Is Historical Cost Accounting a Panacea?
Market Stress, Incentive Distortions, and Gains Trading

Andrew Ellul
Indiana University, CSEF and ECGI

Chotibhak Jotikasthira
University of North Carolina

Christian T. Lundblad
University of North Carolina

Yihui Wang
Fordham University

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ABSTRACT

We provide new empirical evidence concerning the contentious debate over the use of historical cost (HCA) versus mark-to-market (MTM) accounting in regulating financial institutions. These accounting rules, through their interactions with capital regulations, alter financial institutions' trading behavior. The insurance industry provides a natural laboratory to explore these interactions since significant differences exist in regulatory accounting rules: (1) life insurers have greater flexibility to hold speculative-grade assets under HCA than property and casualty insurers, which are required to use MTM, and (2) the degree to which life insurers have to recognize market value through impairment differs across U.S. states. In the context of the sizeable downgrades of asset-backed securities (ABS) during the 2007-2009 financial crisis, we show that insurers facing MTM are more likely to sell the downgraded ABS than insurers holding these assets under HCA. To improve their capital positions, insurers facing HCA disproportionately resort to gains trading, *selectively selling* their corporate and government bond holdings with the highest unrealized gains. This trading behavior transmits shocks across otherwise unrelated markets.

JEL classifications: G11; G12; G14; G18; G22

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1. Introduction

This paper explores the trading incentives of financial institutions induced by the *interaction* between regulatory accounting rules and capital requirements (Heaton, Lucas, and McDonald (2010)). The theoretical literature (for example, Allen and Carletti (2008), Plantin, Sapra, and Shin (2008), and Sapra (2008)) argues that mark-to-market (MTM), or fair value, accounting leads to the forced selling of assets by financial institutions during times of market stress, resulting in a downward spiral of liquidity and prices and potential contagion effects for other markets.[1] These authors also contend that historical cost accounting (HCA), in contrast, may avoid fire sales and contagion effects. We challenge this view on HCA by providing new empirical evidence that HCA, interacting with regulatory capital requirements, induces an altered incentive to "gains trade" where, in order to shore up capital, an institution selectively sells otherwise unrelated assets with high *unrealized* gains.[2]

The role of MTM during the recent financial crisis has generated an intense debate. The accounting rules followed by financial institutions may appear to simply be an issue of measurement and, in frictionless markets, free of any impact on economic fundamentals. However, when markets are illiquid and trading frictions elevated, financial assets may temporarily trade at market prices that are well below fundamental values (Duffie (2010), AFA Presidential Address). In such an environment, write-downs and impairments (associated with the deterioration of asset prices) will lead to an erosion of financial institutions' capital base, potentially forcing the liquidation of some assets. Allen and Carletti (2008) argue that in such environment, HCA will avoid fire sales. In the same vein, Plantin *et al.* (2008) argue that MTM generates excessive volatility in prices, degrading their information content and leading to sub-optimal decisions by financial institutions.

However, HCA may also engender inefficiencies as financial institutions using this type of accounting have an incentive to engage in selective asset sales aimed at the early realization of earnings (Laux and Leuz (2009)). Indeed, Plantin *et al.* (2008) recognize that HCA is not immune to these inefficiencies in normal times when asset prices are high. In this paper, we focus on the implications of this trading incentive and its impact on financial institutions'

[1] This view has received support from the banking industry as well. In a letter to the SEC in September 2008, the American Bankers Association was of the opinion that, among several factors that led to the financial crisis, "one factor that is recognized as having exacerbated these problems is fair value accounting."

[2] Bleck and Liu (2007) theoretically examine the economic consequences of MTM and HCA. They show that HCA may distort management's incentives, and in some cases, may induce a behavior similar to "gains trading" when the management tries to signal good project quality to the market. See also Berger, Herring, and Szego (1995).

portfolios during times of *market stress*. We argue that it is precisely during these episodes that financial institutions have the highest need to realize gains in order to improve capital positions.

To focus ideas, consider a setting in which financial institutions are regulated by a risk-weighted capital adequacy metric. For example, insurance regulators employ the Risk-Based Capital ratio -- the ratio of statutory equity capital (or Total Adjusted Capital (TAC)) to required capital (or Risk-Based Capital (RBC)).[3] A low RBC ratio indicates financial weakness. Now, consider an institution that invested heavily in Asset-Backed Securities (ABS). During the crisis of 2007-2009, many ABS were severely downgraded by credit rating agencies, asserting downward pressure on the institution's RBC ratio. Generally speaking, the downgrades are likely to increase the institution's RBC (the denominator of the RBC ratio), as the capital requirements are set as a function of each asset's credit rating. Further, the downgrades may also decrease the institution's statutory equity capital (the numerator of the RBC ratio) if the downgraded assets are marked-to-market or impaired.[4] Given this pressure, the institution then faces a stark decision: either sell the downgraded ABS to reduce the required RBC or retain them and find additional capital elsewhere.

Since the downgraded assets experienced severe price declines, a crucial determinant of the institution's decision is whether the price declines have already been (or would soon be) reflected in its statutory equity capital. This is where the accounting treatment of these assets is likely to have a first-order effect on trading and portfolio choices. If the downgraded asset is held under MTM, the price decline would be automatically reflected in the balance sheet, and the loss would directly reduce the institution's statutory equity capital. From a purely accounting perspective, the institution would be indifferent between keeping the asset and selling it. However, from a regulatory capital perspective, selling the downgraded asset has an important advantage as swapping a speculative-grade asset for cash or an investment-grade asset immediately reduces the required RBC and improves the RBC ratio. Taken together, selling the downgraded asset is unambiguously beneficial if the asset is held at market value.

