Mortgage modifications and loan performance

Christian Danne and Anne McGuinness

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Abstract

This paper studies the determinants of receiving a loan modification and the factors explaining repayment after mortgage modification using a unique Irish dataset. Compared to previous studies, our dataset allows us to observe borrower and loan characteristics at the time the borrower experiences payment difficulties and to directly observe the outcome of the renegotiation process. The results show that current borrower characteristics rather than loan characteristics matter for receiving a permanent modification and making full payment after modification. A higher mortgage repayment to income ratio, higher household leverage, and higher household expenditure reduce the probability of receiving a permanent modification and the probability of full payment after modification. In addition, both unemployment and divorce prior to engaging in mortgage renegotiations, reduce the probability of receiving a permanent modification and the payment performance after modification. The change in borrowers mortgage repayment and thus their subsequent mortgage affordability is the key driver of a successful modification, irrespective of the modification type.

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1 Introduction

The mortgage arrears crisis in Ireland has been amongst the most severe seen among advanced economies. Despite the recent signs of improvement in the overall macroeconomic environment, 8.3 per cent of all Primary Dwelling Home (PDH) mortgages held by Irish banks were in arrears at 2015q4. These loans continue to pose a risk to the health of the Irish banking sector and economic recovery (Central Bank of Ireland, 2015).

Much of the debate about resolving the mortgage arrears crisis has focused on modifying delinquent loans. Loan modifications have been actively promoted by policy makers through the introduction of several programmes, including the Central Bank of Ireland's (Central Bank) Mortgage Arrears Resolution Process (MARP) and the Mortgage Arrears Resolution Targets (MART). These programmes were designed to provide banks with incentives and guidelines to modify delinquent loans.

This paper uses household balance sheet data to examine the point at which borrowers in financial difficulty engage with their mortgage provider. The data includes borrowers that are in arrears and those who are yet to experience arrears (pre-arrears). It can be divided into five categories: *viable mortgages* which have returned to full repayment without modification; those where *no modification* has been granted but are not making full repayments; those that require *temporary modification* to resolve the borrowers financial difficulty; those that need a *permanent modification*; and finally those that are deemed to be *unsustainable mortgages* this final category could lead to other outcomes that include but are not limited to repossession, Mortgage-To-Rent scheme (MTR) or assisted sales.

Our focus is to identify the determinants of receiving a permanent modification and the subsequent repayment history twelve months afterwards. A permanent modification occurs when renegotiations result in permanent changes to the mortgage contract and/or repayment structure, for example, Term Extensions and Arrears Capitalisations. Temporary modifications[1] and unsustainable mortgages are excluded from our analysis.

For the purpose of this paper a "*successful modification*" occurs when full contracted payments are made twelve months after a permanent modification. It should be noted that typically a modified loan will have lower monthly mortgage repayments, however, this is not the case where arrears capitalisation occurs. Specifically, we examine the determinants of receiving a permanent mortgage modification and the characteristics of successful permanent modifications using micro-data submitted by lenders to the Central Bank of Ireland. The sample consists of PDH mortgages originated between June 1978 and December 2012 that have been subject to renegotiations during the period between January 2012 and December 2013.

Previous studies on the determinants of receiving permanent modifications and borrowers' payment behaviour use borrower information provided at the time of origination (cf. Agarwal et al., 2011; Tracy and Wright, 2012; Adelino et al., 2013; Fuster and Willen, 2013; Voicu

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[1]Temporary modifications are loans that receive contractual change that temporarily alters the borrower's repayment structure.

et al., 2013; Kruger, 2014). Our data set allows us to condition the decision to modify and borrowers' payment performance on *current* borrower and loan characteristics rather than relying on information provided at the time of origination. We can also directly observe the engagement of borrowers and lenders as well as the outcome of the renegotiation process for both arrears and pre-arrears cases. To our knowledge, this is the first study using contemporaneous borrower information to describe the decision to modify loans and the payment performance of modified mortgages.

The first model in this paper explores who receives permanent modification, the results show that current borrower characteristics rather than loan characteristics appear to matter more for both receiving a permanent modification and making full payment after permanent modification. A higher Mortgage-Repayment-To-Income ratio (MRTI), higher levels of non-PDH debt (leverage ratio) and higher household consumption to income ratios reduce the probability of receiving a permanent modification. In addition, borrowers who are unemployed or divorced have lower probabilities of receiving a permanent modification. The results also indicate that a higher Loan-to-Value ratio (LTV) and a higher arrears balance lower the chances of receiving a permanent modification. There are no significant differences in the probability of receiving a modification across different types of mortgages (for example, interest rate type, year of origination, etc.).

The findings of our second set of models suggest that changes in mortgage affordability are key features of successful modifications, irrespective of the modification type received. For example mortgage repayments for permanently modified borrowers account for an average of 28 per cent of monthly net-income. If this were to fall to 18 per cent of income (10 percentage point decline) the probability of full repayment would increase by 1.71 per cent. A number of borrower and loan characteristics play a role in explaining borrowers' repayment performance after modification. Higher non-PDH debt and a higher LTV ratio on the PDH mortgage reduce the likelihood of borrowers making full repayment after modification. Employment has a positive effect on repayment behaviour, while having filed for divorce prior to engaging with the lender reduces the probability of full repayment after 12 months. This suggests that affordability, employment status, housing equity and indebtedness are all important factors of successful modification[2].

The remainder of the paper is as follows. Section 2 provides some stylised facts on loan modifications in Ireland. Section 3 describes the dataset and our identification strategy. Section 4 shows the results and Section 5 concludes.

2   Mortgage modifications and payments

Figure 1 shows the patterns of permanent mortgage modifications and mortgage arrears for PDH loans between 2009 and 2013. The left panel in Figure 1 shows the number of PDH mortgages more than 90 Days-Past-Due (DPD) and the number of permanently modified PDH loans as a

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[2]These findings are in line with research on long-term mortgage defaults by Kelly and McCann (2015). They show that households that experienced unemployment or divorce had a higher probability of long-term mortgage default, but they do not examine mortgage modifications.

share of delinquent PDH loans. Figures are based on the mortgage loan books of three Irish mortgage lenders covering approximately 60 per cent of the total market.

