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Title	Eurozone bank resolution and Bail-In-Intervention, triggers and writedowns
Authors(s)	Conlon, Thomas; Cotter, John
Publication date	2015-02-05
Series	UCD Geary Institute Discussion Paper Series; WP2015/01
Publisher	University College Dublin. Geary Institute
Link to online version	http://www.ucd.ie/geary/static/publications/workingpapers/gearywp201501.pdf
Item record/more information	http://hdl.handle.net/10197/6486

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**UCD GEARY INSTITUTE FOR PUBLIC POLICY
DISCUSSION PAPER SERIES**

**Eurozone bank resolution and Bail-In
- Intervention, triggers and writedowns**

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Geary WP2015/01
February 5, 2015

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Eurozone Bank Resolution and Bail-In - Intervention, Triggers and Writedowns

Prepared for the Conference:
European Banking Union: Prospects and Challenges
University of Buckingham, 21-22 November 2014

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Abstract

The European Union has recently introduced the Single Resolution Mechanism (SRM) to provide a consistent set of rules concerning Eurozone bank resolution. In this study, we retrospectively examine the implications of the SRM for Eurozone banks during the global financial crisis. Empirical results indicate that large, systemically important Eurozone banks would have exclusively required equity writedowns to cover impairment losses. However, to ensure adequate capitalization post bail-in, the majority of large, listed banks would have required conversion to equity for all subordinated and some senior debt creditors. Depositors would not have experienced writedowns in any of the banks examined. Given the subjective nature of resolution triggers outlined in the SRM, we also study the potential benefits of market and balance sheet dependent triggers. While our findings suggest some weak evidence of a capacity to differentiate between failed and surviving banks, the results are indicative of the difficulties in mandating predefined quantitative resolution triggers.

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The authors would like to acknowledge the financial support of Science Foundation Ireland under Grant Number 08/SRC/FM1389. We are grateful to David Mayes, our discussant Alessandro Roselli and participants at the European Banking Union: Prospects and Challenges conference (University of Buckingham, 21 – 22 November 2014) for helpful and informative comments.

1. Introduction

The global financial crisis and subsequent European sovereign debt crisis have yielded strong evidence for the dangerous links between bank failure and sovereign distress. Historically, a persistent increase in government debt has been shown to be a consequence of banking crises (Reinhart and Rogoff, 2013). In an attempt to sever the link between banks and the sovereign, the European Union has introduced a formal framework of procedures to deal with bank resolution. Under this framework, banks on the precipice of failure may be subject to resolution with investors suffering writedowns before public funds may be called upon. The aim of this study is to retrospectively examine the implications of the resolution framework for Eurozone banks and their creditors during the global financial crisis.

The Bank Resolution and Recovery directive (BRRD) has been introduced to provide a consistent set of rules surrounding bank failure in the 28 countries of the European Union. In this paper, we focus on the Single Resolution Mechanism (SRM), the means by which the BRRD will be implemented in Eurozone countries. In order to understand the scale of the problem for Eurozone banks during the crisis, we first detail the level of impairments realized due to losses over the period 2008 – 2012. Under the SRM guidelines, these losses would have been applied to investors, motivating our examination of the balance sheet liabilities of Eurozone banks with particular focus on the largest systemically important institutions. In this context, we then retrospectively apply the bail-in¹ rules mandated by the EU to Eurozone banks during the crisis and examine their impact on differing bank creditors.² Finally, given the somewhat subjective nature of the resolution triggers

¹Bail-in refers to recapitalization of banks through the mandatory write-down of liabilities or, alternatively, the conversion of liabilities to equity.

²For an outline of developments in European banking over recent decades, see Goddard *et al.* (2007).

mandated under the European resolution framework, we examine the benefits of a range of market and balance sheet based resolution triggers.

Our findings are generally supportive of the resolution framework. Total impairment charges for Eurozone banks over the period 2008 through 2012 are measured at €621 billion. In our retrospective analysis, we make the assumption that bail-in is applied to all banks and examine the impact this would have had on banks of different sizes and listed banks. Our findings suggest that equity holders would have been the most impacted by bail-in, especially for the largest 30 banks accounting for 81% of total Eurozone bank assets. However, additional conversion to equity for subordinated and senior debt investors would have been required to ensure banks were adequately capitalized post bail-in. Depositors would not have required bail-in for any of the institutions examined. We finish the study by examining a range of market and balance sheet based triggers for resolution, but find weak evidence in support of quantitative resolution triggers.

Many of the previous studies considering the European framework for bank resolution have primarily focussed on the legislative details or potential structure of the policy (Ignatowski and Korte, 2014; Dermine, 2013; Kudrna, 2012). Others have outlined the commonalities between the resolution methodologies adopted during this crisis and previous crises (Mayes, 2009a,b). Zhou *et al.* (2012) consider potential benefits and risks concerning implementation of a bail-in mechanism. Schoenmaker and Siegmann (2013) simulate the impact of national coordination of bank bail-outs on the efficiency of the resolution, finding maximum efficiency for a supranational approach. In the context of U.S. bank resolution legislation, Ignatowski and Korte (2014) develop a framework to test the impact of recent regulatory changes on banking risk. Our paper differs in many ways from the extant literature on banking resolution, applying the resolution framework retrospectively to Eurozone banks. While Conlon and Cotter (2014) also examine the

impact of the European resolution framework, the current study focusses only on Eurozone banks governed by the SRM. Moreover, additional novel contributions to the literature on bank resolution are provided here, such as the consideration of the bail-in mechanism for the largest systemically important banks, listed versus unlisted institutions and an examination of potential resolution triggers.³ The focus on large systemically important financial institutions is of particular value to regulators, as it informs regarding the potential outcome of SRM resolution during a period of severe market stress.