The situation is very different if the downgraded asset is held under HCA, as the decline in value would not be recognized in the balance sheet unless the institution sold the asset.

[3] This ratio is similar in spirit to various capital ratios used by bank regulators. For more details on the RBC ratio as well as the analysis that follows, please refer to Section 2.

[4] In Section 2.1, we demonstrate that under the NAIC model regulation, the downgrades of ABS from investment to speculative grades reduce the RBC ratios of virtually all insurers holding these assets. However, the precise impact depends on the severity of the downgrades and the associated price declines, as well as the accounting treatment used to book the downgraded assets.

Therefore, selling the asset has two opposing effects on the RBC ratio: (i) a positive effect from reducing the required RBC, and (ii) a negative effect from recognizing the price decline in its statutory equity capital. If the price decline were very large, as was observed for many downgraded ABS in the recent crisis, the negative effect would likely dominate and selling the asset would not be beneficial. To maintain a healthy RBC ratio, the institution may respond by realizing gains on other assets, raising new equity capital, or both. It is precisely in this situation that the incentive for gains trading is elevated: in order to shore up its capital positions, the institution may *selectively sell* other assets held under HCA with the *largest unrealized gains*. By doing so, these gains are realized and flow to its statutory equity capital.

In this paper, we use the insurance industry as a natural laboratory to investigate the above arguments: specifically, whether financial institutions using HCA for troubled assets, compared to others using MTM, are less likely to directly sell troubled assets and more likely to gains trade. Under the National Association of Insurance Commissioners (NAIC)'s model regulation, life and property and casualty (P&C) insurers use the same accounting rules for investment-grade assets but significantly different ones for speculative-grade assets. We focus on the 2007-2009 crisis in which thousands of ABS were sharply downgraded, capital constraints became practically binding, and so the effects of accounting rules were arguably most pronounced. When an ABS is downgraded to speculative-grade, P&C insurers have to immediately recognize its value as the lower of the book or market values. On the other hand, depending on the exact implementation of NAIC model regulation by each U.S. state, life insurers can largely continue to hold the downgraded ABS under HCA. Given the sizeable downgrades among insurers' ABS holdings, these accounting variations, interacting with the capital adequacy rules, are likely to induce significantly different trading behaviors between life and P&C firms, particularly those that are most exposed to ABS downgrades.

Our first empirical strategy is to contrast the behaviors of life and P&C firms, exploiting the stark difference in their regulatory accounting treatments for downgraded ABS. We refer to this as the *between-insurance-type* analysis. We recognize that life and P&C insurers differ along many other dimensions and that the regulatory accounting rules, while not a choice variable at the individual insurer level, are not the only relevant differences. Differences in the business models between the two types, for example, may induce commensurate differences in their investment strategies. As a result, our primary identification strategy may not be without concerns. To address this problem, we also implement a second identification strategy by exploiting variation *within* the life insurance sector in the implementation of NAIC model regulation across U.S. states (technically, insurance regulation in the U.S. takes place at the state level). State-level insurance codes allow for differences in the amount of discretion the local regulatory authority has to require the recognition of market information for downgraded assets; certain states allow their insurance commissioners to be more aggressive in requiring value recognition, while other states do not. We compare the trading behaviors across life insurers domiciled in these two groups of states. This *within-life* analysis helps rule out alternative mechanisms that may drive the results obtained from the *between-insurance-type* analysis.

We examine a panel of 1,882 life and P&C firms from 2004 to 2010 for which *portfolio-security level* positions and transactions data are readily available through the NAIC. First, we show clear evidence that P&C firms (booking downgraded assets under MTM) are significantly more likely than life firms (generally booking downgraded assets under HCA) to sell their ABS holdings affected by downgrades. Similarly, life insurers domiciled in the states that impose greater degrees of market value recognition than strictly required by the NAIC model regulation are more likely to sell the affected ABS, compared to life insurers domiciled in other states.

Second, we find that insurers most impacted by ABS downgrades disproportionately sell the otherwise unrelated government and corporate bonds with the highest unrealized gains. Further, among the most impacted firms, those with RBC ratios in the lowest quartile are significantly more likely than others to engage in gains trading, suggesting that insurers gains trade, in part, to counteract the negative impact of ABS downgrades on their capital positions. Most importantly, gains trading is significantly more prevalent among life insurers than P&C insurers. Our within-life analysis provides additional corroborating evidence: life insurers domiciled in U.S. states that strictly implement the NAIC model regulation, and thus are more likely to keep the downgraded ABS under HCA, engage in significantly more gains trading than life insurers domiciled in other states.

While we believe that our within-life analysis provides a clean identification, we contend that the life versus P&C comparison provides useful complementary evidence given the striking contrast in accounting rules. To ensure robustness, we directly examine plausible alternative explanations, and find that they do not explain the differences in trading between life and P&C firms, which remain even in the subsamples of life and P&C insurers that (1) are equally and consistently profitable, (2) belong to a universal group that includes both types, and (3) have the same fixed-income portfolio duration.

The final question is whether HCA, through its interaction with capital adequacy rules, ultimately engenders price pressures in the assets targeted for gains trading. To answer the question, we investigate returns of corporate bonds and find that bonds carrying large unrealized gains in the balance sheet of life insurers, statistically and economically underperform otherwise similar bonds, during the crisis when gains trading is most widespread. These price pressures are even larger if life insurers holding the high-unrealized-gain bonds are domiciled in U.S. states that strictly follow the NAIC model regulation and allow these insurers full discretion not to recognize the depressed market values of downgraded ABS. Overall, these results show that HCA can also create unintended consequences where market distortions and spillover effects are not entirely avoided.

