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Are banks' below-par own debt repurchases a cause for prudential concern?

ABSTRACT Leading up to the implementation of Basel III, European banks repurchased below-par debt securities. Banks are subjected to a prudential filter that excludes unrealized gains on liabilities from changes in own credit standing from the calculation of capital ratios. By repurchasing securities, unrealized gains become realized and increase Core Tier 1 capital. We show that poorly capitalized banks repurchased securities and lost about €9.1bn in premiums to compensate debt holders. Banks also repurchased the most loss-absorbing securities, for which they paid the highest premiums. These premiums increase with leverage and in times of stress. Hence debt repurchases are a cause for prudential concern.

Keywords: *Banking, fair values, repurchases, prudential filters, subordinated debt*.

JEL codes: *E58, G21, G32, G35, M41*.

I. Introduction

In the years 2009–2013, many European banks repurchased debt that traded below par with the purpose of increasing their Core Tier 1 capital ratio. In anticipation of the new capital requirements that would enter into force in 2014, banks repurchased these securities to turn an unrealized fair value gain into a realized one. Bank regulation excludes these unrealized fair value gains from the calculation of regulatory capital by means of a prudential filter, thereby giving banks an incentive to engage in Liability Management Exercises (LMEs) – i.e., buybacks of debt capital securities.[1] Using data of unprecedented detail, we examine the determinants of 720 European LMEs, as well as their effects on solvency and liquidity and the wealth they transfer from shareholders to debt holders.

According to Admati, DeMarzo, Hellwig, and Pfleiderer (2012), these buybacks can create social benefits since they improve banks' leverage ratios, despite the costs they impose on existing shareholders. Our evidence, however, shows that a significant part of these benefits failed to materialize, as a consequence of the interplay between prudential rules that prohibit banks to recognize unrealized fair value gains on their liabilities that arise from changes in their own credit standing and a context that made it difficult for banks to increase capital through established ways such as raising capital, retaining profits or selling assets. As a result of this interplay, mainly less solvent banks engaged in LMEs, during times of economic stress. In addition, banks bought back securities that were meant to contribute the most to the safety and soundness of the banking system. They repurchased the most loss-absorbing capital securities. The LMEs resulted in a loss of liquidity and a reduction in total regulatory capital. These consequences are opposite to what prudential rules aim to achieve, namely a safe and sound banking system. Lastly, cumulative abnormal returns after the announcement of a LME were negative, highlighting that LMEs are generally bad news for equity investors.

[1] Regulatory adjustments applied to accounting equity to arrive at regulatory capital are often denoted with the term "prudential filters".

In the years leading up to the implementation of Basel III in Europe (2009–2013), banks' demand for equity capital increased significantly. Whereas under Basel II banks could satisfy capital requirements with 2% equity over risk-weighted assets, under Basel III this percentage could be as high as 14.5%. Many European banks could not satisfy these augmented capital requirements within the relatively short notice through conventional methods. Issuing shares, for example, was not always possible for state-owned banks and because of weak investor appetite. In addition, issuing shares dilutes existing shareholders, especially when share prices are low. Alternatively, retaining profits would entail cutting dividend payments, which would give a bad signal to investors. Moreover, retaining profits is only meaningful for profitable banks, but profitable banks were often less pressed to meet higher capital requirements. A third way to increase capital ratios would be to sell assets with high risk weights – namely by "de-risking". However, in the interest of small and medium-sized enterprises, European supervisors actively discouraged banks from de-risking, as evidenced by the EBA press release on the EBA recapitalization exercise and EBA's 2013 recommendation on the preservation of capital (EBA, 2011b, 2013).

In the absence of alternative viable means to increase capital, many European banks responded to the higher anticipated capital requirements by buying back debt that traded below par. These banks actively managed their liabilities to realize a fair value gain that originated from a weak credit standing. This is where the prudential rules come into play. To safeguard the safety and soundness of the banking system, banks are subjected to a prudential rule that disallows them from including, for the calculation of regulatory capital ratios, any unrealized gains or losses on their liabilities valued at fair value that are due to changes in their own credit standing – see Article 64(4) of EC (2006).

To illustrate this prudential rule, a bank with a low credit standing may wish to recognize the unrealized fair value gain on a debt security that trades below par. Recognizing the unrealized gain will directly improve the bank's equity level and its Core Tier 1 ratio. Unfortunately, prudential

regulation disallows the recognition of this gain.[2] However, a bank can circumvent the derecognition requirement by repurchasing the debt security at the lower market value in an LME – thus turning the unrealized gain into a realized one. That is, at a cost – to compensate the debt holder for parting from his security, a bank pays a buyback premium. This buyback premium arises because, for a debt holder to be willing to sell his security, the buyback price should reflect the value of the debt after the buyback. Given that the buyback reduces the bank's default probability, the value of debt increases, leading to positive buyback premiums.

Crédit Agricole offers an example of a typical LME. On April 1, 2009, it announced the buyback of an Upper Tier 2 debt capital security that traded significantly below par, namely at 52%. This is a typical example, as it involves the repurchase of a debt capital security that counts towards a bank's total capital ratio, and for this reason trades at a significant discount, as we will explain later on. Crédit Agricole's motivation for the LME was to increase its solvency ratio.[3] Shortly after the announcement, Crédit Agricole exchanged £545m of this security at a price of 72%, thus paying the holders a 20% buyback premium (Crédit Agricole, 2011b,a). This LME would add €170m (£153m) to income, and would increase equity and Core Tier 1 capital by 5.03 basis points, at a time when Crédit Agricole's Core Tier 1 capital ratio was 8%.[4] Offsetting this gain is a reduction of total regulatory capital by £545m (€605m) due to the decrease in Tier 2 capital. In addition, at the expense of equity, Crédit Agricole paid the debt security holders a cash premium of £114m (20% of £545m). In the absence of the derecognition requirement, the total unrealized fair value

[2]The rule that excludes gains and losses resulting from changes in own creditworthiness is symmetrical. Unrealized gains originating from a deteriorated own credit standing are not included in regulatory capital. Likewise, the loss on a debt security associated with an improved credit standing does not affect regulatory capital either. This rule aligns the measurement of fair-valued liabilities with that of liabilities accounted for at amortized cost.

[3]The Crédit Agricole invitation to offer mentions: "The Notes currently trade at a significant discount compared to their initial issue price. If the transaction is successful, it will result in a modest improvement in the Tier 1 solvency ratio of [Crédit Agricole]."

[4]Note that we used the April 9, 2009 GBPEUR exchange rate of 1.1103. The €170m is pre-tax. After tax, the amount would have contributed (even) less to Core Tier 1.

gain could have been recognized as net income, which would increase common equity and Core Tier 1 capital without a decrease in total regulatory capital or a loss of liquidity.

The illustration shows that the prevailing market conditions in combination with regulatory preferences that discourage de-risking and exclude unrealized fair value gains and losses arising from changes in own credit standing from the calculation of regulatory capital resulted in significant unintended consequences. As the Crédit Agricole example shows, in exchange for a limited increase in the Core Tier 1 solvency ratio, banks sacrificed cash to make debt holders part from their securities. The LMEs that banks executed were at the expense of their total capital ratios and their liquidity, neither of which were in the interest of a safe and sound banking system nor in the interest of banks' owners.

There are several reasons why regulators require banks to derecognize unrealized gains and losses on changes in own credit standing. For example, the value of liabilities may be only temporarily depressed. This would make the unrealized gain a temporary one. It would therefore be imprudent for a bank to consider the gain as realized, as that would allow a bank to distribute it to shareholders instead of preserving it for the redemption of the liability in full. Another often-cited reason for the derecognition requirement is that gains made on a deteriorated own credit standing are counter-intuitive (ECB, 2001; Barth, Hodder, and Stubben, 2008; Alloway, 2009).

Surprisingly little research has been done into the (economic) effects of the prudential filter on unrealized gains and losses originating from changes in own credit standing. But policies that rely on intuition prompt closer examination. The requirement to derecognize the unrealized fair value gain on a weakened credit standing creates an incentive to arbitrage. Option theory shows that the gain increases with leverage and at the same time, given the prudential filter, strengthens the incentive of a bank to realize the fair value gain through the execution of an LME. This incentive becomes even stronger when banks are pressured to increase their capital while having limited alternative opportunities to do so.

Most of the LMEs involved hybrid debt instruments that counted towards a bank's regulatory capital.[5] Buying these instruments back is subject to rules, with particularly strict rules applying to debt capital instruments of the highest prudential quality, where the quality of capital instruments primarily relies on their capacity to absorb losses. The buyback restrictions ensure that instruments are available to absorb losses, for example by way of a write-down, a conversion into equity, or the cancellation or delay of coupon payments. At the same time, the higher loss-absorbing capacity of these instruments makes them more attractive buyback targets: the high loss-absorbing capacity increases the likelihood of the instrument being written off or the bank skipping a coupon payment, which means that these instruments trade at deeper discounts when a bank's solvency ratio is low.

This paper analyzes 720 LMEs of banks from 16 European countries from April 2009 to December 2013. In a drive to improve the quality and quantity of regulatory capital, these banks engaged in LMEs with the objective to realize fair value gains on debt instruments and add these gains to Core Tier 1 capital. We have access to rich and detailed LME data. The comprehensive nature of the data allows us to examine the determinants of LMEs, as well their effects on solvency and liquidity and the wealth they transfer from shareholders to holders of regulatory debt capital instruments and holders of subordinated debt. Since we are the first to investigate LMEs in the context of higher anticipated bank capital requirements, we present extensive descriptive evidence on which banks engaged in LMEs as well as on the cost and inefficiency of LMEs.

We then use regression analysis to examine the determinants of an LME. The results show that the likelihood of an LME decreases (increases) with a bank's solvency ratio (leverage) and decreases with bank size. We also document that banks from Greece, Ireland, Italy, Portugal and Spain, and listed banks were more likely to engage in an LME. The likelihood decreases with profitability and increases with the dividend pay-out ratio. In a next step, we examine the premium that banks pay to an investor to part from his instrument. Our results confirm that the premium increases with the loss-absorbing capacity of capital instruments, economy-wide financial stress measured by the CBOE Volatility Index, and leverage. In addition, the premium decreases with

[5] From here on, we use the terms "security" and "instrument" interchangeably.

the size of a bank. We also investigate whether banks target instruments with a high capacity to absorb losses. We document a negative relation between bank solvency and the probability to buy back the most loss-absorbing instruments. In addition, banks repurchase these instruments more often in times of economic stress. Lastly, we document an unfavorable response from investors around the announcement of a LME, and this response worsens with solvency. Investors penalize relatively solvent banks for engaging in LMEs, which is what one would expect: under normal circumstances, healthy banks would generally not engage in LMEs that benefit debt holders at the expense of equity holders.

Our results show that the prudential filter on unrealized fair value gains originating from a change in own credit standing has no obvious positive effects on the safety and soundness of the banking system. To the contrary: in a context of economic uncertainty, poorly capitalized banks, for which cash conservation is paramount, engaged in the least efficient and least cash conserving LMEs. This is precisely the opposite of what the prudential filter aims to achieve.

Our paper contributes to an emerging field of banking research that examines prudential filters. Existing research on prudential filters is sparse and limited to the filter for Available-for-Sale debt instruments (Bischof, Brüggemann, and Daske, 2014). Our paper examines the prudential filter on unrealized gains or losses on liabilities valued at fair value that are due to changes in a bank's own credit standing. More important is that recent literature recognizes prudential filters as an area of future research (Beatty and Liao, 2014; BCBS, 2015), which is surprising given the attention prudential filters have attracted in the past. For example, the prudential filter on fair value gains and losses due to changes in own credit standing was the subject of controversy around the introduction of IFRS in 2005 (EC, 2005).[6] In addition, whereas there is ample literature on the *level* of regulatory bank capital (Miller, 1995; Mehran and Thakor, 2011; Beltratti and Stulz, 2012; Admati, DeMarzo, Hellwig, and Pfleiderer, 2013; Berger and Bouwman, 2013; Jonghe and Öztekin,

[6] Another prudential filter that attracted controversy is the filter on deferred tax assets (DTAs), which should be deducted from bank capital (Merler, 2015; Sebag and Brunsden, 2015). The EU implementation of Basel III (the CRR) however recognizes some DTAs as capital [Article 39.2 of EC (2013a)].

2015), papers that examine the *structure* of regulatory bank capital are sparse. Our results show that banks appear willing to sacrifice total regulatory capital (i.e., hybrid Tier 1 and Tier 2 capital) for limited gains in Core Tier 1 regulatory capital. Lastly, given the comprehensive data that we use, we are able to document the determinants and consequences of LMEs, including the costs they impose on various debt and equity holders.

Our results are relevant for policy makers and standard setters, as the requirement to derecognize unrealized fair value gains that are the result of a change in own credit standing can be arbitraged and introduce unintended consequences. Our analyses suggest that regulators should prevent banks from buying back the most loss-absorbing instruments, consistent with the argument made by Admati et al. (2012) that if deleveraging is done inefficiently, regulators should limit banks' discretion.

II. Literature and Regulation

A. Literature

There is limited literature on debt buybacks, and none of the existing papers study regulatory bank capital. In addition, prior studies neither focus on a change in capital structure in a context that incentivizes banks to augment solvency ratios during challenging economic times, nor do they examine the exclusion from regulatory bank capital of cumulative unrealized gains and losses on changes in own credit standing.