A large literature documents the propensity of fundamental and accounting based data to predict banking failure. Techniques employed by these early warning models vary considerably but tend to focus either on prediction of systemic crisis events in countries or failure of specific banks (Davis and Karim, 2008). Betz *et al.* (2014) use a combination of macro-economic and micro bank specific variables to predict distress in individual European banks, while Poghosyan and Čihák (2011) identify a set of indicators predicting European bank failure over the period 1990 to 2008. A variety of studies have attempted to improve the ability of early warning models to predict banking distress by incorporating market information (Gropp *et al.*, 2006; Sironi, 2003; Evanoff and Wall, 2001; Flannery, 1998). In particular, evidence that equity market information may be of value in predicting bank distress has been well documented (Curry *et al.*, 2008; Distinguin *et al.*, 2006; Krainer, 2004). In this paper, we contribute to the literature on bank resolution by examining, in a univariate framework, whether equity and fundamental information could act as a trigger for bank resolution. The addition of a quantitative trigger to the framework on bank resolution and recovery might help provide mar-

³Moreover, the BRRD and SRM frameworks have been finalized since the publication of Conlon and Cotter (2014), and findings here, especially those regarding the treatment of senior debt holders and depositors, reflect this.

ket participants with further clarity in light of the somewhat subjective nature of the proposed resolution triggers.

This paper is organized as follows. Section 2 outlines the forthcoming European framework for bank resolution. The data used in the empirical analysis is described in Section 3. Empirical results relating to writedowns, bail-in and resolution triggers are detailed in Section 4. Section 5 provides some concluding remarks.

2. European Bank Resolution

Throughout the global financial crisis, a multitude of Eurozone banks required public intervention in the form of bail-outs to avert potential failure and associated financial disruption. The approaches adopted in the implementation of bail-outs varied substantially across jurisdictions, perhaps contributing to contagion and financial turmoil. Common to many bail-outs was a considerable level of state support.⁴

To reduce the social and economic costs associated with bail-outs and to mitigate the dangers of financial contagion, the European Commission has introduced a common bank resolution policy. The process of resolution refers to the restructuring of a bank that is failing or likely to fail by a resolution authority. The EU Bank Recovery and Resolution Directive (BRRD) provides a set of comprehensive arrangements to deal with failing or failed banks at a national level, in addition to a set of supranational rules to resolve cross-border banking failures. The Single

⁴Some examples of banks requiring substantial public support during the crisis include Anglo Irish Bank, nationalized by the Irish Government on 15th January 2009, Fortis Bank, formally one of the largest financial institutions in the world, but partially nationalized by the Belgian, Dutch and Luxembourg Governments on September 28th 2008 and Hypo Real Estate, fully nationalized by the German state on 5th October 2009.

Resolution Mechanism complements the BRRD by setting out the architecture for applying the BRRD in Member States participating in the Banking Union. In contrast, the BRRD provides rules for the whole EU single market. Although this study only applies the SRM to Eurozone banks, both the SRM and BRRD are detailed here, as the SRM is contingent on a number of facets of the BRRD.

2.1. The EU Bank Recovery and Resolution Directive

The EU Bank Recovery and Resolution Directive comes into force on January 1st 2015, apart from rules on creditor write-downs which are due to take effect from January 1st 2016, (The European Parliament and the Council of the European Union, 2014). The key pillars of the BRRD are preparation and prevention, early intervention, resolution and cooperation, and coordination. The primary aims of resolution, as listed by the directive, are to:

- Safeguard the continuity of essential banking services,
- Protect depositors, client assets and public funds,
- Minimize risks to financial stability,
- Avoid the unnecessary destruction of value.

Some consequences of the BRRD are that banks and authorities will need to prepare recovery and resolution plans for a variety of scenarios, supervisors will be given the means to intervene in troubled banks at a sufficiently early stage and coordinated resolution tools will be available to national authorities.

The directive further lists the following range of circumstances which would lead to the triggering of a resolution for an individual institution:

- If it has reached a point of distress such that there are no realistic prospects of recovery over an appropriate timeframe,

- If all other private sector or supervisory intervention measures have proved insufficient to restore the bank to viability, and
- If winding up the institution under normal insolvency procedures would risk prolonged uncertainty or financial instability and, therefore, resolving the bank would be better from a public interest perspective.

In order to achieve the aforementioned objectives, the resolution authorities will have a range of tools available to them. These include facilitating private sector acquisitions, transferring institutions to a temporary bridge bank, separation into a ‘good’ and ‘bad’ bank, and, finally, bail-in of creditors.

This final bail-in option refers to the ability to recapitalize a bank through the write-down of liabilities and/or their conversion to equity, thus allowing the bank to continue as a going concern. By following the process of bail-in, the authority should be able to avoid, or at least minimize, the requirement for public funds in stabilizing a financial institution. The process of bail-in should result in equity investors being wiped out or diluted and management replaced. Moreover, should circumstances dictate, authorities will further have power to impose writedown or conversion to equity of liabilities held by higher ranked creditors.

Under the BRRD, bail-in will apply to any bank liability not backed by assets or collateral. Exclusions from bail-in include short-term inter-bank lending (under 7 days), client assets, salaries, taxes and pensions. Moreover, deposits protected by a deposit guarantee scheme will not be bailed-in but the guarantee scheme will be liable to assume corresponding losses. Authorities may choose to exceptionally exempt other liabilities from bail-in to prevent financial disruption or contagion. Bail-in is to be applied to liabilities in order of capital structure ranking, with equity absorbing losses in full before any debt liabilities may be written down. Once equity is completely written down, holders of subordinated debt and then senior debt-holders will be bailed in. Finally, deposits from natural persons and

SMEs (including those over €100,000) are to be preferred over senior creditors. To assure the credibility of the BRRD framework, the regulator will prescribe that banks hold a certain level of securities not excluded from bail-in.

The BRRD bail-in rules will apply to all outstanding and newly issued securities from January 1st 2016. Individual member states may also choose to apply the tool prior to 2016.

2.2. Single Resolution Mechanism

The BRRD provides guidelines to deal with distressed banks at a national level across all 28 European Union countries, in addition to provisions to resolve cross-country bank failures. The Single Resolution Mechanism (SRM) was introduced by the European Council in order to ensure that member states who share the same currency or are supervised by the same bank regulator, the European Central Bank, adhere to the same resolution policy (Howarth and Quaglia, 2014). Moreover, negative perceptions about individual member states' ability to withstand large banking failures could amplify potential financial contagion between banks and the sovereign. A Single Resolution Mechanism will help to sever the negative relationship between individual countries and banks, limiting taxpayer exposure.