Our paper is related to several strands of the literature. We contribute to the growing body of research exploring the trading decisions made by institutional investors when faced with a financial shock (for example, Anand *et al.* (2010), Boyson *et al.* (2011), Manconi *et al.* (2012), Hau and Lai (2013), among others). To the best of our knowledge, we are the first to empirically demonstrate the importance of the interaction between accounting and capital regulations on institutional investors' trading decisions and the spillover effects that may result. In contrast to earlier efforts,[5] we show that gains trading, one unintended consequence of HCA, takes place during periods of market stress and can generate significant spillover effects. Furthermore, we are the first to investigate gains trading at the *security level*, as opposed to the aggregate portfolio level, which allows us to better identify gains trading from other strategic trading motives and demonstrate its potential price impact.

Most importantly, our results contribute to the debate on the choice of the accounting system used in regulating financial institutions.[6] The literature (mostly theoretical) suggests that during a financial crisis, marking-to-market may cause distressed selling and financial instability (Allen and Carletti (2008), Plantin *et al.* (2008), and Wallison (2008)).[7] Merrill *et al*. (2013) provide evidence consistent with this prediction, focusing on insurers' trading in residential mortgage-backed securities (RMBS) following modifications in their accounting rules. We

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[5] Carey (1994) finds evidence of gains trading by banks during 1979-1992. He finds that, at the bank level, most banks appear to gains trade to realize earnings as they appear (snacking) or to smooth earnings over time; very few manage tax liabilities or regulatory capital. See also Scholes *et al.* (1990), Beatty *et al.* (1995), Hirst and Hopkins (1998), Kashyap and Stein (2000), and Lee *et al.* (2006) (some refer to gains trading as 'cherry picking').

[6] Goh *et al.* (2009) analyze the determinants of accounting choice and the effects of fair value disclosure on firms' information environment. See also Eccher *at al.* (1996), Petroni and Wahlen (1995), and Wyatt (1991).

[7] See Veron (2008), and Bleck and Liu (2007) for an opposing view.

provide new empirical evidence that suggests that the contentious debate surrounding accounting choices for financial institutions may have been over-simplified as it ignores the important interactions between these choices and the regulatory framework. Specifically, our evidence supports Laux and Leuz (2009, 2010)'s conjecture that HCA is not an unambiguous panacea.

The remainder of the paper is organized as follows. In Section 2, we explain in detail the regulatory accounting and capital adequacy rules, and we formally develop our hypotheses. Section 3 discusses the sample construction and provides relevant summary statistics. Section 4 presents our main empirical analysis, contrasting the trading behavior of insurers facing different accounting rules during the wave of significant ABS downgrades. In Section 5, we investigate the effects of gains trading on portfolio allocation and security prices. Section 6 concludes. We present additional results in an Internet Appendix.

2. Institutional Framework and Hypotheses Development

2.1 RBC Ratio and Impact of ABS Downgrades under Different Accounting Rules

The risk-based capital (RBC) ratio is an essential capital adequacy metric in U.S. insurance regulation. The RBC ratio is defined as:[8]

$$\text{RBC Ratio} = \frac{\text{Total Adjusted Capital (TAC)}}{\text{Risk-Based Capital (RBC)}},$$

where TAC primarily consists of capital and surplus, and RBC is the required capital that reflects both business and asset risks. The NAIC model regulation requires that the RBC ratio has to exceed a value of 2, but earlier regulatory action may be taken following significant declines.[9]

To understand how the ABS downgrades affect an insurer's RBC ratio, we isolate ABS from other components of TAC and RBC and rewrite the RBC ratio as:

$$\frac{\text{TAC}^{*}+\text{ABS}}{\text{RBC}^{*}+(\lambda_{\text{ABS}}\times\text{ABS})},$$

where TAC^{*} is TAC minus the book value of ABS, ABS is the book value of ABS, RBC^{*} is RBC minus the required capital for ABS, and λ_{ABS} is the percentage required capital for ABS.

[8] In banking, a key capital adequacy metric is the capital ratio, defined as the ratio of equity capital to risk-weighted assets. This ratio must be higher than a required minimum, say 6%. In insurance, this required minimum and the risk weight apply directly to each asset in calculating RBC. Thus, RBC ratio is essentially capital ratio divided by 6%.

[9] Specifically, in certain U.S. states that utilize 'trend tests', a negative three-year trend in such metrics, coupled with an RBC ratio of 3 or below, may prompt a regulatory investigation.

From this expression, it is easy to see that ABS downgrades affect the RBC ratio through two interrelated channels. First, the downgrades increase the percentage required capital, λ_{ABS}, which in turn increases RBC and decreases the RBC ratio. Second, depending on the applicable accounting rule, the book value of ABS may also decline, leading to a decrease of both TAC and RBC, and thus having a potentially ambiguous effect on the RBC ratio.

Below, we demonstrate that for our sample of insurers under the NAIC's regulatory framework, the downgrades of ABS from investment to speculative grades will decrease the RBC ratio under *every accounting rule*. That is,

$$\frac{\text{TAC}^{*}+\text{ABS}^{\text{post}}}{\text{RBC}^{*}+\left(\lambda_{\text{ABS}}^{\text{post}}\times\text{ABS}^{\text{post}}\right)} < \frac{\text{TAC}^{*}+\text{ABS}^{\text{pre}}}{\text{RBC}^{*}+\left(\lambda_{\text{ABS}}^{\text{pre}}\times\text{ABS}^{\text{pre}}\right)}, \tag{1}$$

where the superscripts "pre" and "post" denote the values of a variable before and after the downgrades, respectively.

