

[Preliminary and incomplete]

# Forbearance Patterns in the Post-Crisis Period\*

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## Abstract

Using supervisory loan-level data on corporate loans, we show that banks facing high levels of non-performing loans relative to their capital and provisions were more likely to grant forbearance measures to the riskiest group of borrowers. Further dissecting this phenomenon, we find that risky borrowers are more likely to get an increase in the overall limit or the maturity of a loan product from a distressed lender. As a second step, we analyse the effectiveness of this practice and show that borrowers who received forbearance measures are more likely to default. Our evidence also suggests that forbearance and new lending are substitutes for banks, as high shares of forbearance are negatively correlated with new lending to the same group of borrowers.

JEL: G21, G28

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# 1 Introduction

In the recent financial crisis, the banking sector was not only the main trigger of the crash, but also one of the most affected sectors in many countries. The health of bank balance sheets was seriously threatened by corporate defaults, a crash in house prices, and high unemployment. Under these circumstances, lenders and borrowers found it in their interest to keep otherwise non-performing loans alive by preventing a risky borrower's default. Terms such as "evergreening", "zombie lending", or banks "gambling for resurrection" emerged in the economic literature to describe the practice of granting concessions to troubled borrowers. Whilst this can be economically useful in some circumstances, it can equally be used by banks to conceal potential losses. This can cause systemic risk, increase uncertainty about the quality of banks' assets, and undermine trust in the banking sector's solvency, which calls for regulators to monitor and prevent the establishment of this practice.

Using loan-level data on the commercial loans of all Irish banks, we study the determinants and the effectiveness of forbearance after the recent Global Financial Crisis and provide evidence for several patterns observed in banks under stress. In our empirical setting, we distinguish between extensions in the overall credit limit or the maturity of the loan, a stop in amortisation, a decrease in the interest rate, and a rollover of the loan product. Using a standard logit model saturated with various fixed effects, we find that the riskiest borrowers are more likely to be granted a forbearance measure if the lender is facing high levels of non-performing loans (NPLs) relative to its capital and provisions. For the positive relationship between banks' stress levels - measured by the Texas Ratio - and a higher probability of granting forbearance, we offer an explanation through the current regulatory framework. When default is seen as a conscious decision of the bank and the firm, banks face an incentive not to flag loans as non-performing but to grant forbearance because of the impact on their profitability and ultimately their capital ratios (Eisfeldt and Rampini, 2008). As a second step, we look at the effectiveness of forbearance as a means of preventing default. We show that borrowers who receive forbearance are in fact more likely to default compared to their peers within the same risk category. While this can be due to several mechanisms (e.g. selection bias within a risk category), we show that forbearance did not prevent default efficiently after the Global Financial Crisis.

Finally, a question arises over whether or not new lending is subdued because capital and other resources within the bank are allocated to forbore loans. We present evidence that lending and forbearance might be treated as substitutes by banks. Within buckets of similar loans, we find that the share of forbearance is negatively related with the issuance of new credit.

Therefore, we contribute to a strand of literature focused on forbearance techniques of banks which has emerged in the last two decades. For Japan, empirical evidence shows that troubled banks allocated credit to severely impaired borrowers to avoid the realisation of losses on their own balance sheets (e.g. [Peek and Rosengren \(2005\)](#), [Sekine et al. \(2003\)](#), and [Watanabe \(2010\)](#)). Analysing the driving mechanism of forbearance during the country's "lost decade", [Caballero et al. \(2008\)](#) use the term "zombie lending" for credit to unprofitable firms at interest rates below market values. Besides the hazard for banks themselves, the authors show that this misallocation of credit towards otherwise insolvent borrowers had significant negative effects on the real economy. The presence of zombie firms was found to depress job creation, deter the entry of healthy firms, and to decrease employment and investment of healthy firms. Using the effects of following capital injections for Japanese financial institutions, [Giannetti and Simonov \(2013\)](#) show that troubled banks that remained under-capitalized were more likely to engage in "evergreening" by maintaining relationships with weak borrowers. More recently, it became clearer that Japan was not an exception ([Acharya et al., 2016a](#)). [Homar et al. \(2015\)](#) look at European banks and find that weak banks are more likely to grant concessions to weak borrowers. The authors call for more empirical work regarding patterns of forbearance as an important factor in the slow recovery after the Global Financial Crisis. Using the Italian credit registry, [Schivardi et al. \(2017\)](#) show that Italian banks with relatively low capital levels were less likely to cut credit to non-viable firms after the Global Financial Crisis. This credit misallocation led to an increase in the failure rate of healthy firms while it reduced the failure rate of non viable firms. [Acharya et al. \(2016b\)](#) use the announcement of the Outright Monetary Transactions (OMT) as an event on which to identify "zombie lending" patterns for European banks. Institutions which were not sufficiently recapitalised in the wake of the OMT announcement were more likely to extend loans to weak firms instead of their more creditworthy peers who would have been able to invest credit more profitably. This resulted in significant real effects, most notably a slow down of the

economic recovery in the post-crisis period. Our analysis is also motivated by existing work focused on the incentives for banks to engage in forbearance and therefore relatively risky lending. [Keuschnigg and Kogler \(2017\)](#) present a theoretical model showing that weak banks try to avoid writing off non-performing loans in order to prevent a violation of regulatory requirements or even insolvency. This literature also emphasizes possible negative consequences of these patterns for the financial stability when banks do not “clean up their balance sheets” ([Diamond and Rajan, 2011](#)). Analysing the case of China, [Zhang et al. \(2016\)](#) show that high NPL ratios are associated with riskier lending, potentially increasing individual institutions credit risk and threatening financial stability. [Huizinga and Laeven \(2009\)](#) show that distressed banks in the US used discretion in accounting during the Global Financial Crisis in order to inflate the book value of their assets which results in a distorted view of the financial health of these institutions. On the other hand, [Bonaccorsi di Patti and Kashyap \(2017\)](#) show that banks are able to recover significantly faster from large adverse shocks if they manage risky clients more aggressively and thereby reduce credit risk.

Our findings reveal several novelties. First, we argue that capitalisation is not the only determinant factor of forbearance for banks. As can be seen in recent stress tests ([EBA, 2016b](#)), Irish institutions have been sufficiently re-capitalised since the crisis through a public bailout, so that they now comfortably exceed regulatory requirements. However, NPLs are at levels far above the European average, which can pose a threat to capitalisation levels under even moderate economic stress ([IMF, 2016](#)). Therefore, we argue that the quality of a lender’s loan book must be considered when analysing the determinants of “zombie lending”. Secondly, we exploit the quality of the loan level data to measure forbearance techniques using more definitions than are common in the literature. Our reasoning holds that pressure in times of crises creates incentives for different types of forbearance other than subsidised lending through a lower interest rate. More specifically, we analyse whether banks extend credit limits or maturities, or opt to grant other measures such as a stop in amortisation or a rollover of a loan product. The granular loan-level data also allows us to suggest that forbearance measures have not been effective for the banking system. Using a standard stress testing model in the form of a logit-hazard specification, we show that borrowers who received these measures are more likely to default. Finally, the evidence suggests that forbearance ties up banks’ resources that might have been

used for new lending. We conclude our empirical analysis with a correlation analysis that reveals the negative relationship between forbearance and new lending.

In Section 2, we explain the conceptual framework, the different forbearance measures and offer an explanation as to why banks face an incentive to engage in forbearance within the current regulatory framework. Section 3 introduces the data and lays out our analysis of the determinants of forbearance. Section 4 elaborates on the effectiveness of the different forbearance measures in avoiding default, and Section 5 looks at possible correlations between forbearance and new lending. Finally, Section 6 concludes.

## 2 Conceptual Framework

### 2.1 The Crisis and the Irish Case

Ireland experienced one of the worst banking crises in the aftermath of the recent Global Financial Crisis. It originated from a devastating boom-bust cycle in the domestic property market which was financed by bank loans. While the economic growth in the years leading up to 2000 can be interpreted as a healthy convergence of the “Celtic Tiger” with the rest of the European Union, the surge in output in 2003-2007 turned out to be of a different kind: a construction boom (Honohan, 2010). Banks became highly exposed to the housing market through the extremely rapid credit expansion to home owners and property developers. As a consequence of the shift in international financial markets in 2007/2008, Irish banks faced difficulties to maintain funding while domestic investors pulled back from the property market. After prices declined sharply and construction activities collapsed, banks faced an unprecedented increase in NPLs. Finally, public funds had to be used in order to recapitalise the most significant credit institutions in Ireland (Lane, 2011).

The banks’ recovery was then shaped by two stylised facts: (i) a fast recapitalisation of banks due to the public bail-out but (ii) threatening levels of NPLs on their balance sheets. We show these two developments for Irish banks in Figure 1. On the left side, we look at Tier 1 capital as an indicator of the health of an institution’s balance sheet.<sup>1</sup> We can see

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<sup>1</sup>Tier 1 capital is composed of Common Equity Tier 1 and Additional Tier 1 capital, which is available to the institution for unrestricted and immediate use to cover risks or losses as soon as these occur.

