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Resolving a Non-Performing Loan crisis: The ongoing case of the Irish mortgage market

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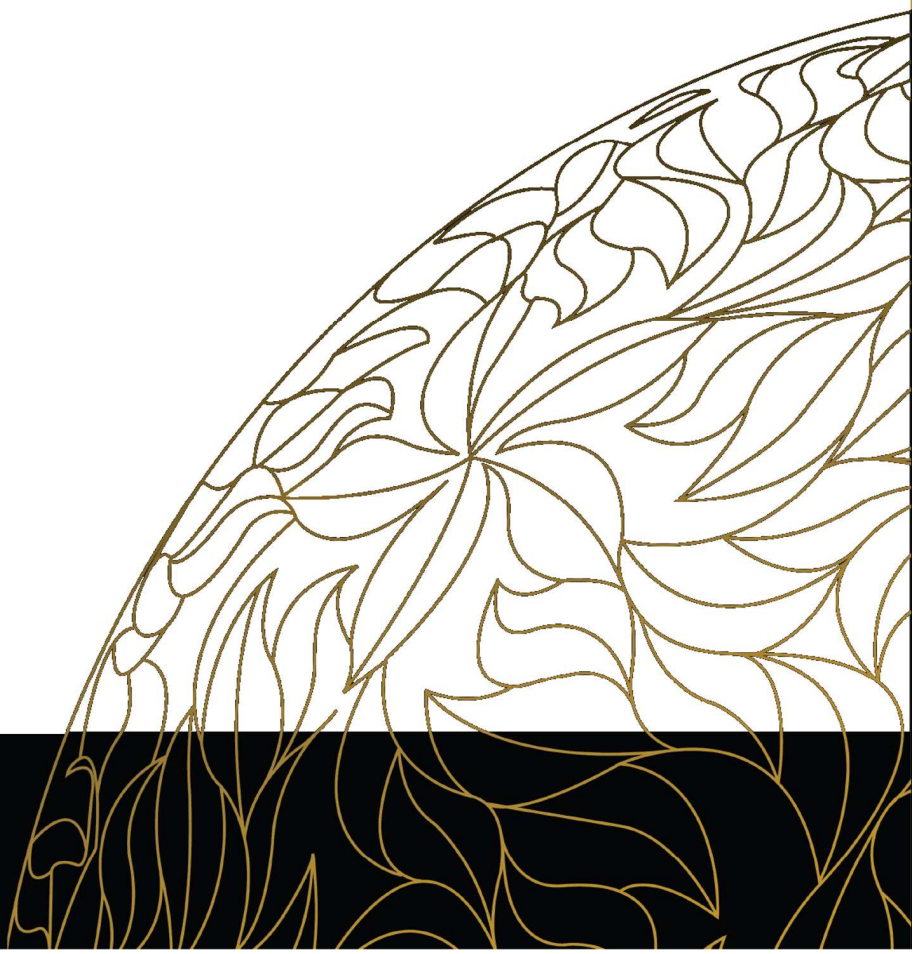

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Resolving a Non-Performing Loan crisis: The ongoing case of the Irish mortgage market

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Abstract

The Irish banking system has in recent years experienced a large build-up in Non-Performing Loans (NPLs) during the crisis followed by a sharp reduction in the 2013-2017 period. In this article I present a recent history of the ongoing resolution of the mortgage arrears crisis in Ireland. Using a large and close to exhaustive panel data set of Irish mortgages from 2008 to 2016, I present a number of new findings on loan transitions between delinquency states, the importance of legacy effects of the crisis in explaining recent entry to arrears, the role of mortgage modification in the reduction in arrears balances, the extent of borrower-lender engagement and the financial vulnerability that remains in pockets of the Irish mortgage market.

Keywords: Mortgages; Non-Performing Loans, Mortgage Modification; Borrower Engagement; Loan Transitions

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Non Technical Summary

In this article I present a wide range of new statistics on the developments in the Irish Primary Dwelling House (PDH) mortgage market using a large and close-to-exhaustive panel of Irish mortgages from 2008 to 2016 on, *inter alia* transitions between arrears states, loan repayments, mortgage modifications, borrower engagements, the legacy effects of the crisis on current loan delinquency and loan vulnerability to future repayment increases. The findings highlight a range of important patterns which are unobservable in publicly available official statistics on mortgage arrears and restructurings.

Research on flows into mortgage arrears shows that the share of loans with no arrears balance entering arrears has been falling on a quarterly basis since 2013, with the current transition rate of 0.5 per cent being the lowest seen since the data were first collected in 2010. Investigating the loans that did transition into arrears in late 2016 reveals important insights about the legacy effects of the recent crisis: of those entering arrears, just 29 per cent had no previous history of either modification or mortgage default; of the remaining 71 per cent the largest group comprised those with a previous history of both default and "permanent" modification.

The research also focuses in detail on "cured loans", i.e. those that had experienced arrears of greater than ninety days past due (90+ DPD, equivalent to three missed payments) during the 2009-2016 period, but at end-2016 were no longer in the 90+ DPD state. The analysis shows that, of all loans that had been in default during the period, 63 per cent had cured by end-2016. Among that group of cured loans, the data suggest that mortgage modification was an extremely important element of the recovery: 10 per cent of cured loans did so without any mortgage modification, while the other 90 per cent received some form of modification during the period.

The engagement of borrowers in mortgage distress is also measured. For those borrowers between three months and two years past due, over three quarters have engaged. The figure is lower in the 720+ group, with engagement at 61 per cent. The implication is that there are 9,680 mortgages (associated with over eight thousand unique properties) that are in the deepest state of arrears and have had no engagement whatsoever with their lender. Coupled with the 1,676 non-engaged mortgages in the 361-720 DPD group and the 2,250 mortgages in the 91-360 DPD group, these represent the most difficult cases for policy makers and lenders faced with resolving the NPL crisis in the Primary Dwelling

House segment of the mortgage market.

On mortgage modification, the paper presents a detailed time line of the issuance of modifications of a "temporary" (or short-term) and "permanent" or longer-term, more sustainable type. This analysis shows that, up to 2013, there were more than twice as many mortgages that had been issued at least one short-term arrangement as had been issued a longer-term arrangement. Between 2013 and 2015 however the rate at which each modification type was each altered dramatically, to the point where by 2016 there were more long-term arrangements than short-term arrangements observed in the data. In total, close to one hundred thousand modifications are shown to have been issued at least one temporary arrangement during the 2009 to 2016 period, with slightly over one hundred thousand having been issued a long-term sustainable arrangement (with it being possible for an individual mortgage to be counted in both categories). I also estimate a simple model to explain the loan-level factors associated with successful mortgage modifications, using as a dependent variable the probability that a modified mortgage is repaying its full contracted amount in the last quarter of 2016. This analysis shows that prior experience of default is an important predictor of subsequent repayment difficulty for modified mortgages.

1 Introduction

The mortgage arrears crisis in Ireland was among the most severe experienced on record. As the largest asset class on Irish banks' loan books, increases in mortgage delinquency had direct implications for solvency in the Irish banking system in the years after 2008: of the €27.7bn of adverse-scenario expected losses predicted at Irish banks between 2011 and 2013 as part of the Prudential Capital Assessment Review (PCAR) 2011, €9.49bn came from the residential mortgage portfolio.[1] The extent of the capital inadequacy arising from this Non-Performing Loan (NPL) crisis placed huge pressure on the Irish sovereign and played a large part in necessitating the fiscal consolidation that characterised Irish budgets during the period from 2011 to 2014. At its height in 2014 Q1, provisions for impaired loans had reached €46.8bn across the Irish retail banking system, impacting severely on profitability in the banking sector.[2]

After experiencing such an extremely sharp and systemically-important increase in mortgage arrears, the Irish mortgage market has also been notable in an international context for the speed with which NPL ratios have been reducing since 2013. World Bank data on the ratio of "bank nonperforming loans to gross loans" shows that at end-2012, the Irish banking system's NPL ratio was the highest among the group comprising Greece, Italy, Spain, Slovenia, Portugal, Italy and Cyrpus. From 2012 onwards however, the Irish NPL ratio has stabilised and reduced from 25 to 15 per cent, whereas it has continued to increase rapidly in Greece and Cyprus and to increase at a more steady rate in Portugal and Italy.[3] There are multiple explanatory forces behind this improvement in loan performance, among which are a rapidly improving economy, aggressive regulatory policy intervention from the Central Bank of Ireland (detailed in Donnery, Fitzpatrick, and McCann (2018)), changing attitudes and investment in resources among Irish lenders, and an improvement in communications and government supports available to distressed debtors.

Given the European context, there are many lessons that can be drawn from the Irish experience to 2017. My aim in this article is to describe a number of factors underlying the aggregate NPL reduction in the PDH mortgage market, as well as to highlight a number of patterns and remaining vulnerabilities which may serve as useful topics for research in other jurisdictions grappling with similar issues. I present a wide range of

[1] A copy of the PCAR report is available here.

[2] This figure for total provisions is reported in Central Bank of Ireland Macro-Financial Review 2017:1, Chart A8.

[3] The information behind this cross-country comparison can be obtained from the World Bank.

new statistics on the Irish mortgage market using a large and close-to-exhaustive panel of Irish mortgages from 2008 to 2016 on, *inter alia* transitions between arrears states, loan repayments, mortgage modifications, borrower engagements, the legacy effects of the crisis on current loan delinquency and loan vulnerability to future repayment increases. The findings highlight a range of important patterns which are unobservable in publicly available official statistics on mortgage arrears and restructurings.

The extent of the Irish mortgage arrears crisis is visible in Figure 1.[4] The rapid growth in arrears through the crisis period is evident in the graph: from 3.3 per cent of all loan balances being in arrears of greater than ninety days (90+ DPD) when data was first collected in September 2009, this figure rose to 12.9 per cent (or close to €18bn of mortgage balances) by September 2013. This increase was almost unprecedented in the recent history of developed-economy financial crises, with only Iceland having comparable levels of financial distress (Andritzky, 2014).[5]

Since 2013 however there has been a steady decrease in the share of PDH mortgages with 90+ DPD arrears, with the figure for March 2017 standing at 7.2 per cent. Given that the rate of foreclosure has been extremely low in Ireland, this decrease in mortgage arrears cannot be attributed to compositional changes arising from the exit of bad loans from banks' balance sheets. Further, while loan portfolio sales can also be used by lenders to reduce NPL ratios, the evidence in Ireland up to end-2016 is that such activity has not been common in the PDH segment of the mortgage market. If foreclosure and loan sales have not been driving the reduction in arrears, there are two main possible channels remaining: firstly, the re-setting of arrears balances to zero as part of a mortgage modification, or secondly "self-cure", where borrowers begin repayment and clear arrears balances after positive changes in their financial circumstances. Much of the research presented in this paper utilises granular loan-level data available to the Central Bank of Ireland to paint a detailed picture of the changes in loan performance experienced in Ireland over the recent crisis and recovery periods. The evidence suggests that mortgage modification has been the primary driver of reductions in arrears balances, with a more limited role attributable