<u>Case 1: MTM</u>. The new lower market value of downgraded ABS is immediately reflected on an insurer's balance sheet, i.e. $\text{ABS}^{\text{post}} < \text{ABS}^{\text{pre}}$. Whether inequality (1) holds is unclear. The numerator effect is always negative: the decline in market value decreases TAC and thus the RBC ratio. The denominator effect is, however, ambiguous ($\lambda_{\text{ABS}}^{\text{post}}\times\text{ABS}^{\text{post}} \gtrless \lambda_{\text{ABS}}^{\text{pre}}\times\text{ABS}^{\text{pre}}$). If the decline in market value is very large relative to the increase in percentage required capital, then RBC for the downgraded ABS may decrease, countering the numerator effect and pushing the RBC ratio higher. At the same time, a larger decline in market value would also mean a larger decline in TAC and an even lower RBC ratio; therefore, whether ABS downgrades reduce the RBC ratio depends on values of the different variables in inequality (1). To better map these variables to what we observe in our empirical setting, we rewrite (1) as

$$y\left[\lambda_{\text{ABS}}^{\text{post}} - (\text{RBC Ratio}^{\text{pre}})^{-1}\right] > \lambda_{\text{ABS}}^{\text{pre}} - (\text{RBC Ratio}^{\text{pre}})^{-1}, \tag{2}$$

where $y = \text{ABS}^{\text{post}}/\text{ABS}^{\text{pre}}$, the ratio of post-downgrade to pre-downgrade book values of the ABS. Now, we will demonstrate that inequality (2) holds for all insurers in our sample under the NAIC model regulation; i.e., under MTM, ABS downgrades practically decrease the RBC ratio in all possible market scenarios. First, note that the right-hand side of (2) is always negative, and in fact, less than or equal to 0.014 - 0.050 = -0.036, since the largest percentage required capital for investment-grade assets is 1.40% ($\lambda^{pre}_{ABS} \leq 0.014$)[10] and the RBC ratios of our sample insurers are between 2 and 20 ($0.5 \geq (\text{RBC Ratio}^{pre})^{-1} \geq 0.050$). Second, note that the left-hand side of (2) may be positive or negative because the percentage required capital for speculative-grade assets, λ^{post}_{ABS}, can be higher or lower than 0.050 (for example, λ^{post}_{ABS} for assets rated B and CCC are 0.046 and 0.100, respectively). If the left-hand side is positive, inequality (2) must hold since the right-hand side is always negative. If the left-hand side is negative, then (2) becomes

$$y < \frac{\lambda^{pre}_{ABS} - (\text{RBC Ratio}^{pre})^{-1}}{\lambda^{post}_{ABS} - (\text{RBC Ratio}^{pre})^{-1}}, \tag{3}$$

which always holds as well, since $y < 1$, but $\lambda^{post}_{ABS} > \lambda^{pre}_{ABS}$ and $\lambda^{post}_{ABS} - (\text{RBC Ratio}^{pre})^{-1} < 0$ together imply that the ratio on the right-hand side of (3) is greater than one.

Case 2: HCA. If the downgraded ABS remain under HCA, then $ABS^{post} = ABS^{pre}$, and because $\lambda^{post}_{ABS} > \lambda^{pre}_{ABS}$, inequality (1) always holds: ABS downgrades unambiguously decrease the RBC ratio.

Case 3: HCA with OTTI. The downgraded ABS remain under HCA but are impaired to reflect a new lower market value. According to the NAIC model regulation, if the decline in market value of an asset is *deemed other than temporary*[11], then insurers using HCA for the asset should recognize such decline as a one-time loss, through the so-called Other-Than-Temporary Impairment (OTTI). In this case, $ABS^{post} = ABS^{pre} - OTTI < ABS^{pre}$, making HCA with OTTI essentially the same as MTM for the purpose of evaluating the immediate impact of ABS downgrades. Therefore, as with MTM, ABS downgrades decrease the RBC ratio.

2.2 Responses to ABS Downgrades under Different Accounting Rules

As shown above, the downgrades of ABS from investment to speculative grades decrease the RBC ratios of insurers holding these assets (and a commensurate reduction in their perceived financial health). Each affected insurer has a few options to bring its RBC ratio back to a healthy level: (i) lower the denominator by selling the downgraded ABS and swapping into lower-risk assets, (ii) increase the numerator by selling other unrelated assets with high unrealized gains

[10] Please refer to the Internet Appendix for the actual percentage required capitals under the NAIC model regulation.
[11] The exact language is as follows. SSAP 26 (clause 9): "… an impairment shall be considered to have occurred if it is probable that the reporting entity will be unable to collect all amounts due according to the contractual terms of a debt security in effect at the date of acquisition. …"

(Laux and Leuz (2009, 2010)), and (iii) increase the numerator by raising new equity capital (Berry-Stolzle, Nini, and Wende (2014)).[12] In this paper, we focus on options (i) and (ii). We will begin by examining whether option (i) is beneficial under each accounting treatment, and then discuss the extent to which option (ii) is employed as a supplementary measure. At the end, we will summarize all arguments and develop our general hypotheses.

Selling the downgraded ABS and swapping into lower-risk, or investment-grade, assets is beneficial if doing so improves the RBC ratio, i.e.

$$\frac{\text{TAC}^{*}+\text{INV}}{\text{RBC}^{*}+(\lambda_{\text{INV}}\times\text{INV})} > \frac{\text{TAC}^{*}+\text{ABS}^{\text{post}}}{\text{RBC}^{*}+\left(\lambda_{\text{ABS}}^{\text{post}}\times\text{ABS}^{\text{post}}\right)}, \tag{4}$$

where INV is the book value of the investment-grade assets bought with the proceeds from selling the downgraded ABS at their market value, and λ_{INV} is the percentage required capital for the investment-grade assets.