The legal basis for the SRM regulation is Article 114 of the Treaty on the Functioning of the European Union (The European Parliament and the Council of the European Union, 2008). Under the terms of the SRM, decisions regarding resolution will be made by a Single Resolution Board (SRB), which will apply the single rulebook on bank resolution provided for in the BRRD.⁵ The SRM regulation fur-

⁵In other non-participating countries, the BRRD will be applied by national resolution authorities. For example, in the United Kingdom the Prudential Regulation Authority has proposed changes to their rules to implement the European Union Bank Recovery and Resolution Directive.

ther establishes a Single Resolution Fund (SRF), to be financed by contributions from the banking sector. Once established, the SRB will be responsible for resolution decisions surrounding about 6,000 banks in participating member states.

Decisions relating to the determination of whether an institution is failing or is likely to fail will be the responsibility of the regulator, the European Central Bank. The SRB further retains the discretion to adjudge an institution as failing or having the potential to fail and may request information from the ECB. The target size of the SRF will equal 1% of all covered deposits in banks in participating member states, or about €55 billion based on 2011 balance sheets. The objective of the SRM is to achieve resolution without recourse to taxpayers in individual member states. While the SRB is responsible for decisions relating to which banks are to be resolved, the national resolution authorities retain responsibility for implementation of resolution actions.

Under the SRM, entities shall be deemed to be failing or likely to fail if any of the following conditions hold (The European Commission, 2014):

- The entity infringes or there are objective elements to support a determination that the institution will, in the near future, infringe the requirements for continuing authorisation in a way that would justify the withdrawal of authorisation by the ECB, including but not limited to the fact that the institution has incurred or is likely to incur losses that will deplete all or a significant amount of its own funds;
- The assets of the entity are, or there are objective elements to support a determination that the assets of the entity will, in the near future, be less than its liabilities;
- The entity is, or there are objective elements to support a determination that the entity will, in the near future, be unable to pay its debts or other

liabilities as they fall due;

- extraordinary public financial support is required except where, in order to remedy a serious disturbance in the economy of a Member State and preserve financial stability, that extraordinary public financial support takes any of the following forms:
 - i. A State guarantee to back liquidity facilities provided by central banks in accordance with the central banks' conditions;
 - ii. A State guarantee of newly issued liabilities;
 - iii. An injection of own funds or purchase of capital instruments at prices and on terms that do not confer an advantage upon the entity.

While the SRM provides for bail-in of institutions, national regulatory authorities shall decide on and implement any bail-in, if the SRB mandates resolution. The order of priority of claims to be written down is to be in accordance with the BRRD. As with the BRRD, the relevant deposit guarantee scheme will be responsible for losses that would have been imposed on guaranteed depositors.

Next, we turn our attention to the data used in the analysis and the empirical results relating to impairments, bail-in and triggers.

3. Data

Fundamental accounting data relating to European Banks is sourced from Bankscope for the period 2006 through 2012. The dataset covers the largest 12 Eurozone countries for which banks fall under the supervision of the European Central Bank (ECB) under the single supervisory mechanism. The specific countries included are Austria, Belgium, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal and Spain. Bankscope provides data on both listed and unlisted banks, resulting in a total of 701 banks.

In selecting the data, banks at the highest level of the business were selected, often resulting in the holding company level. This ensures no double counting, removing multiple aggregation across both holding and subsidiary institutions. An additional selection criterion, to ensure banks are deposit-taking, excludes banks with a deposit to total asset ratio less than 20% (Beltratti and Stulz, 2012).

Market related data for each listed bank is obtained from Datastream, a division of Thompson-Reuters. Using the monthly market prices of each listed bank, returns, total volatility, idiosyncratic volatility and systematic risk are calculated for 2006, 2007 and 2008.

Surviving banks, nationalized banks and banks requiring government capital are identified by drawing on a number of official and published sources, (Molyneux *et al.*, 2014; Laeven and Valencia, 2010; Petrovic and Tutsch, 2009; Goddard *et al.*, 2009).

4. Empirical Results

4.1. Writedowns

The global financial crisis was the largest single catastrophe to hit banks worldwide since at least the 1930s. In Europe, the crisis resulted in public bail-outs of banks in a majority of jurisdictions. These bail-outs took various forms, including capital injections and nationalization.⁶ To get some perspective on the potential size of losses experienced by Eurozone banks (those that will come under the supervision of the ECB under the Single Supervisory Mechanism), we examine total impairment charges experienced by banks in the period 2008 through 2012. To calculate impairments, we aggregate loan-writedowns and non-recurring expenses

⁶Moreover, other forms of bail-outs including guaranteed debt issuance took place in numerous states. This ubiquitous form of bail-out is not considered in this study.

for each Eurozone bank. Total impairment charges for Eurozone banks over the period 2008 through 2012 are measured at €621 billion.

Figure 1 details the total impairment changes for each European country over the period 2008 – 2012. While Spain was not at the epicentre of public bail-outs during the primary crisis years of 2007 to 2009, the total impairment charges experienced by Spanish banks were nominally the largest in the Eurozone. Moreover, these losses were distributed relatively uniformly by year. Italian banks had total impairments of €108 billion. Irish banks had the next largest writedowns over the sample, with the majority of impairments accounted for in the years 2009 and 2010.⁷ German, French and Dutch banks further experienced large impairments, while aggregate impairments in the remaining countries were limited to €35 billion.

[Figure 1 about here.]

Total European impairment changes are further broken out by year and bank status in Figure 2. Banks requiring public injections of capital accounted for the majority of impairments during the years 2008 – 2012. However, losses experienced by surviving banks are also found to be a large proportion of total losses. Finally, while the number of nationalized banks was small, impairments experienced by these institutions were non-negligible. In summary, we have shown that losses experienced by European banks over the global crisis were large and distributed across the majority of countries. We later use these impairments as a benchmark when testing the retrospective performance of the SRM bail-in framework.

[Figure 2 about here.]

⁷The timing here corresponds largely to the transfer of impaired assets from banks to the Irish ‘bad bank’, the National Asset Management Agency (NAMA).

4.2. Eurozone Bank Balance Sheet

Table 1 details a cumulative proportional bank balance sheet calculated for banks from all 12 Eurozone countries examined for the years 2006 through 2008. For each year, the cumulative balance sheet is presented for banks requiring government recapitalization, nationalized banks, banks surviving without recapitalization, the largest 20 banks by total assets and all banks. Considering first the pre-crisis period of 2006, we see that nationalized banks had smaller proportions of equity (3.1%) than all other classifications. Moreover, the top 20 banks had lower equity than average, likely related to their ‘too big to fail’ status. Surviving banks tended to use a larger proportion of customer deposits in their funding and a smaller amount of less sticky bank deposits. Contrasting the levels of long term debt, nationalized banks are the largest outlier using senior debt to fund 33.8% of their balance sheet, more than double that of all other classifications.