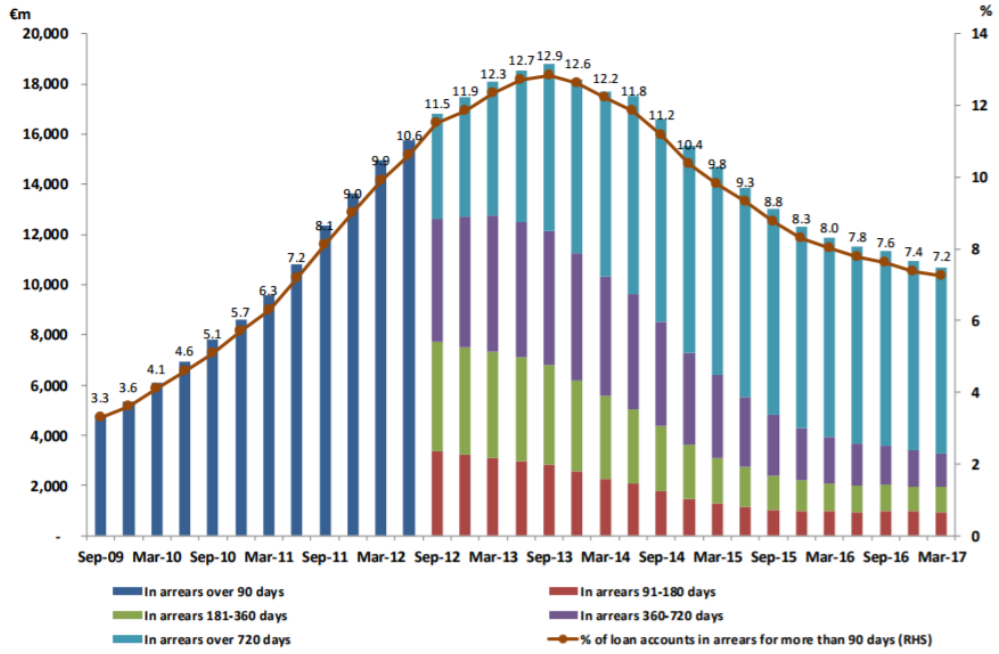
[4]Data presented are from the Central Bank of Ireland's official statistics on mortgage arrears of greater than 90 days (90+ DPD) for the Primary Dwelling House (PDH) segment.

[5]Federal Reserve Bank of St. Louis data show that the Delinquency Rate on Single-Family Residential Mortgages hit a maximum of 11.53 per cent in 2010 Q1, and had fallen to 3.68 per cent by 2017 Q2. Importantly, US data on loan delinquency reports the share of loans that are *thirty* days past due or more. The Federal Reserve Bank of New York's *Quarterly Report on Household Debt and Credit*, using data from Equifax, reports that the share of US mortgages reaching greater than 90 DPD was never higher than eight per cent at the height of the US mortgage crisis in 2010.

to "self-cure".

Figure 1: Primary Dwelling House Mortgage Arrears 2009-2017

Source: Official Central Bank of Ireland Mortgage Arrears Statistics; Left hand axis: Millions of euro of total loan balances in each arrears category. Right hand axis: Percentage of total outstanding mortgage balances in each category.



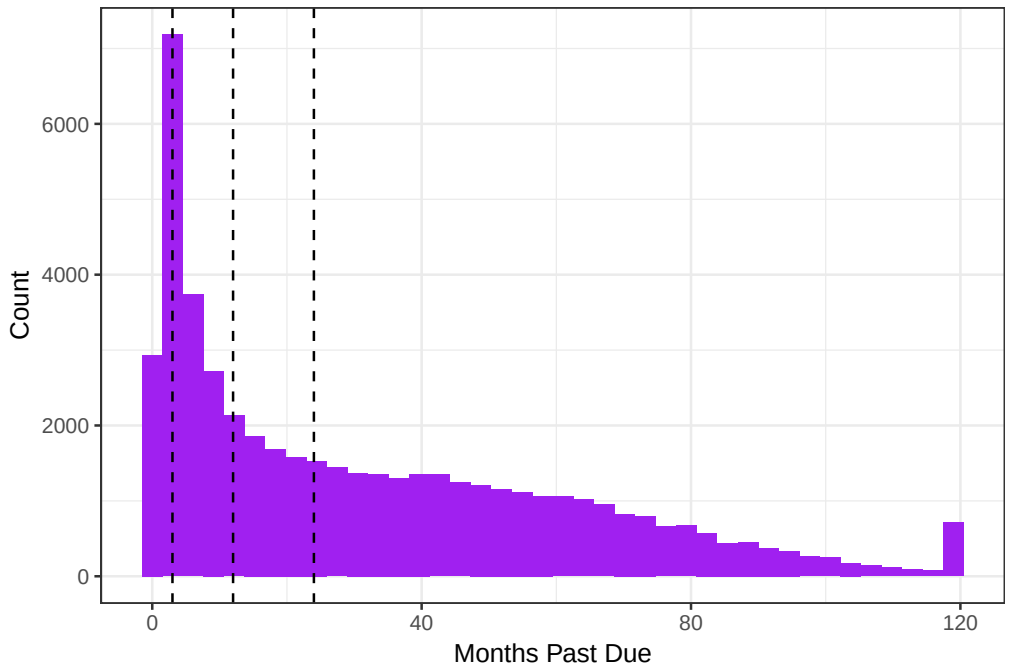
Another consequence of the extremely low level of foreclosure in the Irish mortgage market has been that, despite rapid increases in borrower-lender engagement and the provision of mortgage modifications, there exists a cohort of non-paying mortgages that have continued missing payments for many years up to early 2017. This group is reflected in Figure 1 by the turquoise blue bar representing loans in arrears over 720 days (720+ DPD). These are loans that have arrears balances equivalent to more than twenty four monthly mortgage repayments. The shifting nature of the policy problem facing Irish lenders and authorities over the 2013 to 2017 period is borne out by the growth in the size of the 720+ DPD share in the graph: as the economy has recovered, the number of loans in the earlier stages of mortgage arrears has steadily decreased, while the share of the 720+ group has increased to over two thirds of those in 90+ DPD arrears. This is the main factor behind the comparably high level of arrears which remains on Irish banks' mortgage portfolios.

This "long term mortgage arrears" (LTMA) group has been the subject of earlier research by Kelly and McCann (2016) and Kelly and McCann (2015) who show that this group is characterised by high levels of negative equity, unemployment, falls in income,

high non-mortgage indebtedness and mortgage repayment burdens. Figure 2 plots the distribution of arrears, expressed as months past due, among those loans in arrears of greater than one month at December 2016 using loan-level data for the five main Irish mortgage lenders covering 90 per cent of the PDH market. The graph shows that the right tail of the arrears distribution is strikingly large: in fact, the median arrears balance is at exactly two years past due. The 80th percentile of the distribution is 60 months, meaning that 20 per cent of borrowers in arrears have been in arrears of over five years. This LTMA group will be subject of much detailed analysis in this paper, given that it represents the most complex policy challenge remaining as a legacy of the financial crisis in Ireland.

Figure 2: The distribution of Irish mortgage arrears

Source: Central Bank of Ireland loan-level data from the five largest mortgage lenders in Ireland; Dashed lines represent 90, 360 and 720 DPD. Loans with arrears balances greater than ten years are censored at 120 months past due.



The paper proceeds with a discussion of the data sources used (Section 2), followed by studies of loan transitions between delinquency (Section 3), the loans that have cured over the 2008-2016 period (Section 4), observed repayments (Section 5), borrower engagement (Section 6), mortgage modifications (Section 7) and the vulnerability of mortgages to future increases in repayments (Section 8).

2 Data Sources

The information used in all sections in this paper comes from the Central Bank of Ireland's mortgage Loan Level Data (LLD). The LLD were first collected in March 2011 as part of the Prudential Capital Assessment Review (PCAR) assessment of bank solvency which ultimately resulted in State financial support being provided to six domestic Irish banks in the guise of the Financial Measures Programme (FMP). Of these six banks, four remained as going concerns at the end of the FMP: Allied Irish Banks (AIB), EBS, Bank of Ireland (BOI) and Permanent TSB (PTSB), with EBS being subsumed into the AIB group as part of the FMP. Information on each loan outstanding at December 2010 at the subject banks was provided as part of PCAR, with historic information on each loan's arrears balance going back for twelve months to December 2009 for two banks and going back further to June 2008 for one bank. After the PCAR process, an additional dataset was provided pertaining to the December 2011 profile of all outstanding loans at the subject banks, with twelve months of arrears history to December 2010 provided. After December 2011, the Central Bank has received LLD every six months from these banks, with the most recent dataset usable at the time of writing relating to December 2016. From January 2015, KBC Ireland and Ulster Bank Ireland Limited (UBIL) began submitting LLD files for their Irish mortgage portfolios to the Central Bank, meaning that for the 2015 and 2016 versions of the LLD, the five main mortgage lenders comprising over 90 per cent of the Irish mortgage market are submitting loan-by-loan information.

With the LLD combined across all datasets received from 2010 to 2017, a monthly history of arrears balances and DPD states can be built up for individual loans, linked through time using a unique loan identifier, spanning the period June 2008 to December 2016 in the best-case scenario. This information is complemented by time-varying information which is updated every six months on items such as a loan's current outstanding balance, interest rate, interest rate type, payment type, modification status, loan to value ratio (LTV) and loan maturity date. Furthermore, a wide range of time-invariant fields are also observable in the data, for example First Time Buyer status, Buy to Let status, drawn balance at origination, originating borrower income, originating LTV, borrower and collateral location, date of origination.

In this research paper, all static analysis referring to December 2016 will utilise the "five bank view" which incorporates loan-by-loan information for AIB-EBS, BOI, PTSB,

KBC and UBIL. In certain cases, historical information on loans' performance through the 2009-2016 period is required, and when this is the case the "three-bank view" of the PCAR banks will be used. In these cases, the analysis is incorporating information on roughly two-thirds of the loans in the Irish mortgage market.

Before proceeding, I provide a breakdown of the PDH market at December 2016 by DPD status and modification status in Table 1. Of 664,981 mortgages visible at the five banks in the sample, there are 464,442 that are Zero DPD (those with no arrears) and have never had any modification. 76,813 loans are Zero DPD having been permanently modified, while another 52,372 are Zero DPD having had a temporary modification that has since elapsed.[6] Of 24,944 720+ loans visible in the data, 13,627 have had a previous temporary modification while 7,755 have had no modification whatsoever.

Table 1: December 2016 DPD and Modification status
Total number of cases: 664981

Modified	0 dpd	1-90	91-360	361-720	720+
Never	464422	5826	1880	1333	7755
Permanent	76813	8561	4376	1718	2435
Temp_Now	9072	1703	1255	728	1127
Temp_Past	52372	3674	3260	3025	13627
Totals	602679	19764	10771	6804	24944

3 Loan Transitions

Underlying the aggregate statistics presented in Figure 1 are a series of flows between states which I refer to as "DPD Buckets". I delineate the mortgage market into seven groups, into which every loan in every quarter from June 2008 to December 2016 can be classified. The seven buckets are:

1. Zero DPD
2. 1-30 DPD
3. 31-60 DPD
4. 61-90 DPD

[6] A precise definition of the types of modification that are classified in this paper as being of a temporary or permanent nature is given later in the paper.

