Journal of Accounting, Auditing & Finance
1–29

DOI: 10.1177/0148558X17748406
journals.sagepub.com/home/JAF
SAGE

# Are Banks' Below Par Own Debt Repurchases a Cause for Prudential Concern?

**Martien Lubberink[1] and Annelies Renders[2]**

**Abstract**

In the lead-up to the implementation of Basel III, European banks repurchased debt securities that traded below par. Banks engaged in these Liability Management Exercises (LMEs) to realize a fair value gain that prudential rules exclude from regulatory capital calculations. The LMEs enabled banks to augment Core Tier 1 capital, given that alternative methods to increase capital ratios were not feasible in practice. Using data of 720 European LMEs conducted between April 2009 and December 2013, we show that poorly capitalized banks repurchased securities and lost about €9.1bn in premiums to compensate their 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, liability management, prudential filters, fair value option, subordinated debt

## Introduction

In the years 2009 to 2013, many European banks repurchased debt that traded below par with the aim 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 below par debt securities to realize the associated unrealized fair value gain.[1] Bank regulation excludes unrealized fair value gains on debt securities arising from a deterioration in a bank's own credit standing from the calculation of regulatory capital. Even if banks wanted to use the fair value option for liabilities, regulation prevented them from doing so for the calculation of capital ratios. Banks thus had an incentive to engage in Liability Management Exercises (LMEs), that is, buybacks of debt securities that trade below par, as it allowed them to turn the unrealized gain into a realized gain that increases regulatory capital. Using data of unprecedented detail, we examine the determinants of 720 European LMEs as well as their effects on solvency and liquidity. We also examine the determinants of the buyback

[1]Victoria University of Wellington, New Zealand
[2]Maastricht University, The Netherlands

**Corresponding Author:**
Martien Lubberink, School of Accounting and Commercial Law, Victoria University of Wellington, P.O. Box 600, Wellington 6140, New Zealand.
Email: martien.lubberink@vuw.ac.nz

premium as a measure of the inefficiency of an LME and the types of instruments that were bought back.

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 rules banks could satisfy an 8% capital requirement with 2% common equity over risk-weighted assets, under Basel III, the Common Equity Tier 1 (CET1) requirement can be as high as 14.5%. Many European banks could not satisfy these higher capital requirements at relatively short notice through conventional methods such as retaining profits, issuing shares, or selling assets with high risk weights: Bank profitability and investors' willingness to buy banks shares have been low since the onset of the global financial crisis and European regulators banned banks from selling assets with high risk weights.

In the absence of alternative viable means to increase capital, many European banks decided to repurchase debt that traded below par. These banks actively managed their liabilities to realize gains on liabilities that originated from a weak credit standing. To illustrate this, assume that a bank faces a deteriorated credit standing. This results in a potential gain on a debt security because increases in credit risk result in decreases in debt value. If the bank values the debt security at amortized cost, a repurchase at the lower market value turns the potential gain into a realized one. If the bank fair values the debt security, the bank will recognize an unrealized fair value gain when its credit standing deteriorates, that is, without having to buy back the security. This unrealized gain increases the bank's equity level and its Core Tier 1 ratio. However, this is where the prudential rules come into play. Banks are subject to a prudential filter that requires them to exclude, from 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 (e.g., see Article 64(4) of European Commission [EC], 2006). But, a bank can circumvent the prudential rules by repurchasing the debt security at the lower market value. This, of course, works well if the debt security is traded below par. The realized fair value gain is then included in the calculation of the Core Tier 1 ratio.

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%. Crédit Agricole's motivation for the LME was to increase its solvency ratio.[2] 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, 2011a, 2011b). This LME would add £153m (€170m) 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%.[3] Offsetting this gain is a reduction of total regulatory capital by £545m (€605m) due to the decrease in Upper Tier 2 capital. In addition, Crédit Agricole paid the debt security holders a cash premium of £114m (20% of £545m). If banks were free to recognize gains on liabilities, the total unrealized fair value 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 and a reduction in cash.

Most of the LMEs involve hybrid debt instruments that count toward a bank's regulatory capital.[4] Buying these instruments back is subject to rules, with particularly strict rules applying to debt capital instruments of the highest prudential quality, that is, the most loss-absorbing capital instruments. 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: It 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. As a consequence, buying back these instruments will result in the highest realized gains but will also lead to a decrease in total regulatory capital and loss-absorbing capacity, as well as a reduction of liquidity.

The Crédit Agricole example shows that the prevailing market conditions in combination with regulatory preferences that excluded unrealized fair value gains and losses arising from changes in own credit standing from the calculation of regulatory capital resulted in significant unintended consequences: In exchange for a modest increase in the Core Tier 1 capital ratio, Crédit Agricole 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 are in the interest of a safe and sound banking system.

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. The requirement to exclude 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.

This article analyzes 720 LMEs of banks from 16 European countries from April 2009 to December 2013. 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. Our results show that repurchasing below par debt securities comes at a cost: To compensate the debt holder for parting from his security, the 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 (Admati, DeMarzo, Hellwig, & Pfleiderer, 2017). Given that the buyback reduces the bank's default probability, the value of debt increases, leading to positive buyback premiums. The larger the buyback premium, the smaller the realized gain and the more cash the bank needs to spend on buying back the debt security.

With sparse literature on bank LMEs, we present extensive descriptive evidence on which banks engaged in LMEs as well as on the cost and inefficiency of these LMEs. We then analyze the determinants of an LME. The results show that the likelihood of an LME increases with 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 payout ratio. An examination of the buy back premium confirms that it increases with the loss-absorbing capacity of capital instruments, economy-wide financial stress, and leverage. The premium decreases with bank size. Last, we document a negative relation between bank solvency and the probability to buy back the most loss-absorbing instruments. Banks also repurchase these instruments more often in times of economic stress.

Our evidence shows that as a consequence of the interplay between prudential rules and a context where banks have limited alternative opportunities to increase capital, mainly less resilient banks engaged in LMEs, during times of economic stress. In addition, banks bought back the most loss-absorbing capital securities, which were meant to contribute the most to the safety and soundness of the banking system. The LMEs also resulted in a loss of liquidity and a reduction in total regulatory capital. In summary, our results show that

banning banks from recognizing 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.

Our article 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 instruments (Barth, Gómez-Biscarri, Kasznik, & López-Espinosa, 2017; Chircop & Novotny-Farkas, 2016; Dong & Zhang, in press). Recent literature recognizes prudential filters as an area of future research (Basel Committee on Banking Supervision [BCBS], 2015; Beatty & Liao, 2014), 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 (International Financial Reporting Standards) in 2005 (EC, 2005). Although there is ample literature on the *level* of regulatory bank capital (Admati, DeMarzo, Hellwig, & Pfleiderer, 2016; Berger & Bouwman, 2013; DeAngelo & Stulz, 2015; Firestone, Lorenc, & Ranish, 2017), articles like ours, that examine the *structure* of regulatory bank capital, are sparse. We also contribute to the literature on fair-valued liabilities: While Barth, Hodder, & Stubben (2008) show that gains on liabilities due to a weaker credit standing are more than offset by depressed asset values, we show that excluding these gains from bank capital does not prevent banks from finding (costly) ways to add these gains to Core Tier 1 capital. We thus highlight an unintended consequence of policies that aim to ban gains that some designate as counterintuitive (European Central Bank [ECB], 2001). Last, we contribute to the understanding of the interaction between the *structure* and the *level* of bank capital. Our article lends support to Sommer's (2014) criticism on the narrow focus on equity of some academics. Our results reveal that even without conversion, write-down, or transaction, banks hold more equity ''than we thought they did'' (Sommer, 2014, p. 28), which for our study refers to the unrealized gains associated with instruments that trade below par.