[Table 1 about here.]

Similar analysis is performed for 2007 and 2008, but it is worth noting that balance sheets may, by this time, have become impacted by difficult funding conditions. With the exception of nationalized banks from 2006 to 2007, the proportion of equity held by banks dropped year-on-year. Considering customer deposits, little change is observed for most bank classifications from 2006 to 2008, with the exception of nationalized banks where customer deposits dropped from 25.3% to 19.4%. This drop in deposits for nationalized banks is largely accounted for by drops in current deposits, with some of these funds replaced by a corresponding increase in term deposits. Moreover, nationalized banks increased their proportion of deposits from banks from 19.5% to 25.5%, likely a consequence of government underwriting. The proportion of long-term debt used by banks is found to have decreased over time for all banks. Finally, the proportion of liabilities accounted

for by derivatives, non-interest liabilities and repos amongst others are noted to have increased substantially over time. This is predominantly driven by an increase in the proportion of derivatives, which increased from 6.3% of balance sheet liabilities for all banks in 2006 to 15% in 2008.

Large European banks account for a substantial proportion of total bank assets. For example, the largest 20 banks accounted for 71.1% of all bank assets in Europe during 2006 (see Table 2). Given their systematic importance, we examine the funding position of the largest 20 banks in isolation. Across all years, the equity held by the top 20 banks is lower than the average level. The proportion of customer deposits, bank deposits and long term debt held by these institutions is also smaller than average. This suggests that, under a potential bail-in, these banks would have less available resources for the purposes of bail-in than the average European bank, a result that is borne out in our later analysis. Finally, the proportion of derivatives on the balance-sheet of the top 20 banks is larger than the average. Given the less than clear position regarding derivatives in the BRRD, large banks holding derivatives accounting for an extensive proportion of total liabilities may be of concern to regulators. Moreover, the smaller quantities of liabilities available for bail-in in these large banks may impact the credibility of the resolution framework. Given the funding background detailed, we next consider the application of bail-in to European banks according to asset size.

4.3. Bail-In - A Retrospective Analysis

We now retrospectively investigate the application of the bail-in tool provided for in the BRRD and SRM. To arrive at a required level of bail-in for each bank, the impairment charges accounted for over the period 2008 – 2012 are taken as the

baseline losses experienced.⁸ In each case, we determine the proportion of each balance sheet liability required to be written down in order to cover actual losses experienced. Moreover, the aggregate level of writedown and equity conversion required to achieve the 3% leverage ratio mandated under the Basel III accord is calculated.⁹

The analysis is presented for writedowns and equity conversions relating to bank balance sheets from 2006, although little qualitative variation in results is found for 2007 or 2008. The order in which bail-in is applied is structured in the same manner as that mandated by the BRRD. Importantly, this requires senior debt to be written down prior to any losses being imposed on depositors, which would not have been possible in all countries during the crisis.¹⁰ One restriction on our analysis is the paucity of information relating to the proportion of balance sheet liabilities backed by assets or collateral.¹¹

The first analysis, Table 2, considers the proportion of balance sheet liabilities required for bail-in according to bank size. Previously, governments found themselves taking responsibility for liabilities of very large banks that were a significant proportion of GDP. As this ultimately impacted the sovereign, it is vital to under-

⁸It is important to note that definitions of loan impairment are heterogeneous throughout the EU and there has been a move to a more harmonised definition, which may result in an increase in impaired assets. However, Conlon and Cotter (2014) perform stress tests which demonstrate that depositors would not have been impacted by writedowns, even for much larger levels of impairments. We are grateful to our discussant, Alessandro Roselli, for pointing out this issue.

⁹Note: Without further information regarding which assets were written down, accurate estimation of other risk weighted capital requirements such as tier 1 capital to risk weighted assets is problematic.

¹⁰It is worth noting that this nuance would not have impacted our results, as depositors would not have required bail-in based on the realized impairment charges from 2008 – 2012.

¹¹The results detailed suggest that senior creditors would have been little impacted, negating somewhat the importance of information regarding collateral or asset backed liabilities.

stand the impact of bail-in on banks that are systemically important. Considering the largest 10 banks, we note that these account for 51% of total Eurozone bank assets in 2006. Under the bail-in rules, the total impairments experienced by these banks would have required writedowns of 80.4% of book equity, with no impact on subordinated or senior debt. The next 10 largest banks account for 20% of all Eurozone bank assets and would have required a writedown of equity amounting to 52.2%. Similar results are found for the next 10 banks, accounting for 10% of total assets. These findings for large banks are reassuring, suggesting that writedowns associated with bail-in for the largest European banks would not have any impact on depositors or long term debt holders.

[Table 2 about here.]

Considering the size cohorts, only banks ranked from 30 to 50 would have required writedowns of subordinated or senior debt on aggregate. Losses in these two cohorts are dominated by Irish bank Anglo Irish Bank and Greek banks Eurobank Ergasias SA and Alpha Bank AE. Considering smaller banks, those outside the top 50 only account for 10.7% of all assets. In all cases, writedowns would have been confined to equity holders. For the very smallest banks examined, impairments were limited, even relative to book equity.

Table 2 also details the levels of writedowns and equity conversion required to achieve a leverage ratio of 3% post bail-in.¹² For the largest ten Eurozone banks, equity would have been written down to the tune of 80.43%, with full conversion of subordinated debt into equity required, in addition to a conversion of 3.76% of senior debt. Across the 50 largest Eurozone banks, at least some proportion of

¹²It is possible that resolution authorities would have mandated a higher leverage ratio than 3% for bailed-in banks in order to reassure markets, but no details regarding this are suggested in the BRRD or SRM.

subordinated debt would have been converted into equity. The largest proportion of senior debt that would have required conversion is 15.26%, well below the level of depositors. For the smallest banks, no equity conversion would have been required, as these maintained high levels of equity capital prior to the crisis.

In Europe, large numbers of small, unlisted banks exist but which account for a minority of total bank assets. In Table 3, we apply the bail-in rules to listed and unlisted European banks in turn. While only 62 of the 701 Eurozone banks considered are listed, they account for 64.5% of all assets. Moreover, the total proportion of writedowns required to cover losses was 4.32% of total liabilities and equity, compared to 1.65% for unlisted banks.