Early studies on LMEs rely on small samples. For example, Johnson, Pari, and Rosenthal (1989), examine 42 insubstance defeasance transactions over the years 1980–1985. These transactions are akin to debt securitizations, where US accounting standards allowed firms to purchase US government securities to take risky debt off balance (FASB, 1983). The positive difference between the value of the securities and the value of debt could be recognized as income and be added to retained earnings. Johnson et al. document that debt holders benefited from these transactions; however, they find no evidence that shareholders financed these gains. Johnson et al. also document negative stock returns around the announcement of a transaction, but this result is not significant. Hand, Hughes, and Sefcik (1990), in another paper on insubstance defeasance

transactions, show that these transactions are generally bad news. However, Hand et al. remain inconclusive on the motivation for insubstance defeasance transactions. Their sample firms defeased for various reasons: managing earnings, attempting to avoid violating restrictions in bond covenants, and because it was the best use for excess cash on hand.

Chatterjee, Dhillon, and Ramírez (1995) examine the wealth effects of high-yield bond workouts of 40 distressed US firms during the years 1989–1992. They document mixed evidence: Exchange offers lead to negative announcement returns, whereas tender offers lead to positive announcement returns. Kruse, Nohel, and Todd (2014) also show mixed results for announcements of debt repurchases. Returns around announcements of exchange offers are positive and marginally significant, whereas returns around announcements of cash offers are insignificant. The strongest positive returns that Kruse et al. document are around announcements of assets sales. But then again, that result relies on 19 observations.

Wingler and Jud (1990) also find mixed evidence for the stock returns around the announcement of a tender offer. They examine bond tenders of 26 US utilities over the period 1983–1988 and show that investors favor an offer when a firm's prospects are improving. For firms with declining prospects, investors perceive tender offers as bad news. De Jong, Roosenboom, and Schramade (2009), on the other hand, show no negative abnormal share returns in their study of 109 bond tender offers by 96 European firms over the period 1996–2005.

Mann and Powers (2007) use a sample of 943 tender offers from US corporates. Like Wingler and Jud (1990), Mann and Powers use a sample where bonds that trade at a premium dominate. They show that tender offers are more likely when credit spreads are tight.

Regarding the accounting for debt, there is limited literature which pertains to firms that elected the fair value option around the time of the introduction of SFAS No. 159 *The Fair Value Option*

for Financial Assets and Financial Liabilities in the United States (FASB, 2007). In addition, this literature focuses mainly on fair valued assets.[7]

Song (2008) and Henry (2008) show that firms opportunistically elect the fair value option. In contrast, Guthrie, Irving, and Sokolowsky (2011) find no evidence of opportunistic use of the fair value option. Liu, Chang, and Ryan (2011) distinguish between initial and regular adopters of SFAS No. 159, and show that regular adopters acted according to the intent of SFAS No. 159, though some early adopters may have acted opportunistically. Couch, Thibodeau, and Wu (2014) find that SFAS No. 159 adopters have a significantly greater increase in earnings volatility than non-adopters. The main cause of this result is a dominant number of firms that adopt SFAS No. 159 for assets only, which runs against the spirit of the fair value option, as its use should mitigate the accounting mismatch between assets and liabilities by managing them jointly.

One empirical study that investigates fair value accounting for liabilities is Barth et al. (2008) who empirically examine the prediction of Merton (1974) on the moderating effect of debt on equity changes in the event of a change in own credit standing. Merton predicts that a one dollar reduction in debt does not translate into a one dollar increase in equity. Barth et al. empirically confirm this prediction. In addition, they find that the liability gains on a deteriorated credit standing are more than offset by deteriorated asset values.

Theoretical work by Black and Scholes (1973) shows that deleveraging introduces a transfer of wealth from shareholders to debt holders. Consequently, shareholders will resist deleveraging. However, Myers (1977) implies that the resistance disappears when a firm accepts a project with a net present value that offsets the wealth transfer.

Admati, DeMarzo, Hellwig, and Pfleiderer (2015) go further than Black and Scholes and Myers. They demonstrate that shareholders also suffer from a dilution effect: the price a firms offers

[7]LMEs affect earnings, and therefore the association with earnings management may conjure up. However, our paper primarily focuses on liability management, as the management of liabilities is the primary and predominant motive for LMEs, see also the second paragraph of Section III.

for buying back debt should make a debt holder indifferent between selling a debt instrument and holding on to it. This will only happen if the repurchase price equals the higher post-buyback debt level. For highly levered firms (i.e., banks) a free-rider problem ensues, which makes it punitively unattractive to reduce leverage. Consequently, Admati et al. argue that shareholders resist any and all deleveraging. Once indebted, the cost of deleveraging only increases, leading to increases in leverage, a phenomenon that Admati et al. call the "leverage ratchet effect".

Bulow and Rogoff (1988, 1989, 1990) present reasonings similar to the dilution effect. However, they do so in the context of the Latin American debt crisis in the 1980s. Bulow and Rogoff show that debtor countries do not benefit from buying back their lowly priced debt. All that happens in a repurchase transaction is that the price of debt rises to the higher post-buyback level. The prospective gains of a buyback are therefore deceptive.

B. Regulation

B.1. Introduction

This section describes the relevant regulation that applies to bank debt instruments and their repurchases. It describes the accounting and solvency rules that were in effect during the period that led up to the entry into force of the EU Capital Requirements Regulation (CRR), the European implementation of Basel III. It includes a description of (i) the IFRS rules on the fair value option (EC, 2002), (ii) the relevant European capital requirement rules as well as applicable guidelines and standards from the EBA, and (iii) the rules governing LMEs.

The description of the regulation shows that between April 2009 and December 2013, European regulators actively managed their expectations regarding the quantity and quality of regulatory bank capital. This led to an increased demand for Core Tier 1 capital (equity net of prudential adjustments). More importantly, the description shows that banks relied on LMEs to satisfy the increased demand for Core Tier 1 capital, as alternative ways to increase capital were not necessarily viable during this time period.

B.2. IFRS and the fair value option

The default treatment for liabilities under IFRS is to recognize them at fair value initially, and subsequently at amortized cost using the effective interest method (IAS 39 §47 and IFRS 9 Section 4.2.1). Under IAS 39 and IFRS 9, the fair value option allows firms to designate instruments as "at fair value through profit or loss". Firms can apply the fair value option under certain conditions. One such condition is that firms manage their instruments on a fair value basis. This implies that firms should be able to trade these instruments on a daily basis, which contradicts prudential rules that require instruments to be permanently available to absorb losses.

As a consequence, bank regulators discourage the use of the fair value option for capital instruments. For example, the European Central Bank (ECB) used its influence to tightly control the fair value option, which led to disagreement with the International Accounting Standards Board (IASB) at the time of the introduction of IFRS in Europe. Consequently, Europe endorsed IFRS in 2004 with the exception of two "carve-outs", of which one related to provisions governing the use of the fair value option.[8] Europe retroactively eliminated the fair value option carve-out in June 2005 (EC, 2005). However, the elimination did not apply unconditionally to banks. From 2005 onward, European bank capital rules require the derecognition of any unrealized gains or losses on own liabilities valued at fair value that are due to changes in a banks' own credit standing (CEBS, 2004; EC, 2006).[9]

Moreover, in 2006, the Basel committee adopted the IAS 39 (now IFRS 9) conditions for the use of the fair value option, including the requirement that instruments are managed on a fair value basis.[10] The committee also decided that banks should adjust their regulatory capital for gains and losses from changes in own credit risk as a result of applying the fair value option to financial

[8]The second carve-out pertained to provisions on hedge accounting.

[9]The United States followed suit – it introduced an equivalent rule in 2007 (FFIEC, 2007).

[10]The accounting rules in the United States (SFAS 159 and its successor Subtopic 825-10: Recognition and Measurement of Financial Assets and Financial Liabilities) do not mention this condition, nor does the US implementation of Basel III (OCC, 2013).

liabilities. The motivation to adopt this prudential filter is the particular concern that, if a bank applies the option to its own debt, "it will recognise a gain and a resulting increase in its capital when its own creditworthiness deteriorates. Such an outcome would undermine the quality of capital measures and performance ratios" (BCBS, 2006b). The rule is now part of Basel III and the implementations thereof in Europe and the United States (BCBS, 2010; EC, 2013a; OCC, 2013).

B.3. EU capital requirements and bank capital structure

Until the entry into force of the European implementation of Basel III in 2014, banks were subjected to the Capital Requirements Directive (CRD: EC (2006)). This directive reflects the (first) Basel accord and the Basel II Framework, which require that 8% of risk-weighted assets is backed by capital to absorb losses [Basel I: BCBS (1988), Basel II: BCBS (2006a)].

The CRD allowed banks to structure regulatory capital to minimize the use of equity. The 8% requirement for capital adequacy, for example, pertains to the BIS ratio for total capital. This ratio is the sum of Tier 1 capital (core capital) and Tier 2 capital (or supplementary capital) both divided by risk-weighted assets. Banks could satisfy the total capital requirement with a maximum of 50% Tier 2 capital, where Tier 2 capital instruments are subordinated debt instruments. Table 1 gives an overview of the regulatory capital requirements and the loss-absorbing capacity of capital instruments.

[Table 1 about here]

To satisfy Tier 1 capital requirements under the CRD, banks could rely on hybrid capital– for example, preferred shares and perpetual or permanent instruments that were subordinated to Tier 2 instruments. They could use hybrid capital instruments to a maximum of 50% of capital of the highest quality (book equity net of prudential adjustments). Consequently, Total Tier 1 capital would allow up to 50% of hybrid capital substituting for equity. Given these limits, banks could, in theory, satisfy the 8% regulatory capital requirements with only 2% of equity over risk-weighted assets.

As a response to the global financial crisis, and to the capital standards that were in force at the time, bank regulators vouched to improve the quality and quantity of regulatory capital. In particular, they responded to conclusions of the April G20 of 2009, where global leaders agreed to improve the quality, quantity, and the international consistency of capital in the banking system (G20, 2009).[11]

B.4. The quality of capital

Soon after the April 2009 G20, EBA's predecessor (CEBS) published guidelines that tightened the requirements for equity instruments, also known as Core Tier 1, or core capital of the highest quality (CEBS, 2010). The reason for this tightening was the broad definition of this element of core capital under the CRD, which created a proliferation of certificates and pseudo-shares that could count as core capital of the highest quality. CEBS aligned the new definition of Core Tier 1 with the then forthcoming definition of regulatory bank capital of Basel III (BCBS, 2009, 2010).

The publication of Basel III in December 2010 presented a new definition of capital. The structure of regulatory capital that it defined had kept the two tiers (BCBS, 2010). However, it emphasized the importance of Common Equity Tier 1 (CET1), a new item of Tier 1 capital. This CET1 is capital of the highest quality: Equity capital after the deduction of specific items, such as, for example, goodwill and holdings in financial companies.[12] Compared to Basel II, Basel III applies an increased number of deductions to capital. For example, the deduction of defined benefit pension fund assets is new under Basel III. In addition, Basel III applies the deductions to equity (which is a subset of Tier 1 capital), whereas Basel II applied the deductions to total regulatory cap-

[11]This is just weeks after the meeting of the G20 Finance Ministers and Central Bank Governors, who showed more restraint in their commitment to reform and strengthen the global financial system: they wanted to keep capital requirements "unchanged until recovery is assured." (GHOS, 2009)

[12]Note that CET1 is the Basel III definition of core capital of the highest quality, whereas Basel II and implementations thereof do not define an equivalent of this element of capital. Instead, reference is made to Core Tier 1. In practice, this is Tier 1 capital net of hybrid Tier 1 capital instruments.

ital.[13] As a consequence of these regulatory developments, the demand for equity capital increased significantly.

B.5. The quantity of capital

Besides increasing the quality of capital, Basel III also requires banks to hold at minimum 4.5% of CET1 over risk-weighted assets, plus 2.5% CET1 in a capital conservation buffer. To mitigate procyclicality in the financial sector, Basel III requires a countercyclical buffer that raises the CET1 requirements by again 2.5%. On top of these CET1 requirements is a capital surcharge for systematically important banks which requires them to have in issue an additional 1% to 5% of CET1 capital. The total CET1 requirement can thus stack up to 14.5% under the EU's implementation of Basel III, the CRR (EC, 2013b).

Regarding hybrid and subordinated instruments, Basel III and CRR require banks to have 1.5% Additional Tier 1 capital and 2% Tier 2 capital. However, banks were not forced to issue Basel III compliant hybrid instruments to replace existing capital instruments before the entry into force of Basel III. Old-style instruments would be gradually phased out between January 1, 2014 and January 1, 2021 (EC, 2013a).

It is important to realize that even though Basel III would only enter into force in 2014, banks responded to these regulatory initiatives by issuing instruments that anticipated the upcoming requirements. They did not, however, issue substantial amounts of common equity. Marinova and van Veldhuizen (2014) show that the cumulative amount of equity issued in Europe during our sample period is less than €250m, which is significantly less than the typical nominal amount of an instrument involved in a single (!) LME.[14]

[13] Given that Basel II prudential filters applied to total capital, some deductions applied to Tier 1 and Tier 2 on a 50:50 basis.

