remaining	0.010***	(0.002)	0.010***	(0.002)	0.011***	(0.002)	0.009***	(0.002)
Amount over €200,000	0.162***	(0:030)	$0.151^{***}$	(0.029)	$0.155^{***}$	(0.029)	0.252***	(0:030)
Level of Savings	0.001***	(0.001)	0.001***	(0.001)	0.001***	(0.001)	0.000***	(0000)
Arrears	-0.509***	(0.045)	-0.602***	(0.038)	-0.379***	(0.070)	-0.555***	(0.034)
Arrears*Savings	-0.001***	(0.001)						
Arrears*Single			-0.258***	(0.074)				
Arrears*Term					-0.020***	(0.004)		
Arrears*Amount							-0.843***	(0.102)
Constant	-5.044***	(0.454)	-5.016***	(0.454)	-5.041***	(0.455)	-4.960***	(0.454)
			2		2		2	
Dummies for Origin Year	Yes		Yes		Yes		Yes	
Borrower and Mortgage Controls	Yes		Yes		Yes		Yes	
Observations	180,463		180,463		180,463		180,463	
Borrowers	45,115		45,115		45,115		45,115	
Notes: Logit Regressions. Dependent	variable: Bor	rower refin	anced (=1) o	or not (=0)				

TABLE 11. Logit Interaction Regression - Log Odds

Log odds for level of savings is scaled up by 1000 and Age squared by 10 Standard errors in parentheses \*  $p < 0.10, ^{**} p < 0.05, ^{***} p < 0.01$ 

Description	Continuous variable indicating the age of the primary borrower.	Continuous variable indicating the age squared of the primary borrower.	Dummy variable indicating that the primary borrower is male	Dummy variable indicating that the primary borrower is single.	Dummy variable indicating that the primary borrower was employed at origination.	Dummy variable indicating that the primary borrower was self employed at origination.	Dummy variable that the primary borrower was either retired, in education, or other employment status at origination.	Dummy variable indicating that the primary borrower was unemployed at origination.	Continuous variable indicating the log of total borrower income at origination.	Dummy variable indicating that the mortgage had a current loan to value ratio up to 50%.	Dummy variable indicating that the mortgage had a current loan to value ratio from 50% to 60%.	Dummy variable indicating that the mortgage had a current loan to value ratio from 60% to 70%.	Dummy variable indicating that the mortgage had a current loan to value ratio from 70% to 80%.	Dummy variable indicating that the mortgage had a current loan to value ratio from 80% to 90%.	Dummy variable indicating that the mortgage had a current loan to value ratio over 90%.	Continuous variable indicating the years of mortgage term remaining until maturity.	Continuous variable indicating the levels of lifetime savings available.	Dummy Variable indicating that the borrower was a first time buyer.	Dummy Variable indicating that the outstanding balance of the mortgage was greater than ${\in}200,000.$	Dummy Variable indicating that the mortgage was in arrears.	Dummy Variable indicating that the mortgage had an arrears level less than 1 month of payments.	Dummy Variable indicating that the mortgage had an arrears level between 1 to 3 months of payments.	Dummy Variable indicating that the mortgage had an arrears level between 3 to 6 months of payments.	Dummy Variable indicating that the mortgage had an arrears level between 6 to 12 months of payments.	Dummy Variable indicating that the mortgage had an arrears level over 1 year of payments.	
Variable	Age	Age Squared	Male	Single	Employed	Self Employed	Retired/Education/Other	Unemployed	Log(Income)	LTV up to 50%	LTV 50% to 60%	LTV 60% to 70%	LTV 70% to 80%	LTV 80% to 90%	LTV over 90%	Loan Term Remaining	Savings €	First Time Buyer	Amount >€200,000	Arrears	Arrears - Less than 1 month	Arrears - 1 to 3 months	Arrears - 3 to 6 months	Arrears - 6 to 12 months	Arrears - Over 1 year	

TABLE 12. Variable Description

#### Letter Example

Strictly Private & Confidential

Borrower Name Correspondence Address

**Property Address** 

Date: 31/12/2021

Dear Borrower Name,

## Important: An invitation to you to reduce the interest rate charged on your mortgage and have lower monthly mortgage repayments

We are delighted to invite you and other existing customers of **Bank X** to apply to have the interest rate, which you pay on your mortgage reset to a lower rate. The exact rate that will apply will vary depending on what percentage of the current value of your family home is accounted for by your outstanding mortgage.