The left panel indicates that the number of arrears cases increased from the beginning of 2009 before peaking mid-2013. It indicates that banks took some time to begin offering modifications a the share of permanent modifications relative to the total number of arrears cases accounted for approximately 20 per cent of all arrears cases between 2009 and mid-2012. However, in late-2012 long-term restructures offered to distressed borrowers increased and outpaced than the number of borrowers in arrears. This was due to the revision of the Code of Conduct for Mortgage Arrears (CCMA) and the introduction of the Central Bank's Mortgage Arrears Resolution Targets[3] (MART).
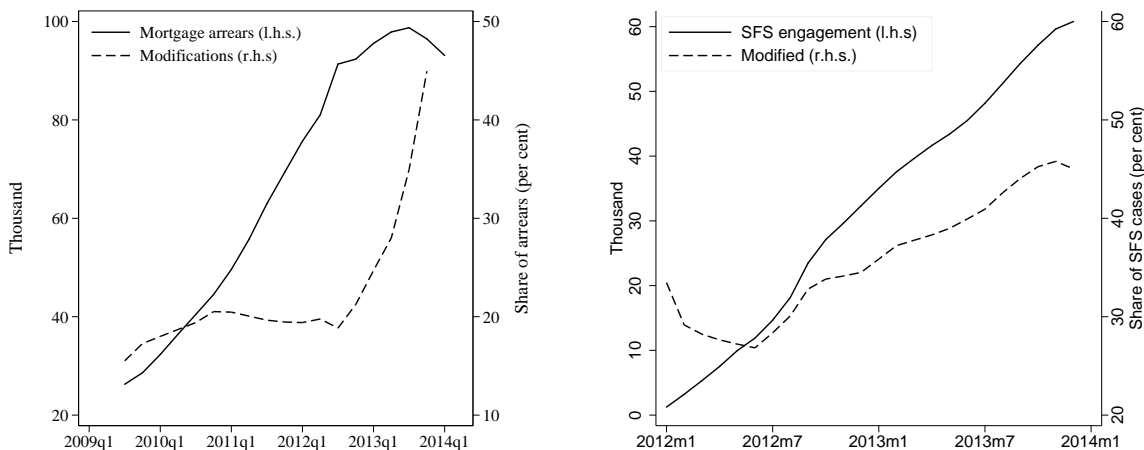

Fig. 1. Mortgage arrears, renegotiations, and permanent modifications
Source: Central Bank of Ireland Loan Level Data (LLD) and Standard Financial Statement (SFS) Data. *Notes:* Figures are based on the mortgage loan books of four Irish mortgage lenders covering approximately 60 per cent of the total market. No arrears data is available prior to 2009q3. No SFS data on engagement is available before January 2012. The figures cannot be compared to MART targets due to definitional differences and the exclusion of Buy-to-Let (BTL) loans. The left panel shows the stock of PDH mortgage loans 90+ DPD in arrears and permanent modifications in the LLD. Right panel shows the total number of mortgage renegotiations for PDH loans and the share of permanent mortgage modifications in the SFS.

The right panel of Figure 1 shows the number of borrowers, including pre-arrears cases, that have engaged with mortgage providers in loan renegotiations since the introduction of the industry-wide Standard Financial Statement (SFS)[4]. It also shows the percentage of engaging SFS borrowers that received permanent mortgage restructures since early-2012. Between January 2012 and December 2013, the number of borrowers engaging in renegotiations with their lenders grew steadily, with more than 60,000 unique households engaging with their lenders in PDH mortgage renegotiations.

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[3]MART was introduced at the beginning of 2013 and outlined procedures and targets for the modification of delinquent loans.

[4]The Standard Financial Statement document ensures that all borrowers seeking mortgage renegotiation are assessed and reviewed in a consistent and transparent nature across all institutions.

Figure 1 highlights that after mid-2012, the share of SFS applications that received permanent modification steadily increased to 45 per cent by December 2013. In addition to the permanent modifications shown in Figure 1, the data also indicates that as of December 2013, 19.7 per cent of SFS households "self-cured" or resumed full mortgage repayment without requiring mortgage restructuring. Temporary modifications were applied to 10.8 per cent of SFS households, while a further 1.5 per cent received alternative restructures including assisted sales and mortgage-to-rent (MTR) options. An additional 23 per cent of SFS households had no arrangement applied by December 2013.[5]

Previous empirical studies on the determinants and effects of mortgage restructures using US data show heterogeneous results and rely mostly on loan rather than borrower characteristics or information provided at the time of origination. Adelino et al. (2013) and Been et al. (2013) show that a higher LTV ratio, negative equity, better initial credit ratings, and higher local unemployment make receiving a modification less likely. In addition, they find that a lower mortgage repayment as a fraction of income increases the likelihood of receiving a modification. Similarly, Kruger (2014) finds that higher FICO mortgage scores[6] and high LTV loans are less likely to receive a modification.

Adelino et al. (2013) indicate that households with lower credit ratings are more likely to receive a modification. They also find that lenders are more likely to forbear, if the borrower has a higher repayment to original income ratio. Herkenhoff (2012) use data from the panel study of income dynamics and finds that negative equity, unemployment, and a higher outstanding balance have a positive effect on the likelihood of receiving a modification. Collins et al. (2013) find that a higher income and loan size at the time of origination make it more likely to get modified as well as having an adjustable rate mortgage.

A number of papers find a linear relationship between payment reduction and the likelihood of re-default (Agarwal et al., 2011; Tracy and Wright, 2012; Fuster and Willen, 2013; Voicu et al., 2013; Kruger, 2014). Lowering monthly repayment burdens reduce the re-default risk of modified loans proportionally, such that a reduction of 5 per cent on current repayments reduces the re-default probability by 5 per cent.

Fuster and Willen (2013) and Kruger (2014) show that overall payment reductions through term extensions have the same effect as permanent interest rate or principal reductions. They also find that modifications that increase current monthly payments, such as arrears capitalisations, increase the likelihood of re-default after modification (Agarwal et al., 2011). On the other hand, Querica et al. (2009) and Haughwout et al. (2010) find that the probability of re-default decreases even more when the payment reduction is achieved though principal forgiveness as opposed to lower interest rates.

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[5]There are a number of reasons why SFS borrowers do not receive any arrangement these include but are not limited to the following: (1) time lag from SFS submission to final application of an arrangement (2) a loan is deemed non-viable for any arrangement and legal proceeding are underway (3) if the borrower rejected the modification recommended by bank and consultation is ongoing (4) there are additional non-cooperating borrowers in cases where borrowers are separated and complete SFS documentation is not available etc.

[6]The FICO model is used by the majority of US banks, the higher the score the lower the credit risk.

3 Data and estimation

3.1 Data and sample selection

The data used for estimation in this paper are taken from the Central Bank of Ireland's Loan Level Data(LLD) and augmented with household Standard Financial Statement (SFS) data of distressed borrowers.[7] The data is restricted to SFS observations collected between January 2012 and December 2013 so that at least 12 months of mortgage repayments are available to December 2014. The LLD consists of the mortgage loan books of three major lenders covering more than 60 per cent of the Irish mortgage market. It contains borrower information at the point of origination as well as current loan characteristics including monthly instalment due, arrears balance, interest rate type, and modification status.