[14] Instead, banks predominantly issued non-equity capital instruments to satisfy the 1.5% Additional Tier 1 capital and 2% Tier 2 capital requirements. For example, in 2011, shortly after the publication of Basel III, Rabobank issued a Basel III compliant Additional Tier 1 hybrid instrument (Glover, 2011). In 2012, Barclays announced the issuance of

Pressure to satisfy the augmented capital requirements originated from regulators. For example, the EBA actively managed expectations with respect to the amounts of capital that banks were expected to report. For the 2011 stress test, the EBA set a Core Tier 1 requirement at 5% of risk-weighted assets. After this stress test, EBA rapidly raised expectations by setting that ratio to 9% for the 2012 EBA recapitalization exercise (EBA, 2012). In setting such a high ratio requirement, the EBA may have responded to the failed 2011 stress test, which did not prevent some banks from failing shortly after the results were published (Pignal and Jenkins, 2011). For the 2014 EU-wide stress test, the benchmark was even set at 8% Common Equity Tier 1 using the tighter definition of capital of Basel III (ECB, 2013).

To sum up: the changes in the regulation that we described above show that even before the entry into force of the CRR, regulators actively managed expectations about the quality and quantity of regulatory capital of European banks. Many European banks hence anticipated the forthcoming rules, either voluntarily or under pressure of their supervisors to meet expectations conveyed through stress tests and the EBA recapitalization exercise. In particular the EBA recapitalization exercise in 2012 stood out, because it required banks to meet a demanding capital requirement (Mésonnier and Monks, 2014).

B.6. The motivation to execute LMEs.

Instead of issuing new shares to satisfy the elevated Core Tier 1 ratio requirements, banks could augment their capital of the highest quality in the following three ways: (i) retaining profits, (ii) selling assets with high risk weights in a process called "de-risking" and (iii) buying back debt with a low market value in an LME to realize a fair value gain.

The first two options were not always open to all banks. Retaining profits would entail cutting dividend payments, which would give a bad signal to investors (Lintner, 1956). In addition, retaining profits is only meaningful for profitable banks, as without profits there is not much to retain. Regarding de-risking, European supervisors actively discouraged banks from selling assets with

an Additional Tier 1 instrument with a trigger that would automatically write down the instrument if the bank's CET1 ratio were to drop below 7% (Glover, 2012).

a high risk weight (EBA, 2011b, 2013). Allowing banks to de-risk would lead them to "shrink" the denominator to increase capital ratios. In practice, this would mean that banks would cut back on lending to small and medium enterprises, as these are relatively risky borrowers, which in Europe is a politically sensitive issue (Chassany, Crowley, and Penty, 2012). Given these limitations, banks sought to increase capital through the execution of LMEs.

B.7. Rules and conventions on LMEs

The quality of capital instruments relies primarily on their loss-absorbing capacity. Banks should be able to impose losses on these instruments – for example, through a write-down or a conversion into equity. In addition, banks can impose losses on capital instruments by cancelling coupon payments on Tier 1 and Upper Tier 2 instruments. See Table 1 for an overview of the requirements for regulatory capital.

The loss-absorbing capacity of capital instruments increases with maturity.[15] However, bank regulation governing the maturity of capital instruments is ambiguous and somewhat inconsistent. In theory, regulatory capital instruments should be perpetual (or undated) and not callable. This to make sure the instruments are permanently available to absorb losses. In addition, prudential regulation prohibits banks from creating any expectations that the instrument will be bought back (BCBS, 2010; EC, 2006, 2013a). In practice, however, European banks in particular redeem capital instruments at the first possible call date, which often is five years after issuance. For example, during the global financial crisis, Deutsche Bank did not honour the call for a Tier 2 instrument, after which the bank found it difficult and costly to access the market for new issuances of capital instruments.

Although these calls violate the requirement that capital be permanently available to absorb losses, they are perfectly legal. The CRD allows banks to call, repurchase or redeem capital instruments after five years [Articles 63a(2) and 64(3) of CRD EC (2006)]. European banks generally do this, albeit that conditions apply, with stricter conditions applying to Tier 1 and Upper Tier 2 in-

[15] An instrument with a short remaining maturity will be repaid in the foreseeable future. This prevents banks from imposing losses on that instrument, thus limiting the loss-absorbing capacity of the instrument.

struments than to Lower Tier 2 instruments. For example, Tier 1 and Upper Tier 2 instruments can only be called with permission of the supervisor if the solvency of the credit institution in question is not (unduly) affected.[16] In practice, this requirement meant that the call should not lead a bank to violate minimum capital requirements. Many LMEs involved instruments that had not been in issue for five years. Such buybacks were legal as well, as long as the issuer was sufficiently solvent and obtained supervisory permission – see for example Article 64(3) of CRD.

Regarding supervisory approval for a buyback, this was necessary, but not always sufficient. In June 2015, Lloyds Banking Group, for example, found a high court ruling against the bank's decision to redeem capital instruments that counted towards its Core Tier 1 capital ratio (Dunkley, 2015a). However, in December, an appeals court quashed this verdict in favor of Lloyds (Dunkley, 2015b). In other words, LMEs are subject to regulatory risk and ambiguity about the interpretation of applicable terms and conditions.

III. Sample selection and data

We gathered data from European banks over the period April 2009 to December 2013. The period starts from the April G20 call for capital of higher quality and quantity and ends with the entry into force of the CRR, the implementation of this G20 call. We exclude Switzerland because this country is not bound by EU regulation. The reasons to study only EU banks are (i) EU accounting and prudential rules control the use of the fair value option and require derecognition of unrealized fair value gains on own credit standing for capital instruments, (ii) the availability of data: European banks engaged in LMEs much more often than US banks[17], and (iii) the quality of the data, as European LME transactions are all corroborated by the Debt Capital Market desks of three separate investment banks.

[16] This last requirement is meant to respect the seniority of Tier 1 and Upper Tier 2 instruments in case a bank is poorly capitalized. Buying these instruments back would impose losses on their holders, whereas the first and proportionately greatest share of any losses should be imposed on equity holders.

[17] 720 LME transactions from 69 EU banks versus 86 from 37 US banks.

We analyzed the summary motivations that the investment banks provided us for each transaction to infer the motives to engage in LMEs. From the 613 justifications provided, 506 (82.6%) indicate that the LME was executed to increase Core Tier 1 capital. The remaining justifications could not rule out that motive, but were generic ("to manage the capital base of the bank") or described the process ("cash tender offer via reverse Dutch auction for up to €150m of its Upper Tier 2 subordinated callable step up notes"). We therefore are confident that increasing Core Tier 1 was the primary motivation to engage in LMEs.

A. Data levels

We use the data for analyses on different levels. At bank level we compare LME banks against non-LME banks. This allows us to identify characteristics that may be typical for banks that execute LMEs. At bank-year level we analyze data of banks that executed LMEs during a fiscal year. This allows us to estimate the likelihood of an LME during a year.

To examine the consequences of buybacks and which instruments banks targeted, we focus on the most granular level: the instrument (or contract) level. Here we analyze particulars of individual instruments that took part in an LME, each of which is governed by a separate contract. At this level, we focus on LMEs of capital instruments: Tier 1, Upper Tier 2, and Lower Tier 2 instruments. However, to compare these LMEs against those that involved non-capital instruments, we also include LMEs of senior unsecured debt instruments. These instruments are closest to capital instruments in ranking and subordination, but not subject to capital adequacy rules.

The three upper panels of Table 2 present an overview of the data at the different levels. Panel A shows that 69 of the 167 sample banks engaged in LMEs. We can compare characteristics of these banks to the 98 sample banks that did not engage in LMEs over the sample period. Most banks that executed LMEs bought back more than one instrument (57 of 69).

[Table 2 about here]

During the sample period (from April 1, 2009 to the end of 2013), the sample covers 787 bank-years, of which 330 (457) are from banks that executed one or more (respectively, zero) LMEs. Panel B shows that our sample includes 121 (666) bank-years with (without) LMEs.

Panel C reports the number of unique announcement dates as well as, at contract level, the total number of instruments that were bought back. The sample includes data from 185 announcement dates. Banks that executed LMEs generally visited the market more than once; they often targeted multiple instruments in one announcement. A total of 720 instruments was bought back, with most buybacks involving Tier 1 and Lower Tier 2 instruments, which partly reflects the use of these instruments by banks.[18]

B. Sample coverage

We rely on Bankscope and Datastream for consolidated bank data, as each of these databases offer incomplete and partial coverage of EU banks. The combined data that we use from both sources covers on average, per year, total bank assets worth €30.6bn, which is 88.3% of total EU consolidated banking assets reported by the ECB, see Panel D of Table 2.

For items that these databases do not offer, we rely on data from the EBA stress tests and the EBA recapitalization exercise. In addition, we use data from the ECB on the 2014 asset quality review. Hand-collected data complement missing EBA and ECB data for the year 2009. Restricting hand collection of prudential data items to only EBA-covered banks should not lead to a loss of generalizable inferences, given that EBA bank data cover more than 70% of the EU bank assets.[19]

Panel E of Table 2 shows that participation in LMEs differs per country. For Denmark, for example, the sample has observations from 25 banks, of which one engaged in an LME, in 2011.

[18] It is nearly impossible under Basel II rules to assess details of individual capital instruments that any bank has in issue. Data kept by data vendors on regulatory capital instruments are often incomplete as banks are not required to disclose this information.

[19] The total assets covered by ECB's asset quality review is over 82%, but it should be noted that the wider scope of the AQR is mainly the result of the inclusion of subsidiaries of banks covered by the EBA. To prevent double counting of subsidiary-owned assets, we rely on EBA's consolidated scope.

Spain, on the other hand, reports 10 LMEs in 2012, whereas the number of sample banks is comparable to that of Denmark. The sample also reflects differences in market structures across Europe – with Denmark, France, Italy, Germany and Spain having many banks, and many other countries having fewer. Luxembourg has a low number of observations, likely because the banks operating in that country are predominantly subsidiaries of banks from other countries. Finland and Norway have no LME data.

C. Announcement data

Banks announce an LME generally via a press release. We use the announcement to retrieve the pre-announcement price. After completion of the exercise, a bank publishes the details: for each instrument included in the LME the bank publishes the exchange price, notional offered amount, and notional accepted amount. With this information and the information from the announcement it is possible to calculate for each instrument included in the LME the buyback premium as well as the realized fair value gain that the bank then can use to augment equity. This realized gain is the difference between the nominal value of the underlying exchanged instrument and the associated paid amount, summed over the instruments involved in an LME.

We measure the cost of the exercise by calculating the difference between the potential fair value gain that a bank could realize, based on the pre-announcement price of the nominal underlying exchanged instruments and the actual gain that the bank realized. This cost is equal to the buyback premium multiplied by the nominal value exchanged. The larger the buyback premium, the more the holder of the instrument gains and the less a bank can increase its Core Tier 1 capital ratio.

IV. Research design and results

A. Characteristics of LMEs

Table 3 presents descriptive evidence on the characteristics of banks that engaged in LMEs versus those that did not during the sample period.

[Table 3 about here]

Panel A shows that banks that engaged in LMEs score poorly on many dimensions: profitability, solvency, regulatory capital ratios and asset quality (measured as non-performing loans over total loans) for these banks are much lower compared to non-LME banks. Density, measured by the ratio of risk-weighted assets over total assets and beta, is also high for banks executing an LME – that is, LME banks appear to have a relatively high risk appetite. The banks that did not engage in an LME are relatively small compared to LME banks: the average total assets of LME banks is €326bn, versus €107bn for non-LME banks.

An explanation for why larger banks executed LMEs is that they generally involved complex hybrid instruments which are subject to extensive regulation. There are economies of scale – for example, the nominal value of a typical capital instrument is €375m or more. Consequently, larger banks likely have more instruments in issue at the start of the sample period.[20] More importantly, the capacity needed to manage these instruments implies that larger banks are more successful in obtaining the required supervisory approval to execute an LME. This is in line with Ioannidou (2005), who shows that larger banks are less likely the subject of formal supervisory intervention.

Panel B of Table 3 reports dividend pay-out statistics of 121 bank-year observations with, and 666 bank-year observations without LMEs. Banks that engaged in LMEs have higher pay-out ratios than non-LME banks in the year before the LME (44.9% versus 25.9%) and in the year of the LME (39.4% versus 23.5%). There is a drop in pay-out ratio after an LME, from 44.9% to 39.4%, however this drop is insignificant (untabulated p-value of 0.37). This suggests that banks generally avoid cutting dividends and revert to other (less efficient) ways of increasing capital.

B. The Buyback premium

The buyback premium is of particular prudential interest, as it reflects a loss of cash – which affects liquidity and solvency. The premium arises because banks generally operate at high levels of leverage. When leverage is very high, the prospect of bankruptcy will negatively affect the value of the bank, its debt and equity.

[20] See footnote 18.

One way to deleverage is by buying back debt. In particular, poorly performing banks and banks with poor solvency ratios may choose to buy back debt given that alternatives may not work in practice: equity investors have no appetite to buy shares, retaining profits may be problematic if profitability is low, and selling assets, especially in illiquid markets, may be cumbersome, politically sensitive or subject to supervisory approval.