## Literature, Regulation, and Predictions

The literature on LMEs and similar transactions is sparse. Early studies focus on earnings management as a motive for these transactions but fail to find conclusive results (Hand, Hughes, & Sefcik, 1990; Johnson, Pari, & Rosenthal, 1989). Mann & Powers (2007) examine tender offers from U.S. corporates and show that these offers are more prevalent when yields are low, a result that is likely driven by firms that desire to lock in favorable rates. These, and other prior studies (e.g., De Jong, Roosenboom, & Schramade, 2009) may have been affected by relatively small samples, often drawn from heterogeneous industries over different business cycles. Consequently, these studies present ambiguous results and fail to identify a clear motive to execute LMEs or similar transactions.

### *Regulation*

*The accounting rules and the prudential filter.* 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 (International Accounting Standard [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.'' Banks can apply the fair value option, but the conditions for its use are restrictive. European bank capital rules reinforce these conditions by way of a prudential filter that excludes from the calculation of capital ratios any unrealized gains or losses on own liabilities valued at fair value that are due to changes in a banks' own credit standing (EC, 2006).

In 2006, the Basel committee adopted the IAS 39 conditions for the use of the fair value option, as well as the prudential filter that excludes gains and losses from changes in own credit risk as a result of applying the fair value option to financial liabilities. The committee did so because of the concern that, if a bank applies the option to its own debt, ''it will recognize 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 European Banking Authority (EBA) supports this cautionary stance on the recognition of unrealized gains in their advice to the EC on unrealized gains (EBA, 2013a).

*European Union (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). In accordance with Basel rules at the time, the CRD required that 8% of risk-weighted assets are backed by capital to absorb losses (EC, 2006). The CRD allowed banks to structure regulatory capital to minimize the use of equity. Banks could satisfy the 8% total capital requirement with minimal amounts of common equity capital. Tier 1 requirements could be met with hybrid capital, such as preferred shares and subordinated perpetual or permanent instruments. Tier 2 (debt) capital could be used to satisfy half of the total capital requirement. Table 1 gives an overview of capital requirements and the loss-absorbing capacity of capital instruments.

*The quality and quantity of capital.* As a response to the global financial crisis and the G20 of April 2009, the publication of Basel III in December 2010 presented a new definition of capital (BCBS, 2010; G20, 2009). Basel III emphasizes the importance of CET1. This is capital of the highest quality: common equity capital after the deduction of specific items, such as goodwill and holdings in financial companies. Compared with Basel II, Basel III applies an increased number of deductions to capital and applies these deductions to equity (a subset of Tier 1 capital), whereas Basel II applied the deductions to total regulatory capital. These regulatory developments significantly increased the demand for equity capital.

Regarding the quantity of capital, Basel III requires banks to hold at least 4.5% of CET1 over risk-weighted assets (RWA) plus 2.5% CET1 in a capital conservation buffer. On top of these requirements are a 2.5% countercyclical buffer and a 1% to 5% capital surcharge for systematically important banks. The total CET1 requirement can thus stack up to 14.5% under the EU's implementation of Basel III, the Capital Requirements Regulation (CRR; EC, 2013).

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 & 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 amount of an instrument involved in a single LME.

Pressure to satisfy the augmented capital requirements originated from regulators. For example, for the 2011 stress test, the EBA set a Core Tier 1 requirement of 5% of RWA.

**Table 1.** Regulatory Capital and Loss-Absorbing Capacity.

| Basel II and CRD | Item | Maturity | ⇓ Less loss-absorbing | Remarks | Requirement | ⇑ Subordination |
|---|---|---|---|---|---|---|
| Capital of highest quality (book equity after deductions) | Core Tier 1 | Cannot be repaid outside liquidation. | | Tier 1 + Tier 2 ≥ 8% of RWA | > of Tier 1[a] | |
| Hybrid instruments[b,c] | Tier 1 hybrids | Permanent, perpetual. | | Coupon and instrument should absorb losses in going concern | ≤½ of Tier 1[a] | |
| Subordinated debt instruments[b,c] | Upper Tier 2 | Permanent, no maturity. | | | Tier 2 ≤ Tier 1 | |
| Subordinated deb instruments[b] | Lower Tier 2 | Maturity ≥5 years and a 5-year gradual capital derecognition period. | | Coupon and instrument should absorb losses in going concern | ≤½ of Tier 1 | |
| Senior unsecured debt | | | | Buyback without permission | | |
| **Basel III and CRR** | **Item** | **Maturity** | **⇓ Less loss-absorbing** | **Remarks** | **Requirement** | **⇑ Subordination** |
| Capital of highest quality | CET1 | Cannot be repaid outside liquidation. | | | 4.5% + buffers up to 10% of RWA | |
| Hybrid instruments[b,d] | AT1 | Permanent, perpetual, preferential. | | Subordinated to Tier 2; coupon may be cancelled | ≥1.5% of RWA | |
| Subordinated debt instruments[b,d] | Tier 2 | Maturity ≥5 years and then a 5-year linear capital derecognition period. | | | ≥2% of RWA | |
| Senior unsecured debt | | | | Buyback without permission | | |

*Note*. 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, 2013). CRD is the Capital Requirements Directive. CRR (the Capital Requirements Regulation, 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 nonsubordinated creditors. Lower Tier 2 instruments are dated instruments of which the principal is subordinated to nonsubordinated creditors. Tier 2 (Basel III) instruments are subordinated to depositors and general creditors of the bank. *RWA* is risk-weighted assets, now RWE or risk-weighted exposures. CET1 is Common Equity Tier 1; AT1 is Additional Tier 1.

[a]Before CRD changed in 2011, the directive had no requirement regarding the amount of common equity nor had it a definition of common equity.

[b]These instruments are callable at the initiative of the issuer after a minimum of 5 years. Buybacks generally need supervisory approval, but CRD rules for Lower Tier 2 instruments are ambiguous (EC, 2006).

[c]Calls are generally allowed if the bank replaces the instrument with an instrument of at least the same quality *or* if the financial and solvency conditions of the institution are not (unduly) affected (EC, 2006). The last requirement sets a low bar, as it should not lead a bank to breach minimum capital requirements.

[d]Under Basel III rules and under the European Union 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.

After this stress test, the EBA rapidly raised expectations by setting that ratio to 9% for the 2012 EBA recapitalization exercise (EBA, 2012). For the 2014 EU-wide stress test, the benchmark was even set at 8% CET1 using the tighter Basel III definition of capital (ECB, 2013).

*The motivation to execute LMEs.* European banks could not easily satisfy these augmented capital requirements at relatively short notice through conventional methods. Issuing shares, for example, was not practically possible for cooperatives and 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 (Lintner, 1956). Moreover, retaining profits is only meaningful for profitable banks, but profitable banks were often less pressed to meet the increased 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 (SMEs), European regulators actively discouraged banks from derisking as this would reduce lending to SMEs (EBA, 2011, 2013b) These limitations led banks to increase capital through the execution of LMEs.

*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 canceling coupon payments on Tier 1 and Upper Tier 2 instruments.