[Table 3 about here.]

We further split the results into banks which survived, were nationalized and those that required government capital. Considering listed banks, equity would have been completely written down for surviving and nationalized banks. Moreover, 7.64% of subordinated debt would have been written down for surviving and 100% for nationalized banks. Finally, listed nationalized banks would also have required a modest writedown of senior debt. For unlisted banks, the situation is less severe, as only the three nationalized unlisted banks would have required writedowns of subordinated debt or equity.

To achieve a 3% leverage ratio, listed banks would have required all subordinated debt to be converted to equity across all classifications. Moreover, a small proportion of senior debt would have been converted to equity for surviving and capital banks. For nationalized banks, 22.72% of senior debt would have been converted. While this is a comparatively large proportion, it suggests that bail-in would have protected depositors even for banks with the largest losses. In the case of unlisted banks, the slight impact of equity conversion would have been limited to the small number of recapitalized and nationalized banks.

In summary, our results show that bail-in writedowns would largely have been imposed on equity investors. In particular, the largest systemically important banks would have required equity writedowns exclusively in order to cover impairments. Some debt to equity conversion would have additionally been required to ensure solvency post bail-in. However, writedowns experienced by listed banks are found to be large relative to equity held, in some cases resulting in writedowns of senior and subordinated debt. These results are primarily driven by a small number of banks which experienced very heavy losses, both relative to their size and to the GDP of their domiciled state. These include Fortis Bank, Anglo Irish Bank, Permanent TSB, Hypo Real Estate, EBS Building Society and Irish Nationwide Building Society. Common to all analysis detailed is an absence of writedowns imposed on depositors even after equity conversion requirements, fulfilling one of the main objectives of the BRRD.

4.4. Bail-In Triggers

Under the framework provided for by the BRRD and SRRM, the triggers for bank resolution are somewhat subjective. Troubled banks are deemed to be failing or likely to fail if they are expected to infringe the requirements for authorisation, if the assets are likely to be less than liabilities, if they are likely not to be able to meet debt repayments or if public intervention is required. However, the lack of a single definitive trigger or set of triggers could result in uncertainty, potentially leading to a spiral of doubt surrounding an institution or unnecessary resolution.

In the retrospective study of bail-in detailed, we have considered the actual bail-out of banks as the trigger. We next investigate a range of potential quantitative market and balance sheet triggers, to determine characteristic differences between failed and surviving banks.¹³ Market-based triggers are forward looking, capturing

¹³Banks requiring nationalization and public capital injections are both considered as failed in

the markets perception of a banks position. Balance sheet triggers are backward looking, revealing the reported financial position of the bank. Each of these has been extensively linked in the literature to the prediction of future banking distress and failure (Betz *et al.*, 2014; Mannasoo and Mayes, 2009; Distinguin *et al.*, 2006).

Market-based triggers are considered in Table 4 for listed European Banks. Four different equity-related triggers are contrasted for bailed-out and surviving banks, namely equity returns, total volatility, systematic risk and idiosyncratic risk.¹⁴ Equity returns, which are not risk adjusted, reveal little significant differences between failed and surviving banks until 2008, by which time the crisis had already manifested. Bailed-out banks had higher equity volatility or total risk during 2006, but consistent evidence is not found during 2007. Systematic risk for bailed-out banks is greater during 2007, but not significantly different during 2006. Finally, considering idiosyncratic risk, bailed-out banks were significantly riskier during 2006 but not during 2007. While some specific evidence concerning the ability of market based triggers to differentiate between failed and surviving banks is provided, the inconsistency of results over time suggest they may be unsuitable as definitive triggers of resolution.

[Table 4 about here.]

We next examine the ability of balance-sheet based triggers to differentiate between failed and surviving banks before and during the global financial crisis. Table 5 details changes in a range of balance sheet fundamentals. For instance, the total book equity of bailed-out banks increased by 20.3% between 2005 and 2006, while

the analysis to follow.

¹⁴Equity returns are calculated as the average monthly return and total volatility as the standard deviation of monthly returns. Systematic risk is measured using a market model, $r_i = \alpha_i + \beta r_m + \varepsilon_i$, where β gives the systematic or market risk and the average value of the squared residual, ε_i^2 , measures idiosyncratic or firm specific risk.

that of surviving banks increased by 9.1%. During 2006, only subordinated debt, total equity and total liabilities and equity were found to be significantly different between surviving and failed banks. A number of significant differences between surviving and failed banks are found during 2007, including total liabilities, total deposits, senior debt, subordinated debt and customer deposits, with no significant differences in total equity. Increases in total equity during 2006 are likely the result of retained earnings, a consequence of profitability and would be unlikely to act as a sensible trigger. Restricted access to subordinated debt markets may be an indicator of financial troubles. However, our findings suggest that failed banks actually increased their proportions of subordinated debt, while surviving banks decreased their dependence, counter to our intuition. Similar findings are shown for customer deposits and bank deposits, with failed banks increasing their dependence on each of these by more than their surviving counterparts. Thus, failed banks did not experience difficulties in raising funds from depositors. Considering the other metrics detailed, little evidence of significant differences between failed and surviving banks emerge.

[Table 5 about here.]

A paucity of viable information regarding liquidity and asset quality for banks during the global financial crisis led to investors withdrawing funding when banks were most in need. With the introduction of creditor bail-in, investors may be forced to withdraw funding from institutions perceived to be in difficulty. The current resolution triggers provide little guidance regarding the metrics that regulators will apply in order to trigger bail-in. To provide investor clarity and prevent safe institutions from suffering liquidity crises, a defined quantitative trigger would help prevent a withdrawal of funding from banks not suffering distress. However, our univariate findings demonstrate the difficulties involved in identifying appro-

priate triggers.¹⁵ While weak evidence exists for the ability of equity market based triggers to differentiate between failed and surviving banks, the evidence for balance sheet triggers is unintuitive in the sample of European banks examined. These findings do not altogether preclude the application of early warning type models in triggering resolution, as regulators would likely have access to better, more detailed and up-to-date information than may be garnered from historic balance sheets.