The SFS is a standardised industry-wide form that is completed by all borrowers who are experiencing financial difficulties and are engaging with their lender to find a resolution. On average, 40 per cent of SFS borrowers were pre-arrears cases who anticipated financial difficulty between 2012q1 and 2015q3.[8] A comparison of data contained within the LLD and the SFS show that long-term mortgage arrears borrowers engage the least with their lenders and are under represented in the SFS data. These borrowers are typically in more financial distress and are less likely to engage with their mortgage provider. These issues highlight a self-selection bias within the data, where typically less financially distressed borrowers engage in mortgage renegotiations. However, when compared to the LLD the data shows that borrowers in arrears of less than one year are well represented within the SFS data.

Notwithstanding its limitations, the SFS is a unique dataset containing detailed socio-demographic and audited financial information at the borrower and household level. Delinquent mortgage holders have to submit an SFS to their lenders at the time they experience payment difficulties or they will not be considered for modification. The dataset contains detailed information on the renegotiation process, including the date of engagement, the time of modification decision, and the modification outcome. The SFS dataset contains approximately 60,000 unique observations that can be matched to the corresponding loan information in the LLD as of December 2013.

The two data sets are merged at the loan level using a unique loan identifier and subsequently restricted to observations for which the renegotiation process has concluded and the outcome is known. The data is split into five categories, viable loans, permanent modifications, temporary modifications, unsustainable and no arrangement. The data shows that as of December 2013, temporary modifications were applied to 10.8 per cent of SFS households, while a further 1.5 per cent received alternative forms of restructuring including assisted sales and mortgage-to-rent (MTR) options. An additional 19.7 per cent of SFS households "self-cured" or resumed full mortgage repayment without requiring mortgage restructuring, while 23 per cent of SFS households had no arrangement applied by December 2013. For the purpose of this analysis we

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[7]Kennedy and McIndoe Calder (2011) provide an in-depth description of the LLD as of 2010.

[8]Pre-arrears cases include, but are not limited to, loss of income due to maternity leave, illness or unemployment where the borrower is yet to miss a payment but expects problems in the near future.

focus on delinquent loans that have either been permanently modified or had no modification (specifically self-cures and no arrangements), i.e., 26 per cent of SFS observations.

The baseline sample used in this analysis contains loans that originated between June 1978 and December 2012 that fell into arrears between January 2012 and December 2013, this provides at least 12 months of payment history to December 2014. We focus on PDH mortgages excluding cases that received a permanent modification prior to SFS data collection and cases that have received a temporary modification after the beginning of the SFS sample. Removing outliers and missing observations results in a baseline sample of 21,308 loan observations of both permanently modified and non-modified SFS loans. These data are then used to analyse the determinants of receiving a permanent modification.

Since we are also interested in the performance of modified loans after 12 months, we construct a second sample, consisting only of permanently modified loans for which we observe the payment status 12 months later. The resulting sample is considerably smaller, with 3,425 observations, but the sample characteristics across the two samples are similar (see Tables A1 and A2 in the Appendix).

The main variables of interest is the *permanent modification dummy (m)*. This variable is 1 if a loan has been granted a permanent modification and zero otherwise, where

$$m_{it} = \begin{cases} 1 & \text{if loan receives permanent modification} \\ 0 & \text{else} \end{cases} \tag{1}$$

Since the dataset does not contain actual monthly payments of borrowers we use an algorithm similar to McGuinness (2014) to calculate *monthly payments* using the instalment amount due in each month and the monthly changes in the arrears balance. We take a medium-term cash flow perspective when evaluating loan performance after modification and focus on borrowers' payment performance 12 months after the modification decision. While meeting the contracted loan terms for 12 consecutive months after modification does not imply long-term sustainability or that it is the cost-minimising alternative, it is considered to be an important benchmark by banking practitioners for the future performance of the loan.

In the case of modified loans, we augment the calculation with information on the type of modification such that payments after modification are conditional on the modification type. Not controlling for the type of modification the borrower receives would result in a biased measure of the actual payment. Payments made p by borrower i at time t are calculated as

$$p_{it} = d_{it} - f(a_{it}, m_{it}, t) \cdot \Delta a_{it} \text{ for each } i, t, \tag{2}$$

where d_{it} is the instalment due for borrower i at time t and Δa_{it} is the change in the arrears balance between t and $t-1$. $f(\cdot)$ is a function that is either 1 or zero depending on the arrears balance a, time t, and the type of modification m. Let $t = 0$ be the month of the SFS decision such that in $t = 1$ the modified loan terms take effect in case the borrower is granted a modification. If $t \neq 1$ the calculation is straightforward and $f(a_{it}, m_{it}, t) = 1$ for all cases of m and a. If $t = 1$,

f depends on m. If m is an arrears capitalisation or a hybrid modification that contains an arrears capitalisation, such that the arrears balance $a_{i1} = 0$, $f(\cdot)$ is zero. In the case of arrears capitalisation, the arrears balance is added to the principal such that if the borrower pays the full specified amount, the arrears balance in $t = 1$ is zero under the modified loan contract. In cases where the borrower was granted full capitalisation of arrears but still has a positive arrears balance $f(a_{i1}, m_{i1}, 1) = 1$ to account for the underpayment at the time of the SFS decision.

Since we are interested in the probability of full payment conditional on the borrower receiving a modification, we construct a categorical variable s_{it} that represents the borrower's *payment status* indicating whether the borrower does not pay, pays the full contractual amount, or a fraction of the amount due.[9]

$$s_{it} = \begin{cases} 0 & \text{if } (p_{it}/d_{it}) = 0 \\ 1 & \text{if } 0 < (p_{it}/d_{it}) < 1 \\ 2 & \text{if } (p_{it}/d_{it}) \geq 1 \end{cases} \tag{3}$$

We control for a number of quantitative and qualitative household and loan characteristics at the time the borrower engages with the bank in renegotiations. All variables are constructed at the household, rather than the borrower level.

Monthly after-tax income, monthly household consumption, and total secured and unsecured household debt at the time of the engagement are taken from the SFS. These are used to calculate: (1) the household's *mortgage repayment to income ratio* (MRTI) as the instalment amount due over the household's after-tax income, (2) the household's *leverage ratio* which is calculated as total secured and unsecured household debt, excluding any primary property debt, over the annualised after-tax income at the time of engagement. *Loan-to-value* (LTV) at the time of engagement is calculated as the outstanding balance over the most recent valuation of the property reported in the LLD, back-calculated using regionally disaggregated house price indices taken from the Central Statistics Office (CSO). In addition to the LTV ratio, we also construct an indicator that accounts for *negative equity*, where households in negative equity at the time of engagement are given their actual LTV value, and zero if the household is in positive equity.