Case 1: MTM. Under MTM, the decline in market value of downgraded ABS has been reflected on the balance sheet, i.e. $\text{INV} = \text{ABS}^{\text{post}}$. Thus, from an accounting perspective, the insurer holding the downgraded ABS would be indifferent between keeping and selling them. However, from a regulatory capital perspective, selling the downgraded ABS has an advantage, as doing so immediately reduces the required capital, i.e. $\lambda_{\text{INV}} < \lambda_{\text{ABS}}^{\text{post}}$. Taken together, inequality (4) always holds: selling the downgraded ABS is unambiguously beneficial.[13,14]

Case 2: HCA. Under HCA, the decline in market value of downgraded ABS has not yet been recognized and therefore $\text{INV} < \text{ABS}^{\text{post}}$. From an accounting perspective, selling the downgraded ABS would force the recognition of their new lower market value, negatively impacting TAC and hence decreasing the RBC ratio. However, from a regulatory capital perspective, switching from speculative-grade ABS to investment-grade assets reduces RBC ($\lambda_{\text{INV}}\times\text{INV} < \lambda_{\text{ABS}}^{\text{post}}\times\text{ABS}^{\text{post}}$) and hence increases the RBC ratio. Thus, whether selling the

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[12] Koijen and Yogo (2014a) show that some life insurers with low RBC ratios raised statutory surplus (numerator) by selling long-term policies at prices below break-even but above the required reserve. In addition, Koijen and Yogo (2014b) show that some insurers also have flexibility to reduce the denominator using shadow insurance.

[13] We assume that the selling insurer is a price taker, while in reality selling the downgraded assets may induce further losses (a fire-sale feedback effect). This complication may explain why P&C firms, using MTM for speculative-grade ABS, (or life firms that have recognized OTTI) do not immediately sell all downgraded ABS.

[14] In the case of MTM, selling the downgraded ABS also helps avoid a future slip in the RBC ratio should the asset price decline further at a later date ($\text{INV} = \text{ABS}^{\text{post}} > \text{ABS}^{\text{post}} + \text{Expected Future Losses from Price Decline}$). This is because the precise rule for MTM is "the lower of book or market values", and therefore the insurer facing MTM can only lose from price movements (unlike HCA).

downgraded ABS is beneficial depends on the tradeoff between the negative numerator effect and the positive denominator effect. From inequality (4), the insurer should sell if

$$y > \frac{(\text{RBC Ratio}^{post})^{-1} - \lambda_{ABS}^{post}}{(\text{RBC Ratio}^{post})^{-1} - \lambda_{INV}}, \quad (5)$$

where $y = \text{INV}/\text{ABS}^{post}$, or in this case, the ratio of market to book values of downgraded ABS. As we earlier discussed, $(\text{RBC Ratio}^{post})^{-1} \geq 0.05$ and $\lambda_{INV} \leq 0.014$; thus, the denominator on the right-hand side of (5) is always positive. It is then clear that the larger the required capital that can be saved (i.e., larger λ_{ABS}^{post}), the lower the right-hand side threshold and the more likely that inequality (5) will hold.[15] On the other hand, the lower the market value (i.e., the larger the losses that will be realized from selling), or lower *y*, the less likely that inequality (5) will hold. That is, if the decline in market value of the downgraded ABS is large, as was the case for many in the recent crisis, selling the downgraded ABS would not be beneficial. In Figure IA1 of the Internet Appendix, we plot the empirical histograms of *y* in 2008 and 2009 to demonstrate that for a number of positions, selling is not beneficial.

<u>Case 3: HCA – With OTTI</u>. Similar to Case 1: MTM, $\text{INV} = \text{ABS}^{post}$ and $\lambda_{INV} < \lambda_{ABS}^{post}$, and hence inequality (4) always holds: selling the downgraded ABS is unambiguously beneficial.

Having described whether selling downgraded ABS is beneficial under each accounting rule, we now turn to gains trading, defined as *selectively selling* other unrelated assets that are held under HCA and have the *largest unrealized gains*. By selling these assets, insurers realize the gains, which flow directly to TAC on a one-for-one basis and thus help to improve the RBC ratio. In this sense, for insurers impacted by ABS downgrades, gains trading and directly selling the downgraded ABS are partial substitutes in returning to a healthy capital position. Therefore, insurers that have already sold downgraded ABS will have a smaller incentive to gains trade than others that have not. Since insurers that use HCA are less likely to benefit from selling the downgraded ABS, they will have a greater incentive to gains trade than others that use MTM.

In Appendix A, we provide a summary of the above discussion. In Appendix B (brief version) and the Internet Appendix (detailed version), we provide numerical examples to

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[15] This means that all else being equal, the ABS that are more severely downgraded (e.g., to CCC) are more likely to be sold. In the extreme, the numerator on the right-hand side may be negative and the downgraded ABS should be sold regardless of their market value.

elucidate the interplay among the many moving parts that affect an insurer's capital positions in the event of downgrades. In this example, we use real (though simplified) balance sheet data from two representative insurers, one life and one P&C, that are expected to suffer a significant and similar decline in their RBC ratios, given their holdings of ABS at the end of 2007.[16] The example illustrates the working of our basic algebra: selling the downgraded ABS reflects the tradeoff between the benefit of reducing the required capital (the denominator effect) and the cost of recognizing the large decline in market value (the numerator effect). For the P&C firm using MTM (and the life firm using HCA with OTTI), the numerator effect is zero and therefore selling the downgraded ABS is beneficial. For the life firm using HCA, the numerator effect can be large and trump the denominator effect; selling the downgraded ABS would further reduce the RBC ratio and therefore gains trading is especially needed.