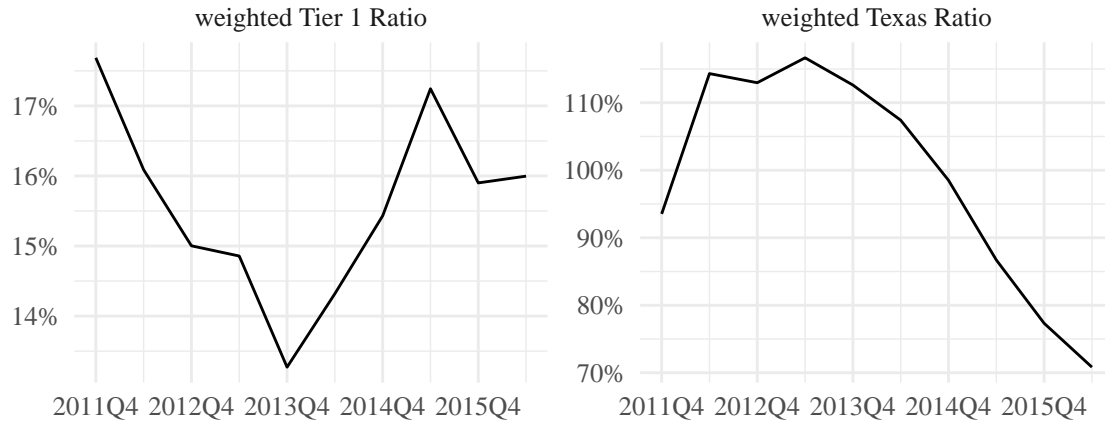


Figure 1: Weighted Tier 1 Capital Ratio and Texas Ratio of Irish banks. Weighted by Total Assets of respective bank.

*Source: Author's calculations; Data: SnL*

that after the public bailouts of banks in response to the crisis, the ratio of Tier 1 capital to risk weighted assets (Tier 1 Capital Ratio) has levelled off well above the regulatory requirement of 8% and the European average of 14.1%.<sup>2</sup> On the right side, we analyse the Texas Ratio, which indicates how close the bank is to the regulatory constraints due to credit risk.<sup>3</sup> The measure is defined as:

$$\text{Texas Ratio} = \frac{\text{Impaired Loans} + \text{Loans 90 days past due but not impaired}}{\text{Tangible Equity} + \text{Loan Loss Provisions}}.$$

Intuitively, a value above 100% is widely considered to be critical and we can see that the Irish banking sector only recovered to below this threshold in 2014. Evidently, Ireland continues to suffer from high levels of impaired loans as a legacy from the Global Financial Crisis. Besides the decline in house prices and resulting wealth effects, unemployment and contractionary fiscal policy have made it impossible for some borrowers to pay back their loans. Hence, NPL ratios have risen to approximately four times the European average, driving the Texas Ratio to critical levels throughout our period of observation.

The high levels of the Texas Ratio suggest a threatening sensitivity to credit risk, which has been confirmed by recent stress tests, such as the latest Financial Sector Assessment Program of the International Monetary Fund and European Banking Authority's stress tests (EBA (2016a); IMF (2016)). In Figure 2, we use data from EBA (2016a) to illustrate

<sup>2</sup>Through the public bank bailouts, 99.9% of Allied Irish Banks and 15% of Bank of Ireland became state-owned.

<sup>3</sup>Developed by Gerard Cassidy and others at RBC Capital Markets, the Texas Ratio got its name from its use to analyse weak banks in Texas during the 1980s.

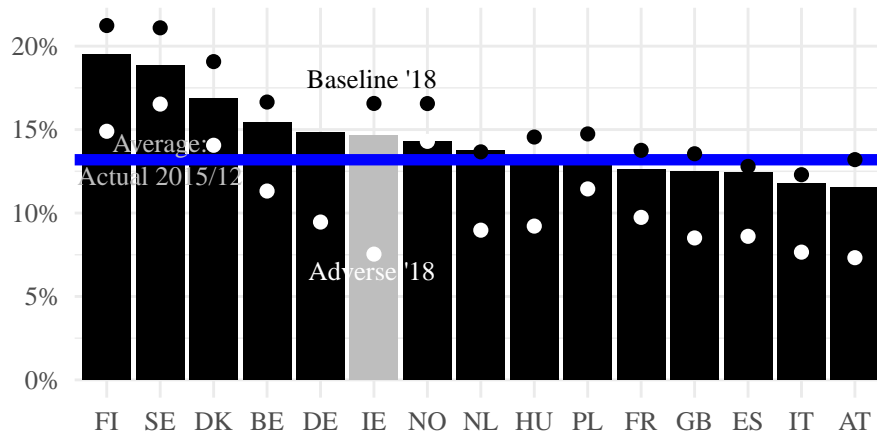


Figure 2: The y-axis measures the Tier 1 Ratios for banks residing in the respective countries under different scenarios. The black (white) dot represents the Tier 1 Ratio under the baseline (adverse) scenario in 2018. The blue line shows the European average.

*Source: Author's calculations; Data: EBA (2016a)*

this risk: although Irish banks seem well capitalised in normal economic conditions, the stress test points out that regulatory requirements may not be reached under the adverse scenario. In addition, compared to other Euro Area countries, the difference of Tier 1 capital levels between the baseline and adverse scenario turns out to be the largest for Ireland.

A breakdown of the drivers behind this large gap, shown in Figure 3, reveals that credit risk is the main contributor and accounts for a 6 percentage point difference in the Tier 1 capital ratio between the two scenarios.<sup>4</sup>

## 2.2 Forbearance

### 2.2.1 Types of Forbearance

In this section, we define and explain the different forbearance measures that we construct from our data. We exploit the quality and granularity of the Irish commercial loan level data to measure forbearance techniques along several definitions. The first definition of forbearance we consider is when banks (temporarily) suspend instalments and allow borrowers to only make interest payments. This measure, referred to as an 'amortisation stop', ensures that the outstanding amount on the loan remains constant until further

<sup>4</sup>In comparison, Italy is less affected by credit risk and is projected to have higher profits under the adverse scenario.

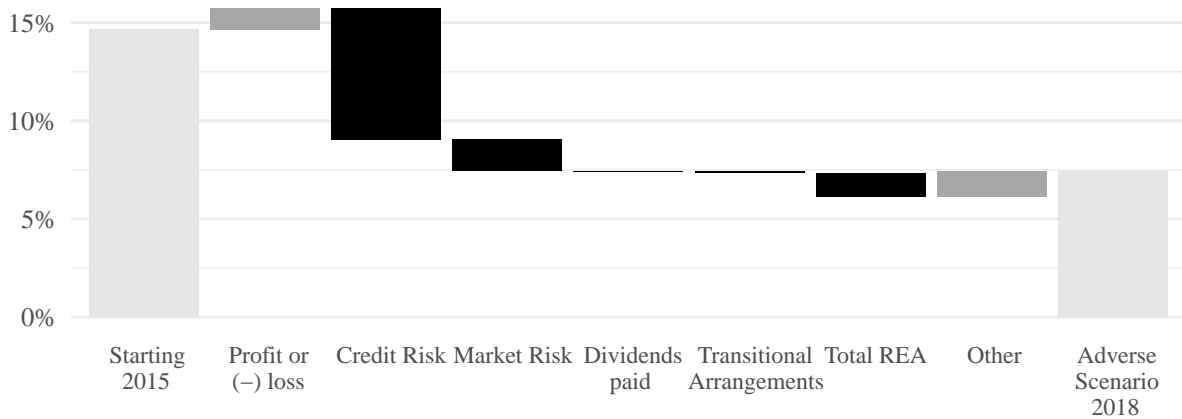


Figure 3: Drivers of changes in the Tier 1 capital ratio from Actual 12/2015 to Adverse 12/2018. Credit Risk refers to: Impairment or (-) reversal of impairment on financial assets. Profit or (-) loss refers to: profit or (-) loss before tax from continuing operations before credit risk and market risk losses.

*Source: Author's calculations; Data: EBA (2016a)*

agreement or maturity. This is straight-forward to detect since banks report any changes in the amortisation status of each loan.<sup>5</sup> Furthermore, a bank can grant two types of loan extensions. First, loans can be extended by increasing the total limit that can be drawn down by the borrower. This measure is especially common for overdrafts. In the framework of forbearance, the idea is that a borrower needs more credit, e.g. to cover current expenses or even to fulfil payments that are outstanding on another existing loan product. We define this measure as a positive change in the total limit that can be drawn by a borrower. Second, the loan's maturity can be extended by pushing back the due date of the loan. Non-amortising loans therefore become due at a later date. For loans with constant repayments, this can result in smaller instalments and therefore a lighter financial burden for the company over time. In a similar manner, the bank can “rollover” a loan. This measure is less straight forward to extract from loan-level data. We consider a loan “rolled-over” if for a given borrower one of its significant loans disappears from the sample (expired or concordantly ended) but the borrower limit does not decrease by more than half of the discontinued loan's amount. This implies that limits on other products were increased or new products were issued. Finally, we follow Caballero et al. (2008) and look at subsidised lending via a comparably lower interest rate. We extend this idea to account for the environment of decreasing interest rates for our sample period. Therefore, we analyse whether banks grant specific borrowers significantly greater interest

<sup>5</sup>Under Capital Requirements Regulation Article 178 (3) a) non-accrual status amounts to a default of a loan. Here, we rely on banks internal indicators of an amortisation stop which does not correlate with default, both before and after CRR/CRD IV took effect.