An important consequence of a debt buyback is that the overall value of debt of a bank increases. Therefore, an investor who is willing to sell a debt instrument back to the bank faces a free-rider problem: *other* debt holders benefit from the investor's willingness to sell his instrument back to the bank. Consequently, the investor will only participate in a buyback transaction if he receives a premium. Bulow and Rogoff (1988) and Admati et al. (2015) predict that the investor will only participate in a buyback transaction if he receives a premium that increases the price to the value *after* the buyback.

Merton (1974) allows us to illustrate why debt holders would command a premium for selling their instrument back to a bank by demonstrating that the value of debt (D) can be expressed as

$$D = AN(-d_1) + Ke^{-rt}N(d_2), \tag{1}$$

where A is the asset value of the bank, K the face value of debt, r the risk-free rate, and t the duration of debt. $N(d)$ is the probability that a standard normal random variable will be less than or equal to d:

$$d_1 = \frac{ln(\frac{A}{K}) + (r + \sigma^2/2)^t}{\sigma\sqrt{t}}$$

$$d_2 = d_1 - \sigma\sqrt{t}. \tag{2}$$

Dividing Equation (1) by the face value of debt (K) allows us to show the effect of deleveraging, see Figure 1. The graph in Figure 1 shows that debt reduction (a move along the graph to the right) leads to an increase in the value of the remaining debt relative to its face value. This constitutes a wealth transfer form shareholders to debt holders.

[Figure 1 about here]

In addition, according to Admati et al. (2015), holders of bank debt will command a premium (π) to part from their instrument, where $\pi = P_X - P_A$. The P_X is the exchange price paid for the bought-back instrument, P_A is its fair value before the buyback announcement. Holders of debt instruments will therefore command a buyback premium that varies inversely with solvency.

Following the discussion on regulation in Section B, banks may predominantly focus their LME efforts on debt instruments that count towards regulatory capital. The accounting rules and prudential regulation jointly work in such a way that, irrespective of the way they are accounted for, gains on these instruments can be realized only through a buyback. We also expect banks to opportunistically exploit the unpredictability of a buyback. Regulatory capital instruments are meant to be permanently available to absorb losses. The prospect of having to absorb losses should therefore contribute to the depth of the discount and the related potential fair value gain in a LME. However, the discount and the related gain would disappear if investors anticipated a buyback.

A successful LME should therefore have an element of surprise. Thanks to the rule on buybacks that grant the initiative of a buyback to the issuer, banks were able to choose instruments with the deepest discounts. These were generally instruments that are least likely to be bought back – for example, instruments that are subject to more onerous buyback requirements, such as instruments that require permission and for which permission may perhaps not be granted, or instruments that were in issue less than five years.

We therefore expect permanent capital instruments (Tier 1 and Upper Tier 2 instruments) to show a larger discount and potential fair value gain than Lower Tier 2 instruments or senior unsecured debt. This is primarily because Tier 1 and Upper Tier 2 instruments are subject to requirements that make them more loss-absorbing than other instruments (see Table 1). In addition, these instruments are also the ones that investors may not expect to be bought back, given the more onerous buyback requirements. Moreover, Admati et al. (2015) offer theoretical support for the idea that banks prefer to buy back the most junior instruments.

Table 4 reports descriptive statistics of the buyback premium, as well as the associated costs, gains and inefficiencies of LMEs. Panel A shows the distribution of the buyback premium for banks that engaged in an LME. The mean premium is relatively high when compared to other research. De Jong et al. (2009), for a wide sample of EU banks before the global financial crisis, for example, report an average (median) premium of 3.9% (1.2%) whereas we find an average (median) premium of 8.22% (5.06%). Mann and Powers (2007) report average (median) premiums of 5.55% (3.24%). A possible explanation for these differences is that our sample contains only banks, which are highly levered and for which buybacks are subject to supervisory permission. In addition, our sample period is situated after the onset of the financial crisis, which may have deepened the discounts.

[Table 4 about here]

The average potential fair value gain that a bank could realize in an LME is 20.0 bp of total assets (29.2 bp of risk-weighted assets). The average actual, or realized, gain however, is substantially lower: 14.3 bp of total assets (21.8 bp of risk-weighted assets). These gains may appear limited, however, when expressed in relation to equity, they are substantial: the mean (median) realized gain is 390 bp (97.4 bp).

The difference between potential and actual gains on LMEs reveal their cost. Although these costs are limited in comparison to total assets (5.66 bp on average), their effect on equity can be substantial: the mean (median) cost of a LME on equity holders is 115 bp (48.9 bp). However, their effect at the 99th percentile can be significantly larger: 1,355 bp.

Panel B shows the buyback premium as a percentage of the par value of the exchanged instrument by regulatory classification. It shows that holders of permanent instruments, namely Tier 1 and Upper Tier 2 instruments, command a higher buyback premium (11.32% and 9.87%) than holders of Lower Tier 2 instruments (5.59%) and non-regulatory instruments (2.48%). The differences in the premiums between regulatory classifications are also significantly different from zero, except for the difference in the premiums paid for Tier 1 and Upper Tier 2 instruments (*p*-

value = 0.19). The next column in Panel B shows the amounts offered per instrument, which are comparable for capital instruments, but about twice as large for unsecured debt instruments.

Panel B also shows the inefficiency of LMEs. For example, the average Upper Tier 2 instrument would, in the absence of an LME, offer a 41.8% unrealized fair value gain. However, this is deceptive: the average realized gain is only 31.9% (41.8% − 9.87%) as part of the potential gain (the premium) is transfered to the holders of the bought-back instruments. The rightmost column of Panel B measures this inefficiency. It measures which part of the potential buyback premium accrues to debt holders. The column shows that LMEs that involve the most loss-absorbing instruments are the least cash conserving: About a quarter of the potential fair value gain goes to the debt holders. The transfer is lower for less loss-absorbing instruments.

The lower part of Panel B shows the mean amount exchanged per instrument as well as the loss of regulatory capital per exchanged instrument (in italics). The amounts are smaller for capital instruments than for unsecured debt. Note that not all instruments offered are exchanged: the success rate of an LME is about 53%.

Table 5 shows a breakdown of the premiums as well as the amounts involved per year and per country. The premiums vary by year, with 2009 (2010) reporting the highest (lowest) premiums. The observations of 2009 may reflect lingering uncertainty during the post-Lehman collapse period as untabulated results show a drop in premiums, from 11.9% for the first half of 2009 to 8.36% for the second half of 2009. The low premiums in 2010 coincide with a low number of exercises. The potential fair value gain of the LMEs reaches a total of €41.6bn. This is significant and in the absence of the recognition ban, it would contribute to improving the capital positions of EU banks.

[Table 5 about here]

Panel A of Table 5 also shows that the actual, or realized, gains on LMEs are significantly lower than the potential gain. The difference is €9.1bn, which is about 22% of the potential fair value gain. In the absence of the derecognition rule, this amount could have been used to augment Core

Tier 1 equity. To put the amount of €9.1bn in perspective, it is 35% of the reported total capital shortfall of €25bn that the ECB reported for the 2014 EU asset quality review (ECB, 2014).

In addition, panel A shows that in 2011 and 2012, the years of the controversial EBA stress test and the EBA recapitalization exercise, banks executed more LMEs than in other years. In these two years, banks offered a total nominal amount of €162.2bn, about 64% of the sample total. In the other years, banks offered significantly less. The number of banks engaging in LMEs is also high for these two years: 36 (2011) and 51 (2012), where in other years this number ranges from 13 to 25. The effect of the LMEs on total EU regulatory capital is a reduction of €110.9bn, with the largest reductions taking place in 2011 and 2012.

Lastly, the penultimate row of panel A shows that the number of LMEs dropped in 2013. The mean premium value for this year is high due to the premium paid by the Eurobank of Greece. Excluding this bank would lead the mean premium value to drop to 3%, which helps explain the decrease in activity for 2013: the gains to be made in an LME dropped.

Panel B of Table 5 shows the transactions per country. France, Ireland, Italy, Spain and the UK were particularly active regarding LMEs. The countries with the lowest efficiency were Portugal and Spain, with Spanish banks transferring 48.2% of the potential fair value gains to debt instrument holders. Cyprus and Ireland show a low discrepancy between potential and actual gains, as banks in these countries were obliged to impose losses on debt holders.

In this section, we presented descriptive evidence on the characteristics of banks that engaged in LMEs versus those that did not and on the inefficiency of LMEs. In the next section we investigate more formally the determinants of an LME using a multivariate regression model.

C. The likelihood of an LME

At bank level, we model the likelihood of an LME using the following probit model, henceforward referred to as the LME model:

$$LME_{[0,1]} = \beta_0 + \beta_1 Solvency + \beta_2 Size + \beta_3 Pay\text{-}out + \beta_4 ROA + \beta_5 GIIPS + \beta_6 Listed + \sum_{n=7}^{8} \beta_n Business\ model + \varepsilon \quad (3)$$

where *LME* is equal to 1 if a bank engages in an LME in a fiscal year, and 0 otherwise.

Solvency is either Tier 1 capital divided by risk-weighted assets ($Solv_{\text{Tier 1}}$) or accounting equity divided by total assets ($Solv_{\text{Equity}}$). *Size* is the natural log of *total assets* in millions of euros. *Pay-out* is dividend as a proportion of net income. *ROA* is net income over total assets. *GIIPS* is an indicator for LMEs from Greece, Ireland, Italy, Portugal and Spain. *Listed* indicates whether the bank is listed on a stock exchange. *Business model* is indicator variable for the following bank types: "retail-funded" or "trading" based on the average values for gross loans and interbank borrowing. Except for *GIIPS*, the regressors are lagged variables to respect the order of causality. The regression model relies on *p*-values that account for two-dimensional within-cluster correlation (Petersen, 2009).

We expect the coefficient on *Solvency* to be negative and the coefficient on *Size* to be positive. We control for dividend *Pay-out* as it may be associated with the probability of an LME for two reasons. First, dividends are sticky over time (Lintner, 1956). Therefore banks may choose to continue paying dividends, even if this is at the expense of retained earnings and additions to Core Tier 1 capital. Ceteris paribus, a dividend-paying bank will need to replenish equity capital sooner than a bank that does not pay dividends. Second, by paying debt holders a premium, banks that engage in LMEs give their non-equity capital instrument holders a preferential treatment over equity holders. To prevent unequal treatment of investors, debt contracts often contain clauses that are referred to as "pushers" and "stoppers". A dividend pusher ensures that instrument holders receive their coupon if a bank pays dividends. A dividend stopper prevents a bank from paying

dividends if it decides to cancel a coupon payment. The buyback of a debt instrument may therefore prompt a bank to continue paying dividends.

We control for profitability (*ROA*), of which the coefficient should be negative, as low profitability limits a bank that wishes to increase retained earnings and capital. We use an indicator variable to control for Greece, Ireland, Italy, Portugal and Spain (GIIPS). These countries were singled out as risky debtor countries during our sample period, and are therefore potentially less able to guarantee their national banks. This implies an expected positive coefficient on this indicator variable. We apply an additional control for listing status, as listed banks may operate in a different disclosure environment and may be subjected to different regulations – for example, MiFID (Directive 2004/39/EC) and exchange listing rules. Lastly, we control for a possible business model effect, as banks may issue debt instruments to distinct investor classes. For this control, we rely on Roengpitya, Tarashev, and Tsatsaronis (2014), who classify European banks into distinct business models. We use separate indicators for retail-funded banks and for trading banks.

Table 6 shows the correlation matrix for the main regression variables. This table shows that the occurrence of an LME in a year negatively correlates with solvency and profitability, and positively with the other variables. The correlations are broadly consistent with our expectations.

[Table 6 about here]

Table 7 presents the results of the LME model. The dependent variable of the probit model is 1 if a bank engages in an LME during a fiscal year, and 0 otherwise. Note that except for GIIPS, all regressors are lagged.

[Table 7 about here]

The coefficients on *Solvency* are negative and significant, as expected: -5.55 for accounting solvency and -6.88 for regulatory solvency, both with p-values of 0.00. The likelihood of an LME thus increases as banks' solvency decreases. The coefficient on *Size* is, as expected, positive and significant. The coefficient on dividend pay-out is positive, and the coefficient on ROA negative.

These two coefficient values are as expected, albeit that the latter is not significant. Next, we find that banks in Greece, Ireland, Italy, Portugal and Spain are more likely to execute an LME, as well as listed banks and banks that adopted a trading or a retail-funded business model.

Overall, the results of Table 7 show that the likelihood of an LME increases with leverage and size. The LME model thus shows that poorly capitalized banks engaged in LMEs, which is consistent with the idea that the unrealized fair value gain on a debt instrument incentivizes banks to buy them back, and inconsistent with prudential rules that prevent poorly capitalized banks from buying back capital instruments. The positive coefficients on size are in line with Ioannidou (2005) and likely reflect bargaining power or economies of scale, as larger banks were in a better position to manage the instruments that they chose to issue and later buy back.

Other factors that increase the likelihood of an LME are location in one of the GIIPS countries, which likely reflects a higher perceived risk of bank failure. Again other factors are listing status and the business model, which may reflect, among other things, the investor base of hybrid capital instrument holders. Note that EU regulations such as IFRS and CRR do not cater to specific business models or countries, which renders a closer examination of these factors less relevant. Hence our decision to not examine these factors more closely.