The loss-absorbing capacity of capital instruments increases with maturity.[5] However, bank regulation governing the maturity of capital instruments is ambiguous. To ensure that regulatory capital instruments are permanently available to absorb losses, they should be perpetual and not callable. However, in practice, European banks in particular ignore this notion of permanence. They redeem capital instruments at the first possible call date. Such premature redemptions are at odds with the notion of permanence, but they are perfectly legal: Bank regulation allows banks to call, repurchase, or redeem capital instruments after 5 years, see Table 1.

Tier 1 and Upper Tier 2 instruments can generally be called if the bank replaces the instrument with an instrument of at least the same quality *or* if the solvency of the credit institution in question is not (unduly) affected. In practice, the last requirement sets a low bar. The redemption should not lead a bank to breach minimum capital requirements and most banks operated above these requirements. However, buybacks of regulatory capital require supervisory approval, which creates some uncertainty. Not all supervisors grant permission equally swiftly and the rules on supervisory approval are ambiguous, although generally stricter for Tier 1 and Upper Tier 2 than for Lower Tier 2 capital.

## *Predictions*

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.

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 & Rogoff (1988) and Admati et al. (2017) predict that an investor will only participate in a buyback transaction if he receives a premium that increases the price to the value *after* the buyback. This also implies a positive relation between the buyback premium and leverage, which is confirmed by Merton (1974). We therefore expect that less resilient banks pay higher premiums to make investors part from their instruments.

Following the discussion on regulation in the previous section, we also expect banks to predominantly focus their LME efforts on debt instruments that count toward 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 therefore contributes 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 for less than 5 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. (2017) and Sommer (2014) offer theoretical support for the idea that banks prefer to buy back the most junior instruments.

## 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 (a) EU prudential rules require the exclusion of unrealized fair value gains or losses from changes in own credit standing for capital instruments, (b) the availability of data: European banks engaged in LMEs much more often than U.S. banks,[6] and (c) the quality of the data, as European LME transactions are all corroborated by the Debt Capital Market desks of three investment banks.

We analyzed the summary motivations provided by the investment banks 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 more 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 are therefore confident that increasing Core Tier 1 was the primary motivation to engage in LMEs.[7]

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 noncapital 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. Moreover, they are similar in that they absorb losses when a bank becomes nonviable (Sommer, 2014).

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. Most banks that executed LMEs bought back more than one instrument (57 out of 69 banks). Our 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.[8] Most buybacks involved Tier 1 and Lower Tier 2 instruments, which partly reflects the use of these instruments by banks.[9]

## *Sample Coverage*

We rely on both 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 €30.6tn, 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 cover, we rely on data from the EBA stress tests, the EBA recapitalization exercise, and ECB data of the 2014 asset quality review. Hand-collected data complements 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 generalizability, given that EBA bank data cover more than 70% of the EU bank assets.[10]

Panel E of Table 2 shows that participation in LMEs differs across countries. For Denmark, for example, the sample has observations from 25 banks, of which one engaged in an LME, in 2011. Spain, on the other hand, reports 10 LMEs in 2012, whereas the number of sample banks is comparable with that of Denmark. The sample also reflects differences in market structures across Europe—with Denmark, France, Italy, Germany, and

**Table 2.** Sample Coverage.

Panel A: Bank Level.

| | Banks |
|---|---|
| Total | 167 |
| Banks executing an LME during 2009-2013 | 69 |
| 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 |

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 (€tn).

| | 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 |

*(continued)*

**Table 2.** (continued)

Panel E: Bank-Years With, Without LMEs.

| | 2013 | | 2012 | | 2011 | | 2010 | | 2009 | |
|---|---|---|---|---|---|---|---|---|---|---|
| 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 |

*Note.* 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 (Liability Management Exercises) during the sample period and those that did not execute an LME during the sample period. Panel B focuses on bank-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 with the total assets of consolidated banking data reported by the European Central Bank, ECB. Panel E reports bank-years with complete accounting information. Of the column pairs, the left-hand number shows bank-years in which a bank did execute an LME; the right-hand number shows sample bank-years without an LME.

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.

### *Announcement Data*

Banks announce an LME via a press release. We use the announcement to retrieve the preannouncement price. After completion of the LME, a bank publishes details for each instrument involved: the exchange price, notional offered amount, and notional accepted amount. We use this information and the information from the announcement to calculate for each instrument included in the LME the buyback premium as well as the realized fair value gain which increases the Core Tier 1 capital ratio. This realized gain is the difference between the nominal value of the underlying exchanged instrument and the paid amount, summed over the instruments involved in an LME.

We measure the cost of the LME by calculating the difference between the potential fair value gain that a bank could realize, based on the preannouncement price of the nominal underlying exchanged instruments and the actual gain that the bank realized. This cost is equal to the buyback premium multiplied with 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.

## Research Design and Results

### *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. Panel A shows that banks that engaged in LMEs score poorly on many dimensions: Profitability, solvency, regulatory capital ratios, liquidity (cash), and asset quality are much lower compared with non-LME banks. Untabulated results show that the relative shortfall of cash does not change for bank-years

**Table 3.** Characteristics of Sample Banks 2009-2013.

Panel A: Ever and Never LMEs.

| Ever LME (number of observations = 330) | Means | *p* (diff) | p1 | p5 | p25 | p50 | p75 | p95 | p99 |
|---|---|---|---|---|---|---|---|---|---|
| *Net income* (€m) | −92.2 | .01 | −10,811 | −4,211 | −461 | 82.0 | 640 | 3,590 | 6,271 |
| *ROA* (%) | −0.53 | .00 | −11.0 | −4.22 | −0.47 | 0.15 | 0.35 | 0.83 | 2.99 |
| *Solvency* (%) | 5.30 | .00 | 0.00 | 0.80 | 3.50 | 5.10 | 6.50 | 10.1 | 17.0 |
| *Tier 1 ratio* (% of *RWA*) | 10.3 | .00 | 0.00 | 6.65 | 8.30 | 10.1 | 12.5 | 15.5 | 18.3 |
| *AQ* (%) | 1.58 | .08 | 0.00 | 0.12 | 0.45 | 0.95 | 1.67 | 4.90 | 11.5 |
| *Cash* | 0.04 | .09 | −1.94 | −1.52 | −0.65 | −0.04 | 0.70 | 1.74 | 2.23 |
| *Density* $\left(\frac{RWA}{TA}\right)$ (%) | 49.7 | .04 | 19.7 | 23.7 | 33.5 | 49.5 | 61.2 | 82.7 | 91.3 |
| *Beta* | 0.98 | .00 | 0.24 | 0.33 | 0.76 | 0.92 | 1.25 | 1.55 | 1.90 |
| *Market to book* | 0.64 | .11 | 0.00 | 0.16 | 0.38 | 0.61 | 0.85 | 1.31 | 2.31 |
| *BIS ratio* (%) | 12.8 | .00 | 0.20 | 9.32 | 11.0 | 12.8 | 14.4 | 17.1 | 19.0 |
| *Equity* (€m) | 14,760 | .00 | −2,463 | 320 | 1,748 | 5,971 | 17,440 | 66,308 | 85,886 |
| *Total assets* (€m) | 325,947 | .00 | 2,677 | 10,499 | 42,147 | 110,742 | 399,220 | 1,550,903 | 1,899,419 |
| Never LME (number of observations = 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 |
| *Cash* | 0.17 | | −2.10 | −1.65 | −0.55 | 0.11 | 0.92 | 2.03 | 3.89 |
| *Density* $\left(\frac{RWA}{TA}\right)$ (%) | 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 |
| *Market to book* | 0.71 | | 0.00 | 0.04 | 0.14 | 0.54 | 0.95 | 2.13 | 3.43 |
| *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 |
| All (number of observations = 787) | Means | | p1 | p5 | p25 | p50 | p75 | p95 | p99 |
| *VIX* | 19.1 | | 13.1 | 13.3 | 14.9 | 16.7 | 21.1 | 33.5 | 36.3 |