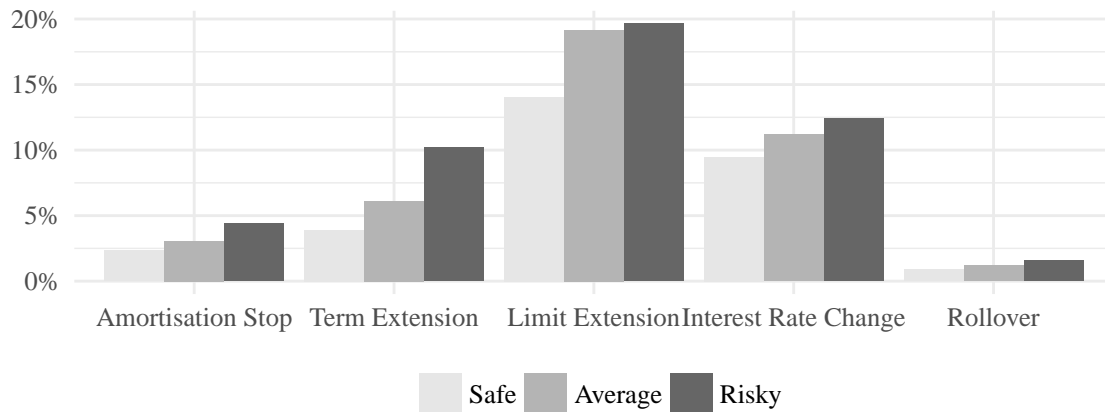


Figure 4: Forbearance measures taken by borrower classification [% of loans per risk class and forbearance measure].

rate decreases compared to their peers. We define an advantageous change in the interest rate if the decrease in a borrower’s interest rate is greater than the decrease for the safest borrowers within the same sector, segment, and product type.<sup>6</sup>

These measures are very heterogeneous. A limit extension can be requested for very different purposes by very diverse borrowers. Safe borrowers might apply for more credit in order to finance projects with net positive returns. In contrast, a stressed borrower might apply for further credit when he is unable to cover due payments and expenses. However, other measures, such as an amortisation stop, might be the most necessary, but also the most risky, when a borrower is in distress. In order to account for this, we split borrowers in three risk categories: safe, average, and risky.<sup>7</sup> Figure 4 shows the share per borrower rating of the different treatments across time. We find that the share of treated loans is the highest for the riskiest borrowers for every forbearance measure. The most commonly applied measure within the group of risky borrowers is a limit extension, followed by an interest rate change. A rollover and an amortisation stop are the least commonly applied measures. The fact that risky borrowers have higher shares of forborne loans goes against banks’ risk aversion, but this phenomenon is intuitive when considering that borrowers in distress are most in need of additional financial support. In the following sections we will focus the banks’ incentives to prevent default and test this hypothesis empirically.

<sup>6</sup>An extensive description of how we measure forbearance can be found in the Appendix.

<sup>7</sup>The borrower classification used here is based on similar observed default rates for the different ratings which are unified across banks.

## 2.2.2 The Banks' Incentives and Constraints

In the context of our research question it is important to understand how the constraints and incentives of banks influence their credit supply to the economy. Banks maximise their profits while staying solvent and holding enough liquid assets to meet their obligations. At the same time, they are subject to the capital and liquidity regulation set out in the Basel II and III framework.

Let us consider the case of a commercial loan close to default (low rating). The bank has an incentive to prevent default because of the impact on its capital ratio. NPLs have a negative impact on capital both now and in the future. First, a provisioning shortfall is deducted from Tier 1 capital<sup>8</sup> in case of default under the Foundation Internal Ratings Based (F-IRB) approach.<sup>9</sup> This shortfall might occur because of the discretionary nature of provisions. Banks have an incentive to “underprovision” and only realise the loss at default. Second, a default leads to higher future provisions since these are based on historical observed default rates. International Financial Reporting Standards (IFRS) 9, in place from January 2018 on, will lead to an earlier recognition of expected losses and thereby mitigate the issue of underprovisioning.

Intuitively, banks have a strong incentive to prevent this potential decrease of capital and adopt forbearance measures in order to support the borrower in difficulty. Nonetheless, forbearance measures themselves might also impact regulatory capital ratios. First, a maturity extension mechanically increases the risk weight as maturity is part of the risk weight formula.<sup>10</sup> Second, an increase of the overall borrower limit translates directly into an increase of the exposure at default and thereby risk weighted assets. Third, reducing the interest rate will lead to lower capital because of the lower future interest earnings but risk weights are unaffected. Fourth, an amortisation stop is a temporary stop/reduction of the regular payments. The effect on capital depends on whether missed payments are repaid in full once the loan becomes amortising again. Lastly, a rollover can be seen as a maturity extension with regards to risk weights, because a considerable amount of the exposure stays on the book of the bank.

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<sup>8</sup>Excess provisions are added to Tier 2 capital.

<sup>9</sup>The majority of corporate, SME and micro SME portfolios are held under the Foundation Internal Ratings Based approach. Minor parts are accounted for using the Standardised Approach and one bank has a small part of their portfolio with the Retail Internal Ratings Based approach.

<sup>10</sup>See Capital Requirements Regulation Article 153 (1) for the F-IRB approach.

Having laid out the motivation for using forbearance measures, the question that arises is whether or not new lending is subdued because capital and other resources within the bank are allocated to forborne loans. New lending mechanically increases risk weighted assets with risk weights being dependent on observed default rates of comparable loans. This explains why, after the Global Financial Crisis, commercial lending had very high risk weights.

One could argue that these considerations only hold once the constraints become binding (low capital ratios). Thus, high risk weighted capital ratios should allow the bank to focus on profitability. We argue that capital ratios alone are not sufficient to capture the pressure for banks to optimise their risk weighted assets. Credit risk poses a significant risk to capital levels as could be seen in the stress test results (see Figure 3). As the risk of a bank's loan portfolio changes over the economic cycle, seemingly prudent provisioning levels can turn out to be insufficient during an economic downturn. This uncertainty around the credit risk and its provisions casts doubt on capital levels. This effect is even more relevant if the overall quality of a bank's book is inferior.<sup>11</sup> A deterioration of the economic environment can potentially lead to a significant average downgrade and would increase risk weighted assets and decrease capital. Therefore, the Texas Ratio defined in Section 2.1 is a more informative measure taking into account the uncertainty surrounding capital levels and credit risk.

## 3 The Determinants of Forbearance

### 3.1 Data

We use the commercial loan level data from the Central Bank of Ireland provided by Irish banks in biannual frequency from 2011 Q4 up to 2016 Q2. This covers all loans to large corporates, small and medium enterprises (SMEs), and Micro SMEs including loan-specific as well as borrower-specific characteristics. Therefore, while most of the previous literature considered only listed firms, we are able to analyse lending to any type of firm that borrows from Irish Banks in Ireland. The loan-specific characteristics contain

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<sup>11</sup>One bank in our sample has around 50% of its commercial loans in default throughout the sample. Accordingly, another 25% of this banks' commercial loan book is close to default.

information on product type, maturity, interest rate, the repayment schedule, a mapped rating of the risk of the loan, and whether the loan is securitised. The borrower-specific characteristics include information about the firm’s sector and segment.

We have 1,686,325 observations (loan  $\times$  time) and 244,908 borrowers in our sample. Once a loan defaults, the borrower and all of the related loans are no longer included in the sample. The data covers the 26 Irish counties, 8 sectors, 3 segments (Corporate, SME and micro SME), and 4 product types (leasing/hire purchase, overdraft, term loan and other).

Table 1 shows a split of the sample by rating, segment, and product type. Starting with rating, we observe not just a high share of defaulted loans (32.3% weighted by outstanding balance) but also a significant share of loans in the riskiest category (26.1% weighted by outstanding balance). This supports the hypothesis that a high number of NPLs indicates an overall stressed loan portfolio. Furthermore, only 6.4% of loans weighted by outstanding balance are in the safe category. Comparing these shares by volume and number of loans, we can see that loans in the safe category are relatively smaller whereas defaulted loans are considerably larger on average. This difference is even more evident turning to the split by segment. We can see that the largest amount outstanding is towards the SME segment but the majority of loans go to micro SMEs. Even more extreme, corporate lending makes up for 18.9% of outstanding balance but only 0.3% of loans. Finally, we look at different product types where term loans represent the largest share by volume as well as number of loans. Furthermore, we see a larger amount outstanding for this product type (120,000 € on average) which is only surpassed by the “Other” category with an average loan size of 265,000 €.<sup>12</sup>

Table 2 shows how many borrowers are affected by our different forbearance measure across the whole sample. 89,255 borrowers receive any kind of measure, with the most frequent being a limit extension, followed by an interest rate change. This means that more than a third of all borrowers in our sample were granted forbearance measures. This split by the individual measures confirms what we show in Figure 4: limit extension is the most popular measure, followed by interest rate changes, term extensions, an amortisation stop and finally a rollover. As even the latter has been applied to 11,353 borrowers in our sample, we argue that none of the measures are negligible.

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<sup>12</sup>The significantly higher average in the “Other” category is due to large loans to corporates, such as syndicated loans.