D. Determinants of the buyback premium

The main variable of interest in the second stage of the analysis is the buyback premium. This is the difference between the buyback price and the value of the instrument before the buyback announcement:

$$\pi = P_X - P_A, \tag{4}$$

where P_X is the exchange price of the instrument expressed as a percentage of the nominal value of the instrument and P_A is the pre-announcement price of the instrument, also expressed as a percentage of the nominal value of the instrument (P_N). Instruments that are bought back in an LME generally trade below par at the announcement date $(P_A < P_N)$. The exchange price should

therefore be higher than the price at the announcement and lower than the nominal value: $P_A < P_X < P_N$.

The reason we focus on the buyback premium is because it is the part of the regulated fair value gain that the bank loses in an LME. It is the manifestation of the ban on the recognition of unrealized gains and losses originating from changes in own credit standing.

The Premium model below allows us to examine the factors that affect the buyback premium for individual bought-back instruments:

$$\begin{aligned}\pi =& \beta_0 + \beta_1 \textit{Tier 1} + \beta_2 \textit{Upper Tier 2} + \beta_3 \textit{Lower Tier 2} + \beta_4 VIX + \beta_5 \textit{Solvency} + \\ & \beta_6 \textit{Size} + \beta_7 \textit{EBA Recap} + \beta_8 \textit{Mills}' + \varepsilon \end{aligned} \tag{5}$$

where π is the buyback premium for each individual bought-back instrument, expressed as a percentage of the nominal underlying value of the instrument, or the inverse hyperbolic sine of the premium: $\sinh^{-1}\pi$. The latter is a log transformation of the premium that is not restricted to only positive values.

Tier 1 is an indicator variable that is set to 1 if the bought-back instrument counted towards Tier 1 capital, and zero otherwise. Likewise, *Upper (Lower) Tier 2* is an indicator variable for an Upper (Lower) Tier 2 instrument, where Table 1 shows the loss-absorbing capacity of these instruments. As the sample used for the regressions contains transactions where the exchanged instrument is a regulatory capital instrument or an unsecured debt instrument, the coefficient values for Tier 1, Upper Tier 2 and Lower Tier 2 are relative to those of unsecured debt instruments. As explained, we expect the coefficients on Tier 1 and Upper Tier 2 instruments to be positive and higher than the coefficient on Lower Tier 2 instruments because Tier 1 and Upper Tier 2 instruments are meant to be more loss-absorbent, and their buybacks are subjected to stricter rules. *Solvency* is either accounting equity divided by total assets ($Solv_{\text{Equity}}$) or Core Tier 1 capital divided by risk-weighted assets ($Solv_{\text{CoreTier 1}}$), where Core Tier 1 capital is Tier 1 capital net of hybrid Tier 1 capital instruments. We expect the coefficient for *Solvency* to be negative.

Given that this analysis uses intra-year data, we now include the CBOE Volatility Index (*VIX*) and EBA recapitalization exercise in this model. *VIX* is the closing value of the CBOE Volatility Index, standardized to values between 0 and 1. We expect the CBOE Volatility Index to be positively associated with the buyback premium, given that worse financial conditions are associated with higher correlations, higher volatilities, and higher spreads (Schwert, 2011; Opschoor, van Dijk, and van der Wel, 2014). *EBA Recap* is an indicator variable that is equal to 1 for repurchases that took place from September to December 7, 2011, the time before the EBA announced the recapitalization exercise results (EBA, 2011a). The response to the EBA recapitalization exercise, which required banks to meet a fairly demanding capital requirement of 9% Core Tier 1, may have prompted banks without excess capital to announce an LME, which would imply a positive coefficient on this indicator variable. On the other hand, buybacks in these months may have alerted investors, who then may have responded by buying hybrid capital instruments in anticipation of an LME, which would imply a negative coefficient on the indicator. As a result, we have no expectations on this indicator variable. Next, we control for the size of banks, where expect to find a negative coefficient. We include the inverse Mills ratio, obtained from the results of the LME model, to control for selection bias.

Table 8 presents the correlations between the variables included in the buyback premium model.[21] The table shows that the buyback premium correlates positively with the most loss-absorbing instruments (Tier 1 and Upper Tier 2), the CBOE Volatility Index, and the EBA recapitalization exercise, albeit that the latter correlation is weak. The other correlation coefficients are negative, in particular the coefficients on solvency and size. Table 8 thus shows that most correlation coefficients are as expected.

[Table 8 about here]

The high and negative correlation coefficient between Tier 1 and Upper Tier 2 appears to indicate that these two instruments are substitutes and more similar to each other than to Lower Tier 2 in-

[21] The variables in the last five rows will be discussed in Table 10 below.

struments. The other high correlation coefficient is the one between the CBOE Volatility Index and the EBA recapitalization exercise, which may induce some multicollinearity problems going forward.[22]

Table 9 shows the results of the buyback premium model. The first column presents the baseline regression results only, with minimal overlap of variables included in the LME model. Subsequent columns include also size and solvency. The coefficients on the capital instruments are all positive and significant, which confirms that investors command a premium for redeeming capital instruments. The coefficients are significant for all three types of instruments: for Tier 1 hybrids the coefficient value is 1.46, for Upper Tier 2 instruments it is 1.13, and for Lower Tier 2 instruments it is 0.88, all with p-values of 0.00. As expected, the coefficient on *VIX* is positive and significant (2.47, p-value of 0.00). The coefficients on the two solvency variables are negative and significant: -10.1 ($p = 0.00$) for the coefficient on accounting solvency and -11.2 ($p = 0.00$) for Core Tier 1 ratio. These results confirm our expectation that less resilient banks pay higher premiums to make investors part from their instruments. The coefficient on size is also consistently negative: larger banks pay a lower premium, a result that can be attributed to either a better information environment or lower risk. Lastly, the coefficient on the EBA recapitalization exercise is negative throughout, though not always significant. This coefficient value is consistent with the interpretation that the EBA recapitalization exercise may have contributed to the information environment, and not consistent with the notion that the exercise forced banks to reveal more about their true solvency position than the two other measures of solvency did.

[Table 9 about here]

Moving to the last four columns, these present the coefficients of a linear regression model with the buyback premium (π) as dependent variable. These coefficients facilitate an assessment of the

[22] Note that, although Table 8 shows a high correlation between CBOE Volatility Index and the EBA recapitalization exercise, the variance inflation factors for these two variables are low (2.01 and 1.98) and for all variables they are well below 10. Therefore, multicollinearity is unlikely to affect the coefficient estimates.

economic significance of the results. For example, the coefficient values on Tier 1 show that these instruments require a 6–10% higher premium than senior unsecured instruments. The coefficient values on solvency indicate that a drop of the solvency ratio by 1% point increases the buyback premium by 34 to 63%, which is economically significant. The coefficient on *VIX* has the potential to increase the premium by at least 10%, which too is economically significant. Although the coefficient values on Upper Tier 2 instruments are higher than the coefficients on Tier 1 instruments, the probabilities shown in the row below the intercept values indicate that we cannot reject the hypothesis that these coefficients are equal.

The results reported in Table 9 confirm our expectations that the buyback premiums paid in LMEs (i) increase with the loss-absorbing capacity of bought back instruments, (ii) increase with economy-wide financial stress measured by the *VIX*, (iii) decrease with solvency, and (iv) decrease with bank size. The results are relevant – for example, the results on loss-absorbing capacity and solvency reveal unintended consequences of the requirement to derecognize fair value gains on debt instruments that are due to a change in credit standing. The results on *VIX* show that supervisors' decisions to require banks to recapitalize in times of economic stress may have unintended consequences. On the other hand, the results on the EBA recapitalization exercise show that a coordinated recapitalization exercise may mitigate the adverse effects of LMEs.

E. Determinants of instruments that banks target

The models above do not distinguish between the types of instruments that banks bought back. To investigate whether banks use their discretion to target specific instruments, we run an ordered probit model at instrument level:

$$T_{[1..4]} = \beta_0 + \beta_1 Solvency + \beta_2 Discount + \beta_3 VIX + \beta_4 Size + \beta_5 Pay\text{-}out + \beta_6 ROA + \beta_7 GIIPS + \beta_8 EBA\ Recap + \beta_9 Listed + \sum_{n=10}^{11} \beta_n Business\ model + \beta_{12} Mills' + \varepsilon \quad (6)$$

where the dependent variable (T) is a categorical variable that increases with the loss-absorbing quality of the instrument. Its value is "4" for an LME involving a Tier 1 instrument, "3" for an

Upper Tier 2 instrument, "2" for a Lower Tier 2 instrument, and "1" for senior unsecured. *Discount* is 1 minus the pre-announcement price expressed as a fraction of the face value of the bought-back instrument: $1 - P_A$. We include this variable as it is likely positively related to the loss-absorbing quality of the bought-back instrument. All other variables are as defined previously.

[Table 10 about here]

Consistent with our expectations, the correlations shown in the lower rows of Table 8, and with Admati et al. (2015), we find that a lower solvency increases the likelihood of the repurchase of a more loss-absorbing instrument. The discount variable also confirms expectations, with deeper discounts for more loss-absorbing instruments. Likewise, the coefficient on *VIX* shows that banks target more loss-absorbing instruments in times of higher economic uncertainty. The positive size coefficient likely indicates that larger banks may have more Tier 1 and Upper Tier 2 instruments in issue. The positive coefficient on ROA is likely a reflection of the supervisory approval process. Holding other factors constant, supervisors may grant permission earlier when the prospects of the bank look good.

F. Cumulative abnormal announcement returns

We focused on the buyback premium because of its prudential relevance: the premium is a transfer of cash from the owners of the bank to its debt holders, which weakens a bank's resilience. However, Admati et al. (2015) and Merton (1974) offer a motivation to examine equity investors' responses as well. Where Admati et al. claim that benefits of deleveraging accrue to debt holders, Merton offers a more moderate view: equity holders may benefit from deleveraging as well – that is, it is unclear what to expect empirically. We therefore examine the effect of solvency on equity investors' responses to LME announcements.

Table 11 reports cumulative abnormal returns (CARs) around 90 LME announcements over our sample period. The CARs rely on the market model using the Datastream European market index, estimated over days -250 to -50 before the announcement. We chose a 10-day return window given that it takes time before investors learn the full outcome of an LME, which is not

unreasonable given an LME success rate of 53%. In the case of the Crédit Agricole example that featured in the introduction, it took a week before investors learned about the success of the announced LME. In fact, the announcement of a LME triggers an initial positive response from investors, see for example the LME announced by Deutsche Bank in February 2016 (Shotter, Jenkins, and Jackson, 2016). However, our sample data shows that the initial positive response turns into a negative one as time progresses.

We control for the following factors: (i) the realized loss that an LME imposes on equity investors (i.e., the aggregate buyback premium relative to equity), (ii) an indicator for permanent capital instruments, (iii) size, (iv) ROA and (v) relative offer size: the aggregate LME offer amount scaled by total assets size. The variables are aggregated over the number of instruments involved in an LME – that is, for each LME announcement.

[Table 11 about here]

Table 11 shows that LMEs have a negative effect on share prices. With CARs down by more than 2%, LMEs are bad news for equity investors. The regression results also confirm our earlier findings. They show a negative relation between bank solvency and cumulative abnormal returns, which is what one would expect: the less leveraged a bank is, the less equity investors benefit from deleveraging, and the more the LME is a transfer of wealth from debt holders at the expense of equity holders. The results also show a strong negative response to the realized losses that an LME imposes on equity holders, again a result that one should expect.

The control variables show that, holding other factors constant, an LME is bad news for smaller banks, whereas CARs increase with return on assets, and with the relative offer size. Closer inspection shows that this last result is driven by senior unsecured debt LMEs, for which the premiums are low.

G. Additional tests

G.1. LME success rate

Not all invitations to offer an instrument succeed in full – the success rate is 53%. We examined the effects the success rate, but we found no result of this examinations that would alter our inferences.

G.2. LME success rate and Cash LMEs versus exchanges

About a third of the LMEs are exchanges, where a bank replaces an existing instrument by a new instrument at new terms. Results of this examination do not alter our inferences either.

G.3. IFRS

It is unlikely that the application of IFRS affects our results, as from 2007 on, the EU implementation of IFRS requires firms whose debt securities are admitted on a regulated market of any Member State to apply IFRS EC (2002).

V. Conclusion

European bank regulation requires banks to derecognize, for the calculation of regulatory capital ratios, any unrealized gains or losses on their liabilities valued at fair value that are due to changes in their own credit standing. This is to safeguard the safety and soundness of the banking system. In the lead-up to the implementation of Basel III, European banks circumvented this derecognition requirement by repurchasing instruments which traded at a discount from their holders in Liability Management Exercises (LMEs). The majority of LMEs involved hybrid debt instruments that counted as regulatory bank capital. These instruments were bought back, after which the gain, net of the buyback premium, contributed to the formation of additional Core Tier 1 capital.

The results of our analyses of the likelihood of an LME show that it decreases with a bank's solvency but increases with size. We also document that banks from Greece, Ireland, Italy, Portugal and Spain, and listed banks are more likely to engage in LMEs. The likelihood decreases with profitability and increases with the dividend pay-out ratio.