It is important to note that our findings, while providing little evidence as to the benefits of quantitative triggers do not rule out the use of contingent liabilities. For example a number of banks have begun to introduce contingent convertibles (CoCos), securities which are convertible into equity if a pre-specified trigger occurs. For some securities issued, the triggers have been backward looking accounting and fundamental measures such as capital ratios (Glasserman and Nouri, 2012). Forward looking market-based triggers may be more appropriate, easing the dangers of market manipulation or conversion errors (Sundaresan and Wang, 2013). Moreover, by incorporating securities providing for bail-in directly in the capital structure of banks market participants have clear guidance before providing capital to institutions.

5. Concluding Remarks

This paper contributes to the literature by retrospectively considering the application of the recent European rules on banking resolution. Specifically, we focus on how resolution under the Single Resolution Mechanism would have impacted Eurozone banks during the global financial crisis. Our results indicate that Eurozone banks experienced total impairment charges of €621 billion over the period

¹⁵Moreover, given the weak results using univariate models, it is less than likely that multivariate models would glean any additional information.

2008 through 2012. Had the bail-in mechanism been in place during this period, these losses would have been primarily imposed on equity investors. For the largest, systemically important financial institutions, bail-in writedowns would have exclusively applied to equity investors. However, to ensure adequate capitalization post bail-in, the majority of large, listed banks would have required conversion to equity for all subordinated and some senior debt creditors. Depositors would not have required bail-in in any of the analyses detailed, fulfilling one of the major objectives of the BRRD.

We augment the retrospective analysis of bail-in for European banks with further analysis of resolution triggers. While a variety of studies have detailed the importance of market-related information in predicting bank failure, this is the first study to examine their importance in the context of triggering bank resolution via bail-in. While our findings suggest some differentiation between the triggers considered for failed and surviving banks, the evidence is somewhat weak. This demonstrates the difficulty in mandating specific quantitative triggers of bank resolution, and is supportive of the more subjective approaches outlined in the BRRD and SRM.

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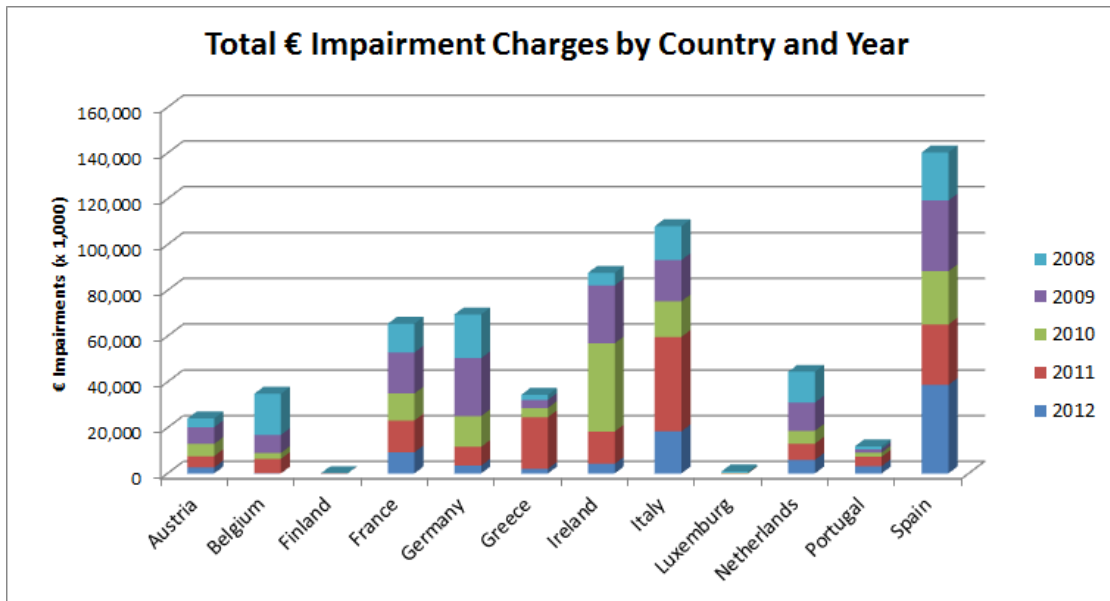


Figure 1: **European Bank Impairment Charges by Country and Year (2008-2012)** . Total European bank impairment charges are calculated from 2008-2012 and broken out by country and year. Total realized impairments are calculated as the sum of loan-writedowns and non-recurring expenses. All data is sourced from Bankscope and stated in thousands of Euro.

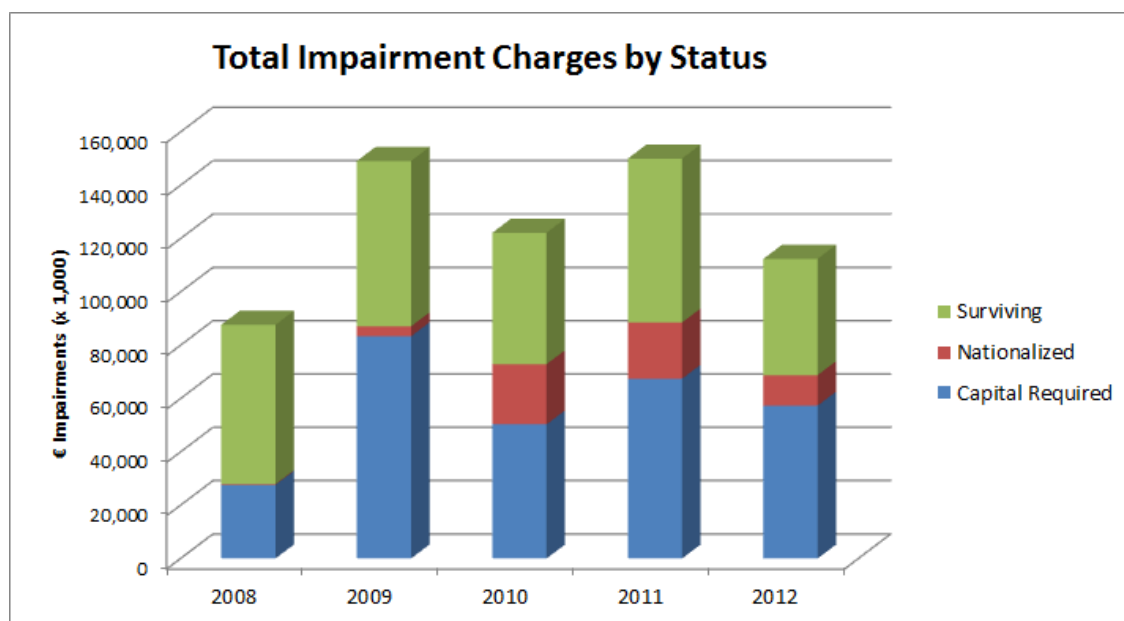


Figure 2: **European Bank Impairment Charges by Bank Status (2008-2012)** . Total European bank impairment charges are calculated from 2008-2012 and categorized as surviving, government capital required and nationalized. Total realized impairments are calculated as the sum of loan-writedowns and non-recurring expenses. All data is sourced from Bankscope and stated in thousands of Euro.