(*continued*)

**Table 3.** (continued)

| Panel B: LME and Non-LME Bank-Year. | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| LME bank-year (number of observations = 121). | Means | *p* (diff) | p1 | p5 | p25 | p50 | p75 | p95 | p99 |
| Payout (previous year) (%) | 44.9 | .00 | 0.00 | 0.00 | 16.1 | 46.7 | 64.9 | 100 | 100 |
| Payout (current year) (%) | 39.4 | .00 | 0.00 | 0.00 | 0.00 | 37.8 | 67.9 | 100 | 100 |
| Non-LME bank-year (number of observations = 666) | Means | | p1 | p5 | p25 | p50 | p75 | p95 | p99 |
| Payout (previous year) (%) | 25.9 | | 0.00 | 0.00 | 0.00 | 25.1 | 41.4 | 68.8 | 97 |
| Payout (current year) (%) | 23.5 | | 0.00 | 0.00 | 0.00 | 23.5 | 36.8 | 65.9 | 97 |

Note. The table reports descriptive statistics, separately for European banks that did (and did not) engage in LMEs, over the period April 2009 to December 2013. *Ever LME (Never LME)* denotes banks that did (did not) engage in LMEs (Liability Management Exercises). 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. RWA is risk-weighted assets. *AQ* is the asset quality of the bank, measured as the loan loss provision over the amount of net loans. *Cash* is net cash over Total assets, standardized. *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 European Union market index. *Market to book* is the lagged ratio of the bank's market value over the value of book equity. *BIS ratio (%)* is the Bank of International Settlements (BIS) capital ratio. *Equity* is common shareholders' equity. *Total assets* is the book value of total assets. *Payout* is the dividend payout ratio. *VIX* is the closing value of the Chicago Board Options Exchange (CBOE) Volatility Index.

with LMEs. Density, measured by the ratio of RWA over total assets, and beta are also high for banks executing an LME—that is, LME banks appear to display a relatively high risk appetite, which the low market-to-book ratios confirm. The banks that did not engage in LMEs are relatively small compared with 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 involve 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 (see footnote 9). 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 payout statistics of 121 bank-year observations with and 666 bank-year observations without LMEs. Banks that engaged in LMEs have higher payout ratios than non-LME banks in the year before the LME (44.9% vs. 25.9%) and in the year of the LME (39.4% vs. 23.5%). There is a drop in payout ratio after an LME, from 44.9% to 39.4%. However, this drop is insignificant (untabulated $p$ value of .37). This suggests that banks generally avoid cutting dividends.

## The Buyback Premium

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. The mean premium is relatively high when compared with 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 & 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 leveraged 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.

The discount at which the instruments taking part in a LME trade is considerable—on average about a quarter of the nominal value with an interquartile range of two thirds of that value. 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 RWA), although the average actual, or realized, gain is significantly lower: 14.3 bp of total assets (21.8 bp of RWA). 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 reveals their cost. Although these costs are limited in comparison with total assets (5.66 bp on average), their effect on equity is substantial: The mean (median) cost of a LME on equity holders is 115 bp (48.9 bp). Their effect at the 99th percentile is 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 nonregulatory instruments (2.48%). The differences in the premiums between regulatory classifications

**Table 4.** European LMEs 2009-2013.

Panel A: Descriptives of Buyback Premiums (Number of Transactions = 720) and Annual Gains and Costs (Number of Bank-Years: 121).

| | *Ms* | *p* value | p1 | p5 | p25 | p50 | p75 | p95 | p99 |
|---|---|---|---|---|---|---|---|---|---|
| *Buyback premium* ($\pi$ in %) | 8.22 | .00 | −1.39 | −0.57 | 2.29 | 5.06 | 10.3 | 29.2 | 65.9 |
| *Potential gain* (in bp of assets) | 20.0 | .00 | 0.20 | 0.45 | 2.44 | 7.73 | 19.5 | 69.5 | 248 |
| *Actual gain* (in bp of assets) | 14.3 | .00 | 0.00 | 0.00 | 1.15 | 4.81 | 14.1 | 45.8 | 203 |
| *Cost* (in bp of assets) | 5.66 | .00 | −0.34 | 0.03 | 0.51 | 1.97 | 4.85 | 26.9 | 49.6 |
| *Potential gain* (in bp of *RWA*) | 29.2 | .00 | 0.03 | 0.53 | 4.50 | 16.0 | 33.7 | 107 | 334 |
| *Actual gain* (in bp of *RWA*) | 21.8 | .00 | −0.03 | 0.00 | 2.17 | 9.33 | 20.8 | 64.4 | 327 |
| *Cost* (in bp of *RWA*) | 7.35 | .00 | −0.64 | 0.05 | 1.11 | 3.70 | 8.20 | 31.0 | 52.8 |
| *Potential gain* (in bp of equity) | 505 | .00 | 0.46 | 6.20 | 40.2 | 148 | 395 | 1,816 | 9,747 |
| *Actual gain* (in bp of equity) | 390 | .00 | −0.49 | 0.00 | 19.5 | 97.4 | 279 | 1,288 | 9,548 |
| *Cost* (in bp of equity) | 115 | .00 | −17.2 | 0.14 | 11.8 | 48.9 | 93.6 | 528 | 1,355 |
| *Discount* | 0.28 | .00 | −0.03 | −0.00 | 0.07 | 0.26 | 0.48 | 0.70 | 0.78 |

Panel B: Characteristics of LME Transactions (Number of Transactions = 720).

| Eligibility | Premium ($\pi$) in % of nominal | *p* (diff) (*p* value) | Offered (€m) | Mean potential gain (%) | Inefficiency (%) $= \frac{Premium}{Potential\ gain}$ |
|---|---|---|---|---|---|
| *Tier 1* | 11.32 | .19 | 373 | 44.9 | 25.2 |
| *Upper Tier 2* | 9.87 | .00 | 301 | 41.8 | 23.6 |
| *Lower Tier 2* | 5.59 | .02 | 366 | 28.0 | 20.0 |
| *Unsecured debt* | 2.48 | | 762 | 17.3 | 14.3 |
| Means | 8.22 | (.00) | 383 | 35.8 | 23.0 |

| Eligibility | *ΔReg. cap.* Exchanged (€m) | Success rate (%) | Number of 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 |

*Note.* The table shows descriptive statistics of 720 European LMEs (Liability Management Exercises) over the period April 2009 to December 2013, involving 121 bank-years. *Ms* denotes mean values. p1, p5, p25, p50, p75, p95, and p99 indicate percentile values for percentiles 1, 5, 25, 75, 95, and 99 and the median (p50). $\pi$ 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 preannouncement price of the nominal amount exchanged. *Actual gain* is the pretax 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. *Discount* is 1 minus the preannouncement price expressed as a fraction of the face value of the bought-back instrument: $1 - P_A$. 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 LME. *Inefficiency* is the ratio of *premium* over *potential gain. Exchanged* is the mean nominal underlying the bank bought back in the LME. *ΔReg. 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. *Number of Instruments* is the number of instruments exchanged.

are also significantly different from zero, except for the difference in the premiums paid for Tier 1 and Upper Tier 2 instruments ($p$ value = .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 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 transferred 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. This column shows that LMEs that involve the most loss-absorbing instruments are the least cash conserving: about a quarter of the potential 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 gain of the LMEs reaches a total of €41.6bn.