5. 91-180 DPD
6. 181-365 DPD
7. 365+ DPD

All loans classified in buckets (5) to (7) are in mortgage default as per the Basel II definition. In addition, some loans in buckets (1) to (4) may also be classified by the lender or regulator as being in default, in cases where the loan officer has deemed there is a material likelihood of non-payment as well as in cases where mortgage restructurings have been issued and the loan remains in regulatory default during a "probation" period.

For all loans existing in any pair of quarters $(t, t+1)$, there is a seven-by-seven matrix of possible transitions between each of the DPD buckets outlined above. Given that there are 35 quarters for which data is available, combined with 49 possible permutations of DPD states in periods t and $t+1$, it is difficult to display information on loan transitions in a digestible way. For this reason, I restrict my presentation on trends in loan transitions to four charts.

Firstly, I document in Figure 3 the percentage of loans that are Zero DPD in quarter t but by quarter $t+1$ or $t+2$ have entered arrears, i.e. a quarterly or a six-monthly transition rate. Figure 3a begins with a graph of the quarterly transition rates. The blue line shows that at the height of the crisis in 2011, between 2 and 2.5 per cent of the Zero DPD loans were entering arrears within the next quarter. While this transition rate has improved greatly, the share of September 2016 Zero-DPD mortgages that had entered arrears by December 2016 was still 1.3 per cent - similar to the number of mortgages transitioning into arrears in late 2008. I also plot with the red line the share of loans that transitioned over a quarterly period to arrears greater than 30 days. This is because the size of 1-30 DPD group can at times overstate the extent of financial distress among mortgaged households due to the existence of cases where households have entered arrears for administrative reasons such as funds not being transferred at the appropriate time or other technical glitches. When analysing the flow into 30+ DPD, I am purging the data of any such idiosyncrasies, focusing on households that have missed two payments or more over the quarter. The transition rate follows a similar trend but with a significantly lower level: at the height of the crisis, 0.8 per cent of Zero-DPD loans transitioned to 30+ DPD in the subsequent three months. Of the September 2016 Zero-DPD cohort, 0.2 per cent of loans had entered 30+ DPD arrears by December.

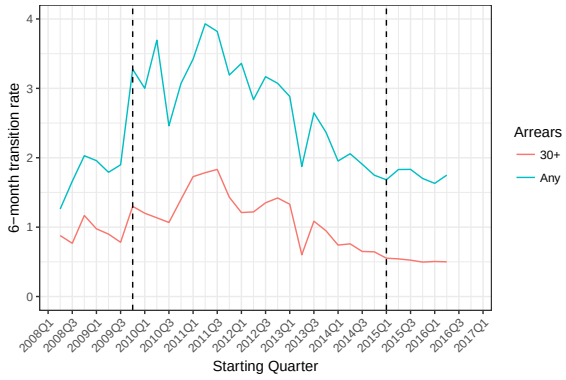
In Figure 3b I repeat the exercise but allow a six-monthly transition to any arrears and 30+ DPD. This graph shows that the transition to 30+ DPD, i.e. that which purges the data of any technical reasons for entering one month of arrears, is at 0.5 per cent, which is lower than at any time since the LLD became available to the Central Bank of Ireland.

Figure 3: Mortgages leaving 0 DPD to enter arrears; quarterly and 6-monthly flow

To the left of the first dashed line, the sample comprises one bank; in between the two dashed lines the sample comprises three banks; to the right of the second dashed line the sample comprises five banks.

(a) Quarterly Flow

(b) Six-Monthly Flow



Next, rather than observing the flow from Zero arrears, I plot the entry and exit from 90+ DPD, the closest measure to the Basel definition of mortgage default available in the data, in Figure 4. In Figure 4a, the quarterly flow into default is shown to have reached a maximum of just over 1.25 per cent in late 2011, and is now at 0.37 per cent, a similar level to that seen in early 2008. The flow of loans out of 90+ DPD (either to early-stage arrears or to Zero DPD), often referred to as the "cure rate", is shown in Figure 4b to have grown from 4 per cent of defaulted loans in 2011 Q1 to over 11 per cent in late 2014. Since then, the cure rate has steadily fallen, likely to reflect in part the compositional shift towards difficult-to-resolve long term mortgage arrears cases dominating the 90+ DPD group in recent years.[7]

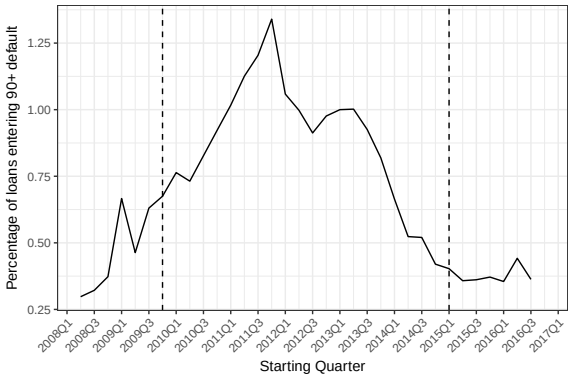
Figure 5 reports the share of loans in each DPD bucket in each quarter t that transitioned to an improved (i.e. lower-DPD) state by $t + 1$. This improvement can occur in two ways: either an over-payment relative to the contracted monthly instalment due, which would pay off some of the arrears balance, or a mortgage modification which includes an arrears capitalization, which involves a portion of a loan's arrears balance being

[7]The patterns reflected in Figure 4b should not be interpreted as estimates of the cure rates often used in stress-testing exercises. The numbers shown in this paper simply reflect whether loans have exited the 90+ DPD delinquency status. In regulatory terms, loans may leave 90+ DPD but remain in default, due to a "probation" period applied after mortgage modification.

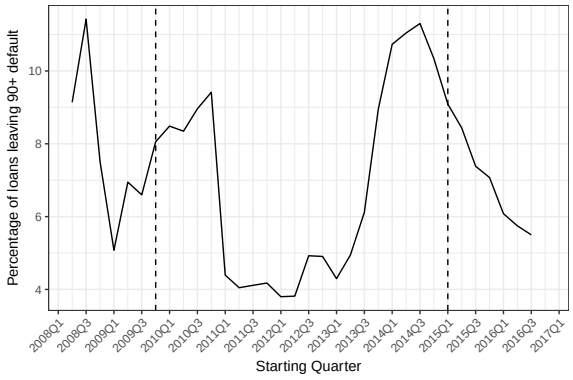
Figure 4: Quarterly entry and exit from 90+ DPD default.

To the left of the first dashed line, the sample comprises one bank; in between the two dashed lines the sample comprises three banks; to the right of the second dashed line the sample comprises five banks.

(a) Default Flow



(b) Cure Flow

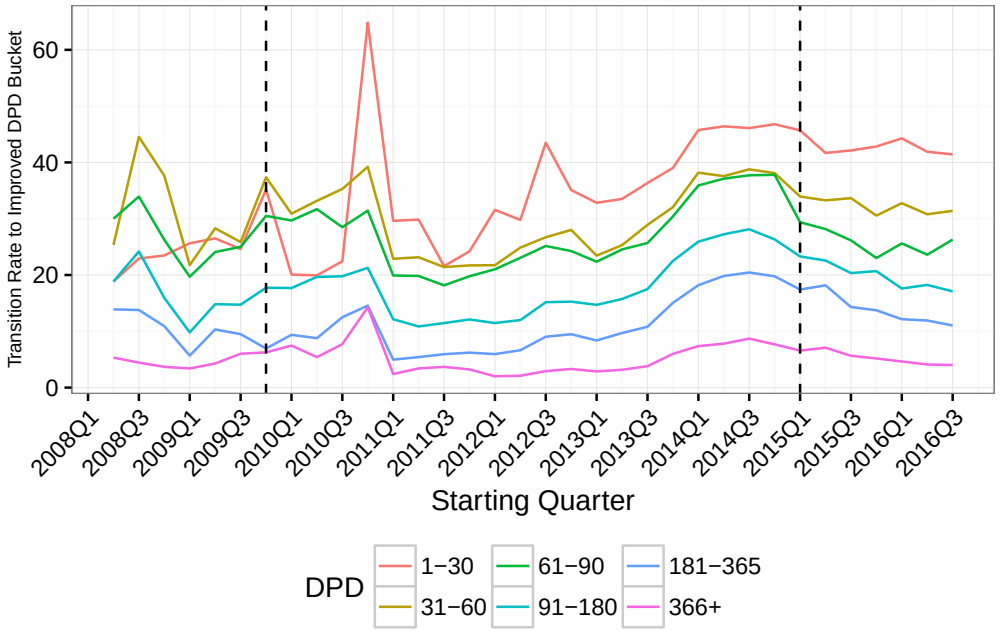


added onto the overall outstanding loan balance, with the arrears balance reduced by the offsetting amount. The graph shows a clear rank ordering: for loans in lower-DPD states at time t, there is a higher likelihood that the loan will move to a lower-DPD state in time $t + 1$. While slightly noisy in the 2008 to 2011 period, this rank ordering is monotonic and consistent in all quarters from 2011 to 2016 inclusive. A stark improvement in these "improvement flows" is evident through 2011-2014: for loans in early-stage (1-30 DPD) arrears, the transition rate to Zero DPD grew from 22 per cent in 2011q3 to 42 per cent in 2016q3. Similar increases have been observed in all DPD states apart from the 365+ group, where the transition rate never surpassed 10 per cent. The falling transition rates since 2015, particularly in the 61-90, 91-180 and 181-365 groups, may partially be explained by a changing borrower composition: as the arrears situation has steadily improved, there may be tendency towards only the more difficult-to-resolve cases remaining in these higher-DPD groups, as many of the easier-to-resolve cases have already exited from these higher-DPD states in previous periods.

Figure 6 analogously shows the transition to a *higher*-DPD state in each t from 2008q2 to 2016q4. The rank ordering seen in the previous graph does not exist for this series: rather, the group with the highest transition rate to greater arrears is the 61-90 group, followed by the 31-60 and 91-180 groups. The distinction between the 1-30 DPD groups and the two other in-arrears but non-defaulted groups (31-60, 61-90) is striking in this regard: it appears that, for loans entering arrears in the 1-30 DPD category, there is a strong likelihood of improvement, with the most recent transition rate to Zero DPD being more than four times as high as the most recent transition rate to a higher-DPD state.