A caveat of this confidential data is that we do not obtain the firms' names. This has two consequences: first, we cannot enrich the data with balance sheet information in order to control for firm characteristics. Secondly, we cannot identify the same firm across banks. While the data allows us to identify a borrower having several loan products within a bank, we cannot control for the fact that the firm might have a relationship to another bank. However, [Albertazzi and Marchetti \(2010\)](#) use the Italian credit registry to show that the ability of borrowers to compensate through substitution across banks appears to have been limited after Lehman's collapse.

### 3.2 Empirical Approach

In a first step, we want to estimate the probability of forbearance measure  $i$  being applied for a given borrower  $j$  in the next six months with the following logit model:

$$Pr(forb_{i,j,t+1}) = \alpha + \beta_1 X_{l,t} + \beta_2 T_{k,t} + \beta_3 Rating_{l,t} * T_{k,t} + forb. \ before_{j,t} + fixed \ effects + \epsilon \quad (1)$$

where  $X_{l,t}$  contains the time varying characteristics per loan  $l$ : rating and  $\ln(\text{Outstanding Balance})$ ,  $T_{k,t}$  corresponds to the time varying Texas Ratio of bank  $k$ , and  $forb. \ before_{j,t}$  is a dummy if borrower  $j$  received any forbearance measure before. Finally, we include various fixed effects: *loan age* fixed effects control for the influence of the loan age on the estimated probability of forbearance, *sector  $\times$  time* fixed effects attempt to control for the macroeconomic environment, *bank  $\times$  segment  $\times$  product type* fixed effects control for the variation between different loan products of different sizes at a given bank, and *county* fixed effects to consider geographical variation. In order to control for other bank and time varying characteristics that might correlate with the Texas Ratio, we also include *bank  $\times$  time* fixed effects. Given that borrowers do not leave the sample once they received a treatment, the dummy whether any loan by borrower  $j$  was modified before  $t$ ,  $forb. \ before_{j,t}$ , tests if it is more likely for a loan to be forborne if another measure has already been granted. Contrary to forborne loans which stay in the sample, non performing loans are excluded from the sample once default occurs. Thus, our specification does not suffer from endogeneity problem which would arise if we had NPLs on the left hand side and the Texas Ratio - including NPLs - on the right. Regarding the dependent variable, we start by testing the probability of receiving any of the five different forbearance measures: an

extension in the overall credit limit or the maturity of the loan, a stop in amortisation, a change in the interest rate, or a rollover of the loan product. As a second step, we then test the specification for each measure individually in order to identify the patterns driving our results.

### 3.3 Results

#### 3.3.1 Overall Forbearance

In Table 3, we show the results of our logit model regressions. From column (1) to (7) we include fixed effects and lastly the forbearance before dummy up to the full specification of equation (1). The interpretation of the results only becomes relevant once we load in at least fixed effects controlling for the demand side ( $sector \times time$ ). On the other hand, the supply side fixed effects ( $bank \times time$ ) are important because the Texas Ratio of a bank is likely to be correlated with other time varying bank characteristics. Nonetheless,  $bank \times time$  fixed effects do not allow us to make a statement about the influence of the Texas Ratio on the probability of forbearance in absolute terms but only in relative terms. Therefore, we add fixed effects in the following order in columns (2-6):  $loan\ age$ ,  $sector \times time$ ,  $bank \times time$ ,  $bank \times segment \times product\ type$ , and  $county$ . In order to gauge whether risky borrowers are more or less likely to receive forbearance we have to add up the difference in probabilities for the different ratings and the differential slopes with respect to the Texas Ratio and ratings. When controlling for  $loan\ age$  and  $sector \times time$  we find that for the average Texas Ratio of 105%, the probability of receiving forbearance is higher for risky borrowers than for safe borrowers. The coefficient for risky loans (having safe borrowers as the reference group) is significantly negative in column (3) but the effect is outweighed by the significantly positive interaction term for risky borrowers with the Texas Ratio (again with safe borrowers as the reference group). Therefore, we can say that a stressed borrower paired with a stressed bank has a higher probability of agreeing on forbearance than a risky borrower with a less stressed bank and a safe borrower with a stressed bank.

We present this main result in a more intuitive way in Figure 5, which is based on the regression in column (7) without  $bank \times time$  fixed effects. In order to calculate the actual

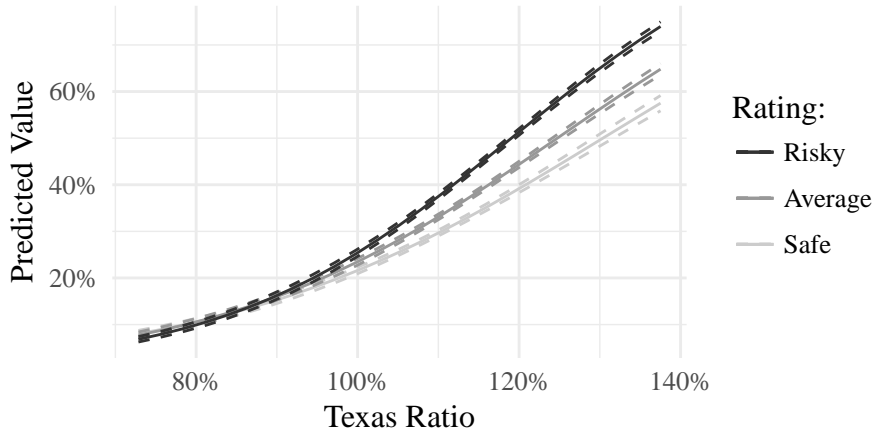


Figure 5: Predicted probability of any measure taken by borrower rating class and Texas Ratio. All other variables at mean or mode.

probabilities of receiving forbearance, we vary the Texas Ratio and keep all other values (e.g. segment, bank,  $\ln(\text{Outstanding Balance})$ ) at mean or mode. We can see that for the average Texas Ratio of 105%, the probability of a risky loan receiving forbearance is 5 percentage points higher than for a safe loan and at an absolute value of about 52%. For a risky loan, the difference in predicted probability is around 60 percentage points between a bank with a Texas Ratio at the 95th percentile (134%) and a bank at the 5th percentile (70%). Given the higher Texas Ratio a borrower of a risky loan has a 70% probability of receiving any forbearance measure within the next six months. Therefore, we show two main results. Our first result, increasing probability of receiving a forbearance measure with decreasing borrower rating, is driven by two mechanisms: first, only borrowers in need will ask for forbearance. Secondly, borrowers have an informational advantage over their lenders which they might exploit in a situation where default is unavoidable. This strategic motive can play a role if the borrower knows that the bank believes forbearance is effective and that the bank has an incentive to help because it cannot afford to let the borrower default. Our second result is the increasing probability of receiving a forbearance measure with the increasing Texas Ratio of the lender. This is in line with the incentives for constrained banks to preserve their capital ratios by forbearing loans, outlined in Section 2.2.2. Furthermore, we find that larger loans are more likely to receive a forbearance measure.

Turning back to Table 3, in column (4) we add  $bank \times time$  fixed effects which are crucial to control for anything correlated with the bank's Texas Ratio. We find the interaction

effect of the safe borrower’s rating (with the safe rating as the reference category) and the bank’s Texas Ratio to be significantly positive. In other words, for a risky borrower, the probability of receiving forbearance increases more with respect to bank level stress than for a safe borrower. One has to bear in mind that the base probability of receiving forbearance is lower but insignificant for risky borrowers as can be seen in column (4). The coefficient is significant and negative once we control for *bank*  $\times$  *segment*  $\times$  *product type* and *county* fixed effects. For the average value of the Texas Ratio, 105%, the coefficient on the interaction term outweighs the difference in the baseline probability. Therefore, for the average value of the Texas Ratio and above, the probability of receiving forbearance is higher for risky borrowers compared to safe borrowers. This result is robust throughout columns (4-6).

Another way of interpreting the results is to look at odds-ratios.<sup>13</sup> Summing up the coefficients of interest in column (7), we can say that at an average Texas Ratio of 105%, the odds of a risky loan receiving forbearance are 28.5% higher than for a safe loan, *ceteris paribus*. With regards to the second result we compare the odds of receiving forbearance for a risky loan with a bank at times of very low and very high values of the Texas Ratio. At the 95th percentile (Texas Ratio of 134%), the odds of receiving forbearance for a risky loan are 67% higher than at the 5th percentile (Texas Ratio of 70%), *ceteris paribus*. The other important factor in explaining the probability of receiving forbearance is if the loan already received another forbearance measure. The odds are 224% higher to receive forbearance if the borrower already received forbearance.

The previously presented results are robust given the saturation with fixed effects. Furthermore, we cluster standard errors at *bank*  $\times$  *time* level to tackle the problem of heteroskedasticity. Another concern could be that at high levels of the Texas Ratios, banks have an additional incentive to forbear the most important borrowers by loan size as they are concerned about the exposure at default. Although we already control for the loan size in our regression, we conduct another robustness test, shown in Table 9 in the Appendix, where we add a double interaction effect:  $\ln(\text{Outstanding Balance}_{l,t}) : \text{Texas Ratio}_{k,t}$ . We can see that the additional effect of the loan size at high Texas Ratios is not significant and that our main results hold.

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<sup>13</sup>As we run a logit model we look at  $e^\beta$  to get the odds-ratio.