Panel A of Table 5 also shows that the actual, or realized, gains on LMEs are significantly lower than the potential gains. The difference is €9.1bn, which is about 22% of the potential gain. 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 2 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.

Last, 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 United Kingdom were particularly active regarding LMEs. The countries with the lowest efficiency were Portugal and Spain, with Spanish banks transferring 48.2% of the potential 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.

## *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:

**Table 5.** European LMEs, Years, Countries.

Panel A: Gains and Losses Per Year (Amounts in €m).

| Year | π (%) | Potential gain | Actual gain | Cost | Inefficiency (%) | Offered | −ΔReg. 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 | −ΔReg. 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 |

*Note.* The table shows amounts involved in European LMEs (Liability Management Exercises) 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 gain that a bank could realize in a LME, based on the preannouncement price of the nominal amount exchanged, pretax. The *Actual gain* is the pretax 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 €. *−ΔReg. cap.* is the negative change in total regulatory capital resulting from the LME. *Bank-years* is the number of sample bank-year observations.

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

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 ($Solv_{Tier\ 1}$) or accounting equity divided by total assets ($Solv_{Equity}$). *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 payout 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 nonequity capital instrument holders a preferential treatment over equity holders. To prevent unequal treatment of investors, debt contracts often contain clauses that align the payment of dividends and coupons. 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. Last, 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, & Tsatsaronis (2014), who classify European banks into distinct business models. We use separate indicators for retail-funded and trading banks.

Table 6 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. 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 .00. The likelihood of an LME thus increases as banks' solvency decreases. The coefficient on *Size* is positive and significant. The coefficient on *Pay-out* is positive, and the coefficient on *ROA* is 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 6 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 gain on a debt instrument incentivizes banks to buy them back, but is 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 are in a better position to manage the instruments that they choose to issue

**Table 6.** LME Model (First Stage).

| | β | *p* | β | *p* |
|---|---|---|---|---|
| $Solv_{Equity}$ (−) | –5.55 | .00 | | |
| $Solv_{Tier\ 1}$ (−) | | | −6.88 | .00 |
| *Size* (+) | 0.25 | .00 | 0.28 | .00 |
| *Payout* (+) | 0.17 | .00 | 0.19 | .00 |
| *ROA* (−) | −0.21 | .24 | −0.19 | .24 |
| *GIIPS* (+) | 0.73 | .00 | 0.62 | .00 |
| *Listed* | 1.31 | .00 | 1.25 | .00 |
| *Trading* | 2.99 | .00 | 3.08 | .00 |
| *Retail* | 2.92 | .00 | 3.07 | .00 |
| *Intercept* | −5.15 | .00 | −5.03 | .00 |
| *Pseudo* $R^2$ | | .39 | | .38 |
| Wald $\chi^2$ | | 111 | | 138 |
| Probability $>\chi^2$ | | .00 | | .00 |
| Correctly classified (%) | | 89.0 | | 87.3 |
| Number of observations | | 762 | | 645 |

*Note.* 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 an LME (Liability Management Exercise) during a fiscal year, else the dependent variable is 0.

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

$Solv_{Equity}$ is accounting equity divided by total assets. $Solv_{Tier\ 1}$ is Tier 1 capital divided by risk-weighted assets. *Size* is the natural log of *total assets* in millions of euros. *Payout* 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. *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).

and later buy back, for example, larger banks may obtain permission more quickly than smaller banks. 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.[11]

## *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:

$$\pi = P_X - P_A, \tag{2}$$

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 preannouncement 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 gain that the bank loses in an LME.

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

$$\pi = \beta_0 + \beta_1 Tier\ 1 + \beta_2 Upper\ Tier\ 2 + \beta_3 Lower\ Tier\ 2 + \beta_4 VIX + \beta_5 Solvency + \beta_6 Size + \beta_7 EBA Recap + \beta_8 Mills' + \varepsilon, \quad (3)$$

where $\pi$ 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 toward Tier 1 capital, and 0 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. We expect the coefficient for *Solvency* to be negative.

Given that this analysis uses intrayear data, we now include in Equation 3 the closing value of the Chicago Board Options Exchange (CBOE) Volatility Index (*VIX*), standardized to values between 0 and 1, as well as the EBA recapitalization exercise. We expect the *VIX* to be positively associated with the buyback premium, given that worse financial conditions are associated with higher correlations, higher volatilities, and higher spreads (Opschoor, van Dijk, & 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, 2011). 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. However, 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. We expect to find a negative coefficient for the size of banks. Last, we include the inverse Mills ratio, obtained from the results of the LME model, to control for selection bias.

Table 7 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 .00. As

**Table 7.** Premium Model (Second Stage).

| Dependent variable | $sinh^{-1}\pi$ | | | | | | | | $\pi$ | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* | β | *p* |
| *Tier 1* (+) | 1.46 | .00 | 1.57 | .00 | 1.31 | .00 | 1.34 | .00 | 8.40 | .00 | 9.78 | .00 | 8.14 | .00 | 6.11 | .00 |
| *Upper Tier 2* (+) | 1.13 | .01 | 1.33 | .00 | 1.12 | .01 | 1.08 | .01 | 7.63 | .01 | 10.1 | .00 | 8.74 | .00 | 6.73 | .00 |
| *Lower Tier 2* (+) | 0.88 | .01 | 0.96 | .00 | 0.78 | .01 | 0.65 | .05 | 3.09 | .08 | 4.05 | .06 | 2.92 | .09 | 0.45 | .37 |
| *VIX* (+) | 2.47 | .00 | 2.23 | .00 | 2.15 | .00 | 1.85 | .00 | 15.7 | .00 | 12.9 | .00 | 12.4 | .00 | 10.6 | .00 |
| $Solv_{Equity}$ (−) | | | | | −10.1 | .00 | | | | | | | −63.3 | .01 | | |
| $Solv_{Core\ Tier\ 1}$ (−) | | | | | | | −11.2 | .00 | | | | | | | −33.7 | .03 |
| *Size* (−) | | | −0.20 | .00 | −0.20 | .00 | −0.19 | .01 | | | −2.44 | .00 | −2.44 | .00 | −1.86 | .00 |
| *EBA Recap* | −0.65 | .00 | −0.40 | .04 | −0.51 | .01 | −0.19 | .24 | −5.81 | .01 | −2.83 | .10 | −3.48 | .05 | −1.15 | .29 |
| *Mills'* | −0.20 | .15 | −0.26 | .07 | −0.09 | .30 | −0.39 | .01 | −3.14 | .09 | −3.90 | .03 | −2.88 | .06 | −2.15 | .04 |
| *Intercept* | 0.00 | .00 | 3.18 | .00 | 3.81 | .00 | 4.66 | .00 | 1.90 | .00 | 32.7 | .00 | 36.6 | .00 | 30.3 | .00 |
| *Probability* T1 = UT2 | | .30 | | .45 | | .55 | | .41 | | .73 | | .89 | | .78 | | .78 |
| $\bar{R}^2$ | | .15 | | .18 | | .21 | | .24 | | .12 | | .19 | | .21 | | .20 |
| Probability $>F$ | | .00 | | .00 | | .00 | | .00 | | .00 | | .00 | | .00 | | .00 |
| Number of observations | | 593 | | 593 | | 593 | | 493 | | 593 | | 593 | | 593 | | 493 |

*Note*. The table reports results of regressions that rely on European Liability Management Exercises over the period April 2009 to December 2013.