Figure 5: Share of loans improving their DPD status

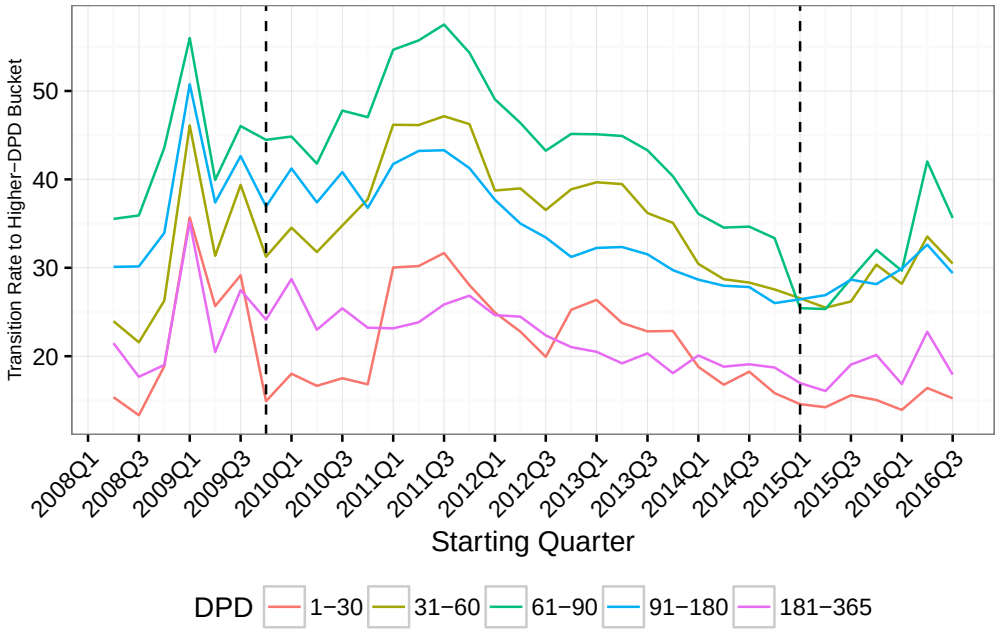
To the left of the first dashed line, the sample comprises one bank; in between the two dashed lines the sample comprises three banks; to the right of the second dashed line the sample comprises five banks.



However, once loans do enter the 31-60 and 61-90 DPD group, these probabilities change dramatically, with these mortgages being equally likely to have arrears growth as arrears reduction. These patterns may intuitively reflect a selection bias whereby loans with minor temporary financial difficulties and loans in "technical arrears" for reasons of administrative error are quick to rectify the error. They may also however highlight the importance to banks of early engagement with borrowers to slow the flow of early-arrears mortgages, given the large increase in default probabilities that is implied by the 31-60 and 61-90 groups in Figure 5 and 6.

Figure 6: Share of loans increasing their DPD status

To the left of the first dashed line, the sample comprises one bank; in between the two dashed lines the sample comprises three banks; to the right of the second dashed line the sample comprises five banks.



3.1 Who is entering arrears in late 2016?

Much domestic research has focussed on the question of the causes of mortgage arrears during the Irish crisis. Kelly and O'Malley (2016) show in a transition-based model with data from 2010q1 to 2014q2 that mortgage defaults were more likely for loans with higher Debt Service to Income ratios, higher Current Loan to Value (CLTV) ratios, higher interest rates and higher regional unemployment. Variable rate loans (both "Standard Variable" as well as "Tracker" mortgages) are also shown in the paper to have higher default probabilities than fixed-rate loans, as are Second and Subsequent Buyers (relative to First Time Buyers) and loans of an older vintage. McCarthy (2014) shows using a cross-sectional model with linked survey and loan-level data at mid-2013 that lower incomes, bigger income falls, job loss, fragile employment, the ratio of mortgage repayment burden to income, CLTV, additional equity release mortgages, lower educational levels and the number of dependent children all play a role in explaining mortgage arrears in Ireland at the height of the crisis period. Using a unique dataset on distressed households engaging with their lender, Kelly and McCann (2016) show that, in addition to the aforementioned explanatory factors, non-mortgage indebtedness also plays a role in explaining the entry to mortgage default, and that in the case of all of these factors, there is an additional effect on entry to long-term

mortgage arrears (arrears of more than one year, LTMA), over and above the effect that these factors have in explaining entry to 90 DPD default.

Since the 2011-2013 period on which most of the above papers are based, the Irish economy has undergone a rapid recovery. Unemployment rates have fallen from a peak of 15.1 per cent in 2012 Q1 to 6.8 per cent in 2017 Q1. House prices have risen from a trough of 58.7 per cent of January 2005 levels in March 2013 to 94.3 per cent in June 2017, an increase of 61 per cent. The analogous figure in the Dublin housing market in 77 per cent. Despite these changes, Figure 3 highlighted that the quarterly transition rate into arrears from Zero DPD remained above 1 per cent in late 2016. Given the dramatic improvement in the economy, the question naturally arises: which type of households enter arrears during a period of rapid economic growth following a financial crisis? In order to answer this question, I firstly delineate the 5,524 mortgages that entered arrears between September and December 2016 along two dimensions: their modification status (four groups: never modified, permanently modified, currently temporarily modified, previously temporarily modified) and their previous default experience (two groups: never experienced default from 2008q2 to 2016q4, or have previously experienced default in that timeframe). In order to carry out this exercise I must rely on the "3-bank" version of the data, meaning that the sample for this exercise comprises the two thirds of the mortgage market covered by AIB-EBS, BOI and PTSB.

Table 2 shows us that the share of entrants to arrears in the last quarter of 2016 that had never experienced either default or modification was 29 per cent (1,589 from 5,524). This means that the legacy effects of the financial crisis are vitally important in explaining recent flows into arrears, with 71 per cent of the entrants to arrears having a history of previous default or modification. Among these, the largest group is the 1,854 (one third of all new entrants to arrears) mortgages that had been permanently modified and had previously been in default. Given that these mortgages were entering arrears from the Zero-DPD state in September 2016, it is highly likely that an arrears capitalization had formed part of their permanent modification (resetting the DPD count to zero as part of the modification). An additional group comprised mortgages that had never previously been in default but had been permanently modified (566, or 10.3 per cent) or had received a temporary modification in the past that had since elapsed (736, or 13.3 per cent). These flows highlight the fragility of a group of mortgage modifications, and suggest that the work-out of the stock of financially distressed mortgages will continue to pose difficulties

in the Irish mortgage market for some time. These findings confirm the patterns reported in Table 2 and in fact accentuate the importance of the legacy effects of the recent crisis in explaining new flows into arrears during an economic recovery.

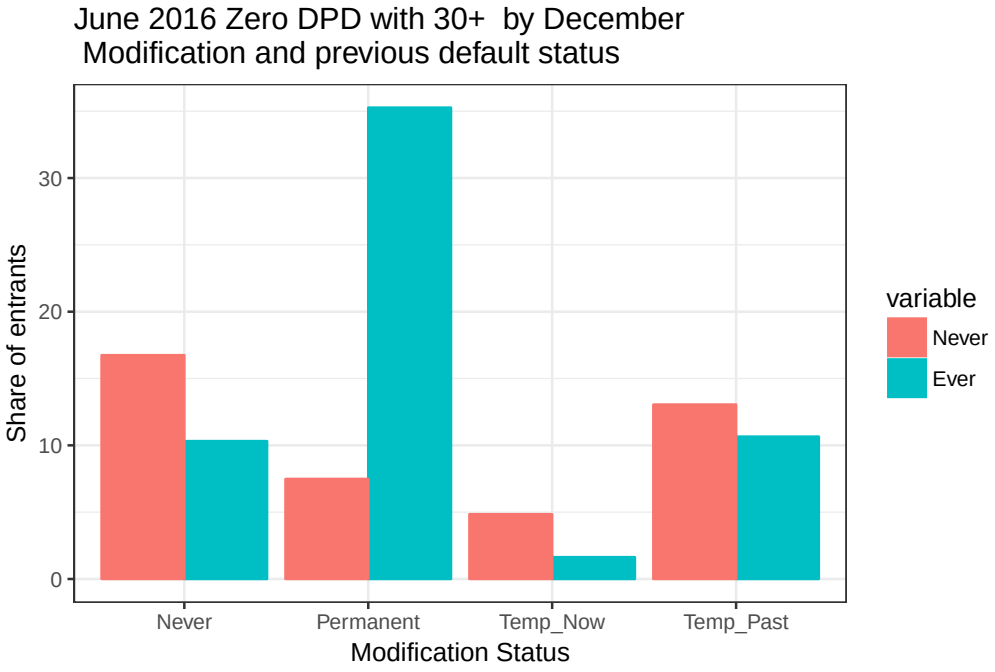
Table 2: The arrears entrants between September and December 2016: Had they previous modification or default?
Total number of cases: 5524

	Default History			
	Numbers		Share of Total	
Modified	Never	Previous	Never	Previous
Never	1589	279	28.77	5.05
Permanent	566	1854	10.25	33.56
Temp_Now	105	78	1.90	1.41
Temp_Past	736	317	13.32	5.74

Given that many of those entering the earliest stages of arrears have a high probability of avoiding further arrears, it is also instructive to strip out those leaving Zero DPD for 1-30 DPD. Figure 7 takes the Zero DPD cohort from June 2016 and plots the combined modification and default history for those loans that had missed two payments or more by December 2016. Looking at this group, the importance of recurring problems among the previously permanently modified group appears even more important. The share of loans that have entered this deeper state of default without any previous history of modification or default is now just 17 per cent, while the share with both previous default and permanent modification has risen to 35 per cent.

In Table 3 I formalise the patterns shown in Table 2 using a series of simple linear probability model specifications. The sample in each case is the set of loans at AIB-EBS, BOI and PTSB that was at Zero DPD in September 2016, while the dependent variable is a dummy that takes a one for mortgages that had entered arrears by December 2016. Column (1) of Table 3 shows that the relationships that were shown to hold during the crisis period continue to hold (Kelly and O'Malley, 2016; McCarthy, 2014; Kelly and McCann, 2016). Loans with a higher Current Loan to Value ratio have a higher probability of entering arrears (PEA). Similarly, SVR loans have a higher PEA than fixed-rate loans (but Tracker and Fixed loans appear to have a similar PEA), and while controlling for these contract types, loans with a higher interest rate also have a higher PEA. Regional economic conditions are shown to matter, in that Dublin mortgages have a lower PEA than the rest of the country. Mortgages on multi-loan facilities are also shown to have

Figure 7: Modification and default history for those entering 30+ DPD in 2016 H2
Horizontal axis gives previous modification status of each mortgage (Never modified; Permanent Modification; Current Temporary Modification; Previous Temporary Modification). Red and blue bars represent previous default history (no previous defaults versus previous default experience



a higher PEA than single-loan facilities, while married couples also have a higher PEA than other borrower types. Controlling for all of the above, there are cohort effects, with newer loans (2008-2012 and 2012-2016) having a lower PEA than loans issued before 2003, a result which may arise from a pure loan age effect, as well as potentially due to a more restrictive origination risk appetite of Irish banks in recent years.

In Table 3 Column (2) I extend on the previous Irish literature to show that, controlling for a wide range of loan-level explanatory factors that can help to explain mortgage default, previous modification status has important explanatory power. This suggests that indicators for previous financial difficulty are important predictors of credit risk during a post-crisis recovery. Relative to zero-DPD loans that have never had any modification, all modified groups (Permanent, Current Temporary, Previous Temporary) have a higher PEA. The coefficient sizes indicate that loans currently in a temporary arrangement (5.6 percentage points differential PEA relative to never-modified loans) appear to have higher PEA than permanently modified loans (3.7) , which in turn have a higher PEA than loans currently not forborne but having had a temporary modification at some point in the past (2.4). These percentage point effects are all large relative to the average PEA across the

regression sample which is 1.4 per cent.