Loan age, measured in years at the time of engagement, is taken from the LLD. Information on *borrowers' age*, the *number of borrowers* and the *interest rate type* of the mortgage are taken from the LLD. In the case of multiple borrowers, borrowers' age is proxied by the age of the primary borrower as reported by the lender. We add the *arrears balance*, taken from the LLD, relative to the household's current income as a measure of current mortgage distress.

We construct a measure that proxies for borrowers' *change in marital status* based on the information that borrowers provided at the time of underwriting and the information provided in the SFS. This measure is a dummy that takes on the value 1, if borrowers were married or cohabiting at the time of underwriting and reported to be single or divorced at the time of filling

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[9]Note that the results in Section 4 are invariant to small changes in the construction of s when, for example, changing the upper margin of full payment to 95 per cent, or the setting the margin for no payment to + 5 per cent.

out the SFS and zero otherwise.[10]

Employment at the household level is measured in two different ways. First, regardless of whether the household is a single person household, a couple, or a family we construct a dummy variable that is 1 if at least one person is in full time employment and zero otherwise. Second, we account for differences in the household's earning potential between single and multi-person households by constructing a set of dummies based on whether the household has zero income, one income, or two incomes from full time employment. To make our measure as tractable as possible and to account for earning potential of the household, we consider stay-at-home parents and retired household members as not employed, assuming that both groups at least theoretically could engage in some employment, if necessary.

Table 1. Summary statistics numerical variables

	Full sample			Permanently modified			Non-modified only		
	Mean	Median	StDev	Mean	Median	StDev	Mean	Median	StDev
Borrower characteristics									
MRTI	0.31	0.26	0.21	0.28	0.24	0.19	0.32	0.27	0.22
Consumption/ income	0.77	0.73	0.26	0.77	0.74	0.24	0.77	0.73	0.26
Leverage ratio	1.34	0.35	2.85	1.22	0.36	2.60	1.38	0.34	2.92
Age	45.00	44.00	9.45	45.76	45.00	9.19	44.76	44.00	9.51
Loan characteristics									
LTV	93.36	90.42	52.74	87.54	81.90	53.45	95.14	93.23	52.39
Negative equity	143.28	139.24	29.46	143.71	139.59	29.73	143.16	139.14	29.4
LTI	5.46	4.81	3.72	5.16	4.50	3.66	5.56	4.88	3.74
Arrears balance/income	0.18	0.02	0.35	0.16	0.04	0.31	0.18	0.01	0.37
Loan age	7.21	6.50	3.25	7.45	6.50	3.31	7.14	6.50	3.22
No. borrowers	1.56	2.00	0.51	1.70	2.00	0.48	1.51	2.00	0.52
Observations		21,308			5,042			16,266	

Source: Central Bank of Ireland LLD and SFS (2014). *Notes:* Figures based on households submitting an SFS between January 2012 and December 2013. Income and consumption is measured in EUR. MRTI and leverage ratios are the shares of monthly mortgage payments due over the monthly household income, and the total non-PDH mortgage household debt over the annualised income respectively. Loan age and borrowers' age are measured in years. Borrowers' age is based on the primary borrower in case of multiple borrowers.

Table 1 shows the summary statistics of the numerical variables of the baseline sample by modification status at the time of engagement. As shown by Table 1, loans that receive a permanent modification are characterised by a lower MRTI and a lower leverage when compared to non-modified loans. Permanently modified loans have a leverage ratio of 122 per cent on average, whereas, non-modified loans show a leverage ratio of 138 per cent at the time of engagement. Permanently modified and non-modified loans, however, do not differ in terms of the share of consumption and age. Both groups show a consumption to income ratio of 77 per cent and similar average age. Permanently modified loans also show a lower LTV ratio when compared to loans that do not receive a modification. Permanently modified loans also appear to have a lower arrears balance relative to income when compared to non-modified loans. Loans that have been offered a permanent modification show an arrears to income ratio of 16 per cent, whereas the ratio of non-modified loans is 18 per cent. Also, permanently modified loans appear to be

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[10]Note that in those cases, were borrowers were jointly assessed at the time of origination but got divorced in the mean time often submit two individual SFS statements for the same property loan. We treat these as one submission and one household despite the fact that borrowers are actually separated.

older and are more often jointly assessed at the time of underwriting than their non-modified counterparts.

Table 2 shows the sample distribution of categorical variables by modification status. Modified borrowers show a lower level of full-time employment than non-modified loans. In both groups, the majority of households only have one income to rely on and only 24.77 and 27.07 per cent of households consisting of two or more people have two incomes from full time employment at their disposal. Loans receiving a modification are less likely to be divorced, with 7.77 per cent of modified and 8.72 per cent of non-modified households filing for divorce prior to engaging in renegotiations. Tracker loans are the largest group engaging in renegotiations in the sample, followed by Standard Variable Rate (SVR) mortgages. Of modified loans 54.27 per cent and 41.77 per cent are Tracker and SVR loans respectively. At the same time, 58.60 per cent of non-modified loans are Trackers and 36.79 per cent of those are SVR loans. Of those households offered permanent modifications 8.40 per cent also own a Buy-to-Let (BTL) property, compared to 10.87 per cent of households that are not selected for a permanent modification.

Table 2. Summary statistics categorical variables

In per cent of sample	Full sample	Permanently modified	Non-modified only
Household characteristics			
Unemployment rate	23.99	25.06	23.66
Employed (one income)	49.48	50.17	49.27
Employed (two incomes)	26.53	24.77	27.07
Divorce since origination	8.49	7.75	8.72
BTL	10.29	8.40	10.87
Loan characteristics			
Tracker	57.58	54.27	58.60
SVR	37.96	41.77	36.79
Fixed rate	4.46	3.96	4.62
Observations	21308	5042	16266

Source: Central Bank of Ireland LLD and SFS (2014). *Notes:* Distributions are calculated with respect to the underlying (sub-)sample.

3.2 Estimation

Our estimation strategy is as follows. First, we estimate the determinants of receiving a modification at the time of engagement using a standard logit model. In a second step, we use the sub-sample for which we can observe borrowers' performance 12 months after modification to characterise the determinants of the payment status of modified mortgages using an ordered logit model.[11]

The baseline model for the probability of receiving a permanent modification has the form

$$P\left(m_{it} = 1 | \mathbf{x}_{it}\right) = \Lambda\left(\mathbf{x}_{it}'\beta + \alpha_j + \gamma_k + \delta_t\right), \tag{4}$$

where m_{it} indicates whether the loan receives a modification or not, $\mathbf{x}_{it}$ is a $h \times 1$ vector of

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[11]Note the Brant-test in Table A3 confirms that the proportional odds assumption of the ordered logit model holds in the data.

borrower and loan characteristics, β is a vector of coefficients, and $\Lambda(\cdot)$ is the logistic cumulative multivariate distribution function. The parameters α, γ, and δ are bank, county, and time fixed effects respectively controlling for the lender j, the county location k of the property, and the time of engagement t.