We argue for the use of the Texas Ratio in Section 2.1 and use it for our regressions. Nonetheless, we have not yet analysed which of the components of the Texas Ratio, namely NPLs and the Tier 1 Ratio, are driving these results. Table 10 shows the same regression we previously interpreted for the NPL Ratio<sup>14</sup> instead of the Texas Ratio. We find that the results for the Texas Ratio can be confirmed for the NPL Ratio. In column (8), we add the Tier 1 ratio interacted with the borrower rating and it turns out to be insignificant. Once we include both, the interaction of the NPL Ratio and the Tier 1 Ratio with the borrower rating in column (9), it is only the NPL Ratio interaction term that remains significant. Therefore, we conclude that the level of NPLs is driving our results when we use the Texas Ratio as a measure for bank stress in determining of the granting of forbearance.

### 3.3.2 Different Measures of Forbearance

In Table 4, we look at the different forbearance measures<sup>15</sup> individually so that the dependent variable is equal to one if a specific forbearance measure was granted within the following 6 months. For policy makers, it is indispensable to know which measure exactly the mechanism found in our previous results.

Column (1) shows the results for any forbearance measure which can be found in column (7) of Table 3 in order to contrast the individual forbearance measures results. The two main results laid out in the previous section can be confirmed for Term and Limit extensions. For these two measures, the interaction term of the borrower's rating and the bank's Texas Ratio is significantly positive (with the safe rating as the base category). The baseline probability of receiving a limit extension is significantly lower for a risky borrower than for a safe borrower. This effect is outweighed by the interaction for values of the Texas Ratio of greater than 120%. One has to bear in mind that we define limit extension as a forbearance measure only for borrowers in distress (risky). A limit extension for a safe borrower is not necessarily forbearance but more likely growth financing. Therefore, the probability of receiving a limit extension, in the sense of growth financing, is naturally higher for a safe borrower paired with a not stressed bank, than receiving a limit extension as a forbearance measure for a risky borrower paired with a similar bank. The significantly

<sup>14</sup>The NPL Ratio is defined as:  $\frac{\text{Non-Performing Loans (Impaired or 90 days past due)}}{\text{Total Loans}}$ .

<sup>15</sup>see Section 2.2.1 for the definitions of each forbearance measure.

positive coefficient on the interaction term in column (5) confirms that the probability of agreeing a limit extension increases more strongly with the Texas Ratio of the bank for risky borrowers than for safe borrowers. For term extensions the argument is the same, whereas in this case the baseline coefficient in column (3) is negative but insignificant.

Turning to the other three forbearance measures, the results differ. For an amortisation stop - column (2), an interest rate change - column (4) or a rollover - column (5) we do not find a significant influence of neither the bank's nor the borrower's risk. The interaction term for rollover and amortisation stop is positive but insignificant given our very conservative standard error clustering. The size of the loan is the only variable with a significant coefficient. This is to say that an amortisation stop and an interest rate change is more likely for larger loans and the contrary holds for a rollover. For all the individual forbearance measures the probability of receiving it is higher if the borrower received a forbearance before.

### **3.3.3 Sequencing of forbearance measures**

Forbearance is not necessarily a one off treatment and we observe that banks and borrowers often agree to more than just one measure over time. The question arises if there is an observable pattern in the sequencing of measures. We want to check if certain types of forbearance are typically applied first while others might be predominantly used as a “measure of last resort”, after other measures were deemed insufficient. A simple descriptive analysis can be found in Table 5. Among all borrowers who received more than one measure, we measure how many times each forbearance type has been applied as a first, second, or third measure. The first column describes what measures were taken first, given that two or more measures were taken for a given borrower. Because a borrower can have multiple loan products, there can be more than one forbearance measure per borrower. The distribution of measures taken first resembles that of the overall distribution presented in Figure 4 and Table 2. Limit extensions are the most common, followed by an interest change, whereas a rollover is the least common measure. Furthermore, out of the 244,908 borrowers in our sample, 52,255 receive two or more forbearance measures and 33,342 receive three or more. For the distribution of the measures applied second, for all cases where there were at least two measures applied, we find that limit extensions are

less often applied as a second measure compared to being employed as the first measure. All other forbearance measures are employed more frequently as a second measure than as a first measure. As for the third measure we find that the relative shares differ from those of the first and second measure. A limit extension is much less likely to be taken as a third measure compared to a first and amortisation stop and interest rate changes are more likely. To conclude, a limit extension seems to be a measure more often applied at first, whereas interest rate changes and an amortisation stop become more important as a second and third measure.

## 4 Effectiveness of Forbearance

### 4.1 Empirical Approach

As a second step, we want to estimate the default probabilities dependent on whether forbearance was granted or not. Therefore, we estimate the probability of default for a given borrower with the following logit hazard model:

$$Pr(Def_{j,t}) = \alpha + \beta_1 X_{l,t} + \beta_2 F_{j,t} + forb. \ before_{j,t} + fixed \ effects + \epsilon \quad (2)$$

where  $Pr(Def_{j,t})$  is the probability of default on any loan held by borrower  $j$  in any period in the future,  $X_{l,t}$  consists of the time varying characteristics of loan  $l$ : rating and  $\ln(\text{Outstanding Balance})$ ,  $F_{j,t}$  is a dummy for (any) forbearance measure for any loan held by borrower  $j$  within the last six months, and  $forb. \ before_{j,t}$  is the dummy for any previous forbearance measure towards borrower  $j$ . Again, we include *loan age*, *sector*  $\times$  *time*, *bank*  $\times$  *time*, *bank*  $\times$  *segment*  $\times$  *product type*, and *county* fixed effects and we cluster standard errors at *bank*  $\times$  *time* level.

### 4.2 Results

The regression results of the logit model can be found in Table 6. We first analyse if the granting of any forbearance measure is associated with a lower probability of default in the future. As the ratings are defined by the ex-ante probability of default, the increasing

coefficients with riskiness across all columns are reassuring. However, even controlling for the rating, the interaction of the dummy for any forbearance with the rating is positive for all ratings when controlling at least for *loan age* and *sector*  $\times$  *time*. In other words, a risky borrower who received forbearance is more likely to default than a risky borrower who did not receive forbearance. This result is robust when loading in fixed effects.

We suggest that these results could be driven by two different mechanisms. First, a selection bias might cause a bank to choose to give forbearance to the “worst” borrowers (closest to default) within the group of risky borrowers in an attempt to prevent default where it is most necessary. Secondly, borrowers might act strategically and demand forbearance knowing that they are going to default even with forbearance. The intuition is that it might be profitable for firms to keep business alive even just for a limited period of time.

We cannot disentangle these two effects. However, we can conclude that they outweigh the positive impact of forbearance as a financial support for struggling borrowers in order to prevent default. Using the regression results in column (6), with all fixed effects loaded in, we find that the odds of default for a borrower having received any forbearance measure in the last six months are 20% higher than if the borrower was not treated. In column (7), we add the forbearance before dummy but we find no significant effect for this variable. Outstanding balance has a significantly positive coefficient, which means that larger loans are more likely to default.

In Figure 6, we show our result graphically. The graph shows the probability of default for risky borrowers who received a forbearance measure and those who did not receive a measure in time  $t$ . In order to calculate the actual probabilities, we keep all variables at mean or mode and change only the dummy for any measure. If no measure was taken during the last six months, the probability of default is around 8.7%. The probability for a risky borrower who received forbearance in the last six months is significantly higher at around 9.25%. The default probabilities are significantly lower if we do not condition the results on the riskiness of the borrower. Figure 8 in the appendix shows the probabilities ranging from 1.4% to 1.8% for the average borrower.

Again, it is crucial for policy makers to know which measures of forbearance are associated with a higher probability of default. In Table 7, we can see the results for the different

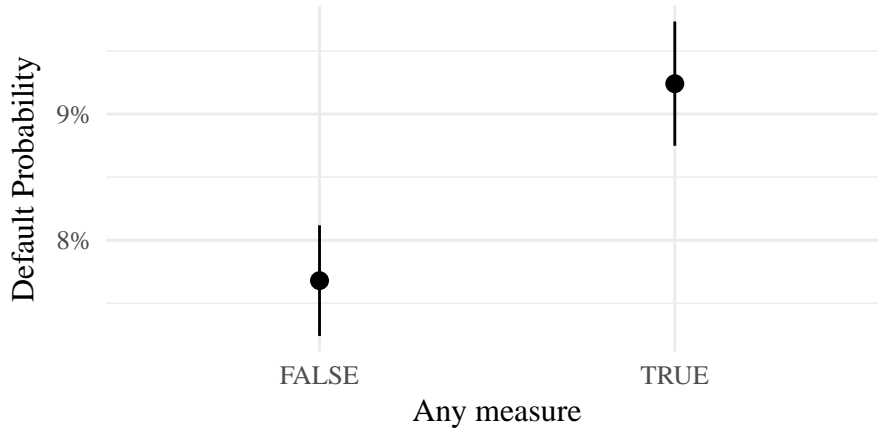


Figure 6: Predicted probability of default for a risky loan, depending on any measure being taken. All other variables at mean or mode.  
*Source: Author's Calculations; Data: CBI*

measures. In column (1), we see the result for any measure as a benchmark for the results of the individual measures. All regressions control for the full set of fixed effects. The findings outlined regarding the negative impact of any measure on subsequent default are confirmed for term extensions, interest rate changes, and amortisation stops. The probability of default is higher given that a risky borrower has received these three different forbearance measures. The overall finding cannot be confirmed for limit extensions or rollovers. For these two, the coefficients are negative but insignificant. However, only a negative coefficient could be interpreted as the positive effect of this forbearance measure. Therefore, also for those measures, we cannot show that they effectively lower default rates for stressed borrowers.