We summarize the general predictions of our above arguments as follows:

<u>General Hypothesis 1</u>: *financial institutions have a larger incentive to divest downgraded positions held at MTM than otherwise similar positions held under HCA.*[17]

<u>General Hypothesis 2</u>: *financial institutions holding downgraded positions under HCA will have a larger incentive than institutions holding these assets at MTM to sell other unrelated assets to capture unrealized gains.*

2.3 Empirical Identification

Broadly speaking, both life and P&C insurers hold three main asset classes: (a) government and corporate bonds, (b) structured securities, including ABS, and (c) common and preferred equities. For *both* types of insurers, the regulatory accounting rules for government bonds, investment-grade corporate bonds, and investment-grade ABS are the same (HCA)[18], and so are the general rules of equities (MTM). What differs between the two insurance types is the

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[16] For simplicity, we assume that life insurers recognize OTTIs on either all downgraded positions or none. In reality, life insurers recognize OTTIs on some positions and do not on others (with the latter being more likely), their behavior should vary across positions, and the more OTTIs they recognize, the more likely they are to sell their downgraded positions.

[17] General Hypothesis 1 is broadly consistent with the theoretical predictions of Allen and Carletti (2008), Plantin *et al*. (2008), and others.

[18] It is important to draw a distinction between the accounting rules followed by insurance companies in producing their financial statements for investors (GAAP) and the Statutory Accounting Principles (SAP) used by insurance regulators. Securities that are most likely targeted for sale in a severe downgrade event are largely classified as Available for Sale (AFS) under GAAP. While GAAP states that AFS securities should be marked to market, SAP adopts a very different approach where unrealized gains/losses are not recognized in the equity capital calculation.

accounting treatment for corporate bonds and ABS the moment they fall from investment to speculative grades.

The NAIC model regulation defines six risk classes by credit ratings, and all fixed income securities held by insurers fall into one of these risk classes. An important threshold is between Class 2 and Class 3; the former refers to a BBB-rated security while the latter refers to a BB-rated security. When a security is downgraded from investment to speculative grades, it crosses that threshold and the NAIC guidelines require that P&C insurers switch from HCA to MTM, i.e., immediately recognize the security's value as the lower of the book value or the market price (or model price if no market price is available). On the other hand, life insurers face no such requirement; they can continue holding the downgraded bond under HCA, except in the extreme case where the bond is considered 'in or near default' (Class 6).[19] Hence, our first identification strategy takes advantage of this stark difference in accounting rules *between life and P&C insurers* for the ABS that are downgraded to Classes 3, 4, and 5.

The implementation and enforcement of the NAIC model regulation take place at the U.S. state of domicile. Each state's insurance code lays out the rules to be followed by insurers domiciled in that state as well as the discretion allowed to the insurance commissioner in applying the rules. Our objective is to capture variation across states in the discretion afforded to the commissioner in requiring market value recognition in the case of rating downgrades. Since this variation has long been established and insurers rarely change their states of domicile, we can treat it as exogenous and use it to identify, *within the same type of insurers,* the effects of market value recognition on insurers' trading and portfolio decisions following the downgrades of their assets. This is our second identification strategy.

We examine state-level insurance codes to glean information on the rules pertaining to how debt and debt-like instruments, including ABS, are booked for regulatory accounting purposes. We specifically search within the codes, first, under "Valuation of Investments" (or a similar section, such as "Valuation of Securities") and, second, under all other relevant sections, such as "Accounting Provisions", to understand the potential discretion the insurance commissioner has in applying the NAIC guidelines. We then followed up with extensive discussions with state regulators. Our analysis reveals that state mandates can be quite different.

[19] A Class 5 security is one that corresponds to a CCC/Caa credit rating; even in such case, NAIC rules permit life insurers to continue holding the security at amortized historical cost. See the Internet Appendix for further details.

In some states, the NAIC guidelines are strictly enforced, while in others, regulators have the autonomy to institute rules both within and above the guidelines.

A few examples suffice to highlight the differences across states. For example, the insurance code of Illinois (section 126.7) specifically states that:

> For the purposes of this Article, the value or amount of an investment acquired or held, or an investment practice engaged in, under this Article, unless otherwise specified in this Code, shall be the value at which assets of an insurer are required to be reported for statutory accounting purposes as determined *in accordance with procedures prescribed in published accounting and valuation standards of the NAIC, ...* (Our *emphasis*.)

In this case, we classify Illinois as a state that strictly implements the NAIC model regulation. On the other hand, the insurance code of New York (section 1414) states that:[20]

> (a) (1) All obligations having a fixed term and rate of interest and held by any life insurance company or fraternal benefit society authorized to do business in this state, if amply secured and not in default as to principal or interest, shall be valued as follows: … [description of HCA] … (3) *The superintendent shall have the power to determine the eligibility of any such investments for valuation on the basis of amortization, and may by regulation prescribe or limit the types of securities so eligible for amortization*. All obligations which in the judgment of the superintendent are not amply secured shall not be eligible for amortization and shall be valued in accordance with subsection (b) [which describes MTM] hereof. (Again, our *emphasis*.)

We hence classify New York as a state that allows discretion to the commissioner in applying the NAIC guidelines. In the Internet Appendix, we present in full the applicable parts from the codes of Illinois and New York. Based on similar information, which we systematically capture using two criteria as discussed in Appendix C, we classify U.S. states into those that strictly implement the NAIC guidelines and those that permit some discretion to their commissioner. Below, we argue that the latter (former) are likely to yield greater (lower) levels of market value recognition among life insurers and hence refer to them as “high MTM states” (“low MTM states”).