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

For each individual bought-back instrument, the dependent variable ($\pi$) is either the buyback premium, namely, the difference between the exchange price and its price 3 days before announcement, expressed in percent of the nominal underlying value of the instrument, or the inverse hyperbolic sine of the premium: $sinh^{-1}\pi$ or $ln\left(\pi + \sqrt{1+\pi^2}\right)$. 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 nonsubordinated creditors. *Lower Tier 2* is an indicator variable for exchanged instruments that are dated instruments of which the principal is subordinated to nonsubordinated creditors. *VIX* is the closing value of the CBOE Volatility Index, standardized to values between 0 and 1, measured at the announcement date $Solv_{Equity}$ is accounting equity divided by total assets. $Solv_{Core\ Tier\ 1}$ 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).

**Table 8.** Target Instruments.

| | Clustered OLS | | | | Ordered probit | | | |
|---|---|---|---|---|---|---|---|---|
| | β | *p* | β | *p* | β | *p* | β | *p* |
| $Solv_{Equity}$ (−) | −7.89 | .01 | −7.90 | .01 | −15.0 | .00 | −15.0 | .00 |
| *Discount* (+) | 2.10 | .00 | 2.11 | .00 | 2.99 | .00 | 2.99 | .00 |
| *VIX* (+) | 0.92 | .02 | 0.92 | .02 | 1.01 | .04 | 1.01 | .04 |
| *Size* | 0.08 | .03 | 0.08 | .08 | 0.10 | .05 | 0.10 | .07 |
| *Pay-out* | −0.03 | .51 | −0.03 | .58 | −0.08 | .23 | −0.08 | .32 |
| *ROA* | 11.6 | .00 | 11.6 | .00 | 18.4 | .01 | 18.4 | .01 |
| *GIIPS* | −0.20 | .06 | −0.19 | .15 | −0.22 | .22 | −0.22 | .31 |
| *EBA Recap* | −0.40 | .15 | −0.40 | .15 | −0.45 | .22 | −0.45 | .23 |
| *Listed* | −0.10 | .76 | −0.09 | .78 | −0.12 | .81 | −0.13 | .81 |
| *Trading* | −0.45 | .11 | −0.44 | .16 | −0.76 | .11 | −0.77 | .15 |
| *Retail* | −0.14 | .64 | −0.13 | .78 | −0.30 | .54 | −0.31 | .66 |
| *Mills'* | | | 0.01 | .97 | | | −0.01 | .98 |
| *Intercept* | 1.66 | .00 | 1.62 | .14 | | | | |
| Cut 1 | | | | | −0.77 | .00 | −0.80 | .00 |
| Cut 2 | | | | | 1.17 | .00 | 1.13 | .00 |
| Cut 3 | | | | | 1.59 | .00 | 1.56 | .00 |
| $\bar{R}^2$, *Pseudo* $R^2$ | | .32 | | .32 | | .18 | | .18 |
| Probability $>F$ | | .00 | | .00 | | .00 | | .00 |
| Number of observations | | 593 | | 593 | | 593 | | 593 |

*Note.* The table reports results of regression results from European LME (Liability Management Exercise) 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.

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

$Solv_{Equity}$ is accounting equity divided by total assets. *Discount* is 1 minus the preannouncement price expressed as a fraction of the face value of the bought-back instrument: $1-P_A$. *VIX* is the closing value of the Chicago Board Options Exchange (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 LMEs from Greece, Ireland, Italy, Portugal, and Spain. *EBA Recap* is an indicator for observations of repurchases that took place from September to 7 December 2011. *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 ordinary least squares (OLS) model relies on *p* values that account for two-dimensional within-cluster correlation (Petersen, 2009).

expected, the coefficient on *VIX* is positive and significant (2.47, *p* value of .00). The coefficients on the two solvency variables are negative and significant: −10.1 ($p = .00$) for the coefficient on accounting solvency and −11.2 ($p = .00$) 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. Last, 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.

Moving to the last four columns, these present the coefficients of a linear regression model with the buyback premium ($\pi$) as dependent variable. These coefficients facilitate an assessment of the economic significance of the results. For example, the coefficient values on Tier 1 show that these instruments require a 6% to 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 7 confirm our expectations that the buyback premiums paid in LMEs (a) increase with the loss-absorbing capacity of bought-back instruments, (b) increase with economy-wide financial stress measured by the *VIX*, (c) decrease with solvency, and (d) decrease with bank size. These results reveal unintended consequences of the requirement to exclude unrealized fair value gains on debt instruments that are due to a change in credit standing from regulatory capital. The results on *VIX* show that supervisors' decisions to require banks to recapitalize in times of economic stress may have unintended consequences. However, the results on the EBA recapitalization exercise show that a coordinated recapitalization exercise may mitigate the adverse effects of LMEs.

## *Determinants of Instruments That Banks Target*

To investigate whether banks use their discretion to target specific instruments, we run an ordered probit model at instrument level:

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

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 debt. *Discount* is 1 minus the preannouncement 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.

Consistent with our expectations and with Admati et al. (2017), we find that 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 probably a reflection of the supervisory approval

process. Holding other factors constant, supervisors may grant permission earlier when profitability of a bank looks good.

## Additional Tests

### *Alternative Motivations for LMEs*

Our article relies on the motivations for LMEs mentioned in the offer documentation: 82.6% of the transactions were the result of a bank wanting to augment regulatory capital. Nevertheless, we investigated the following alternative motivations: (a) earnings management, (b) tax, and (c) capital structure. As for the earnings management motive, we find only six bank-year observations, out of 330, where one or more LMEs helped a bank turn a negative net income number into a positive one. We also could not find a significant association between abnormal loan loss provisioning (an indication of earnings management) and LME activity.

Regarding the tax motive, a buyback would be at the expense of tax savings, as tax deductibility is the primary reason for banks to issue nonequity capital instruments. In addition, including deferred tax assets (DTAs) in the analyses of Table 7 gives positive coefficients that are significant for three out of the four full model specifications. This pricing effect lowers the gains of an LME. We thus rule out a tax motive. Regarding the capital structure motive, we find that 31% of the LMEs are exchanges, where a bank replaces an existing instrument by a new instrument at new terms. If purely deleveraging motivated banks to engage in LMEs, we would observe differences between cash LMEs and exchanges. We included an indicator variable for cash LMEs in the analyses of Tables 7 and 8. This indicator variable remains insignificant: cash LMEs and exchanges are largely indistinguishable. We also find no significant differences between LME and non-LME bank-years regarding annual changes in total assets and densities. Last, we do find positive changes in the annual (Core) Tier 1 ratios for bank-years with LMEs ($p$ values of .084 for $\Delta$Tier 1 and .0124 for $\Delta$Core Tier 1), using multivariate analyses controlling for size, profitability, payout, solvency, business model, and GIIPS. These results support the view that increasing capital is the main motive for banks to execute an LME, not altering a bank's capital structure.

### *LMEs That Involve Senior Unsecured Instruments, LME Success Rate, and IFRS*

Banks target capital instruments jointly with senior unsecured instruments, that is, with only a few exceptions. This precludes comparing LMEs that involve only capital instruments against LMEs that involve only senior unsecured instruments. An examination of the effects of the 53% LME success rate does not affect our inferences. Neither does IFRS: 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).