## 5 Correlation with new Lending

Existing literature shows that when stressed banks keep relationships with risky borrowers alive, they issue significantly lower volumes of new lending compared with their peers (e.g. [Acharya et al. \(2016b\)](#); [Caballero et al. \(2008\)](#)). This literature strongly emphasises the negative real effects this behaviour can have for the economy. The presence of zombie firms was found to depress job creation, deter the entry of healthy firms, and to decrease employment and investment levels in healthy firms ([Giannetti and Simonov, 2013](#)).

The empirical evidence from this literature suggests a relationship between credit supply

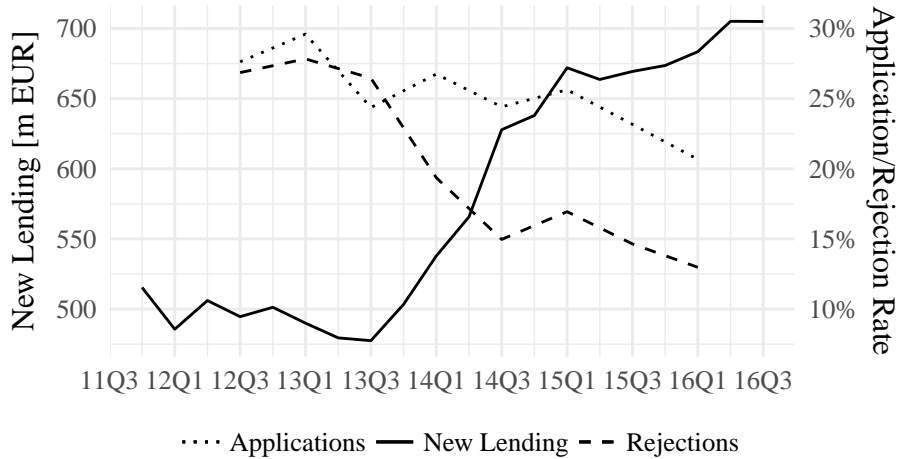


Figure 7: The left y-axis shows the quarterly new lending to Irish SMEs (seasonally adjusted in m EUR). *Source: Author’s Calculations; Data: CBI*

The right y-axis shows application rate for new products (% of firms) and rejection rate for new products (% of applications) for Irish SMEs. *Data: RED-C SME Market Report*

and lower volumes of new credit . In Figure 7, we analyse seasonally adjusted quarterly new lending to Irish firms. While Irish banks were under stress due to their high NPL levels, their new lending to the SME sector was subdued. In order to exclude the hypothesis that this is due to constrained credit demand after the Global Financial Crisis, we look at survey data on SME credit applications during that time.<sup>16</sup> The dotted (dashed) line in Figure 7 shows the application (rejection) rate for Irish SMEs over time. The application rate for new products and thereby demand for new credit was high in 2012 and continuously dropped throughout the sample. The coincidence of the period of low new lending volumes and high credit demand suggests that the low volumes were driven by banks credit supply. The dashed line confirms the high rejection rate for new product applications around the time of low new lending volumes. In our empirical analysis, we want to see if this is correlated with forbearance patterns which might tie up capital so that supply for new loans remains suppressed.

In the following, we test this correlation of forbearance and new lending for Ireland. First, we set up buckets of borrowers,  $b$ , by *bank*, *segment*, *time*, and *county* because we suggest that lending decisions are made separately for these groups. Then, we estimate

<sup>16</sup>We obtain these data from the RedC Reports on SME lending provided by the Department of Finance of Ireland. As SMEs are by far the largest borrower group, we argue that it is representative to look at this group in order to get an overview of the lending market.

the following OLS regression:

$$Share(New\ Lending)_{b,t} = \alpha + Share(Forbearance)_{b,t-1} + fixed\ effects + \epsilon \quad (3)$$

where  $Share(New\ Lending)_{b,t}$  is the sum of lending to new borrowers over the total lending in bucket  $b$  in time  $t$  and  $Share(Forbearance)_{b,t-1}$  is the sum of loans to forbore borrowers over the total lending in  $t - 1$  in bucket  $b$ . Again, we add fixed effects to control for the macroeconomic environment ( $county \times time$ ) and variation between banks ( $bank$ ), and between banks over time ( $bank \times time$ ).

The results in Table 8 confirm a negative correlation between forbearance and new lending in the same bucket and across all specifications. This means that the higher the share of forbearance within a certain segment and county by a specific bank, the lower the share of new loans. This result holds when saturating the regression with fixed effects (see columns 1-4). In terms of magnitude, a 1% higher share of forbore loans is correlated with a 0.076% lower share of new lending, as can be seen in our most conservative specification in column (4). We test the robustness of this result in two ways: first, we use contemporaneous new lending in column (5). As our unit of time is relatively large (six months) the decision to “substitute” new lending with forbearance could happen within the same time period. Second, instead of using the share of new lending and forbearance, we use the natural logarithm of new lending and forbearance instead of shares in column (6). However, for both robustness checks, results remain highly significant even in our most conservative specification. Combining this with our previous results and the literature we can suggest that forbearance - which occurs mostly for risky borrowers - is a trade-off for new loans, which are potentially safer.

## 6 Conclusion

In this paper, we analysed the forbearance patterns of stressed banks in the post-crisis period. More specifically, our analysis presents five measures: an extension in the credit limit or maturity, a pause in amortisation, a comparably lower interest rate change, and a rollover of a loan product. We find that risky borrowers are more likely to receive the first two of these measures when banks are facing high levels of NPLs relative to

their capitalisation and provisions. As a second step, we evaluate the effectiveness of this practice. Using a logit-hazard model, we find that borrowers who received forbearance were more likely to default than their peers within the same risk category. While we cannot conclude that the forbearance measures themselves caused defaults, we argue that credit might have been misallocated to the weakest borrowers which were subsequently not “rescued” from default. In the last part of our empirical analysis, we show that banks with a high share of forborne loans issue lower volumes of new credit. This could result in tighter financial conditions for new firms who might potentially be more productive.

Our analysis highlights the importance of the health banks’ loan books. While banks can be well-capitalised on paper, they might be under pressure by high levels of non-performing loans on their balance sheets. We suggest that banks have an incentive not to recognise loans as non-performing and offer an explanation through the regulatory framework. This is crucial for policy makers as uncertainty about the real quality of the loan book, if widespread in the economy, can lead to systemic risk and undermine trust in the banking sector’s solvency.



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## Tables

Table 1: Summary statistics by segment, rating, and product type

Split by:	Sample share by outstanding balance	Sample share by number of loans
<b>Rating</b>		
Safe	6.4%	8.7%
Average	35.2%	40.0%
Risky	26.1%	32.5%
Default	32.3%	18.9%
<b>Segment</b>		
Corporate	18.9%	0.3%
SME	61.6%	30.7%
Micro SME	19.4%	69.0%
<b>Product Type</b>		
Term Loan	81.8%	49.6%
Overdraft	6.9%	34.3%
Leasing/Hire Purchase	4.6%	14.3%
Other	6.7%	1.7%

*Note: Ratings are based on underlying ex-ante probabilities of default for individual loans, segments relate to the size of the firm, and product type describes the type of loan held by the borrower. These summary statistics are averages over 1,686,325 observations (loan  $\times$  time) held by 244,908 borrowers in our sample.*

Table 2: Number of borrowers who received a forbearance measure

	Number of borrowers
Rollover	11,353
Amortisation Stop	14,087
Term Extension	17,377
Interest Rate Change	27,837
Limit Extension	69,209
Any measure	89,255
All borrowers	244,908

*Note: The numbers presented here are across time, which means that borrowers can obtain more than one measure.*

Table 3: Logit regression: Probability of application of any forbearance measure - Texas Ratio

	Dependent variable:						
	Any measure <sub>j</sub>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rating - Average <sub>t</sub>	-0.152 (0.296)	-0.136 (0.295)	-0.202 (0.237)	0.029 (0.120)	-0.153 (0.113)	-0.162 (0.112)	-0.094 (0.172)
Rating - Risky <sub>t</sub>	-0.843 (0.585)	-0.856 (0.589)	-0.887*** (0.338)	-0.408 (0.268)	-0.565** (0.263)	-0.578** (0.263)	-0.589** (0.273)
ln(Outstanding Balance <sub>t</sub> )	0.218*** (0.012)	0.213*** (0.012)	0.207*** (0.013)	0.212*** (0.013)	0.132*** (0.009)	0.130*** (0.008)	0.096*** (0.009)
Texas Ratio <sub>k</sub>	-0.011** (0.005)	-0.011* (0.005)	-0.001 (0.018)				
Rating - Average <sub>t</sub> :Texas Ratio <sub>k</sub>	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.001 (0.001)	0.003** (0.001)	0.003** (0.001)	0.002 (0.002)
Rating - Risky <sub>t</sub> :Texas Ratio <sub>k</sub>	0.009 (0.006)	0.009 (0.006)	0.011*** (0.004)	0.006* (0.003)	0.008*** (0.003)	0.008*** (0.003)	0.008** (0.003)
Forbearance Before <sub>j</sub>							1.178*** (0.098)
Fixed Effects:							
Loan age		Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time			Yes	Yes	Yes	Yes	Yes
Bank x Time				Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type					Yes	Yes	Yes
County						Yes	Yes
Observations	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,324,317