# For those who avail of this offer and if approved, it will lead to a reduction in the rate of interest charged and lower monthly repayments compared to the Bank's current Variable Rates.

This letter is being issued to you following the announcement by **Bank X** of plans to extend its range of variable rate mortgages to existing and new customers. Variable rate mortgages charge a lower rate of interest to customers whose mortgage borrowings represent a smaller percentage of the value of the property. So when you apply for an variable rate mortgage, on mortgage accounts for 50% of the current value of the family home, you can expect to be charged a lower rate of interest than a customer whose mortgage accounts for 90% of the current value of the property.

The information below is based on your mortgage details as of 31<sup>st</sup> December 2021. Please use this information to complete the enclosed 'Application Form'. Any additional home loan mortgage accounts, which are not outlined below need to be included in your application form.

Mortgage Account Number	Balance Outstanding*	Term Outstanding	Current Interest Rate	Undrawn Amounts**		
< xxx xxxxx xxxx xx>	<€xxx,xxx.xx>	<xx <br="" years="">Months&gt;</xx>	<xx.xx%></xx.xx%>	<€xx,xxx,xx>		

 $^{*}$  Your balance outstanding is inclusive of overpayments and/or arrears (if any) and does not represent the redemption amount of your mortgage(s).

\*\* Undrawn amounts refers to all amounts which have yet to be drawn down subject to your mortgage loan conditions and includes amounts yet to be withdrawn on a XX mortgage account.

Please refer to the "Completing the Form" section enclosed in the Application Form before completing your application.

To avail of this offer, customers must submit a completed application to **Bank X** to enable us to reset your current mortgage rates to an applicable variable rate mortgage. The application must be accompanied by a current valuation of your family home and this letter includes a voucher which you can use to instruct and pay your chosen local valuer selected from Bank X panel of appointed valuers. The full list of appointed property valuers can be found on www.bankwebsite.ie. All other fees (legal, financial advice, etc.) are to be paid for by you, the customer.

Please note that if you currently have a Type Y Account and you switch to a variable rate, your Type Y Account will then be closed.

If your loan is secured on another property (referred to as "cross charged property") in addition to your family home, you will need to obtain property valuations from a **Bank X** panel valuer in respect of such cross charged property but at your own expense. The interest rate which will apply will depend on what percentage of the valuations of your family home together with such other cross charged properties is accounted by your outstanding mortgage.

For more information visit www.bankwebsite.ie where you can get an indication of what you could save on your monthly repayments using our rate switch calculator. Alternatively contact us on 1850 123 4567 or call into your local branch.

Yours sincerely

Joe Bloggs Head of Mortgages To see how your interest rate might change with an variable rate mortgage, this table sets out the different rates which currently apply.

Loan- to Value Ratio (LTV)	Variable Rate
Less than or equal to 50% LTV	A%
Greater than 50% and less than or equal to 60% LTV	В%
Greater than 60% and less than or equal to 70% LTV	C%
Greater than 70% and less than or equal to 80% LTV	D%
Greater than 80% and less than or equal to 90% LTV	E%
Greater than 90% LTV (includes negative equity)	F%

Information correct as at 31<sup>st</sup> December 2021.

**Note:** This letter is for information purposes only and does not constitute a formal offer. **The Bank may decide at its discretion to amend or terminate the variable rate offer at any time in the future.** 

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