In Column (3) I provide further evidence that the legacy effects of the financial crisis are being felt in 2016q4. The coefficient estimate in Column (3) suggests that loans having ever previously been in default between 2008 and 2016 have a 7.5 percentage point higher PEA than loans having never previously been in default. This effect is extremely large in magnitude relative to the average PEA of 1.4 percentage points across the entire regression sample. This finding sheds new light on the causes of mortgage default in an economic recovery from financial crises, with such effects having been impractical to estimate in the 2010-2013 period when most loans entering financial difficulty were doing so for the first time. Controlling for the "Ever Default" group appears to absorb all explanatory power from the Permanently Modified group, and to reduce substantially the coefficient sizes on the two Temporary Modified groups. The coefficients on the interest rate and the dummy variable for married borrowers also lose their statistical significance in Column (3) once the "Ever Default" control is included.

Column (4) repeats the specification of Column (3) but allows for non-linearities in the housing equity effect by including dummy variables for CLTV categories rather than a linear continuous CLTV term. The non-linearities appear to be very important, with the group with CLTV over 150 have a PEA three times as large as the group with CLTV between 110 and 150. The coefficient size for the "Ever Default" group is unchanged in this specification relative to Column (3).

Table 3: Who enters arrears in 2016q4?

	Entered			
	(1)	(2)	(3)	(4)
Ever_Default			0.075***	0.075***
Modified Permanent		0.037***	−0.001	−0.001
Modified Temp. Now		0.056***	0.016***	0.016***
Modified Temp. Past		0.024***	0.018***	0.018***
CLTV	0.0002***	0.0001***	0.0001***	
SVR	0.007***	0.005***	0.005***	0.004***
Tracker	−0.002**	0.009***	−0.002**	−0.002**
Interest Rate	0.053**	0.406***	−0.0002	0.008
Dublin	−0.002***	−0.001***	−0.001***	−0.001***
Married	0.001***	−0.0003	0.0001	−0.0002
Multi-loan	0.002***	−0.002***	−0.001***	−0.001***
Originating year effects, relative to base group pre-2003				
(2003,2005]	−0.0002	−0.0002	−0.0001	0.001
(2005,2008]	0.002**	0.001**	0.001	0.001**
(2008,2012]	−0.010***	−0.005***	−0.003***	−0.001**
(2012,2016]	−0.017***	−0.009***	−0.006***	−0.004***
LTV group effects, relative to base group with CLTV under 80				
(80,95]				0.002***
(95,110]				0.005***
(110,150]				0.006***
(150,250]				0.017***
Constant	0.003*	−0.013***	0.002	0.004***
Observations	448,285	448,285	438,917	438,763
R^2	0.005	0.017	0.038	0.037

Note: *p<0.1; **p<0.05; ***p<0.01
Sample is all loans with Zero Arrears at Sept 2016.
Dependent variable takes a one for any loan in arrears at Dec 2016.

4 A detailed discussion of cured loans

Figure 1 highlighted a significant and steady decrease in mortgage arrears of greater than 90 days (90+DPD) from its 2013q3 peak of 12.9 per cent of all outstanding mortgages to 7.2 per cent in 2017q1. In this section I take a detailed look using Loan Level Data at the group of mortgages that experienced 90+DPD during the crisis period, allowing a story to be told about their evolution to end-2016. Due to the fact that LLD for KBC and UBIL are only available from 2015q1, the analysis in this section focuses on the "three bank view", comprising AIB-EBS, BOI and PTSB. For a loan to be factored into the calculations in this section, it must continue to exist at December 2016, meaning that the small number of loans that have exited the banks' mortgage portfolios due to foreclosure will not be considered.

Looking at each loan's history from 2009q4 (or 2008q2 for one bank), I can identify 73,296 mortgages that were in 90+DPD at some point during the period to 2016q4. Table 4 shows that, of this ever-defaulted group, 54 per cent had returned to Zero DPD by December 2016. The next largest group is the 720+ DPD group - 24 per cent of the ever-defaulted group at these three banks have ended up in long-term arrears of over two years. The rest of the group is relatively evenly split between the 1-90 DPD, 91-360 DPD and 361-720 DPD groups (9, 7 and 5 per cent of the ever-defaulted group, respectively).

Table 4: December 2016 DPD status of all loans having ever been in default 2009q4-2015q4
Total number of cases: 73296

dpd	N	Share
0 dpd	39758	54.24
1-90	6655	9.08
91-360	5112	6.97
361-720	4002	5.46
720+	17768	24.24

Table 5 details the number of ever-defaulted loans at the three subject banks according to their combined modification status and DPD status at December 2016. The figure shows that ever-defaulted loans having never been modified were about twice as likely to end up in 720+ DPD as to end up in Zero DPD (6,426 versus 3,699 mortgages). This propensity is similar for the Previously Temporarily Modified group, whereas the Permanently Modified group has in the majority ended in Zero DPD by December 2016. It should be noted that many of these returns to zero DPD are mechanical, in that an arrears capitalization may

form part of a permanent modification, which automatically resets arrears balances to zero. The fact that of 41,424 ever-defaulted mortgages with a permanent modification, there are 10,152 that are in arrears at December 2016 (a 24.5 per cent arrears rate) suggests that there may be a significant number of restructured mortgages where additional engagement between borrower and lender may be required before financial sustainability is achieved.[8]

Table 5: December 2016 DPD and Modification status of all loans having ever been in default 2009q4-2015q4
Total number of cases: 73296

Modified	0 dpd	1-90	91-360	361-720	720+
Never	3699	785	811	877	6426
Permanent	31272	4687	2585	1160	1720
Temp_Now	912	237	210	112	181
Temp_Past	3875	946	1506	1853	9441

I now focus exclusively on the group of loans that have "cured", i.e. they were at some point in 90+DPD but are now below 90 DPD at December 2016. This group comprises 46,413 in our three subject banks. Table 6 gives the proportion of these cured loans by modification status. There is a clear dominance of one explanatory factor behind these cures: 77 per cent of the loans that have returned from 90+ DPD have had a permanent modification along the way. The share of mortgages that have cured without any modification, often referred to as "self-cures" is 9.7 per cent. This suggests that the Central Bank's aggressive stance on mortgage NPLs, detailed in Donnery, Fitzpatrick, and McCann (2018), has played a central role in explaining the aggregate fall in the number of 90+DPD mortgages. It is difficult to ascertain with the data to hand whether, due to the improving economy, modified loans may have cured in the absence of modification.

[8]The 24.5 per cent arrears rate among the permanently modified group is higher than the share of restructured mortgages "meeting the terms of the arrangement" published in Central Bank mortgage arrears statistics. This is possible for a number of reasons. Firstly, the analysis here focuses on the group of mortgages that are permanently modified while having also been in default during the 2009-2016 period, whereas the official statistics report on all restructured mortgages. Secondly, it is possible for a mortgage to "meet the terms of the arrangement" by paying the contracted monthly payment while also maintaining the arrears balance that was outstanding at the beginning of the arrangement.

Table 6: Modification status of all loans having cured from default by December 2016
Total number of cases: 46413

Modified	N	Share
Permanent	35959	77.48
Temp_Past	4821	10.39
Never	4484	9.66
Temp_Now	1149	2.48

5 Current Repayment Behaviour

The DPD count used in the analysis up to this point measures the arrears balance of a mortgage relative to its monthly instalment due. While DPD is a highly informative measure, and is the cornerstone of supervisory activity relating to banks' asset quality, there may be additional underlying variation of interest to policy makers even within DPD buckets. One such source of variation is in the actual monthly repayments being made by borrowers.

McGuinness (2014) has previously documented the repayment behaviour of households that had received a mortgage modification up to 2013q4. She reports that at end-2013 roughly 55 per cent of permanently modified mortgages were paying their full contracted amount (or more), with another 30 per cent making a partial payment for an amount less than the monthly contracted instalment. At the time of writing, information on the precise amount repaid on each loan was not available, meaning that repayments were inferred from changes in arrears balances. Since 2015q1, the Central Bank has begun receiving data on the actual monthly amount repaid, meaning that the ratio of the amount repaid to the amount due can be calculated on a loan-by-loan basis at a monthly frequency, rather than having to be inferred from other data sources.

Table 7 reports the variation across DPD buckets at end-2016 in the share of mortgages that were paying their full contracted amount, or greater. There is significant variation across DPD buckets, with close to half of loans in the 1-30, 31-60 and 61-90 DPD groups making full repayments. This suggests that, despite being in arrears, these loans will not progress further into deeper states of arrears if current behaviour continues. While it is intuitive that the share of fully-paying mortgages should fall as we move to higher-DPD mortgages, it is noteworthy that in the long-term mortgage arrears (LTMA) groups, there is a non-negligible share of fully-paying loans. For loans over one year but less than two

years in arrears, close to one third of mortgages are making full payments, suggesting that they may be financially sustainable despite their large arrears balances. In the 720+ group, where twenty four or more monthly repayments have been missed, there are nonetheless 15 per cent of these mortgages that are making full contracted payments in late 2016. This again suggests that longer-term financial sustainability may be possible for these loans, provided that the outstanding arrears balances are appropriately dealt with through strategies such as arrears capitalization or split/warehouses.

Table 7: Share of Loans Making Full Payments by Current DPD Bucket

DPD_Bucket	Share
1-30	44.24
31-60	45.02
61-90	46.05
91-180	36.63
181-365	31.09
366-720	29.78
720+	13.97

Table 8 reports the share of loans by modification status, as defined in this paper, that are making full repayment. The share of permanently and currently temporarily modified loans that are making full repayment at end-2016 is 88 and 86 per cent, respectively. These numbers are extremely close to the official statistics reported by the Central Bank on the share of modified mortgages "'currently meeting the terms of the arrangement".[9] An interesting group that does not feature in the official statistics on mortgage restructuring is the group that have temporarily received a modification in the past (often a short-term interest-only period) but are no longer in any modification. Among this group, the share of fully-paying loans is only 74 per cent, suggesting that repeat instances of financial difficulty have been extremely common in this cohort. Future engagement between lender and borrower may be required in cases where non-payment has arisen after the elapsing of a temporary modification arrangement.

[9]See Central Bank of Ireland "Mortgage Arrears Data" quarterly releases. https://www.centralbank.ie/statistics/data-and-analysis/credit-and-banking-statistics/mortgage-arrears

Table 8: Share of Modified Loans Making Full Payments by Modificaton Status

Modified	Share
Never	96.85
Permanent	86.75
Temp_Now	75.61
Temp_Past	75.25

6 Borrower Engagement

Central to the resolution of the mortgage NPL crisis is the issue of borrower engagement. If borrowers do not engage with any of the potential debt resolution solutions available, there is very little that can be done by either policy makers or lenders apart from the initiation of foreclosure proceedings. For this reason, measurement of the size of the group of engaged borrowers is an essential ingredient in a full and comprehensive understanding of the policy challenges that are still to be faced in the Irish mortgage market. For the purposes of this research, an "Engaged Borrower" is defined as any mortgage for which we see in the data any of the following:

1. The loan is marked as being permanently modified.
2. The loan is marked as currently being in a temporary modification.
3. The loan is marked as having completed a Standard Financial Statement (SFS).[10]

Table 9 reports the share of loans in each December 2016 DPD bucket that have engaged by our definition. The first thing to note is that, of 664,981 Primary Dwelling mortgages outstanding and in the data at end-December 2016, 151,263 or 22.7 per cent are measured as having engaged with their lender. 109,512 of these engaged mortgages are currently at Zero DPD. It is not surprising that such a large share of engaged borrowers are currently at Zero DPD, given that all permanently modified mortgages automatically switch to Zero DPD when an arrears capitalization forms part of the modification. There is also a large cohort of borrowers who engage with their lender *before* missing a payment (often referred to as "pre-arrears" SFS entries). Where financial distress has been resolved before missed payments have arisen for the pre-arrears group, it is also to be expected that these engaged borrowers would have retained their Zero DPD status up to end-2016.