Note: Logit Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of receiving forbearance in  $t + 1$  whereas the dependent variables are measured in  $t$ . We split the borrowers in Safe, Average and Risky based on their ex-ante probability of default. Forbearance Before is a dummy which is one if a borrower has ever received forbearance before  $t + 1$ . Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

Table 4: Logit regression: Probabilities of different measures being applied, taking into account prior forbearance

Measure <sub>i</sub> :	Dependent variable:					
	Any measure <sub>j</sub>	Amortisation Stop <sub>j</sub>	Term Extension <sub>j</sub>	Interest Rate Change <sub>j</sub>	Limit Extension <sub>j</sub>	Rollover <sub>j</sub>
	(1)	(2)	(3)	(4)	(5)	(6)
Rating Average <sub>t</sub>	-0.094 (0.172)	0.099 (0.665)	-0.614 (0.473)	0.050 (0.193)	-0.184* (0.103)	-0.445 (0.386)
Rating Risky <sub>t</sub>	-0.589** (0.273)	0.851 (0.592)	-0.512 (0.470)	0.073 (0.331)	-0.483** (0.225)	-0.102 (0.441)
ln(Outstanding Balance <sub>t</sub> )	0.096*** (0.009)	0.030* (0.015)	0.029 (0.021)	0.240*** (0.025)	0.008 (0.008)	-0.112*** (0.014)
Rating Average <sub>t</sub> :Texas Ratio <sub>k</sub>	0.002 (0.002)	0.001 (0.006)	0.009** (0.005)	-0.001 (0.002)	0.003*** (0.001)	0.001 (0.004)
Rating Risky <sub>t</sub> :Texas Ratio <sub>k</sub>	0.008** (0.003)	0.0005 (0.006)	0.014*** (0.005)	-0.002 (0.004)	0.004* (0.002)	0.0005 (0.005)
Forbearance Before <sub>j</sub>	1.178*** (0.098)	1.184*** (0.186)	0.676*** (0.146)	1.667*** (0.226)	0.728*** (0.085)	0.291*** (0.111)
Fixed Effects:						
Loan age	Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Time	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,324,317	1,321,654	972,779	1,304,003	1,181,047	1,285,117

Note: Logit Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of receiving a specific forbearance measure  $i$  in  $t + 1$  whereas the dependent variables are measured in  $t$ . We split the borrowers in Safe, Average and Risky based on their ex-ante probability of default. Forbearance Before is a dummy which is one if a borrower has ever received forbearance before  $t + 1$ . Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

Table 5: Number of occurrence of each measure granted in a sequence of measures.

	First Measure		Second Measure		Third Measure	
Term Extension	5,370	8.6%	6,506	10.4%	3,598	8.8%
Limit Extension	34,201	55.1%	32,109	51.1%	19,860	48.6%
Interest Rate Change	14,271	23.0%	15,119	24.1%	11,186	27.4%
Amortisation Stop	5,102	8.2%	5,687	9.0%	4,341	10.6%
Rollover	3,179	5.1%	3,438	5.5%	1,840	4.5%
Total number of borrowers	52,255		52,255		33,342	

Note: Among all borrowers who received more than one measure, we measure how many times each forbearance type has been applied as a first, second, or a third measure.

Table 6: Logit regression: Probability of default for any product by borrower - Influence of any measure taken by borrower

	Dependent variable:						
	Probability of Default <sub>j</sub>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rating Average <sub>t</sub>	1.199*** (0.181)	1.204*** (0.185)	1.370*** (0.111)	1.380*** (0.116)	1.280*** (0.118)	1.281*** (0.118)	1.281*** (0.118)
Rating Risky <sub>t</sub>	2.895*** (0.291)	2.898*** (0.286)	3.001*** (0.151)	3.061*** (0.152)	3.010*** (0.155)	3.010*** (0.155)	3.010*** (0.154)
ln(Outstanding Balance) <sub>t</sub>	0.131*** (0.026)	0.132*** (0.026)	0.102*** (0.026)	0.100*** (0.026)	0.127*** (0.019)	0.128*** (0.019)	0.127*** (0.018)
Rating Safe <sub>t</sub> :Any Measure <sub>j</sub>	-0.061 (0.450)	-0.021 (0.450)	0.378** (0.172)	0.409** (0.164)	0.397** (0.189)	0.400** (0.188)	0.387** (0.178)
Rating Average <sub>t</sub> :Any Measure <sub>j</sub>	-0.274 (0.254)	-0.244 (0.254)	0.151* (0.081)	0.176** (0.076)	0.225*** (0.077)	0.231*** (0.076)	0.217*** (0.079)
Rating Risky <sub>t</sub> :Any Measure <sub>j</sub>	-0.234 (0.176)	-0.210 (0.171)	0.190*** (0.054)	0.169*** (0.047)	0.192*** (0.034)	0.197*** (0.033)	0.184*** (0.035)
Forbearance Before <sub>j</sub>							0.019 (0.031)
Fixed Effects:							
Loan age		Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time			Yes	Yes	Yes	Yes	Yes
Bank x Time				Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type					Yes	Yes	Yes
Region						Yes	Yes
Observations	1,563,456	1,563,456	1,563,456	1,563,456	1,563,456	1,563,456	1,563,456

Note: Logit Hazard Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of default of any loan held by borrower  $j$  in any period in the future whereas the dependent variables are measured in  $t$ . We split the borrowers in Safe, Average, and Risky based on their ex-ante probability of default. Forbearance Before is a dummy which is one if a borrower has ever received forbearance before  $t$ . The loan exits the sample once a default occurs. Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

Table 7: Logit regression: Probability of default for any product by borrower - Influence of different measures taken by borrower

Measure <sub><i>l</i></sub> :	Dependent variable:					
	Probability of Default <sub><i>j</i></sub>					
	Any Measure <sub><i>j</i></sub>	Term Extension <sub><i>j</i></sub>	Interest Rate Change <sub><i>j</i></sub>	Limit Extension <sub><i>j</i></sub>	Rollover <sub><i>j</i></sub>	Amortisation Stop <sub><i>j</i></sub>
	(1)	(2)	(3)	(4)	(5)	(6)
Rating Average <sub><i>l</i></sub>	1.281*** (0.118)	1.298*** (0.068)	1.294*** (0.079)	1.312*** (0.063)	1.271*** (0.074)	1.235*** (0.080)
Rating Risky <sub><i>l</i></sub>	3.010*** (0.155)	3.195*** (0.072)	3.140*** (0.071)	3.161*** (0.062)	3.067*** (0.064)	2.921*** (0.090)
ln(Outstanding Balance <sub><i>l</i></sub> )	0.128*** (0.019)	0.099*** (0.020)	0.144*** (0.020)	0.126*** (0.017)	0.126*** (0.017)	0.131*** (0.020)
Rating Safe <sub><i>l</i></sub> :Measure <sub><i>l</i></sub>	0.400** (0.188)	0.462*** (0.157)	1.535*** (0.176)	0.400*** (0.102)	0.419*** (0.087)	0.402* (0.229)
Rating Average <sub><i>l</i></sub> :Measure <sub><i>l</i></sub>	0.231*** (0.076)	0.344*** (0.126)	1.085*** (0.116)	0.231*** (0.086)	0.237** (0.116)	0.517*** (0.109)
Rating Risky <sub><i>l</i></sub> :Measure <sub><i>l</i></sub>	0.197*** (0.033)	0.744*** (0.062)	0.266*** (0.073)	-0.015 (0.051)	-0.038 (0.034)	0.326*** (0.056)
Fixed Effects:						
Loan age	Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Time	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type	Yes	Yes	Yes	Yes	Yes	Yes
Region	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,563,456	956,718	1,326,984	1,304,332	1,304,332	1,561,260

Note: Logit Hazard Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of default of any loan held by borrower *j* in any period in the future whereas the dependent variables are measured in *t*. We split the borrowers in Safe, Average, and Risky based on their ex-ante probability of default. Measure on loan *l* is specified by the heading of each column. The loan exits the sample once a default occurs. Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

Table 8: OLS regression: Relationship between forbearance and new lending by buckets: County × Time × Bank × Segment

	Dependent variable:					
	Share(New Lending <sub><i>t</i></sub> )				ln(New Lending <sub><i>t</i></sub> )	
	(1)	(2)	(3)	(4)	(5)	(6)
Share(Forbearance) <sub><i>t-1</i></sub>	-0.034*** (0.007)	-0.053*** (0.007)	-0.066*** (0.007)	-0.076*** (0.008)		
Share(Forbearance) <sub><i>t</i></sub>					-0.045*** (0.011)	
ln(Forbearance) <sub><i>t</i></sub>						-0.160*** (0.042)
Fixed Effects:						
Bank		Yes	Yes			
County x Time			Yes	Yes	Yes	Yes
Bank x Time				Yes	Yes	Yes
Observations	754	754	754	754	873	872
R <sup>2</sup>	0.033	0.136	0.383	0.419	0.290	0.597
Adjusted R <sup>2</sup>	0.032	0.134	0.144	0.185	0.011	0.438