When a bond is downgraded from investment to speculative grades, the NAIC guidelines (SSAPs 26 and 43) allow life insurers to continue holding the bond at historical cost; but, if the decline in market value following the downgrade is deemed other than temporary, then life insurers should recognize OTTI. This clearly gives life insurers full discretion in determining whether or not to recognize OTTI. From this extreme, the commissioner may either (a) strictly follow the NAIC guidelines, i.e., leaving full discretion to life insurers, or (b) impose some instructions on the situations in which MTM should/must be used or OTTI should/must be recognized. Compared to the case of (a), life insurers are forced to use MTM or recognize OTTI more often in the case of (b). Thus, averaging the two possibilities, the level of market value recognition upon rating downgrades should be (weakly) greater among the states that leave

[20] The code refers to HCA as “valuation on the basis of amortization” or in short “amortization.”

discretion to the commissioner. Moreover, since the difference across states only occurs in the cases where the recognition of market value is discretionary, it does not apply to P&C insurers.

As with any interpretation of rules, it is not always unambiguously clear to which group a state belongs. To address this issue, we conduct two robustness checks in which (i) we reclassify a few relatively ambiguous states into the other group (Alternative 1), and (ii) we rank states by the realized OTTI frequency of state-domiciled insurers during the pre-crisis period and classify as high MTM states those with realized OTTI frequencies above the median (Alternative 2). In Appendix C, we show that the classification in (ii), though mechanical in nature, is highly correlated with the insurance-code-based classifications.

2.4 Testable Hypotheses

In the context of insurance industry, as discussed in Section 2.3, General Hypothesis 1 translates to the following testable hypotheses:

H1a (between-insurance-type): P&C insurers are more likely to sell downgraded assets than are life insurers.

H1b (within-life): Life insurers domiciled in high MTM states are more likely to sell downgraded assets than are those domiciled in low MTM states.

We next test the premise that financial institutions conduct gains trading to improve capital positions that have been adversely affected by asset downgrades:

H2a: Insurers that face a larger decline in RBC ratio as a result of asset downgrades will engage in greater degrees of gains trading.

H2b: Holding the impact of downgrades constant, insurers that have low RBC ratios will engage in greater degrees of gains trading.

Finally, we test General Hypothesis 2, which translates to the following two testable hypotheses:

H2c (between-insurance-type): Holding the impact of downgrades constant, life insurers will engage in greater degrees of gains trading than will P&C insurers.

H2d (within-life): Holding the impact of downgrades constant, life insurers domiciled in low MTM states will engage in greater degrees of gains trading than will life insurers domiciled in high MTM states.

3. The Data

3.1 Sample Construction

We combine three sets of data in our analysis: information on insurance firms, ABS securities and their rating changes, and government/corporate bonds and their trade prices. Our sample period is from 2004 to 2010. This period covers the financial crisis of 2007-2009 and also a non-crisis period that we use for comparison. When using quarterly data, we classify the first two quarters of 2007 as the non-crisis period because few ABS were downgraded in these quarters.

Our primary data on insurers' transactions and positions are from the NAIC (Schedule D).[21] The data provide year-end holdings of invested securities for each insurer and detailed transaction information on every trade. Both the position and transaction data include the identities of the insurers and the relevant securities (e.g., 9-digit CUSIP). We merge the year-end position data with transaction data to infer quarter-end positions. Finally, the NAIC data provides the *book-adjusted carrying value* and *fair value* of each position. We employ this information to infer whether an insurer holds its ABS and bonds at historical cost or at fair value.

The financial information on each insurer is from Weiss Ratings, which provides financial strength ratings and other annual firm characteristics, such as invested assets, capital and surplus, and the RBC ratio.[22] We eliminate small insurers with invested assets less than $13 million (the bottom 1%) and/or with an RBC ratio either below 2 or above 20 to avoid any bias from small or unusual firms.[23] We also delete all of AIG's affiliated insurers and 32 others that provide financial insurance and guarantees for bonds, such as credit default swaps and municipal finance, as these firms were affected by the downgrades of ABS through a different channel.[24] Finally, we also require that an insurer holds at least one corporate bond and one government bond because we investigate gains trading primarily in these assets. Our final sample consists of 11,330 firm-years, representing 570 life insurers and 1,488 P&C insurers.

Our data on ABS ratings are from S&P's Ratings IQuery and were downloaded in February 2011. We extract all the data in the structured credit subsector, which comprehensively covers initial ratings and history for all securitized issues rated by S&P from 1991 to 2010. The

[21] Further details of the NAIC data can be found in Ellul, Jotikasthira, and Lundblad (2011).
[22] In 2010, Weiss Ratings was split from the Street.com to focus on the business of rating insurance companies.
[23] Small insurers do not have many trading choices. Insurers with RBC ratios below two are subject to supervisory intervention, while those with RBC ratios above 20 are unusual and may behave differently from the average.
[24] We identify bond insurers from Ratings IQuery, which reports financial insurance providers in securitized issues. In addition to AIG, we also exclude Ambac Assurance, MBIA Insurance, Financial Guaranty Insurance, etc.

database records issue and tranche identity (9-digit CUSIP), issue amount, class, maturity, collateral type, rating, and rating date. In this dataset, we identify 127,719 ABS securities in 13,430 issues, among which 65% are mortgage-backed securities, 20% are collateralized debt obligations, and 15% are asset-backed securities backed by consumer loans. Using 9-digit CUSIPs to merge with insurers' holdings, we identify 24,452 relevant ABS. Although S&P rated the largest number of ABS among all rating agencies[25], it does not cover all ABS held by insurers. Relying on the line numbers self-reported by insurers to identify all non-agency ABS holdings, we find that S&P covers about 50% of all ABS holdings. We take into account this imperfect coverage by S&P when we calculate the impact of the downgrades on insurers' RBC ratios. In most of our analysis, we nevertheless rely on the S&P sample because we need detailed information on rating downgrades and dates to identify relevant trigger.