[10]The SFS is an obligatory financial return which must be filled out by any household engaging with their lender with a view to availing of mortgage modification. The micro-data underlying each household's SFS return is collected by the Central Bank and has previously been analysed in Danne and McGuinness (2016) and Kelly and McCann (2016).

Table 9 also gives the proportion of each DPD group at end-2016 that have engaged. The final column of the table shows that 65 percent of the early arrears (1-90 DPD) group have engaged. For the 91-360 and 361-720 groups, over three quarters have engaged in each case. The figure is lower in the 720+ group, which represents the largest group among loans in arrears as outlined in Figures 1 and 2, with engagement at 61 per cent. The implication is that there are 9,680 mortgages (associated with over eight thousand unique properties) that are in the deepest state of arrears and have had no engagement whatsoever with their lender. Coupled with the 1,676 non-engaged mortgages in the 361-720 DPD group and the 2,250 mortgages in the 91-360 DPD group, these represent the most difficult cases for policy makers and lenders faced with resolving the NPL crisis in the Primary Dwelling House segment of the mortgage market.[11]

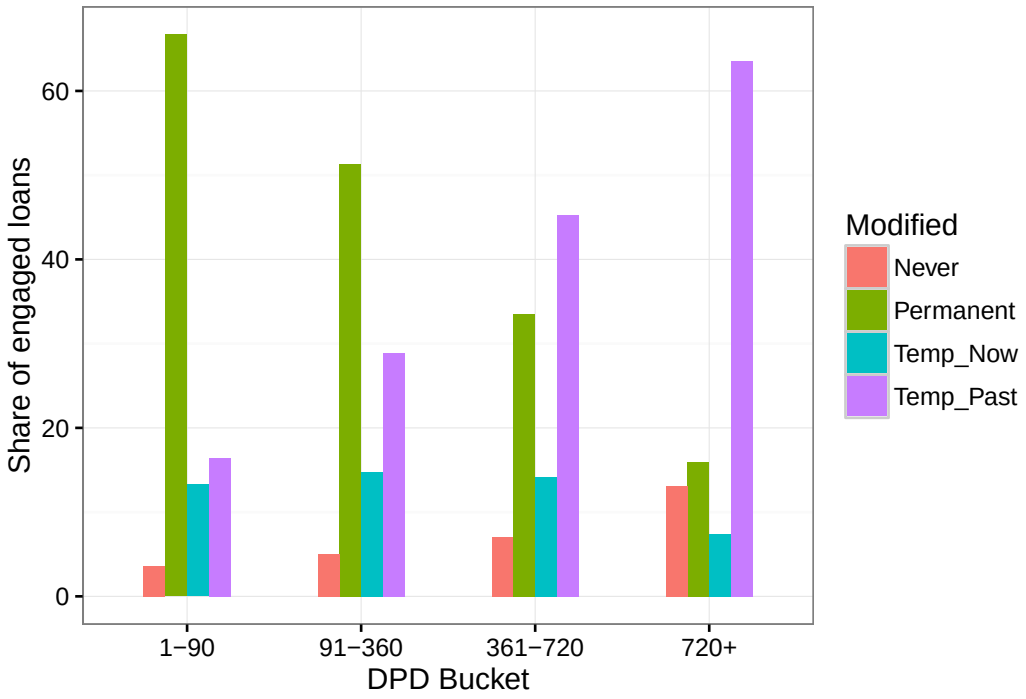
Table 9: December 2016 Engaged and Non-Engaged Loans per DPD bucket

	Loan Count		Share	
DPD	NO	YES	NO	YES
0 dpd	493167	109512	81.83	18.17
1-90	6926	12838	35.04	64.96
91-360	2250	8521	20.89	79.11
361-720	1676	5128	24.63	75.37
720+	9680	15264	38.81	61.19
Total	513718	151263	73.3	22.7

Close to two thirds of the 720+ group have been shown to have engaged with their lender. Given this non-negligible share of engagement among the most distressed loans, one may suspect that the solutions arrived at as a result of this engagement have been less effective than for other borrower groups, or that there were instances where, upon engagement and assessment of borrower circumstances, the lender deemed that no viable arrangement was possible. To observe what has occurred since engagement for this group, Figure 8 splits the engaged cohort of each DPD group by modification status. The results are striking: of 15,264 loans that have engaged and are in 720+, just 16 per cent have received a permanent modification, while 64 per cent had received a temporary modification that has since elapsed, with another 13 per cent having never had a modification arrangement. These figures are in stark contrast to the group of earlier-arrears engaged loans: the share of permanently modified loans among the engaged cohort is 67 and 51

[11] As in all sections of this paper, the above figures only refer to long-term mortgage arrears cases at the five main mortgage lenders in Ireland. Mortgages held by smaller banks and non-bank financial institutions are not included in these figures.

Figure 8: The within-DPD bucket share of engaged loans that have been modified

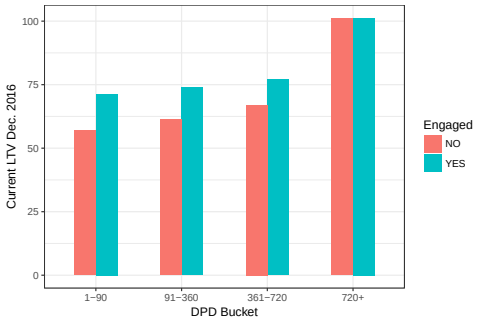


per cent in the 1-90 and 91-360 DPD groups, respectively. These findings suggest that the arrangements that have been arrived at between lender and borrower have been characterised by lower levels of sustainability than those among the lower-arrears groups. If the 720+ group is to be resolved while remaining in the Irish banks' mortgage portfolios, deeper and longer-lasting restructure arrangements must be arrived at.

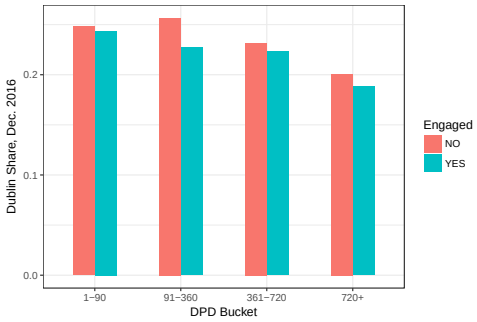
In targeting solutions to the LTMA crisis, it is important for policy makers to have an understanding of the characteristics of the non-engaging cohort. Figure 9 compares, within December 2016 DPD buckets, the engaged and non-engaged groups along a number of dimensions. For most groups, CLTV and current outstanding balances are larger among the engaged than the non-engaged groups (Figures 9a and 9c). This confirms that non-engagement is not synonymous with "strategic default" as defined in the economics literature (Gerardi, Herkenhoff, Ohanian, and Willen, 2013). Under such a definition, those that have the weakest equity positions (i.e. highest CLTV) would be those most likely to avoid engagement of all kinds with their lender. The share of loans in Dublin is also shown to be lower among the engaged than the non-engaged group (Figure 9b). These differences are in all cases quite small. Further, borrower age, the share of tracker mortgages and loan vintage all appear to be indistinguishable across the engaged and non-engaged groups within each DPD bucket.

Figure 9: Are engaged borrowers different to non-engagers?

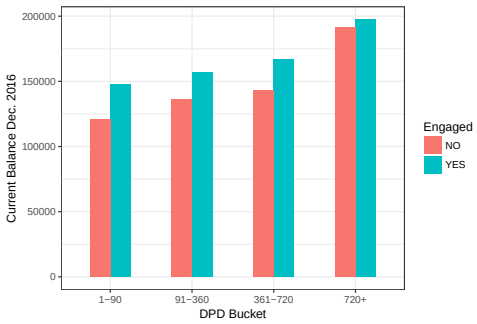
(a) Current LTV



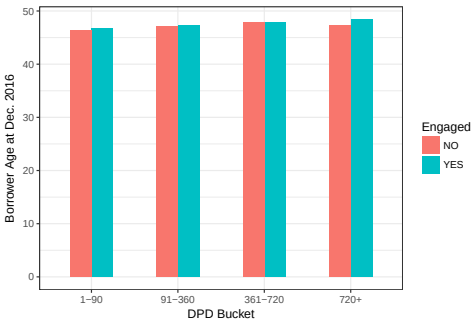
(b) Dublin Share



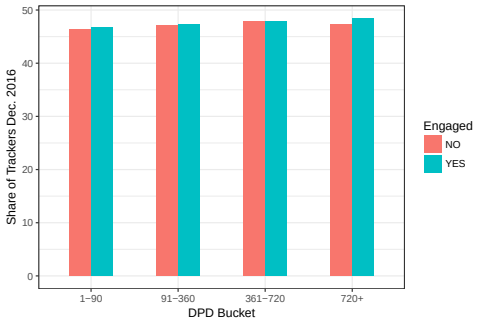
(c) Current Outstanding Balance



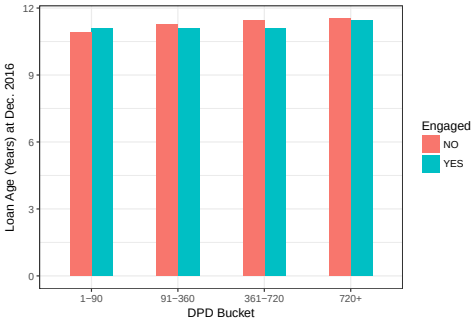
(d) Borrower's Age



(e) Share of Tracker Mortgages



(f) Vintage (loan age in years)



7 Measuring Mortgage Modification

The research presented in earlier sections of this paper has highlighted the importance of mortgage modification in the Irish mortgage market. A large international literature has focussed on the effectiveness or otherwise of mortgage modifications, with much reference to the Home Affordable Modification Programme (HAMP) which followed the financial crisis in the USA. Agarwal, Amromin, Ben-David, Chomsisengphet, Piskorski, and Seru (2017) for example showed that the HAMP was associated with lower rate of foreclosures, consumer debt delinquencies, house price declines, and an increase in durable spending in US states where lenders used the programme more intensely. Agarwal, Amromin, Ben-David, Chomsisengphet, and Evanoff (2011) focus on the frictions introduced by securitization, showing that bank-held loans are substantially more likely to be renegotiated, as well as being less likely to re-default after modification, than securitized loans. Mayer, Morrison, Piskorski, and Gupta (2014) adopt a different approach, identifying increases in default rates in otherwise-identical portfolios of mortgages which can be explained by the introduction of a mortgage modification programme after the settlement of a US government lawsuit against a failed mortgage lender, suggesting that the possibility of strategic default must be assessed by those introducing modification programmes. Adelino, Gerardi, and Willen (2013) try to explain the low overall tendency of mortgage servicers in the USA to renegotiate mortgages. They find that securitization does not explain the extremely low renegotiation rate on delinquent mortgages during the US crisis, and instead offer that information asymmetries between borrower and lender, combined with the pertinent possibility of re-default, make renegotiation unattractive from a lender's perspective.