The results of our analyses of the premium that banks pay to an investor to part from his instrument confirm that it increases with (i) the loss-absorbing capacity of capital instruments, (ii) economy-wide financial stress measured by the CBOE Volatility Index, and (iii) solvency. The buyback premiums are at the expense of banks' liquidity and banks' overall regulatory capital position. In addition, the buyback benefits debt holders at the expense of equity holders. The total buyback premium that the sample banks paid amounts to €9.1bn, this out of a potential fair value gain of €41.6bn that banks could recognize and add to Core Tier 1 capital if prudential rules allowed them to do so. The increase of €32.4bn in Core Tier 1 capital is offset by an overall reduction in total regulatory capital of €110.9bn.

Results of our examination of instruments that banks target for a repurchase show that the likelihood that a bank buys back more loss-absorbing instruments increases with leverage and economy-wide financial stress. Lastly, we also document an unfavorable response from investors when banks announce an LME, and the response worsens with solvency. Investors penalize healthy banks for engaging in an LME.

Altogether, these results show that the requirement to derecognize fair value gains on debt has important unintended consequences. For example, prudential rules should prevent banks from buying back the most loss-absorbing instruments. But our results show that these instruments are the most attractive buyback targets. In addition, regulation allows buybacks of the most loss-absorbing instruments only if a bank is sufficiently solvent. However, our results show that the least solvent banks engaged in LMEs. Our results also show that the incentive to engage in an LME increases in times of economic stress.

These results have several policy implications: contrary to the objectives of bank solvency rules, the ban on recognizing unrealized fair value gains on debt instruments may not help the safety and soundness of the banking system. In a context of economic uncertainty, poorly capitalized banks, for which cash conservation is paramount, engaged in the least efficient and least cash conserving LMEs. This is precisely opposite to what the prudential filter aims to achieve.

Returning to the question in the title of this paper, the answer is affirmative: below-par own debt repurchases should be a cause for prudential concern. Contrary to their expectations, regulators' main concern should be the effectiveness of regulation. Banks will circumvent the prudential filter on recognizing unrealized gains originating from a weakened own credit standing by engaging in LMEs. In particular the least resilient banks will engage in LMEs when they are most vulnerable. These banks would benefit from having their debt fair valued to preserve liquidity and solvency. Therefore, our results weaken the case of the exclusion of unrealized gains and losses that originate from changes in own credit standing in the calculation of regulatory capital.

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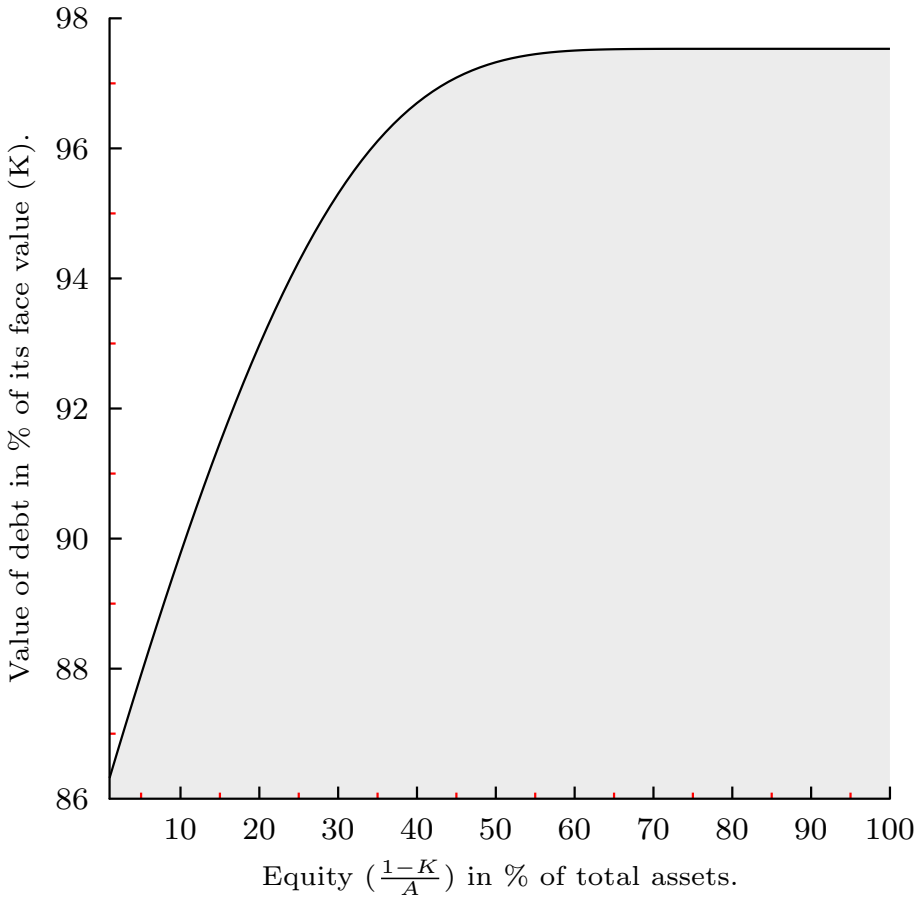

Figure 1: The value of debt: the g0.8ph follows the function $\frac{D}{K} = \frac{A}{K}N(-d_1) + e^{-rt}N(d_2)$, where $d_2 = d_1 - \sigma\sqrt{t}$, $d_1 = \frac{ln(\frac{A}{K}) + (r + \sigma^2/2)^t}{\sigma\sqrt{t}}$, A is total assets, K the face value of debt as a fraction of total assets times 100, r the risk-free rate, and t the duration of debt. $N(d)$ is the probability that a standard normal random variable will be less than or equal to d. The figure assumes the following parameter values: t is 2.5 years – assuming average maturity of a 5-year Tier 2 hybrid capital security. The risk-free rate: $r = 1.0\%$, annual standard deviation $\sigma = 20.0\%$.

TABLE 1

Regulatory capital and loss-absorbing capacity

The table outlines the loss-absorbing capacity of capital instruments, with the most loss-absorbing items at the top. The descriptions follow capital definitions of Basel II (BCBS, 2006a), the Basel press release on instruments eligible for inclusion in Tier 1 capital (BCBS, 1998), CRD (EC, 2006), Basel III (BCBS, 2010, 2011), and CRR (EC, 2013a). CRR (Europe's Basel III implementation) entered into force on January 1, 2014. *Tier 1 hybrid* and *Additional Tier 1* instruments are senior in ranking to common stock and rank junior to depositors, general creditors and subordinated debt of the bank. *Upper Tier 2* instruments are undated, permanent instruments that are subordinated in full to non-subordinated creditors. *Lower Tier 2* instruments are dated instruments of which the principal is subordinated to non-subordinated creditors. *Tier 2* (Basel III) instruments are subordinated to depositors and general creditors of the bank. *RWA* is risk-weighted assets.

Basel II and CRD	Item	Maturity		Remarks	Requirement	
Capital of highest quality (book equity after deductions)	Core Tier 1	Cannot be repaid outside liquidation	⇓ Less loss absorbing	Tier 1 + Tier 2 $\leq$8% of RWA	$> \frac{1}{2}$ of Tier 1	⇑ Subordination
Hybrid instruments[1,2]	Tier 1 hybrids	Permanent, perpetual		Coupon and instrument should absorb losses in going concern	$\leq \frac{1}{2}$ of Tier 1	
Subordinated debt instruments[1,2]	Upper Tier 2	Permanent, no maturity		Coupon and instrument should absorb losses in going concern	Tier 2 $\leq$ Tier 1	
Subordinated debt instruments[1]	Lower Tier 2	Maturity $\geq$ 5 years and then a 5-year gradual capital derecognition period			$\leq \frac{1}{2}$ of Tier 1	
Senior unsecured debt				Buyback without permission		
Basel III and CRR	Item	Maturity		Remarks	Requirement	
Capital of highest quality	Common equity Tier 1 (CET1)	Cannot be repaid outside liquidation	⇓ Less loss absorbing		$\geq$ 4.5% + buffers up to 10% of RWA	⇑ Subordination
Hybrid instruments[1,3]	Additional Tier 1 (AT1)	Permanent, perpetual, preferential		Subordinated to Tier 2; coupon may be cancelled	$\geq$ 1.5% of RWA	
Subordinated debt instruments[1,3]	Tier 2	Maturity $\geq$ 5 years and then a 5-year linear capital derecognition period			$\geq$ 2% of RWA	
Senior unsecured debt				Buyback without permission		

[1] These instruments are callable at the initiative of the issuer after a minimum of five years.

[2] Except for Lower Tier 2 instruments, calls and buybacks (i) need supervisory approval, (ii) are allowed if the financial and solvency conditions of the institution are not (unduly) affected (EC, 2006).

[3] Under Basel III rules and under the EU bank recovery and resolution directive, all instruments shall be written off or converted into equity at the point that the viability of the bank is at risk (BCBS, 2011; EC, 2014). The CRR allows calling the instrument before maturity after prior supervisory approval and if the bank replaces the called instrument by an instrument of equal or higher quality at terms that are sustainable for the income capacity of the institution; or the bank demonstrates that its capital position is well above the minimum capital requirements after the call option is exercised.

TABLE 2

Sample coverage

The table describes the sample, which covers the period April 2009 to December 2013. Panel A reports observations of European banks that executed one or more LMEs during the sample period and those that did not execute an LME during the sample period. Panel B focuses on banks-years only. Panel C reports the number of instruments that were involved in LMEs – each number represents a contract governing an instrument. Panel D shows the coverage of the sample banks measured by consolidated total assets, compared to the total assets of consolidated banking data reported by the ECB. Panel E reports bank-years. Of the column pairs, the left-hand number shows bank-years in which a bank did execute a LME; the right-hand number shows sample bank years.

Panel A: Bank level	Banks	Bank-years
Total	167	787
Banks executing an LME during 2009–2013	69	330
Of which, banks with		
a single LME	(12)	
more than one LME	(57)	
Banks that did not execute an LME over the sample period	98	457

Panel B: Bank-year level		Bank-years
All bank-years		787
Of which, bank-years with	LMEs	121
	no LME	666

Panel C: Instrument level		Announcement dates	Instruments, Contracts
Total		185	720
Of which	Tier 1	97	280
	Upper Tier 2	50	97
	Lower Tier 2	92	302
	Unsecured debt	11	41

Panel D: Total bank assets	Average	2013	2012	2011	2010	2009
Sample	30.6	29.4	32.6	33.0	31.4	26.5
ECB	34.7	32.4	35.5	35.9	34.6	34.8
Coverage (%)	88.3	90.7	91.9	91.8	90.7	76.2

Panel E: Bank-years with, without LMEs	2013		2012		2011		2010		2009
Austria	1	2	2	2		2		2	2
Belgium		4	2	4		4		4	1	4
Cyprus		3	1	3		3		3		3
Denmark		24		25	1	25		25		25
Finland		1		1		1		1		1
France		21	5	21	3	21		21	2	21
Germany		14		14	1	15		15		15
Greece	4	7	4	8		8		9	1	9
Ireland		2		3	3	3	2	4	3	4
Italy	3	19	7	20	4	19	1	19	2	19
Luxembourg	1	2		2		2		1		1
Netherlands	1	7	1	7	4	7	1	7	2	7
Norway		1		1		1		1		1
Portugal		5	1	5	4	5		5		4
Slovenia		2	2	4		4		4		4
Spain	1	19	10	19	6	26	4	25	5	20
Sweden		4		4		4		4	1	4
United Kingdom	4	13	7	13	5	13	4	13	4	11
Total	15	150	42	156	31	163	12	163	21	155

TABLE 3

Characteristics of sample banks 2009–2013

The table reports descriptive statistics, separately for European banks that did (and did not) engage in LMEs, over the period April 2009–December 2013. *Ever LME (Never LME)* denotes banks that (did not) engage in LMEs. The table reports 330 bank-year observations from 69 banks with, and 457 bank-year observations from 98 banks without LMEs. p1, p5, p25, p50, p75, p95, p99 indicate percentile values for percentiles 1, 5, 25, 75, 95, and 99 and the median (p50). *p (diff)* indicates the significance of the differences in means of variables reported in the upper and lower part of each panel. *Net income* is the income the bank realized over the fiscal year. *ROA* is net income over average total assets. *Solvency* is lagged accounting equity divided by lagged total assets. *Tier 1 ratio* is the lagged Tier 1 capital ratio. *AQ* is the asset quality of the bank, measured as the loan loss provision over the amount of net loans. *Density* is the lagged ratio of risk-weighted assets over total assets. *Beta* is a bank's stock beta, estimated using 60 monthly observations of bank returns and the Datastream EU market index. *Equity* is common shareholders' equity. *Total assets* is the book value of total assets. *Pay-out* is the dividend pay-out ratio.