As we were unable to address the endogenous selection of loans for permanent modification we estimate the model for payment performance on permanently modified loans with at least twelve months payment history.[12] The model for estimating the determinants of the payment performance of modified loans takes the form:

$$P\left(s_{it+12} = 0 | \mathbf{y}_{it}\right) = \Lambda\left(-\mathbf{y}'_{it}\beta - \alpha_j - \gamma_k - \delta_t\right) \tag{5}$$

$$P\left(s_{it+12} = 1 | \mathbf{y}_{it}\right) = \Lambda\left(-\mathbf{y}'_{it}\beta - \alpha_j - \gamma_k - \delta_t\right) - \Lambda\left(\mu_1 - \mathbf{y}'_{it}\beta - \alpha_j - \gamma_k - \delta_t\right) \tag{6}$$

$$P\left(s_{it+12} = 2 | \mathbf{y}_{it}\right) = 1 - \Lambda\left(\mu_1 - \mathbf{y}'_{it}\beta - \alpha_j - \gamma_k - \delta_t\right), \tag{7}$$

where s_{it+12} is the payment status of the i-th borrower 12 months after the permanent modification is decided, μ_1 is the estimated transition parameter of the ordered logit model, and $\mathbf{y}_{it}$ contains the stacked matrices of the borrower and loan characteristics. The model uses the same borrower and loan covariates as described in Equation 4. The time fixed effects δ represent decision-time fixed effects of the SFS assessment.

4 Results

We first report the results for the likelihood of receiving a modification. Then we show which characteristics are associated with full payment 12 months after modification. We evaluate the marginal effects of the models at the median, since some of the covariates, such as LTV, have a skewed distribution.

4.1 Determinants of receiving a modification

Table 3 shows the logit estimates for the determinants of receiving a modification. The first column of Table 3 reports the results of the baseline specification of the model.

The results show that a higher MRTI, household consumption, and household leverage reduces the likelihood of receiving a modification. All three variables are significant at the one per cent level. Increasing average MRTI by 10 per cent from 28 per cent to 30.8 per cent of income reduces the probability of receiving a modification by 0.59 per cent. A household spending an additional 10 per cent of its monthly after-tax income have a 0.47 per cent lower chance of receiving a permanent modification. Similarly, increasing the household's leverage ratio from 1.22 per cent

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[12]Extensive investigative work was undertaken to examine alternative methodologies, we found that the lack of time varying borrower data prevented us from using survival models such as the Cox model, while the lack of a reliable instrumental variable meant that a Heckman model was not a viable option either.

to 1.34 per cent of income (i.e. 10 per cent), reduces the probability of receiving a modification by 0.054 per cent. However, for households with BTL properties this leverage ratio is insignificant as BTL ownership becomes their primary leverage driver (Column 4). Owning a BTL reduces the likelihood of receiving a permanent restructure by 3.8 per cent.

In the baseline specification (Table 3: Column 1), being employed increases the chances of receiving a long-term modification by 1.48 per cent. By comparison Column 3 shows that, regardless of the household size, having one full-time income increases the chances of receiving a modification, whereas having an additional income in the case of two or more borrowers, does not have a significant effect on the probability of receiving a modification. There is little difference across model specifications for marital status and borrower age. Table 3 shows that the probability of receiving a permanent modification reduces by approximately 3.9 per cent for those divorces, while borrower age does not have a significant effect on the likelihood of receiving a permanent mortgage modification.

The marginal effect LTV at the median and whether the property is in negative equity show the non-linear effect of overall LTV on the change in the probability of receiving a modification. For each additional per cent, a higher LTV ratio reduces the probability of receiving a modification by 0.05 per cent in the baseline estimation. When explicitly controlling for negative equity (Table 3: Column 2), the Negative Equity variable shows a positive but statistically insignificant coefficient. Since the Negative Equity variable is essentially an interaction term for loans that have a LTV above 100 per cent, the bottom row of Table 3 reports the F-test of joint significance of the LTV and Negative Equity variable. As the two variables are jointly significant, there is still a negative effect of the overall LTV on the likelihood of receiving a modification. The effect, however, is smaller for negative equity loans than for loans that are in positive equity.

Having a larger amount of outstanding arrears relative to income reduces the probability of receiving a modification. For an additional one per cent of arrears relative to income, the likelihood of receiving a modification falls by 1.82 per cent in the baseline. The coefficients for Tracker and SVR loans are insignificant indicating that interest-rate type is not a determinant for receiving a modification.

The results in Column 5 show that having an active temporary modification reduces the probability of receiving a permanent modification by 19.32 per cent. This is surprising as the findings by McGuinness (2014) highlight a marked increase in the number of permanently modified loans after the introduction of the MART targets in 2013, and it was thought this was due to temporary modifications switching to permanent modifications. However, the negative coefficient may be explained by the fact that our vector of covariates are capturing the drivers of the switch from temporary to permanent modifications.

4.2 Characteristics of successful modifications

In this Section, we provide evidence on how the characteristics of modifications affect borrowers' payment behaviour after modification. We characterise the effect of permanent modification by

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Table 3. Determinants of receiving a modification