Liability Type	2008				2007				2006						
	Capital	Nat.	Surv.	All	Top 20 Banks	Capital	Nat.	Surv.	All	Top 20 Banks	Capital	Nat.	Surv.	All	Top 20 Banks
Total Customer Deposits															
<i>Deposits - Current</i>	29.1%	19.4%	35.8%	32.0%	27.7%	29.6%	20.1%	36.1%	32.3%	28.8%	29.9%	25.3%	37.1%	33.2%	30.2%
<i>Deposits - Savings</i>	14.6%	5.9%	16.0%	14.9%	12.6%	14.7%	6.5%	18.0%	15.9%	13.4%	16.3%	18.1%	17.1%	16.7%	15.2%
<i>Deposits - Term</i>	5.9%	0.9%	6.9%	6.2%	5.8%	6.4%	0.9%	6.8%	6.4%	5.8%	7.0%	1.7%	9.4%	8.0%	8.1%
	8.6%	12.7%	12.9%	10.9%	9.3%	8.5%	12.7%	11.3%	10.0%	9.5%	7.7%	6.2%	10.7%	9.1%	7.8%
Deposits from Banks															
Total Long Term Debt	16.7%	25.5%	10.1%	13.8%	12.8%	18.5%	22.4%	12.2%	15.7%	14.8%	18.8%	19.5%	13.1%	16.0%	15.2%
<i>Senior Debt</i>	13.9%	33.4%	18.3%	16.8%	15.6%	16.5%	32.9%	19.5%	18.7%	17.5%	18.0%	35.4%	21.1%	20.1%	18.8%
<i>Subordinated Debt</i>	11.2%	31.2%	14.0%	13.3%	12.6%	13.8%	30.9%	16.3%	15.8%	14.9%	15.6%	33.8%	16.5%	16.6%	15.1%
<i>Other Funding</i>	1.5%	1.5%	1.3%	1.4%	1.4%	1.5%	1.8%	1.5%	1.5%	1.4%	1.4%	1.6%	1.5%	1.4%	1.4%
	1.2%	0.8%	3.0%	2.1%	1.6%	1.2%	0.1%	1.7%	1.4%	1.2%	2.4%	0.0%	4.6%	3.4%	3.9%
Other Liabilities															
(Derivatives, Non-Interest, Repos Etc.)															
<i>Derivatives</i>	37.3%	20.3%	31.2%	33.7%	41.0%	31.4%	20.4%	27.0%	28.8%	35.2%	29.3%	16.7%	24.1%	26.4%	32.4%
	15.1%	6.4%	15.7%	15.0%	19.9%	7.6%	3.3%	8.1%	7.7%	10.2%	6.2%	2.4%	6.6%	6.3%	8.5%
Total Liabilities	97.0%	98.6%	95.4%	96.3%	97.0%	96.0%	95.7%	94.8%	95.4%	96.3%	95.7%	96.9%	94.8%	95.3%	96.1%
Total Equity	3.0%	1.4%	4.6%	3.7%	3.0%	4.0%	4.3%	5.2%	4.6%	3.7%	4.3%	3.1%	5.2%	4.7%	3.9%

Table 1: **Cumulative Liabilities from European Bank Balance Sheets 2006-2008**

A cumulative European bank balance sheet is determined by summing over all liabilities. Proportions are then found as a percentage of total balance sheet liabilities for each of 2006 through 2008. Banks are categorized as ‘Capital’ - bank required government re-capitalization, ‘Nat.’ - bank was nationalized by government, ‘Surv.’ - Survived without assistance from government, ‘All’ - All banks, ‘Top 20 Banks’, cumulative balance sheet for twenty large banks. Other liabilities include derivatives, non-interest, repos, trading liabilities. Banks are included from twelve Eurozone countries listed in the data section.

Ranking	Prop. Total Banking Assets	Total Liab. & Equity	Writedown Only			Writedown + Equity Conver.		
			Total Equity	Subord. Debt	Senior Debt	Total Equity	Subord. Debt	Senior Debt
1-10	51.13%	3.03%	80.43%	0.00%	0.00%	80.43%	100.00%	3.76%
11-20	19.99%	2.16%	52.24%	0.00%	0.00%	52.24%	51.91%	0.00%
21-30	10.07%	4.55%	69.37%	0.00%	0.00%	69.37%	30.56%	0.00%
31-40	5.02%	9.22%	100%	100.00%	6.66%	100%	100.00%	15.26%
41-50	3.06%	6.15%	100%	57.53%	0.00%	100%	100.00%	4.94%
51-70	3.00%	4.98%	68.62%	0.00%	0.00%	68.62%	0.00%	0.00%
71-100	2.14%	1.97%	17.93%	0.00%	0.00%	17.93%	0.00%	0.00%
101-150	1.89%	1.51%	17.36%	0.00%	0.00%	17.36%	0.00%	0.00%
151-200	1.16%	1.78%	27.47%	0.00%	0.00%	27.47%	0.00%	0.00%
201+	2.53%	0.64%	9.56%	0.00%	0.00%	9.56%	0.00%	0.00%

Table 2: Retrospective bail-in writedowns and equity conversion by bank Size for Eurozone banks.
This table retrospectively measures the proportion of writedown losses and equity conversion that would have been imposed on liability holders of banks in the event of bail-in. Bail-in proportions are calculated for banks ranked and aggregated according to asset size. Bank balance sheets from 2006 are used as the basis for the bail-in analysis. Bail-in costs are calculated using total realized impairment charges, calculated as the sum of loan writedowns and non-recurring expenses between 2008 and 2012. Equity conversion assumes a required 3% leverage ratio post resolution. For each liability type, the proportion of each balance sheet liability required to be written down to cover these losses is then calculated. The data is comprised of Eurozone banks from twelve countries which are covered by the EU bank resolution framework.