Note: OLS Regressions saturated with fixed effects. The dependent variable is the volume-weighted share of new lending ((1)-(5)) or the ln of new lending ((6)) per bucket of borrowers within a bank, segment, and county. The independent variable is the volume-weighted share of forborne loans in *t-1* or *t* (first two lines) or the ln of the sum of forborne loans in *t* (last line). Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

# Appendix

## Additional Graphs

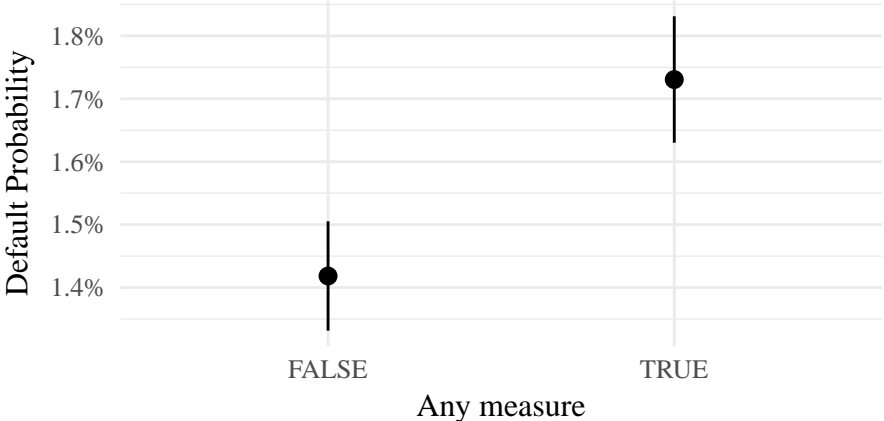


Figure 8: Predicted probability of default for a loan, depending on any measure being taken and any measure having been taken before. All other variables at mean or mode.  
*Source: Author's Calculations; Data: CBI*

## Additional Tables

Table 9: Robustness: Additional double interaction term Texas Ratio  $\times$  Outstanding Balance

	<i>Dependent variable:</i>						
	<i>Any Measure<sub>j</sub></i>						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Rating Average <sub><i>t</i></sub>	-0.149 (0.299)	-0.132 (0.298)	-0.199 (0.241)	0.031 (0.124)	-0.149 (0.115)	-0.158 (0.115)	-0.088 (0.173)
Rating Risky <sub><i>t</i></sub>	-0.845 (0.587)	-0.857 (0.590)	-0.888*** (0.339)	-0.409 (0.271)	-0.565** (0.263)	-0.579** (0.264)	-0.597** (0.275)
ln(Out. Bal. <sub><i>t</i></sub> )	0.271** (0.105)	0.264** (0.107)	0.261** (0.108)	0.244** (0.109)	0.180** (0.083)	0.178** (0.083)	0.185** (0.086)
ln(Out. Bal. <sub><i>t</i></sub> ):Texas Ratio <sub><i>k</i></sub>	-0.001 (0.001)	-0.001 (0.001)	-0.001 (0.001)	-0.0003 (0.001)	-0.0005 (0.001)	-0.0005 (0.001)	-0.001 (0.001)
Rating Average <sub><i>t</i></sub> :Texas Ratio <sub><i>k</i></sub>	0.003 (0.003)	0.003 (0.003)	0.003 (0.003)	0.001 (0.001)	0.003** (0.001)	0.003** (0.001)	0.002 (0.002)
Rating Risky <sub><i>t</i></sub> :Texas Ratio <sub><i>k</i></sub>	0.009 (0.006)	0.009 (0.006)	0.011*** (0.004)	0.006* (0.003)	0.008*** (0.003)	0.008*** (0.003)	0.008** (0.003)
Forbearance Before <sub><i>k</i></sub>							1.179*** (0.098)
Fixed Effects:							
Loan age		Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time			Yes	Yes	Yes	Yes	Yes
Bank x Time				Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type					Yes	Yes	Yes
County						Yes	Yes
Observations	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,324,317

*Note: Logit Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of receiving forbearance in  $t + 1$  whereas the dependent variables are measured in  $t$ . We split the borrowers in Safe, Average and Risky based on their ex-ante probability of default. Forbearance Before is a dummy which is one if a borrower has ever received forbearance before  $t + 1$ . Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$*



Table 10: Logit regression: Probability of application of any forbearance measure - NPL Ratio and Tier 1 Ratio

	<i>Dependent variable:</i>								
	Any measure <sub>j</sub>								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Rating Average <sub>l</sub>	-0.150 (0.218)	-0.134 (0.220)	-0.138 (0.177)	0.032 (0.076)	-0.051 (0.060)	-0.055 (0.059)	-0.036 (0.100)	0.136 (0.427)	-0.828* (0.435)
Rating Risky <sub>l</sub>	-0.829*** (0.309)	-0.844*** (0.311)	-0.568*** (0.198)	-0.400*** (0.124)	-0.400*** (0.109)	-0.412*** (0.108)	-0.344** (0.149)	0.219 (0.563)	-0.875* (0.466)
ln(Outstanding Balance <sub>l</sub> )	0.219*** (0.013)	0.214*** (0.013)	0.208*** (0.013)	0.213*** (0.013)	0.133*** (0.008)	0.132*** (0.008)	0.098*** (0.008)	0.096*** (0.009)	0.098*** (0.008)
NPL Ratio <sub>k</sub>	-0.024* (0.013)	-0.024* (0.013)	-0.018 (0.014)						
Rating Average <sub>l</sub> :NPL Ratio <sub>k</sub>	0.008 (0.007)	0.008 (0.007)	0.008 (0.006)	0.002 (0.003)	0.006** (0.003)	0.006** (0.002)	0.004 (0.003)		0.008*** (0.003)
Rating Risky <sub>l</sub> :NPL Ratio <sub>k</sub>	0.031*** (0.010)	0.032*** (0.010)	0.026*** (0.007)	0.020*** (0.005)	0.022*** (0.005)	0.023*** (0.005)	0.019*** (0.006)		0.024*** (0.006)
Forbearance Before <sub>j</sub>							1.175*** (0.099)	1.177*** (0.098)	1.175*** (0.098)
Rating Average <sub>l</sub> :Tier 1 Ratio <sub>k</sub>								-0.001 (0.026)	0.041* (0.024)
Rating Risky <sub>l</sub> :Tier 1 Ratio <sub>k</sub>								-0.003 (0.034)	0.023 (0.027)
Fixed Effects:									
Loan age		Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sector x Time			Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bank x Time				Yes	Yes	Yes	Yes	Yes	Yes
Bank x Segment x Prod. Type					Yes	Yes	Yes	Yes	Yes
County						Yes	Yes	Yes	Yes
Observations	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,393,284	1,324,317	1,324,317	1,324,317

Note: Logit Regression with standard errors clustered at Bank x Time level. The dependent variable is the probability of receiving forbearance in  $t + 1$  whereas the dependent variables are measured in  $t$ . We split the borrowers in Safe, Average and Risky based on their ex-ante probability of default. Forbearance Before is a dummy which is one if a borrower has ever received forbearance before  $t + 1$ . Significance levels: \* $p < 0.1$ ; \*\* $p < 0.05$ ; \*\*\* $p < 0.01$

## Description of variables

All of our forbearance measures are dummy variables that switch to 1 if the forbearance measure  $i$  has been applied in time  $t$ . In the following, we provide the exact definition for each measure.

### Rollover

A loan is considered rolled over if for a given borrower one of its significant loans disappears from the sample (expired or concordantly ended) but the borrower limit does not decrease by more than half of the expired loan's amount. This implies that limits on other products were increased or new products issued to increase the borrower limit. A loan is considered significant if it makes up for at least half of the total borrower limit.

### Change in interest rate

In essence, we use the definition of “zombie lending” by Caballero et al. (2008) which we extend to account for the environment of decreasing interest rates for the our sample period. Therefore, we first calculate the percentage change in the interest rate per loan across time,  $\Delta r_l$  followed by the average change in the interest rate for buckets,  $\Delta r_b$ , by: Sector, Segment, Product Type, and Rating. Next, we take the deviation of an individual loan from its bucket mean,  $\Delta r_{l,b} = \Delta r_l - \Delta r_b$ . Finally, we define an advantageous change in the interest if this decrease in deviation from the bucket mean is larger than that of the lowest decile of the two best rating categories,  $\Delta r_{l,b} < \Delta r_{l,b} || \text{lowest decile of best rating categories}$ .

### Amortisation stop

We extract this information on the basis of the banks' reports whether a loan is amortising or not. Therefore, this dummy variable is 1 if a loan switches from amortising to non amortising and 0 otherwise.

### **Limit extension**

This dummy variable is 1 if we observe an increase in the borrower's total limit (sum of all loans).

### **Term extension**

This variable is defined by whether we see a positive change of the maturity of a loan product.

### **Overall forbearance dummy**

The overall forbearance dummy switches to 1 if any loan of a borrower received any of the these forbearance measures in a given period.

## **Abbreviations**

EBA	European Banking Authority
F-IRB	Foundation-Internal Ratings Based
IFRS	International Financial Reporting Standards
IMF	International Monetary Fund
NPL	Non-performing Loans
OMT	Outright Monetary Transactions
REA	Risk Exposure Amount
SME	Small Medium Enterprise