Panel A: Ever LME (no. of obs: 330)

	Means	*p* (diff)	p1	p5	p25	p50	p75	p95	p99
Net income (M€)	−92.2	0.01	−10,811	−4,211	−461	82.0	640	3,590	6,271
ROA (%)	−0.53	0.00	−11.0	−4.22	−0.47	0.15	0.35	0.83	2.99
Solvency (%)	5.30	0.00	0.00	0.80	3.50	5.10	6.50	10.1	17.0
Tier 1 ratio (% of RWA)	10.3	0.00	0.00	6.65	8.30	10.1	12.5	15.5	18.3
AQ (%)	1.58	0.08	0.00	0.12	0.45	0.95	1.67	4.90	11.5
Density ($\frac{RWA}{TA}$) (%)	49.7	0.04	19.7	23.7	33.5	49.5	61.2	82.7	91.3
Beta	0.98	0.00	0.24	0.33	0.76	0.92	1.25	1.55	1.90
BIS ratio (%)	12.8	0.00	0.20	9.32	11.0	12.8	14.4	17.1	19.0
Equity (M€)	14,760	0.00	−2,463	320	1,748	5,971	17,440	66,308	85,886
Total assets (M€)	325,947	0.00	2,677	10,499	42,147	110,742	399,220	1,550,903	1,899,419

Never LME (no. of obs: 457)

	Means		p1	p5	p25	p50	p75	p95	p99
Net income (M€)	263		−1,800	−299	1.33	31.2	203	2,310	4,973
ROA (%)	−0.02		−10.4	−2.60	0.08	0.32	0.70	1.27	3.22
Solvency (%)	8.80		0.00	2.10	4.60	7.30	11.0	17.0	58.8
Tier 1 ratio (% of RWA)	11.9		4.00	4.00	8.85	11.2	14.5	19.9	25.3
AQ (%)	1.42		0.00	0.01	0.28	0.70	1.68	4.64	11.4
Density ($\frac{RWA}{TA}$) (%)	44.0		14.0	17.7	24.8	36.1	49.4	136	268
Beta	0.49		0.03	0.09	0.28	0.46	0.63	1.08	1.27
BIS ratio (%)	15.1		9.5	10.1	12.7	14.1	16.9	21.6	24.8
Equity (M€)	4,794		−0.19	25.7	150	1,026	2,794	18,263	87,981
Total assets (M€)	106,520		122	236	1,407	11,833	77,049	1,899,419	1,933,861

Panel B: LME bank-year (no. of obs: 121)

	Means	*p* (diff)	p1	p5	p25	p50	p75	p95	p99
Pay-out (previous yr.) (%)	44.9	0.00	0.00	0.00	16.1	46.7	64.9	100	100
Pay-out (current yr.) (%)	39.4	0.00	0.00	0.00	0.00	37.8	67.9	100	100

Non-LME bank-year (no. of obs: 666)

	Means		p1	p5	p25	p50	p75	p95	p99
Pay-out (previous yr.) (%)	25.9		0.00	0.00	0.00	25.1	41.4	68.8	97
Pay-out (current yr.) (%)	23.5		0.00	0.00	0.00	23.5	36.8	65.9	97

TABLE 4

European Liability Management Exercises 2009–2013

The table shows descriptive statistics of 720 European LMEs over the period April 2009 to December 2013, involving 121 bank-years. p1, p5, p25, p50, p75, p95, p99 indicate percentile values for percentiles 1, 5, 25, 75, 95, and 99 and the median (p50). π is the mean buyback premium: $P_X - P_A$, where P_X is the exchange price of the instrument expressed as a percentage of the nominal value of the instrument; P_A is the price of the instrument before the announcement, also expressed in a percentage of the nominal value of the instrument (P_N). *Potential gain* is the potential fair value gain that a bank could realize in a LME, based on the pre-announcement price of the nominal amount exchanged. *Actual gain* is the pre-tax fair value gain that a bank realized in a LME, based on the exchange price of the nominal amount exchanged. *Cost* is the difference between potential gain and actual gain. The denominators *assets*, *risk weighted assets (RWA)*, and *equity* in Panel A are lagged. *p (diff)* tests the difference between the two values reported to the left of this statistic. *p*-value tests the mean being 0. *Offered* is the mean amount the bank announces in the Liability Management Exercise. *Inefficiency* is the ratio of *cost* over *potential gain*. *Exchanged* is the mean nominal underlying the bank bought back in the Liability Management Exercise. Δ*Reg. cap.*: the italic font denotes the mean loss of total regulatory capital resulting from the LME. *Success rate* is the mean of the ratio of exchanged over offered. *Instruments* is the number of instruments exchanged.

Panel A: Descriptives of buyback premiums (no. of transactions: 720) and annual gains and costs (no. of bank-years: 121)

	Means	*p*-value	p1	p5	p25	p50	p75	p95	p99
Buyback premium (π in %)	8.22	0.00	−1.39	−0.57	2.29	5.06	10.3	29.2	65.9
Potential gain (in bp of assets)	20.0	0.00	0.20	0.45	2.44	7.73	19.5	69.5	248
Actual gain (in bp of assets)	14.3	0.00	0.00	0.00	1.15	4.81	14.1	45.8	203
Cost (in bp of assets)	5.66	0.00	−0.34	0.03	0.51	1.97	4.85	26.9	49.6
Potential gain (in bp of RWA)	29.2	0.00	0.03	0.53	4.50	16.0	33.7	107	334
Actual gain (in bp of RWA)	21.8	0.00	−0.03	0.00	2.17	9.33	20.8	64.4	327
Cost (in bp of RWA)	7.35	0.00	−0.64	0.05	1.11	3.70	8.20	31.0	52.8
Potential gain (in bp of equity)	505	0.00	0.46	6.20	40.2	148	395	1,816	9,747
Actual gain (in bp of equity)	390	0.00	−0.49	0.00	19.5	97.4	279	1,288	9,548
Cost (in bp of equity)	115	0.00	−17.2	0.14	11.8	48.9	93.6	528	1,355

Panel B: Characteristics of LME transactions (no. of transactions: 720)

Eligibility	Premium (π) in % of nominal	*p* (diff) (*p*-value)	Offered(M€)	Mean potential gain (%)	Inefficiency (%) $= \frac{Premium}{Potential\ gain}$
Tier 1	11.32	0.19	373	44.9	25.2
Upper Tier 2	9.87	0.00	301	41.8	23.6
Lower Tier 2	5.59	0.02	366	28.0	20.0
Unsecured debt	2.48		762	17.3	14.3
Means	8.22	(0.00)	392	35.8	23.0

Eligibility	Exchanged (M€) Δ*Reg. cap.*	Success rate (%)	# Instruments
Tier 1	*187*	54.0	280
Upper Tier 2	*161*	53.5	97
Lower Tier 2	*179*	52.8	302
Unsecured debt	392	51.0	41
Means	192	53.2	720

TABLE 5

European Liability Management Exercises years, countries

The table shows amounts involved in European LMEs over the period April 2009 to December 2013. π is the mean buyback premium: $P_X - P_A$, where P_X is the exchange price of the instrument expressed as a percentage of the nominal value of the instrument; P_A is the price of the instrument before the announcement, also expressed in a percentage of the nominal value of the instrument (P_N). *Potential gain* is the maximum potential fair value gain that a bank could realize in a LME, based on the pre-announcement price of the nominal amount exchanged, pre-tax. The *Actual gain* is the pre-tax fair value gain that a bank realized in a LME, based on the exchange price of the nominal amount exchanged. *Cost* is the difference between *Actual gain* and *Potential gain*. This is a measure of the cost of the LME. *Inefficiency* is the ratio of *Cost* over *Potential gain*. *Offered* is the amount the bank announces in the buyback offer, in millions of €. $-\Delta$ *Reg. cap.* is the negative change in total regulatory capital resulting from the LME. *Bank-years* is the number of sample bank-year observations.

Panel A: Gains and losses per year (amounts in M€)

Year	π (%)	Potential gain	Actual gain	Cost	Inefficiency (%)	Offered	$-\Delta$ Reg. cap.	Bank-years
2009	10.06	9,002	6,814	2,188	24.3	33,982	19,278	25
2010	5.23	8,928	7,816	1,112	12.5	39,996	21,019	13
2011	7.10	12,641	9,871	2,770	21.9	70,856	35,375	36
2012	9.16	10,120	7,504	2,616	25.8	91,305	29,960	51
2013	9.60	859	439	420	48.9	15,715	5,305	18
Overall	8.22	41,550	32,443	9,107	21.9	251,854	110,937	143

Panel B: Gains and losses per country (amounts in M€)

Country	π (%)	Potential gain	Actual gain	Cost	Inefficiency (%)	Offered	$-\Delta$ Reg. cap.	Bank-years
Austria	6.63	845	699	147	17.4	4,913	2,599	6
Belgium	15.67	969	735	235	24.3	2,126	1,775	3
Cyprus	3.00	151	141	9	6.0	413	314	1
Denmark	4.69	51	46	5	9.8	675	149	2
France	6.13	4,189	3,279	909	21.7	33,194	12,147	15
Germany	8.25	1,894	1,514	380	20.1	10,049	4,774	4
Greece	20.07	1,342	953	389	29.0	5,271	2,201	8
Ireland	4.34	11,109	10,083	1,025	9.2	28,573	18,024	11
Italy	4.23	3,815	2,961	853	22.4	60,159	14,723	17
Luxembourg	3.41	31	24	6	19.4	698	188	1
Netherlands	7.45	2,451	1,683	767	31.3	17,583	10,396	9
Portugal	22.67	1,493	911	582	39.0	5,951	2,119	6
Slovenia	7.43	1	1	0	0.0	100	1	1
Spain	10.93	3,478	1,800	1,678	48.2	35,305	14,282	31
Sweden	12.33	185	132	53	28.6	975	535	1
United Kingdom	6.94	9,548	7,480	2,068	21.7	45,869	26,711	27
Aggregate	8.22	41,550	32,443	9,107	21.9	251,854	110,937	143

TABLE 6

Correlations for bank-years

The table reports correlations of variables from European LME data over the period April 2009 to December 2013. *LME* is 1 if a bank engages in a LME during a fiscal year, else it is 0. $Solv_{Equity}$ is accounting equity divided by total assets. $Solv_{\text{Tier 1}}$ is Tier 1 capital divided by risk-weighted assets. *Size* is the natural log of *total assets* in millions of euros. *Pay-out* is dividend as a proportion of net income. *ROA* is net income over total assets. *GIIPS* is an indicator for LMEs from Greece, Ireland, Italy, Portugal and Spain. *Listed* indicates whether the bank is listed on a stock exchange. Business model is either "*Retail-funded*" or "*Trading*" based on the average values for gross loans and interbank borrowing. Except for *GIIPS*, the variables of the upper panel are lagged variables.

Bank-year obs. ($n = 645$)	LME	$Solv_{\text{Equity}}$	$Solv_{\text{Tier 1}}$	Size	Pay-out	ROA	GIIPS	Listed	Trading
$Solv_{\text{Equity}}$	−0.20								
$Solv_{\text{Tier 1}}$	−0.15	0.40							
Size	0.28	−0.64	−0.29						
Pay-out	0.09	−0.03	−0.07	0.03					
ROA	−0.05	0.11	0.07	0.01	0.03				
GIIPS	0.19	−0.06	−0.24	0.11	0.14	−0.20			
Listed	0.00	0.23	0.03	−0.15	0.11	0.05	−0.02		
Trading	0.29	−0.08	−0.02	0.07	−0.02	0.00	0.01	−0.21	
Retail	0.39	−0.09	0.00	0.07	−0.04	−0.11	0.03	−0.33	0.23

TABLE 7

LME model (first stage)

The table reports results of a probit regression that relies on European LME data over the period April 2009 to December 2013. The dependent variable is 1 if a bank engages in a LME during a fiscal year, else the dependent variable is 0.

$$LME_{[0,1]} = \beta_0 + \beta_1 Solvency + \beta_2 Size + \beta_3 Pay\text{-}out + \beta_4 ROA + \beta_5 GIIPS + \beta_6 Listed + \sum_{n=7}^{8} \beta_n Business\ model + \varepsilon$$

$Solv_{\text{Equity}}$ is accounting equity divided by total assets. $Solv_{\text{Tier 1}}$ is Tier 1 capital divided by risk-weighted assets. *Size* is the natural log of *total assets* in millions of euros. *Pay-out* is dividend as a proportion of net income. *ROA* is net income over total assets. *GIIPS* is an indicator for Liability Management Exercises from Greece, Ireland, Italy, Portugal and Spain. *Listed* indicates whether the bank is listed on a stock exchange. Business model is either "*Retail-funded*" or "*Trading*" based on the average values for gross loans and interbank borrowing. *Pseudo-*R^2 is McFadden's pseudo-R^2. Except for *GIIPS*, the regressors are lagged variables to respect the order of causality. The regression model relies on *p*-values that account for two-dimensional within-cluster correlation (Petersen, 2009).