Dependent variable: Receiving modification					
	(1)	(2)	(3)	(4)	(5)
Borrower characteristics					
MRTI	-0.0593***	-0.0596***	-0.0596***	-0.0591***	-0.0680***
	(0.0210)	(0.0214)	(0.0210)	(0.0210)	(0.0208)
Consumption/income	-0.0471***	-0.0489***	-0.0488***	-0.0486***	-0.0460***
	(0.0123)	(0.0126)	(0.0123)	(0.0123)	(0.0121)
Leverage ratio	-0.0054***	-0.0055***	-0.0053***	-0.0021	-0.0050***
	(0.0011)	(0.0011)	(0.0011)	(0.0019)	(0.0011)
Employed	0.0148**	0.0153**		0.0153**	0.0130*
	(0.0070)	(0.0072)		(0.0070)	(0.0069)
Employed (one income)			0.0189***		
			(0.0071)		
Employed (two incomes)			-0.0004		
			(0.0089)		
Divorce since origination	-0.0388***	-0.0396***	-0.0400***	-0.0387***	-0.0388***
	(0.0103)	(0.0106)	(0.0103)	(0.0103)	(0.0102)
Age	-0.0005	-0.0006	-0.0006*	-0.0005	-0.0001
	(0.0004)	(0.0004)	(0.0004)	(0.0004)	(0.0004)
BTL				-0.0380**	
				(0.0182)	
Loan characteristics					
LTV	-0.0005***	-0.0007***	-0.0005***	-0.0005***	-0.0005***
	(0.0001)	(0.0002)	(0.0001)	(0.0001)	(0.0001)
Negative equity		0.0001			
		(0.0001)			
Arrears balance/income	-0.0182**	-0.0186**	-0.0187**	-0.0198**	-0.0242***
	(0.0092)	(0.0094)	(0.0092)	(0.0093)	(0.0092)
SVR	0.0033	0.0031	0.0034	0.0033	0.0070
	(0.0144)	(0.0148)	(0.0144)	(0.0144)	(0.0142)
Tracker	0.0099	0.0102	0.0101	0.0099	0.0186
	(0.0149)	(0.0152)	(0.0149)	(0.0149)	(0.0147)
Loan age	0.0008***	0.0008***	0.0008***	0.0008***	0.0007***
	(0.0003)	(0.0003)	(0.0003)	(0.0003)	(0.0003)
No. of borrowers	0.0526***	0.0539***	0.0558***	0.0526***	0.0579***
	(0.0066)	(0.0069)	(0.0067)	(0.0066)	(0.0066)
Temporary modification					-0.1932***
					(0.0107)
Observations	21,308	21,308	21,308	21,308	21,308
Log-likelihood	-10612	-10611	-10608	-10610	-10413
Pseudo-R^2	0.0898	0.0899	0.0901	0.0900	0.107
AIC	21348	21348	21342	21345	20952
BIC	21841	21850	21844	21847	21454
F-test (p-value)		0.000			

Notes: ***, **, * denote 1, 5, and 10 per cent level of significance. Standard errors clustered at the bank/month-of-engagement level in parentheses. Boom-year house purchase, county, bank, and engagement date fixed effects are not reported. Coefficients represent marginal effects evaluated at the median for continuous variables and marginal effect of a discrete change from 0 to 1 in the case of categorical variables. F-test (p-value) refers to the F-test of joint significance of LTV and Negative Equity.

examining how the mortgage contract has changed (Table 4). We examine the change in the instalment amount due, the MRTI, the arrears balance and the maturity date by permanent modification types. In the case of Term Extensions, these characterisations move as per our expectations. However, given that arrears capitalisations, not only change the arrears balance but also affect the loan's outstanding balance it also affects the borrower's LTV and LTI. In the case of split mortgages, it is difficult to characterise the modification using the measures in Table 4 since a part of the loan is warehoused, which will also affects the loan's LTV and LTI.

Notwithstanding these limitations, Table 4 shows that term extensions have the largest relative change in the instalment amount due after modification when compared to other types of modifications. On average, the monthly instalment due falls by 13.66 per cent or 3.6 per cent relative to borrowers' income. Hybrid, split, and trial modifications show, on average, only moderate changes of 1.8, 0.43, and 0.98 per cent. Arrears capitalisations show an average increase in payments of 2.41 per cent.

Table 4. Characteristics of modifications by type

	Extension	Capitalisation	Hybrid	Split	Trial
Δ instalment (per cent)	-13.66	2.41	-1.80	-0.43	-0.98
Δ MRTI (per cent)	-3.60	1.77	-0.53	-0.23	-0.40
Δ arrears balance (EUR)	170	-1,290	50	350	460
Δ maturity (months)	47.84	0.00	12.34	0.00	0.00

Source: Central Bank of Ireland LLD and SFS (2014). *Notes:* Figures represent average percentage changes between pre and post permanent modification for instalment due and MRTI. The arrears balance and maturity are calculated as the change between the value at the time of the SFS submission and the value after the SFS decision. Changes are not adjusted for interest rate changes.

The changes in payments are similarly reflected in terms of the change in borrowers' arrears balance and the change in maturity after modification.[13] Table 4 indicates that the average increase in term extensions was just under 4 years, while a combined modification (hybrid) extended the term by an average of one year. The data also highlights that the average reduction in arrears balances is just €1,290 for those that receive an arrear capitalisation. This low average is value due to a number of factors, borrowers who have received arrears capitalisations are typically in arrears for shorter periods and have not accrued very large balances. In addition, some borrowers received partial arrears capitalisation this allows borrower to clear some arrears but also maintain an affordable monthly mortgage repayment.[14]

Table 5 shows the ordinal logit estimates of the model for borrowers' payment status after one year. We estimate the model described in Equations 5 − 7 for permanently modified loans with subsequnet twelve months repayment history. The covariates are measured at the beginning of the modification period, while the outcome is measured 12 months after modification occurs.

The average predicted probability of making no payment, partial, or full payment is 20.50, 19.34, and 60.16 per cent respectively. The first column in Table 5 shows the marginal effects for

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[13]Note that the average increase in the arrears balance for Term Extension, Hybrids, Splits, and Trial modifications is due to non-or under-payments of borrowers during the renegotiation process with the lender.

[14]Table 4 illustrates observed changes and thus is not adjusted for *natural* changes in borrowers' instalments due to, for example re-setting of mortgage interest rates for SVRs, Trackers, or Fixed Rate Mortgages.

Table 5. Determinants of performance of modified loans

Dependent variable: Payment status			
	No payment	Partial payment	Full payment
Borrower characteristics			
Consumption/income ratio	0.0327*	0.0237*	-0.0563*
	(1.72)	(1.73)	(-1.73)
Leverage ratio	0.0064***	0.0046***	-0.0110***
	(3.51)	(3.59)	(-3.59)
Employed	-0.0257**	-0.0186**	0.0443**
	(-2.44)	(-2.51)	(2.49)
Divorce since origination	0.0362**	0.0262**	-0.0623**
	(2.17)	(2.20)	(-2.20)
No of borrowers	0.0300***	0.0217***	-0.0517***
	(2.71)	(2.75)	(-2.75)
Loan characteristics			
LTV	0.0002***	0.0005***	-0.00117***
	(3.49)	(2.99)	(-3.29)
Negative equity	0.0000	0.0000	-0.00008
	(0.29)	(0.30)	(-0.29)
Loan age	0.0028*	0.0021*	-0.0049*
	(1.67)	(1.66)	(-1.67)
Payment Distribution (%)	13.6	15.6	70.8
Observations	3,425		
Log-likelihood	-2690		
Pseudo-R^2	0.0253		
AIC	5481		
BIC	5788		
F-test (p-value)	0.000		

Notes: ***, **, * denote 1, 5, and 10 per cent level of significance. Standard errors clustered at the bank/month-of-SFS-decision level in parentheses. Boom-year house purchase, county, bank, borrower age, interest rate type and engagement date fixed effects are not reported. Coefficients represent marginal effects evaluated at the median for continuous variables and marginal effect of a discrete change from 0 to 1 in the case of categorical variables. F-test (p-value) refers to the F-test of joint significance of LTV and Negative Equity.

the probability of making no payment (13.6 per cent). The second column shows the marginal effects for borrowers making partial payments after modification (15.6 per cent). While the third column shows the marginal effects for borrowers' probability of making full payment (70.8 per cent).