## Conclusion

In the lead-up to the implementation of Basel III and as a response to the higher anticipated capital requirements, European banks repurchased debt instruments which traded at a discount. The majority of these LMEs involved hybrid 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.

Using highly detailed data, we investigated the determinants of 720 European LMEs from April 2009 to December 2013 as well as the effect on banks' solvency and liquidity.

We also examined the determinants of the buyback premium, a measure of the inefficiency of the LME, and the types of instruments that were bought back. Our results show that the likelihood of an LME decreases with a bank's solvency. We also find that the buyback premium increases with (a) the loss-absorbing capacity of capital instruments, (b) economy-wide financial stress, and (c) leverage. The buyback premiums are at the expense of banks' liquidity and overall regulatory capital.

Altogether, these results indicate that the prevailing market conditions in combination with regulatory preferences that discouraged derisking and excluded unrealized fair value gains and losses arising from changes in own credit standing from the calculation of regulatory capital resulted in significant unintended consequences. Namely, our results show that the most loss-absorbing instruments are the most attractive buyback targets. Yet regulation allows buybacks of the most loss-absorbing instruments only if a bank is sufficiently solvent. But, 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. The examination of the buyback premium shows that LMEs not only affect solvency (specifically: the total capital ratio) but also liquidity—this at a time of increased regulatory focus on cash conservation, for example, the announced regulation of the Liquidity Coverage Ratio and Net Stable Funding Ratio and calls for limiting distributions to investors (EBA, 2017).

Our findings have several policy implications: Contrary to the objectives of bank solvency rules, the prudential filter on 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.

Below par own debt repurchases should therefore be a cause for prudential concern. In general, banks do not recognize unrealized gains because they are uncertain. However, once banks lose their resilience and in times of economic uncertainty, the prudential rules that are the subject of our study become ineffective: Banks will circumvent the rules that ban the recognition of unrealized gains originating from a weakened own credit standing. They then execute LMEs. In particular, the least resilient banks will engage in LMEs when they are most vulnerable. A recent case of Deutsche bank confirms this point outside our sample period: On February 12, 2016, Deutsche Bank, after a setback of regulatory capital, announced a buyback of debt worth US$5.37bn, with predictable effects on capital and liquidity. Regarding liquidity, the completion note reveals that Deutsche Bank had increased its purchase price ''by 1.50–2.60 percentage points or respectively lower the spreads by 20–25 bps at which it accepts bonds within this tender offer,'' to ''. . . provide liquidity to holders of the debt securities listed in the tender offer.'' Our analyses suggest that regulators should prevent banks from buying back the most loss-absorbing instruments, consistent with the argument made by Admati, DeMarzo, Hellwig, & Pfleiderer (2012) that if deleveraging is done inefficiently, regulators should limit banks' discretion.

## Acknowledgments

The authors thank Anat Admati, Linda Allen, Toby Daglish, Holger Daske, Peter Easton, Wouter Elsenburg, Robert Faff, John Hand, Martin Hellwig, Allan Hodgson, Micheal Keefe, Wayne Landsman, Matt Levine, Ries de Kogel, Charles Littrell, Piers Maddox, Yan Meng, Zoltan Novotny-Farkas, Thomas Omer, Stephen Ryan, Bharat Sarath, Susan Shan, Tom Smith, Stephen Taylor, Peter Wells, Xiao-Jun Zhang, Tony van Zijl, participants at research seminars at the University of

Technology Sydney; Victoria University Wellington; ESSEC Asia Pacific, Singapore; UQ Business School, Brisbane; the Ministry of Finance of the Netherlands, and participants at the 27th Australasian Finance and Banking Conference, Sydney; the European Accounting Association meetings, Glasgow; the AFAANZ meeting, Hobart; the 7th Financial Markets and Corporate Governance Conference, Melbourne; and the 2017 *JAAF* conference, Dunedin for very useful comments. The authors also thank Nomura International, JPMorgan, and Credit Suisse for providing the LME data.

## Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

## Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: The authors thank Hien Hoang for data collection. A.R. acknowledges financial support from the NWO (Veni Research Grant 016.135.086)

## Notes

1. The unrealized gain is the difference between the accounting value of debt and the (lower) market value of debt.
2. 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].''
3. We used the April 9, 2009 GBPEUR exchange rate of 1.1103. The €170m is pretax. After tax, the amount would have contributed (even) less to Core Tier 1.
4. From here on, we use the terms ''security'' and ''instrument'' interchangeably.
5. 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.
6. 720 Liability Management Exercise (LME) transactions from 69 European Union (EU) banks versus 86 from 37 U.S. banks.
7. We excluded debt–equity swaps because in banking (in particular during the aftermath of the financial crisis), a debt–equity swap in practice is a bail-in of bond-holders or creditors that occurs when a bank is in resolution or when the bank is unable to continue as a going concern. These swaps are likely not voluntarily decided or timed by bank managers, but by regulators, receivers, or administrators.
8. Of the 720 LMEs, 34 were bought back at a discount (negative premium) when trading at or over par at the announcement date. Except for three LMEs, all were announced jointly with other LMEs of the same bank on the same day. Overall, 28 of the 34 LMEs were announced after 2011 (i.e., in calmer times) and almost all of them were executed by Spanish banks as part of EU- or State-imposed reorganizations (Fondo de reestructuración ordenada bancaria [FROB]). It is likely that investors were aware for some time that these banks would execute an LME, thus driving the price at the announcement date up.
9. 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.
10. The total assets covered by European Central Bank's asset quality review (AQR) 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 European Banking Authority (EBA). To prevent double counting of subsidiary-owned assets and liabilities, we rely on EBA's consolidated scope.

11. We ran this regression including a book-to-market variable of which the coefficient is positive but weakly significant only. This finding does not change our inferences. Moreover, it confirms Bhagat, Bolton, & Lu (2015), who show that leverage primarily drives risk.

## ORCID iD

Martien Lubberink https://orcid.org/0000-0003-2731-2998

## References

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. C. (2012). *Debt overhang and capital regulation* (Working Paper No. 3114). Retrieved from https://www.gsb.stanford.edu/faculty-research/working-papers/debt-overhang-capital-regulation

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. C. (2016). *Fallacies, irrelevant facts, and myths in the discussion of capital regulation: Why bank equity is not expensive* (Working Paper No. 2065). Stanford, CA: Rock Center for Corporate Governance at Stanford University.

Admati, A. R., DeMarzo, P. M., Hellwig, M. F., & Pfleiderer, P. C. (2017). The leverage ratchet effect. *The Journal of Finance*. Retrieved from http://onlinelibrary.wiley.com/doi/10.1111/jofi.12588/full

Barth, M. E., Gómez-Biscarri, J., Kasznik, R., & López-Espinosa, G. (2017). *Bank earnings and regulatory capital management using available for sale securities* (Working Paper No. 3047). Retrieved from https://ssrn.com/abstract=2448482

Barth, M. E., Hodder, L. D., & Stubben, S. R. (2008). Fair value accounting for liabilities and own credit risk. *The Accounting Review*, *83*, 629-664.