	β	*p*	β	*p*
$\text{Solv}_{\text{Equity}}$ $(-)$	−5.55	0.00		
$\text{Solv}_{\text{Tier 1}}$ $(-)$			−6.88	0.00
Size $(+)$	0.25	0.00	0.28	0.00
Pay-out $(+)$	0.17	0.00	0.19	0.00
ROA $(-)$	−0.21	0.24	−0.19	0.24
GIIPS $(+)$	0.73	0.00	0.62	0.00
Listed	1.31	0.00	1.25	0.00
Trading	2.99	0.00	3.08	0.00
Retail	2.92	0.00	3.07	0.00
Intercept	−5.15	0.00	−5.03	0.00
Pseudo-R^2		0.39		0.38
Wald χ^2		111		138
Prob. $> \chi$		0.00		0.00
Correctly classified (%)		89.0		87.3
No. of obs.		762		645

TABLE 8

Correlations for LMEs at instrument level

The table reports correlations of variables from European LME data over the period April 2009 to December 2013. π is the buyback premium, namely the difference between the exchange price and its price three days before the buyback announcement, expressed in percent of the nominal underlying value of the instrument. *Tier 1* is an indicator variable for exchanged instruments that are undated, permanent, capital instruments that are senior in ranking to common stock and always rank junior to depositors, general creditors and subordinated debt of the bank. *Upper Tier 2* is an indicator variable for exchanged instruments that are undated, permanent, instruments that are subordinated in full to non-subordinated creditors. *Lower Tier 2* is an indicator variable for exchanged instruments that are dated instruments of which the principal is subordinated to non-subordinated creditors. *Unsecured* are senior unsecured debt instruments. *VIX* is the closing value of the CBOE Volatility Index, standardized to values between 0 and 1, measured at the announcement date. $Solv_{\text{Equity}}$ is accounting equity divided by total assets. $Solv_{\text{Core Tier 1}}$ is Core Tier 1 capital divided by risk-weighted assets, where Core Tier 1 capital is Tier 1 capital net of hybrid Tier 1 capital instruments. *Size* is the natural log of *total assets* in millions of euros. *EBA Recap* is an indicator for observations of repurchases that took place from September to 7 December 2011.

[1] These variables will the referred to in Table 10 below: *Target* is a categorical variable that increases with the loss-absorbing quality of the instrument. Its value is 4 for Tier 1, 3 for Upper Tier 2, 2 for Lower Tier 2, 1 for Senior unsecured debt *Discount* is 1 minus the pre-announcement price expressed in fraction of the face value of the bought back instrument. *Pay-out* is dividend as a proportion of net income. *ROA* is net income over total assets. *GIIPS* is an indicator for Liability Management Exercises from Greece, Ireland, Italy, Portugal and Spain.

Individual LMEs ($n = 493$)	π	Tier 1	UT2	LT2	Unsecured	*VIX*	$Solv_{\text{Eq}}$	$Solv_{\text{CT1}}$	Size	EBA Recap	Target	Discount	Pay-out	ROA
Tier 1	0.27													
Upper Tier 2	0.10	−0.30												
Lower Tier 2	−0.28	−0.69	−0.33											
Unsecured	−0.11	−0.20	−0.09	−0.21										
VIX	0.25	0.19	−0.03	−0.11	−0.12									
$Solv_{\text{Equity}}$	−0.21	−0.22	0.03	0.14	0.13	−0.23								
$Solv_{\text{Core Tier 1}}$	−0.17	−0.11	0.04	0.07	0.03	−0.21	0.51							
Size	−0.20	0.00	0.10	−0.07	0.01	0.07	−0.07	0.10						
EBA Recap	0.10	0.12	−0.09	−0.02	−0.10	0.73	−0.22	−0.08	0.20					
Target[1]	0.32	0.91	0.06	−0.73	−0.45	0.20	−0.24	−0.10	0.03	0.11				
Discount	0.41	0.39	0.02	−0.28	−0.25	0.10	−0.01	0.35	−0.39	0.02	0.44			
Pay-out	0.11	0.01	0.01	−0.02	0.01	−0.01	−0.20	−0.13	−0.16	−0.08	0.01	0.06		
ROA	−0.07	0.09	0.06	−0.15	0.05	0.10	0.07	−0.02	0.40	0.15	0.10	−0.34	−0.07	
GIIPS	0.05	−0.16	−0.09	0.15	0.15	−0.26	0.36	0.15	−0.41	−0.34	−0.22	0.07	0.16	−0.18

TABLE 9

Premium model (second stage)

The table reports results of a regression that relies on European LMEs over the period April 2009 to December 2013.

$$\pi = \beta_0 + \beta_1 \textit{Tier 1} + \beta_2 \textit{Upper Tier 2} + \beta_3 \textit{Lower Tier 2} + \beta_4 \textit{VIX} + \beta_5 \textit{Solvency} + \beta_6 \textit{Size} + \beta_7 \textit{EBA Recap} + \beta_8 \textit{Mills}' + \varepsilon$$

For each individual bought-back instrument, the dependent variable (π) is either the buyback premium, namely the difference between the exchange price and its price three days before the buyback announcement, expressed in percent of the nominal underlying value of the instrument, or the inverse hyperbolic sine of the premium: $\sinh^{-1}\pi$ or $\ln(\pi+\sqrt{1+\pi^2})$. As the sample used for the regressions contains transactions where the exchanged instrument is a regulatory capital instrument or an unsecured debt instrument, the coefficient values for Tier 1, Upper Tier 2 and Lower Tier 2 are relative to those of unsecured debt instruments. *Tier 1* is an indicator variable for exchanged instruments that are undated, permanent, capital instruments that are senior in ranking to common stock and always rank junior to depositors, general creditors and subordinated debt of the bank. *Upper Tier 2* is an indicator variable for exchanged instruments that are undated, permanent, instruments that are subordinated in full to non-subordinated creditors. *Lower Tier 2* is an indicator variable for exchanged instruments that are dated instruments of which the principal is subordinated to non-subordinated creditors. *VIX* is the closing value of the CBOE Volatility Index, standardized to values between 0 and 1, measured at the announcement date. $\textit{Solv}_{\text{Equity}}$ is accounting equity divided by total assets. $\textit{Solv}_{\text{Core Tier 1}}$ is Core Tier 1 capital divided by risk-weighted assets, where Core Tier 1 capital is Tier 1 capital net of hybrid Tier 1 capital instruments. *Size* is the natural log of *total assets* in millions of euros. *EBA Recap* is an indicator for observations of repurchases that took place from September to 7 December 2011. *Mills'* is the inverse Mills ratio. The regression model relies on *p*-values that account for two-dimensional within-cluster correlation (Petersen, 2009).

Dependent variable:	$\sinh^{-1}\pi$								π							
	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*	β	*p*
Tier 1 (+)	1.46	0.00	1.57	0.00	1.31	0.00	1.34	0.00	8.40	0.00	9.78	0.00	8.14	0.00	6.11	0.00
Upper Tier 2 (+)	1.13	0.01	1.33	0.00	1.12	0.01	1.08	0.01	7.63	0.01	10.1	0.00	8.74	0.00	6.73	0.00
Lower Tier 2 (+)	0.88	0.01	0.96	0.00	0.78	0.01	0.65	0.05	3.09	0.08	4.05	0.06	2.92	0.09	0.45	0.37
VIX (+)	2.47	0.00	2.23	0.00	2.15	0.00	1.85	0.00	15.7	0.00	12.9	0.00	12.4	0.00	10.6	0.00
$\textit{Solv}_{\text{Equity}}$ (−)					−10.1	0.00							−63.3	0.01		
$\textit{Solv}_{\text{Core Tier 1}}$ (−)							−11.2	0.00							−33.7	0.03
Size (−)			−0.20	0.00	−0.20	0.00	−0.19	0.01			−2.44	0.00	−2.44	0.00	−1.86	0.00
EBA Recap	−0.65	0.00	−0.40	0.04	−0.51	0.01	−0.19	0.24	−5.81	0.01	−2.83	0.10	−3.48	0.05	−1.15	0.29
Mills'	−0.20	0.15	−0.26	0.07	−0.09	0.30	−0.39	0.01	−3.14	0.09	−3.90	0.03	−2.88	0.06	−2.15	0.04
Intercept	0.00	0.00	3.18	0.00	3.81	0.00	4.66	0.00	1.90	0.00	32.7	0.00	36.6	0.00	30.3	0.00
Prob T1 = UT2		0.30		0.45		0.55		0.41		0.73		0.89		0.78		0.78
$\overline{R}^2$		0.15		0.18		0.21		0.24		0.12		0.19		0.21		0.20
Prob. > *F*		0.00		0.00		0.00		0.00		0.00		0.00		0.00		0.00
# of obs.		593		593		593		493		593		593		593		493

TABLE 10

Target instruments

The table reports results of regression results from European LME data over the period April 2009 to December 2013. The dependent variable denotes the loss-absorbing quality of the repurchased instrument: 4 for Tier 1, 3 for Upper Tier 2, 2 for Lower Tier 2, 1 for Senior unsecured debt.

$$T_{[1..4]} = \beta_0 + \beta_1 Solvency + \beta_2 Discount + \beta_3 VIX + \beta_4 Size + \beta_5 Pay\text{-}out + \beta_6 ROA + \beta_7 GIIPS + \beta_8 EBA\ Recap + \beta_9 Listed + \sum_{n=10}^{11} \beta_n Business\ model + \beta_{12} Mills' + \varepsilon$$

$Solv_{\text{Equity}}$ is accounting equity divided by total assets. *Discount* is 1 minus the pre-announcement price expressed in fraction of the face value of the bought back instrument. *VIX* is the closing value of the CBOE Volatility Index, standardized to values between 0 and 1, measured at the announcement date. *Size* is the natural log of *total assets* in millions of euros. *Pay-out* is dividend as a proportion of net income. *ROA* is net income over total assets. *GIIPS* is an indicator for Liability Management Exercises from Greece, Ireland, Italy, Portugal and Spain. *Listed* indicates whether the bank is listed on a stock exchange. Business model is either "*Retail-funded*" or "*Trading*" based on the average values for gross loans and interbank borrowing. *Pseudo-*R^2 is McFadden's pseudo-R^2. The clustered OLS model relies on p-values that account for two-dimensional within-cluster correlation (Petersen, 2009).

	Clustered OLS				Ordered Probit			
	β	p	β	p	β	p	β	p
$Solv_{\text{Equity}}$ $(-)$	−7.89	0.01	−7.90	0.01	−15.0	0.00	−15.0	0.00
Discount $(+)$	2.10	0.00	2.11	0.00	2.99	0.00	2.99	0.00
VIX $(+)$	0.92	0.02	0.92	0.02	1.01	0.04	1.01	0.04
Size	0.08	0.03	0.08	0.08	0.10	0.05	0.10	0.07
Pay-out	−0.03	0.51	−0.03	0.58	−0.08	0.23	−0.08	0.32
ROA	11.6	0.00	11.6	0.00	18.4	0.01	18.4	0.01
GIIPS	−0.20	0.06	−0.19	0.15	−0.22	0.22	−0.22	0.31
EBA Recap	−0.40	0.15	−0.40	0.15	−0.45	0.22	−0.45	0.23
Listed	−0.10	0.76	−0.09	0.78	−0.12	0.81	−0.13	0.81
Trading	−0.45	0.11	−0.44	0.16	−0.76	0.11	−0.77	0.15
Retail	−0.14	0.64	−0.13	0.78	−0.30	0.54	−0.31	0.66
Mills			0.01	0.97			−0.01	0.98
Intercept	1.66	0.00	1.62	0.14				
Cut 1					−0.77	0.00	−0.80	0.00
Cut 2					1.17	0.00	1.13	0.00
Cut 3					1.59	0.00	1.56	0.00
$\overline{R}^2$, Pseudo-R^2		0.32		0.32		0.18		0.18
Prob. $> F$		0.00		0.00		0.00		0.00
No. of obs.		593		593		593		593

TABLE 11

Cumulative abnormal announcement returns

The table reports cumulative abnormal returns (CAR) around an announcement of a LME as well as OLS results on the determinants of CARs. The sample contains 90 LME announcements over the period April 2009 to December 2013. Abnormal returns for bank i on day t rely on the market model, estimated over days $[-250, -50]$ before the announcement using Datastream data. For the market index we use the EU market index to estimate $AR_{i,t} = R_{i,t} - (\beta_{0,i} + \beta_{1,i} R_M)$, see Benninga (2014); Kothari and Warner (2007) for methodology. $Solv_{\text{Equity}}$ is accounting equity divided by total assets. *Realized loss* is the realized loss scaled by lagged equity: the amount equity holders lost. *ROA* is net income over total assets. *Permanent instrument* is set to one (1) for Tier 1 instruments and Upper Tier 2 instruments. *Size* is the natural log of *total assets* in millions of euros. *Relative offer size* is the amount offered at an announcement day, relative to the log of total assets. *Mills'* is the inverse Mills ratio. The variables are aggregated over the number of instruments that were involved in an LME, for each announcement day. The p-values adjust for clustering of LMEs in event time (announcement date).

	$\text{CAR}_{[-2,10]}$		$\text{CAR}_{[-1,10]}$		$\text{CAR}_{[-2,15]}$	
	μ	p	μ	p	μ	p
Mean values of CAR in %	-1.62	0.01	-2.08	0.00	-1.85	0.02
Determinants of cumulative abnormal returns	β	p	β	p	β	p
$\text{Solv}_{\text{Equity}}$ $(-)$	-1.01	0.03	-0.71	0.06	-0.65	0.07
Realized loss $(-)$	-4.76	0.01	-2.83	0.00	-6.43	0.01
ROA$(+)$	2.57	0.04	2.20	0.01	2.74	0.04
Permanent instrument	0.07	0.03	0.06	0.04	0.08	0.00
Size	-2.62	0.12	-1.36	0.44	-3.57	0.04
Relative offer size	0.02	0.00	0.02	0.10	0.04	0.00
Mills	-0.02	0.78	-0.02	0.73	0.00	0.97
Intercept	0.37	0.17	0.19	0.50	0.43	0.11
Prob $>$ F		0.00		0.00		0.00
$\overline{R}^2$		0.26		0.13		0.34
# of obs.		90		90		90