Conditional on being selected for a modification, only a limited number of borrower and loan characteristics matter for borrowers' payment performance after modification. Household age and the loan's interest-rate type do not have significant effects. While higher household leverage ratios reduce the likelihood of meeting the contractual payment after modification. A 10 per cent higher leverage reduces the probability of full payment by 0.11 per cent. Similarly, being employed increases the probability of making full payment by 4.43 per cent, whereas being divorced, reduces the likelihood of making full payment by 6.23 per cent.

A higher LTV ratio also reduces borrowers' likelihood of meeting the contractual payments after modification. Although, the coefficient for Negative Equity is insignificant, the F-test at the bottom of Table 5 indicates that both variables, LTV and Negative Equity are jointly significant. Thus, a 10 per cent higher LTV reduces the probability of making full payment after modification by 1.17 per cent, however if the property is also in Negative Equity, the overall probability of repayment falls to 1.25 per cent.

More mature loans and additional borrowers at the time of underwriting reduce the probability of making full payment after 12 months. An additional month in terms of maturity at origination and an additional borrower both reduce the probability of full payment by 0.49 and 5.17 per cent respectively.

Table 6 presents the results for borrowers' payment status after one year when the characteristics of modification in Table 4 are accounted for. For convenience, we only report the ordered logit results for the probability of making full payment. Table 6 shows that a relative change in the monthly payments does not have a significant effect on the probability of making full repayments after modification. On the other hand, a relative change in borrowers' MRTI increases the probability of making full repayments. For a 10 per cent drop in borrowers' MRTI, the probability of full repayment increases by 6.8 per cent.

Column 3 in Table 6 suggests that for a one month increase in the loan's maturity through modification, increases the probability of making full payment by 2.2 per cent. The remaining household and loan characteristics show qualitatively similar results to Table 5. As with previously reported tables borrower age and interest-rate type have no significant effect on repayment status and therefore not reported.

The final column in Table 6 estimates the joint effect of the characteristics of permanent modification. It highlights that the change in installment, and the change in maturity are both proxies for affordability, as such, when jointly tested only MRTI remains significant. Table 6 indicates that the change in affordability, captured by the change in borrowers' MRTI or the change in maturity rather than the change in the arrears balance, matters for the probability of full payment after 12 months.

Since the characterisation of modifications by the variables in Table 6 is rather crude, Table

Table 6. Characteristics of performance of modified loans

Dependent variable: Payment status					
	(1)	(2)	(3)	(4)	(5)
Modification Characteristics					
Δ instalment due	-0.0002				0.00005
	(-1.41)				(0.35)
Δ MRTI		-0.171***			-0.121***
		(-5.08)			(-2.75)
Δ maturity			0.00217***		0.00025
			(5.21)		(0.40)
Δ Arrears Balance				0.00075	0.00073
				(0.77)	(0.75)
Borrower Characteristics					
Consumption/income ratio	-0.0546*	-0.0495	-0.0521	-0.126***	-0.122***
	(-1.67)	(-1.52)	(-1.61)	(-2.89)	(-2.77)
Leverage Ratio	-0.0111***	-0.0107***	-0.0108***	-0.00941**	-0.00898**
	(-3.63)	(-3.50)	(-3.55)	(-2.35)	(-2.22)
Employed	0.0443**	0.0419**	0.0413**	0.0454*	0.0442*
	(2.48)	(2.36)	(2.33)	(1.96)	(1.90)
Divorce since origination	-0.0616**	-0.0605**	-0.0567**	-0.0698*	-0.0684*
	(-2.17)	(-2.13)	(-2.01)	(-1.93)	(-1.90)
No of borrowers	-0.0515***	-0.0472**	-0.0484***	-0.0704***	-0.0683***
	(-2.73)	(-2.51)	(-2.58)	(-2.80)	(-2.71)
Loan Characteristics					
LTV	-0.00117***	-0.00107***	-0.00103***	-0.00107**	-0.000997*
	(-3.27)	(-2.97)	(-2.82)	(-2.11)	(-1.96)
Negative equity	-0.00008	-0.0001	-0.00009	-0.000008	-0.00002
	(-0.31)	(-0.38)	(-0.34)	(-0.02)	(-0.07)
Loan age	-0.00499*	-0.00521*	-0.0049*	-0.00402	-0.00427
	(-1.70)	(-1.78)	(-1.67)	(-1.06)	(-1.12)
Observations	3425	3425	3425	2149	2149
Log-likelihood	-2581	-2585	-2572	-2576	-1969
Pseudo-R^2	0.065	0.0637	0.0683	0.067	0.0283
AIC	5268	5275	5250	5257	4047
BIC	5594	5601	5576	5583	4353
F-test (p-value)	0	0	0.001	0	0

Notes: ***, **, * denote 1, 5, and 10 per cent level of significance. Standard errors clustered at the bank/month-of-SFS-decision level in parentheses. Boom-year house purchase, county, bank, borrower age, interest rate type and engagement date fixed effects are not reported. Coefficients represent marginal effects evaluated at the median for continuous variables and marginal effect of a discrete change from 0 to 1 in the case of categorical variables. F-test (p-value) refers to the F-test of joint significance of LTV and Negative Equity.

7 tests how much of the effect of modification is captured by the change in the arrears balance and the change in the MRTI. We do this by constructing an interaction term between the type of modification the borrower has received and the change in borrowers' MRTI pre- and post-modification. Constructing an interaction term also allows us to test the effect of all types of modifications simultaneously in one model.

Table 7. Determinants of performance by modification type

Dependent variable: Payment status					
	Term Ext.	Arrears Cap.	Hybrid	Split	Trial
ΔMRTI	-0.129***	-0.238***	-0.175***	-0.185***	-0.0701*
	(-3.55)	(-5.55)	(-5.13)	(-5.35)	(-1.79)
ΔMRTI$*Mod-dummy$	-0.0244	-0.0532	0.0729	0.624	-0.244***
	(-0.25)	(-0.96)	(0.15)	(1.29)	(-4.82)
Observations	3425	3425	3425	3425	3425
Statistical Difference Test ($mod-type == 1,0$)					
Prob$>$ chi2	0.3189	0.0079	0.6013	0.0969	0.0060

Notes: ***, **, * denote 1, 5, and 10 per cent level of significance. Standard errors clustered at the bank/month-of-SFS-decision level in parentheses. The explanatory variables from Table 6 are controlled for but not reported. Coefficients represent marginal effects evaluated at the marginal effect of a discrete change from 0 to 1 for the modification type.