Status	No. Banks	Prop. Total Bank Assets	Total Liab. & Equity	Writedown Only			Writedown + Equity Conver.		
				Total Equity	Subord. Debt	Senior Debt	Total Equity	Subord. Debt	Senior Debt
<i>Listed Banks</i>									
All	62	0.645	4.32%	97.95%	0.00%	0.00%	97.95%	100%	5.95%
Surviving	25	0.376	4.79%	100%	7.64%	0.00%	100.00%	100%	4.78%
Capital	32	0.577	3.60%	82.20%	0.00%	0.00%	82.20%	100%	3.89%
Nationalized	5	0.047	9.66%	100%	100%	15.71%	100.00%	100%	22.72%
<i>Unlisted Banks</i>									
All	639	0.355	1.65%	31.16%	0.00%	0.00%	31.16%	0.00%	0.00%
Surviving	611	0.621	1.51%	25.32%	0.00%	0.00%	25.32%	0.00%	0.00%
Capital	25	0.368	1.61%	38.75%	0.00%	0.00%	38.75%	12.42%	0.00%
Nationalized	3	0.011	11.03%	100%	100%	11.73%	100%	100%	17.12%

Table 3: **Retrospective bail-in writedowns and equity conversion for listed and unlisted Eurozone banks.** This table retrospectively measures the proportion of losses that would have been experienced by liability holders of banks in the event of bail-in both for listed and unlisted banks. Bank balance sheets from 2006 are used as the basis for the bail-in analysis. Bail-in costs are calculated using total realized impairment charges, calculated as the sum of loan writedowns and non-recurring expenses between 2008 and 2012. Equity conversion assumes a required 3% leverage ratio post resolution. For each liability type, the proportion of each balance sheet liability required to be written down to cover these losses is then calculated. The data is comprised of Eurozone banks from twelve countries which are covered by the EU bank resolution framework.

Year	Bailed-Out	Surviving	Difference	t-value	p-value	Number Bailed-out	Number Surviving
Equity Return							
2006	0.312	0.325	-0.013	-0.24	0.815	22	20
2007	-0.041	0.019	-0.061	-1.32	0.196	24	21
2008	-0.682	-0.378	-0.304	-4.71	0.000	24	21
Equity Volatility							
2006	0.193	0.155	0.038	2.04	0.048	22	21
2007	0.184	0.181	0.003	0.13	0.900	24	21
2008	0.596	0.390	0.206	2.55	0.016	24	21
Equity Systematic Risk							
2006	0.873	1.121	-0.248	-1.25	0.219	22	21
2007	0.896	0.530	0.366	2.40	0.021	24	21
2008	1.308	0.910	0.398	2.15	0.038	24	21
Idiosyncratic Risk							
2006	0.170	0.118	0.052	3.09	0.004	22	20
2007	0.134	0.164	-0.029	-1.31	0.200	22	21
2008	0.400	0.250	0.150	2.07	0.048	24	21

Table 4: **Bail-in Analysis - Market Triggers**

Notes: The potential of market-based triggers to indicate potential bail-in requirement is examined retrospectively in the case of European Banks. Equity returns are calculated as the average monthly return and total volatility as the standard deviation of monthly returns. Systematic risk is measured using a market model, $r_i = \alpha_i + \beta r_m + \varepsilon_i$, where β gives the systematic or market risk and the average value of the squared residual, ε_i^2 , measures idiosyncratic or firm specific risk. A difference-in-means test is performed for failed and surviving banks before and including the global financial crisis period. The Satterthwaite approximation for the standard errors is applied, which does not assume equal variances of the two samples.

Year	Bailed-Out	Surviving	Difference	t-value	p-value	Number Bailed-out	Number Surviving
Total Liabilities							
2006	0.363	0.050	0.313	1.270	0.210	63	631
2007	0.134	0.061	0.073	2.700	0.009	64	636
2008	0.055	0.067	-0.012	-0.860	0.395	65	636
Total Deposits, Money Market and Short Term Funding							
2006	0.480	0.036	0.445	1.160	0.253	63	631
2007	0.204	0.062	0.142	2.640	0.010	64	636
2008	0.077	0.077	0.000	0.000	0.996	65	635
Senior Debt							
2006	1.115	2.863	-1.748	-0.840	0.403	55	94
2007	0.538	0.021	0.518	1.770	0.081	60	100
2008	-0.002	0.024	-0.026	-0.260	0.797	58	92
Subordinated Debt							
2006	0.156	-0.063	0.219	2.970	0.004	56	385
2007	0.180	-0.108	0.287	4.560	0.000	58	371
2008	5.063	-0.021	0.084	0.800	0.427	60	340
Total Long Term Funding							
2006	1.201	0.571	0.630	1.020	0.311	62	552
2007	0.436	0.284	0.152	0.500	0.619	64	558
2008	0.122	-0.016	0.138	0.960	0.341	65	551
Customer Deposits							
2006	0.542	0.050	0.492	1.180	0.242	62	626
2007	0.148	0.064	0.084	3.550	0.000	64	634
2008	0.040	0.074	-0.034	-1.660	0.099	65	635
Bank Deposits							
2006	0.327	0.104	0.223	0.950	0.347	61	623
2007	0.349	0.191	0.158	0.990	0.324	63	630
2008	0.266	0.199	0.068	0.060	0.553	64	629
Total Equity							
2006	0.203	0.091	0.112	1.150	0.041	63	631
2007	0.116	0.068	0.049	0.850	0.398	64	636
2008	-0.225	0.032	-0.257	-7.770	0.000	65	636
Total Liabilities and Equity							
2006	0.201	0.053	0.148	1.890	0.063	63	631
2007	0.124	0.061	0.063	2.350	0.022	64	636
2008	0.031	0.063	-0.032	-2.410	0.018	65	636

Table 5: **Bail-in Analysis - Balance Sheet Triggers**

Notes: The potential of balance sheet based triggers to indicate potential bail-in requirement is examined retrospectively in the case of European Banks. A difference-in-means test is performed for failed and surviving banks before and including the global financial crisis period. The Satterthwaite approximation for the standard errors is applied, which does not assume equal variances of the two samples.