In Ireland, McGuinness (2014) has reported on the evolution of mortgage modifications up to end-2013. At that point, the Central Bank of Ireland's MART policy of targets for "sustainable solutions" to financially vulnerable mortgage holders was beginning to have an impact, with the number of permanently modified mortgages in the data available growing from 20,000 to close to 40,000 in the twelve months to December 2013. The analysis of the viability of these modifications carried out by McGuinness (2014) however showed that much work remained to be done: at that point 45 per cent of "permanently modified" mortgages were under-paying relative to the contracted amount due (with 15 per cent making no payment and a further 30 per cent making a payment for an amount less than the contracted instalment due).

Looking in more depth at the characteristics of modified loans in Ireland up to 2013, Danne and McGuinness (2016) show that loans were more likely to receive a modification after filling out an SFS if they had higher incomes, lower falls in income since loan origination, lower likelihood of unemployment, lower debt service burdens, lower non-mortgage indebtedness, less consumption relative to income. Looking at ex-post repayment following on from mortgage modification, the authors then show that these same characteristics are in operation in explaining which modified mortgages are more likely to make full repayments.

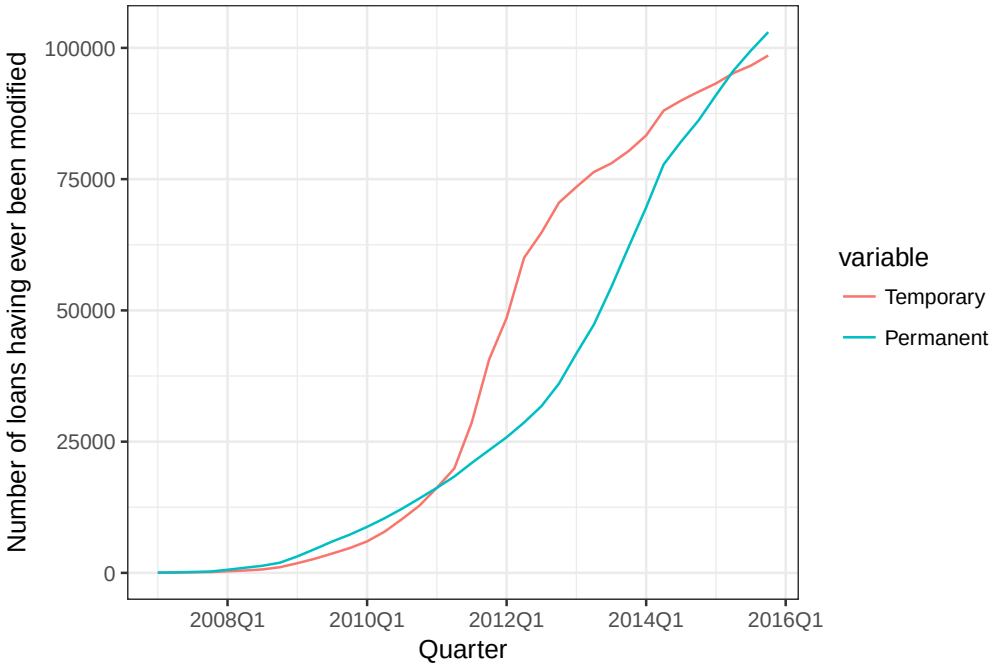
Figure 10 plots the timeline of mortgage modifications from 2011q1 to 2016q4. Using the LLD information on the date of issuance of permanent and temporary modifications, I measure the cumulative number of mortgages at each point in time that had *ever previously* received either a temporary or a permanent modification. For two of the five banks, some temporary modifications that had been issued in the 2008 to 2014 period but had elapsed before January 2015 may be missing from the data, meaning that these figures are likely to understate the true size of the group of ever-modified mortgages (but this data issue should have no bearing on the measurement of permanent modification).[12] The figure shows us that, in the early stages of the mortgage arrears crisis, banks were relying on temporary arrangements such as Interest-Only (IO) periods to attempt to alleviate the repayment difficulties faced by borrowers. By the beginning of 2013, 75,000 mortgages had received a temporary modification, while 40,000 mortgages had received a permanent modification. The rate of change across the two modification types diverged from then on, in line with the focus of the MART policy regime on longer-term sustainable solutions: by 2015q1, the number of permanently modified mortgages surpassed the number of ever-temporarily modified loans. By end-2016, over 100,000 mortgages visible in the LLD had received a permanent modification, while over 90,000 had received a temporary modification.[13]

Figure 11a provides a timeline of the number of loans receiving their first modification (whether permanent or temporary) in each year. When all modifications are considered together, it is clear that large volumes of mortgages were indeed processed by the banks in the early years of the financial crisis. In particular, in 2009, 2010 and 2011 over thirty thousand mortgages received their first mortgage modification of any description in each

[12] Temporary modifications: repayment reductions, interest only arrangements. Permanent modifications: arrears capitalizations, term extensions, split mortgages, or hybrids thereof.

[13] A loan can be counted in both the total number of loans having received a permanent and a temporary arrangement, i.e. the groups are not mutually exclusive.

Figure 10: Number of mortgages having ever been modified at each date, by modification type



year. The total number of mortgages captured as ever modified in this graph far surpasses the number of restructured mortgages reported in official Central Bank of Ireland statistics due to the fact that currently lapsed temporary arrangements are not counted in the official statistical release. Figure 11b however shows that the picture is very different when permanent modifications alone are considered: close to twenty five thousand mortgages per year received their first permanent modification in 2013 and 2014; before this however the figures were much lower, confirming that the large volumes of mortgages being modified for the first time reported in Figure 11a related mostly to temporary arrangements.

McGuinness (2014) has previously reported that the repayment performance of mortgage modifications improved with time through the 2009 to 2013 period, as lenders improved their capacity to issue modifications and their targeting of the appropriate solution for each borrower improved. In Figure 12a, I report the December 2016 DPD profile of mortgages as a function of the year in which they were first modified. The sum of each bar is the percentage of each year's cohort of newly-modified mortgages that has some arrears at end-2016. For the 2009 and 2010 cohorts, over 25 per cent of these mortgages are in arrears at end-2016, compared to close to 20 per cent for the 2011-2013 group. Looking at the arrears distribution, the share of deep arrears (720+ DPD) is over 10 per cent for the 2009 and 2010 groups, whereas it is under 10 per cent for the post-2011 group and even

Figure 11: Number of loans modified for the first time, by year of first modification

(a) All modifications (b) Permanent modifications only

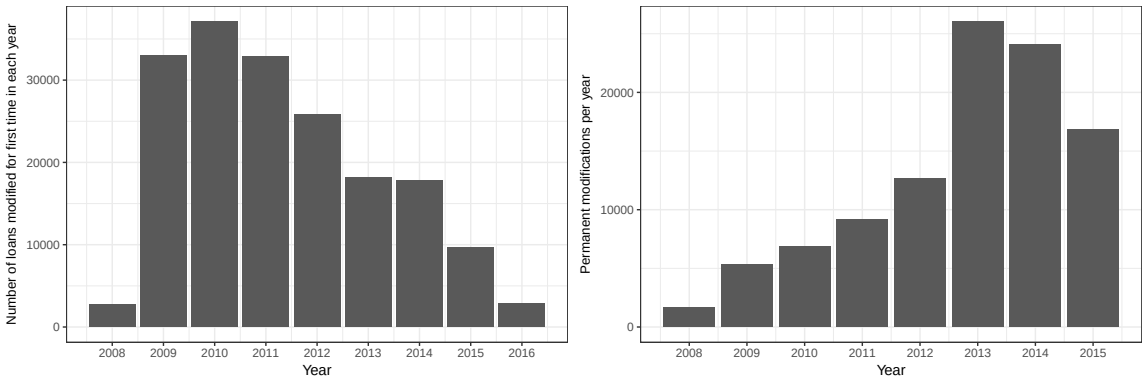
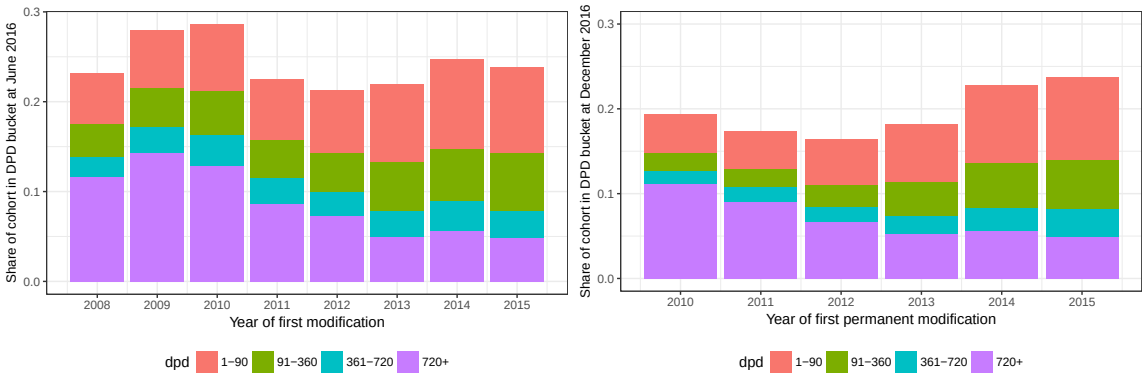


Figure 12: Current loan performance as a function of year of first modification

(a) All modifications (b) Permanent modifications only



under 5 per cent for modifications issued in 2013 and 2014. In Figure 12b, I look solely at loans based on the year in which they were first permanently modified. The picture changes substantially, with arrears rates at December 2016 being under 20 per cent in each cohort. The pattern of improved performance among the 2011-2013 group relative to the 2009 and 2010 cohort still holds, particularly when focussing solely on the group that have ended 2016 in 720+ DPD.

7.1 Explaining the Repayment Probability of Modified Mortgages

Table 10 runs simple linear probability models where the dependent variable takes a one if a mortgage is making repayments equal to or greater than the contracted instalment amount in the last quarter of 2016. The sample frame for these regressions is all mortgages having

ever received a temporary or permanent modification in the 2008q2 to 2016q4 period for which we have data. The sample is further restricted to mortgages issued by AIB-EBS, BOI or PTSB, as the default history of mortgages over the period can only be tracked consistently for these banks. This leaves us with an extensive sample of over 126,000 mortgages that have received some form of modification up to end-2016.

In Column (1) it is confirmed that many of the factors that were shown in Table 3 to be relevant for entry to mortgage arrears in 2016 Q4 are also relevant in explaining the propensity to fully repay among modified mortgages. Loans with a higher CLTV, SVR mortgages, tracker mortgages, loans with higher interest rates, loans outside Dublin, and loans issued in the pre-crisis period all have a lower probability of making full repayments. Unlike in the full sample of mortgages, loans on a multi-loan facility have a higher probability of full repayment. In Column (2) I show that, among the group of modified loans, loans that are either currently or were previously on a temporary modification have a lower probability of full repayments than those on a permanent modification. The differentials are 6.6 and 9 percentage points, respectively. In Column (3) I provide further evidence of persistence in financial distress: controlling for the full set of variables from Columns (1) and (2) there is a statistically significant and economically very large coefficient on the "Ever in Default" term: those having ever been in default between 2008 and 2016 are much less likely than other modifications to be making full repayments.