For convenience in Table 7 the explanatory variables presented in Table 6 are controlled for but not reported as they are not statistically different. In all specifications a fall in borrowers' MRTI, irrespective of the type of modification, increases the probability of making full repayment. Table 7 indicates that the change in the borrowers pre- and post-modification MRTI is the driving factor for successful repayments, irrespective of the type of modification the borrower receives. The P-values on the Chi-squared test of statistical difference also supports the notion that borrowers change in MRTI is more important then how that change came about.

5   Conclusion

Since 2009, Primary Dwelling mortgage arrears steadily increased to a peak of 12.9 per cent in 2013q3. The developing crisis sparked significant debate on how to modify delinquent loans. The approach taken by lenders in the early stages of the crisis was to focus on temporary interest-rate modifications rather than permanently changing the borrowers mortgage contract. As a result borrowers were not provided with any long term certainty with respect to their mortgage repayments and were constantly approaching their mortgage provider to renegotiate temporary contracts.

Changes in regulations not only required that institutions assess borrowers using a Standardised Financial Statement (SFS) but they also had to meet Central Bank targets for the type of modification granted. McGuinness (2014) highlights a marked increase in the number of permanent modifications granted after these regime changes.

This paper uses a combination of loan-level mortgage data and household SFS data to examine the determinants of receiving a permanent modification and the subsequent effectiveness of that modification on loan performance. We define a successful permanent modification as those that meet the new mortgage repayment contract twelve months after modification. While this does

not necessarily mean that the loan is long-term sustainable, however, the twelve month payment status is considered an important benchmark for future loan performance.

Compared to previous studies, our dataset allows us to observe borrower and loan characteristics around the time borrowers experience payment difficulties and to directly observe the outcome of that renegotiation process. To our knowledge, this is the first study using contemporaneous borrower information to describe the decision to modify loans and the payment performance of modified mortgages.

For the purpose of this paper permanent modifications include term extensions, arrears capitalisations, hybrids, splits and trails. The most common modification granted is arrears capitalisations (both partial and full capitalisation occur), this modification typically increases the borrowers monthly mortgage repayment unless some combination of term extension or interest rate reduction are also applied (i.e. hybrid modification).

The results indicate that current borrower characteristics rather than loan characteristics are more significant for both receiving a permanent modification and subsequently making full payment after modification. The likelihood of permanent modification increases when borrowers are employed, while divorce, higher LTV ratios and arrears balances reduce the probability of receiving a permanent modification. A lower mortgage repayment to income ratio (MRTI), lower household leverage (non-PDH debt), and lower household consumption also increase the probability of receiving a permanent modification, while changes in mortgage affordability is a key feature of the subsequent success of the modifications, irrespective of the modification received. We find that of those permanently modified over a year previously, 70 per cent were meeting their new contracted repayment amount twelve months after modification.

Our findings suggest that permanent modifications are typically applied to less distressed borrowers. These borrowers are deemed by banks to be more viable in the long-term, especially given that the most are granted arrears capitalisations which is the more expensive permanent modification. It is also likely that due to our biased sample selection our result underestimate the impact of permanent modification as the omitted observations belong to long-term mortgage arrears cases.

While this research focuses on the "success" of permanent modification twelve months after renegotiation it is important to remember that these candidates are in fact the distressed borrowers with the highest ex-ante repayment capacity. Further, loans classified as successful in our methodology will not necessarily result in full repayment of the interest and capital due on the mortgage. Therefore these loans continue to pose a risk to the health of the Irish banking sector and require continuous monitoring.

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Appendix A Additional results

Table A1. Summary statistics numerical variables (12 months after modification)

	Full sample			Permanently modified			Non-modified only		
	Mean	Median	StDev	Mean	Median	StDev	Mean	Median	StDev
Borrower characteristics									
MRTI	0.28	0.23	0.21	0.26	0.22	0.19	.29	.23	.22
Expenditure/income	0.78	0.74	0.25	0.78	0.75	0.25	.78	.74	.26
Leverage ratio	1.27	0.37	2.70	1.08	0.38	2.29	1.35	.37	2.84
Age	45.29	44.00	9.49	45.85	45.00	9.21	45.06	44	9.59
Loan characteristics									
LTV	92.55	88.87	52.34	88.89	83.66	53.20	94	91.24	51.93
Negative equity	143.01	138.23	29.59	143.96	139.14	29.59	142.67	137.98	29.59
LTI	5.62	4.91	3.81	5.34	4.72	3.71	5.73	4.98	3.85
Arrears balance/income	0.16	0.01	0.33	0.15	0.03	0.29	.16	0	.35
Loan age	7.04	6.25	3.23	7.24	6.50	3.24	6.97	6.25	3.22
No. borrowers	1.60	2.00	0.51	1.72	2.00	0.47	1.55	2	.51
Observations		13207			3425			9782	

Source: Central Bank of Ireland LLD and SFS (2014). *Notes:* Figures based on households submitting an SFS between 2012m1 – 2013m12. Income and expenditure is measured in EUR. MRTI is the shares of monthly mortgage payments due to monthly household income; the leverage ratios is total non-PDH mortgage household debt over the annualised income. Loan age and borrower's age are measured in years.

Table A2. Summary statistics categorical variables (12 months after modification)

In per cent of sample			
	Full sample	Only modified	Only non-modified
Household characteristics			
Unemployment rate	25.69	25.94	25.60
Employed (one income)	48.96	50.11	48.53
Employed (two incomes)	25.35	23.95	25.88
Divorce since origination	7.88	6.99	8.21
BTL	10.10	7.59	11.04
Loan characteristics			
Tracker	56.41	54.55	57.11
SVR	39.14	41.55	38.23
Fixed rate	4.45	3.91	4.66
Observations	13207	3425	9782

Source: Central Bank of Ireland LLD and SFS (2014). *Notes:* Fractions are calculated with respect to the underlying (sub-)sample.

Table A3. Brant-misspecifiation test

	χ^2	p-value
Consumption/income	1.76	0.41
Leverage ratio	3.38	0.18
Employment	4.07	0.13
Divorce since origination	4.59	0.10
Age	1.01	0.60
LTV	10.99	0.00
Arrears/ income	2.15	0.34
SVR	0.56	0.76
Tracker	5.95	0.05
Loan age	5.05	0.08

Notes: Test of the parallel line assumption of the ordered logit model. The test is based on specification reported in Table 5