Basel Committee on Banking Supervision. (1998, October 27). *Instruments eligible for inclusion in Tier 1 capital* (BIS Press Release). Basel: Bank for International Settlements. Retrieved from www.bis.org/press/p981027.htm

Basel Committee on Banking Supervision. (2006a). *International convergence of capital measurement and capital standards: A revised framework, comprehensive version*. Basel: Bank for International Settlements. Retrieved from www.bis.org/publ/bcbs128.pdf

Basel Committee on Banking Supervision. (2006b). *Supervisory guidance on the use of the fair value option for financial instruments by banks*. Basel: Bank for International Settlements. Retrieved from www.bis.org/publ/bcbs127.pdf

Basel Committee on Banking Supervision. (2010). *Basel III: A global regulatory framework for more resilient banks and banking systems*. Basel: Bank for International Settlements. Retrieved from www.bis.org/publ/bcbs189.htm

Basel Committee on Banking Supervision. (2011). *Final elements of the reforms to raise the quality of regulatory capital issued by the Basel Committee*. Basel: Bank for International Settlements. Retrieved from www.bis.org/press/p110113.htm

Basel Committee on Banking Supervision. (2015). *The interplay of accounting and regulation and its impact on bank behaviour: Literature review*. Bank for International Settlements, Basel. Retrieved from http://www.bis.org/bcbs/publ/wp28.htm

Beatty, A., & Liao, S. (2014). Financial accounting in the banking industry: A review of the empirical literature. *Journal of Accounting & Economics*, *58*, 339-383.

Berger, A. N., & Bouwman, C. H. (2013). How does capital affect bank performance during financial crises? *Journal of Financial Economics*, *109*, 146-176.

Bhagat, S., Bolton, B. J., & Lu, J. (2015). Size, leverage, and risk-taking of financial institutions. *Journal of Banking & Finance*, *59*, 520-537.

Bulow, J., & Rogoff, K. (1988). The buyback boondoggle. *Brookings Papers on Economic Activity*, *2*, 675-698.

Chircop, J., & Novotny-Farkas, Z. (2016). The economic consequences of extending the use of fair value accounting in regulatory capital calculations. *Journal of Accounting & Economics*, *62*, 183-203.

Crédit Agricole. (2011a). *Crédit Agricole S.A. announces the successful outcome of its offer to repurchase up to £750 million of its outstanding upper tier 2 notes*. Retrieved from https://www.credit-agricole.com/en/finance/finance/financial-press-releases

Crédit Agricole. (2011b). *Crédit Agricole to seek to repurchase up to £750 million of its £1,050 million outstanding Upper Tier 2 Notes*. Retrieved from https://www.credit-agricole.com/en/finance/finance/financial-press-releases

DeAngelo, H., & Stulz, R. M. (2015). Liquid-claim production, risk management, and bank capital structure: Why high leverage is optimal for banks. *Journal of Financial Economics*, *116*, 219-236.

De Jong, A., Roosenboom, P., & Schramade, W. (2009). Who benefits from bond tender offers in Europe? *Journal of Multinational Financial Management*, *19*, 355-369.

Dong, M., & Zhang, X.-J. (in press). Selective trading of available-for-sale securities: Evidence from U.S. commercial banks. *European Accounting Review*.

European Banking Authority. (2011). *European Banking Authority—EU Capital exercise 2011*. London, England: Author.

European Banking Authority. (2012). *EU Capital exercise final results*. London, England: Author.

European Banking Authority. (2013a). *Discussion paper on technical advice on possible treatments of unrealised gains measured at fair value (EBA/DP/2013/03)*. London, England: Author.

European Banking Authority. (2013b). *The EBA publishes a recommendation on the preservation of capital*. London, England: Author.

European Banking Authority. (2017). *Opinion of the European Banking Authority on own funds in the context of the CRR review*. London, England: Author.

European Central Bank. (2001). *Fair value accounting in the banking sector*. Frankfurt, Germany: Author.

European Central Bank. (2012). EU Capital exercise final results. *European Banking Authority, London*. Retrieved from www.eba.europa.eu/risk-analysis-and-data/eu-capital-exercise/final-results

European Central Bank. (2014). *Aggregate report on the comprehensive assessment, October 2014*. Frankfurt, Germany: Author.

European Commission. (2002). *Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards*. Brussels, Belgium: Author.

European Commission. (2005, July 8). *EU Accounting Regulatory Committee supports Commission proposal to endorse ''IAS 39 Fair Value Option*'' (European Commission Press Release IP/05/884). Brussels, Belgium: European Commission. Retrieved from http://europa.eu/rapid/press-release_IP-05-884_en.htm

European Commission. (2006). *Directive 2006/48/EC of the European Parliament and of the Council of 14 June 2006 relating to the taking up and pursuit of the business of credit institutions (recast)*. Brussels, Belgium: Author.

European Commission. (2013). *Regulation (EU) No 575/2013 of the European Parliament and of the Council of 26 June 2013 on prudential requirements for credit institutions and investment firms and amending Regulation (EU) No 648/2012*. Brussels, Belgium: Author.

European Commission. (2014). *Directive 2014/59/EU of the European Parliament and of the Council of 15 May 2014 establishing a framework for the recovery and resolution of credit institutions and investment firms and amending Council Directive 82/891/EEC, and Directives 2001/24/EC, 2002/47/EC, 2004/25/EC, 2005/56/EC, 2007/36/EC, 2011/35/EU, 2012/30/EU and 2013/36/EU, and Regulations (EU) No 1093/2010 and (EU) No 648/2012, of the European Parliament and of the Council*. Brussels, Belgium: Author.

Firestone, S., Lorenc, A., & Ranish, B. (2017). *An empirical economic assessment of the costs and benefits of bank capital in the US. Finance and Economics Discussion Series 2017-034*.

Washington, DC: Board of Governors of the Federal Reserve System. Doi:10.17016/FEDS.2017.034

G20. (2009). *Global plan for recovery and reform*. London, England: G20 Information Centre. Retrieved from www.g20.utoronto.ca/2009/2009communique0402.html#supervision

Hand, J. R., Hughes, P. J., & Sefcik, S. E. (1990). Insubstance defeasances: Security price reactions and motivations. *Journal of Accounting & Economics*, *13*, 47-89.

Ioannidou, V. P. (2005). Does monetary policy affect the central bank's role in bank supervision? *Journal of Financial Intermediation*, *14*, 58-85.

Johnson, J. M., Pari, R. A., & Rosenthal, L. (1989). The impact of in-substance defeasance on bondholder and shareholder wealth. *The Journal of Finance*, *44*, 1049-1057.

Lintner, J. (1956). Distribution of incomes of corporations among dividends, retained earnings, and taxes. *American Economic Review*, *46*, 97-113.

Mann, S. V., & Powers, E. A. (2007). Determinants of bond tender premiums and the percentage tendered. *Journal of Banking & Finance*, *31*, 547-566.

Marinova, K., & van Veldhuizen, S. (2014). *Bank recapitalization* (CPB Background Document, 1-36. 11–07–2014). Retrieved from https://www.cpb.nl/en/publication/bank-recapitalization

Merton, R. C. (1974). On the pricing of corporate debt: The risk structure of interest rates. *The Journal of Finance*, *29*, 449-470.

Opschoor, A., van Dijk, D., & van der Wel, M. (2014). Predicting volatility and correlations with financial conditions indexes. *Journal of Empirical Finance*, *29*, 435-447.

Petersen, M. A. (2009). Estimating standard errors in finance panel data sets: Comparing approaches. *Review of Financial Studies*, *22*, 435-480.

Roengpitya, R., Tarashev, N., & Tsatsaronis, K. (2014, December). Bank business models. *BIS Quarterly Review*, 55-65. Retrieved from https://www.bis.org/publ/qtrpdf/r_qt1412.htm

Sommer, J. H. (2014). Why bail-in? And how! *Economic Policy Review*, *20*, 208-228.