In Column (4) I confirm that the non-linearity in the housing equity effect uncovered in Table 3 is also relevant in the case of modified mortgages: loans with CLTV above 150 have three times lower probability of full repayment than those between 110 and 150, who themselves have a negative coefficient twice as large as those between 95 and 110. Finally, in Column (5) I delineate the types of modification offered to Irish mortgage holders in more detail, showing that those on "split mortgage" arrangements, where part of the principal is placed into a warehouse, have the highest probability of repayment relative to the base category, while the worst performing modification types are Interest Only arrangements and cases where borrowers had a previous temporary modification but are currently classified as Not Forborne.

Table 10: Which modified mortgages are fully paying in late 2016??

	Dependent variable: probability of full repayment (or more)				
	Full_Pay				
	(1)	(2)	(3)	(4)	(5)
Ever in Default			−0.287***	−0.284***	−0.320***
CLTV	−0.002***	−0.002***	−0.001***		−0.002***
SVR	−0.092***	−0.089***	−0.054***	−0.046***	−0.050***
Tracker	−0.037***	−0.050***	−0.048***	−0.039***	−0.009
Interest Rate	−0.126	−0.577***	−0.899***	−0.710***	−0.119
Dublin	0.024***	0.026***	0.020***	0.020***	0.019***
Married	0.009***	0.007***	0.003*	0.007***	0.0001
Multi-loan	0.017***	0.012***	−0.002	−0.006***	0.004**
Modification Group; base group Permanent Mods					
Temp Now		−0.066***	−0.090***	−0.087***	
Temp Past		−0.090***	−0.167***	−0.161***	
Loan Origination Groups relative to pre-2003 loans					
(2003,2005]	0.048***	0.051***	0.034***	0.015***	0.031***
(2005,2008]	0.064***	0.067***	0.047***	0.029***	0.039***
(2008,2012]	0.100***	0.105***	0.044***	0.021***	0.048***
(2012,2016]	0.103***	0.097***	0.001	−0.009	−0.010
LTV Groups relative to LTV less than 80					
(80,95]				−0.026***	
(95,110]				−0.042***	
(110,150]				−0.104***	
(150,250]				−0.355***	
Forbearance Types, base group Arrears Capitalizations					
IO					−0.130***
Not Forborne					−0.161***
Other					0.042***
Reduced Payment					0.010**
Split					0.077***
Term Extension					−0.097***
Constant	1.001***	1.055***	1.178***	1.104***	1.169***
Observations	127,312	127,312	126,541	126,299	126,541
R^2	0.066	0.081	0.214	0.215	0.219

Note: *p<0.1; **p<0.05; ***p<0.01

Sample is all loans with any previous modification as of end-2016

8 Loan vulnerability

I finish the paper by identifying pockets of vulnerability that remain beneath the aggregate picture of the falling level of arrears in the Irish mortgage market in recent years. Table 11 reports the December 2016 status of all performing PDH mortgage loans at the five subject banks. There are 622,443 performing mortgages at these banks. Of these, only 464,422 (74.6 per cent) can be said to have exhibited none of the effects of the financial crisis that began in 2008. 138,257 are accounted for as being Zero DPD, but have experienced a modification of some description. Central Bank of Ireland loan loss forecast (LLF) models show that the default probability on previously-modified performing loans is five times higher than that for a "truly performing" loan with no crisis legacy. Table 3 has confirmed that intuition, showing that previous experience of modification or default is an extremely important predictor of entry to arrears in 2016 Q4. There are then another 19,764 loans that are in arrears of greater than zero but less than ninety days, some of whom are likely to enter deeper states of arrears if the patterns of Figures 5 and 6 persist in 2017 and beyond.

Table 11: The December 2016 performing book - DPD and Modification
Total number of cases: 622443

DPD Bucket	Never	Permanent	Temp_Now	Temp_Past
0 dpd	464422	76813	9072	52372
1-30 dpd	4243	5510	947	2248
31-60 dpd	1064	1930	416	901
61-90 dpd	519	1121	340	525

Beyond the risk of re-default among previously modified loans, the existence of interest-only (IO) or other forms of temporary reduced payment arrangements has the potential to mask underlying vulnerability among the group of loans currently meeting the contracted monthly repayments. Such mortgages will at some point face increases to their monthly repayments which have the potential to impose additional financial strain on borrowers. Table 12 shows that five per cent of the zero DPD loans that are making full repayments are currently on such temporary arrangements and thus vulnerable to payment increases in the future. Among the 1-30, 31-60 and 61-90 groups, 16, 23 and 32 per cent of those currently making full repayments are vulnerable to future repayment increases, respectively. Among those currently making full repayments while being in a deep-arrears state, roughly one third are vulnerable. In such cases, the current repayment capacity may only be

temporarily masking a deeper financial unsustainability which will become apparent when the contracted move to full capital and interest repayments is scheduled to begin.

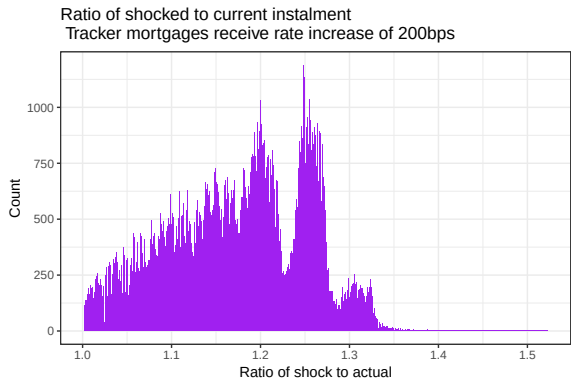
Table 12: Share of Loans Facing Future Instalment Increases

DPD_Bucket	Fully Paying	Missing Payment
0 dpd	5.23	n/a
1-30	15.94	14.82
31-60	22.87	18.95
61-90	32.48	20.15
91-180	32.65	18.49
181-365	33.43	18.04
366-720	37.33	15.57
720+	33.45	10.39

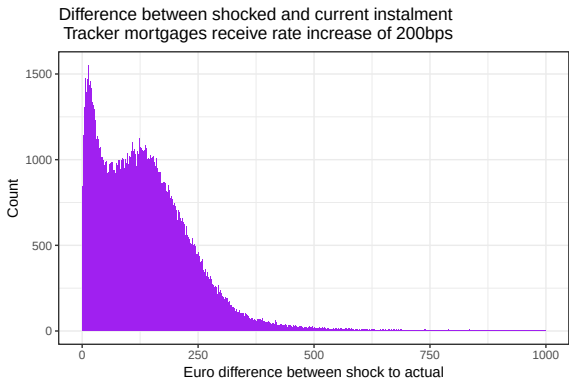
Another vulnerability lying within the Irish mortgage market relates to the currently favourable interest rate being received by those on tracker mortgage products. These loans, which follow mechanically the ECB's policy rate with a margin defined at loan origination, have an average annualised interest rate of 1.1 per cent, compared to an average of 3.9 for SVR mortgages in our sample. Byrne, Kelly, and O'Toole (2017) show that this benefit received by debtors on tracker mortgages has led to significantly lower default rates relative to similar borrowers on SVR contracts with elevated repayment burdens. An obvious vulnerability faced by the 263,066 mortgages on tracker rates in our sample relates to the normalization of monetary policy which may arise in the coming years as the ECB raises interest rates in response to improved economic circumstances and inflationary pressures. As a simulation, I re-calculate the repayment amount of every loan currently on a tracker rate and paying capital and interest under a scenario where interest rates are 200bps higher than currently. The histogram in Figure 13a shows that under such a scenario it would not be uncommon for repayments to increase by a quarter. In euro terms, Figure 13b shows that the majority of loans would face increases of less than 200 euro, but that a large amount would be between 100 and 200 euro. The data is not available to assess the extent to which such increases would make these mortgages unsustainable. Nonetheless, lenders must make efforts to engage with borrowers on such tracker arrangements in the eventuality that ECB policy rates begin to rise.

Figure 13: Vulernability of tracker mortgages to a 200bps interest rate increase

(a) Ratio



(b) Euro difference



9 Conclusion

The Irish banking system is unique among European economies in having had a large build-up in Non-Performing Loans (NPLs) during the recent crisis but in also having experienced a sharp reduction in NPLs in the 2013-2017 period. In this article I present a recent history of the ongoing resolution of the mortgage arrears crisis in Ireland. Using a large and close to exhaustive panel data set of Irish mortgages from 2008 to 2016, I present a number of new findings on loan transitions between delinquency states, the importance of legacy effects of the crisis in explaining recent entry to arrears, the role of mortgage modification in the reduction in arrears balances, the extent of borrower-lender engagement and the financial vulnerability that remains in pockets of the Irish mortgage market.

A number of key findings emerge from the empirical analysis in this paper. Firstly, on loan transitions, I show that the share of mortgages that are transitioning into 30+ DPD (where more than one payment has been missed) is lower in 2016q4 than at any point since data collection began in 2008. Given the detailed loan level data available and the period over which I observe these loans, two previously unexplored drivers of mortgage default are also uncovered in this paper. Firstly, a loan's history of previous default is an extremely important predictor for entry to arrears in late 2016. Secondly, loans that have a history of previous mortgage modification (both permanently modified, currently in a temporary arrangement or having availed of a temporary arrangement in this past) are significantly more likely to enter arrears than Zero-DPD mortgages with no history of such arrangements.

On borrower-lender engagement, I show that 151,263 or 22.7 per cent of outstanding

PDH loans had engaged with their lender via either mortgage modification or the completion of a Standard Financial Statement (SFS) return by end-2016. The size of this group highlights the extent of the economic shock that faced Irish households from 2008 onwards. Looking within each DPD group, I show that over three quarters of the mortgages currently between 90 and 720 DPD have engaged with their lender, whereas 60 per cent of the 720+ DPD group have engaged. The non-engaged group of deep-arrears borrowers represent the most challenging cohort for policymakers attempting to design non-foreclosure solutions to the NPL crisis in the Irish mortgage market.

Observing the amount repaid on each mortgage in each month, I assess the probability that a loan will repay its full contracted amount due, or more, at end-2016. I show firstly that among the 1-90 DPD group of early-arrears mortgages, close to half of all loans are fully repaying. This suggests that there is a substantial possibility that these loans will recover and achieve long-run financial sustainability. Among the LTMA group, 30 per cent of loans in the 360-720 DPD group are fully paying, while even in the 720+ group there are 14 per cent of mortgages making full repayments. Looking at modifications, I find that 87 per cent of permanently modified loans are making full repayments at end-2016, whereas among the group of loans with either current or previous temporary modifications, only 75 per cent are making full repayments.

I finish the paper with a calculation of the number of loans that are vulnerable to future increases in their monthly contracted repayments due to the move from Interest-Only to Capital & Interest repayments. I find that 5 per cent of Zero DPD loans that are currently making full repayments will face such an increase in the future, while among the in-arrears group that are currently fully paying, around one-third will face such an increase in the future. An assessment of the sustainability of these mortgages under Capital & Interest repayments is crucial to understanding whether additional restructuring of the loan may be necessary to avoid further arrears and potential foreclosures.

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