The data on corporate bond characteristics and trading are obtained from Mergent Fixed Income Securities Database (FISD) and TRACE. We merge the FISD data with the position and transaction data of insurance firms to identify the corporate bonds being held and transacted as well as the bond characteristics, such as issue size, age, maturity, and rating. We identify corporate bond downgrades using S&P's ratings whenever available, to be consistent with our data source of ABS ratings. When S&P's ratings are missing, we use the ratings from Moody's (or Fitch if Moody's ratings are not available). Data on corporate bond transaction prices are from TRACE, which covers over-the-counter transactions for both investment- and speculative-grade bonds since early 2005. Finally, the data on government bond characteristics, such as offering date and maturity date, are from CRSP and the CUSIP Master File.

3.2 Insurance Companies and Their ABS Holdings

Table 1 shows summary statistics on key financial variables for our sample firms over the 2007-2009 crisis period. A detailed description of the variables is in Appendix D.

[Insert Table 1 here]

From 2007 to 2009, we have complete financial information for 1,224 life firm-years and 3,637 P&C firm-years. Life firms are generally larger than P&C firms. Invested assets are $7.24 billion, on average, (median of $758 million) for life firms and $958 million, on average,

[25] According to SEC (2011), as of 2010 year-end, S&P and Moody's ratings are outstanding for a total of 117,900 and 101,546 ABS securities, respectively.

(median of $152 million) for P&C firms. Capital and surplus are also larger for life firms, with the average of $765 million (median of $104 million), compared to $435 million (median of $66 million) for P&C firms. In addition, life firms, similar to banks, operate at much higher leverage than P&C firms. Return on equity, as a measure of profitability, is similar for both types.

The capital positions of life and P&C firms are similar. The average life and P&C firms have RBC ratios of 9.40 and 9.02, respectively.[26] This similarity suggests that life and P&C firms should have similar needs, from a capital adequacy standpoint, to respond to the shock to their capitalizations following the ABS downgrades. Both types heavily invest in investment-grade bonds, including government and corporate bonds, which together represent 72-74% of invested assets, on average. Hence, their trading behavior in these assets should be representative of their portfolio choice and important to analyze.

Table 2 reports insurers' holdings of ABS over the period 2004-2010.

[Insert Table 2 here]

The first two columns show that the fractions of life firms holding ABS (about 85%) are greater than those of P&C firms (about 70%) before the crisis. Moreover, over the course of the crisis, these fractions for P&C firms decline substantially to less than 53% at the end of 2010. In the remaining columns, we report the number and percentage holding of ABS for insurers that hold at least one ABS at each year end. Three features of the data are notable. First, insurers' holdings of ABS are quite large during the crisis, about 6-7% of the par value of their fixed-income holdings for life firms and about 5% for P&C firms. Still, these numbers underestimate insurers' exposure to the ABS markets since Ratings S&P does not cover all ABS in the NAIC data. Second, insurers build up their holdings of ABS in the years leading up to the crisis and reduce the exposures after. Finally, substantial heterogeneity in ABS holdings exists even within each insurance type. For example, in 2007, the median life firm holds only 16 ABS (6% of bond portfolio) while those in the top ten percent hold over 175 such securities (over 15% of bond portfolio). The same heterogeneity is also present among P&C firms. We employ this heterogeneity within each insurance type, albeit measured in a different but more economically meaningful way below, to test whether insurers' incentives to gains trade are generated by their exposure to ABS downgrades.

[26] The required capital for business risks accounts for a relatively larger fraction of RBC for P&C firms. Therefore, although P&C firms have significantly lower leverage than life firms, their RBC ratios are about the same.

3.3 Downgrades of ABS and Their Impact on Insurance Companies

We are particularly interested in the downgrades from investment to speculative grades because these downgrades would (i) significantly increase capital requirements, and (ii) force some but not all insurers to recognize the market values of downgraded assets either by switching from HCA to MTM or by recognizing OTTI. Figure 1 presents the total number of investment-to-speculative downgrades of ABS on a quarterly basis.

[Insert Figure 1 here]

The downgrade wave starts in 2007Q3, with 952 downgrades from investment to speculative grades. In each of the following four quarters, we observe over 3,500 such downgrades. From 2007Q3 to 2009Q4, over 33,000 ABS were downgraded from investment to speculative grades.

The right axis of Figure 1 shows that only a small portion of the downgrades in the early stage of the crisis (5-9% before the end of 2008) affected insurers. However, the insurers were increasingly hit by the ABS downgrades in 2009 (15-18% of all downgrades in each quarter). This evidence may explain why insurers pushed hard to have the NAIC change its capital assessment methodology for Residential and Commercial Mortgage-Backed Securities (Becker and Opp (2014) and Hanley and Nikolova (2014)).[27]

What is central to our analysis is the impact of these ABS downgrades on an insurer's capital position, not its holdings of ABS or downgraded ABS *per se*. Recall that a downgrade degrades the capital position, as proxied by the RBC ratio, of an insurer holding the downgraded asset in two ways; first, it increases the percentage capital requirement (denominator), and second, it may force the recognition of price decline, lowering the insurer's statutory capital (numerator). Leverage amplifies these effects as they both operate through capital which is only a fraction of total assets. Thus, even though life and P&C firms had similar portfolio allocations to ABS entering the crisis, the significant ABS downgrades during the crisis impacted the capital positions of life firms more than those of P&C firms. In Table IA3 in the Internet Appendix, we report summary statistics of these effects, measured for each firm as the expected change in the RBC ratio as a result of actual ABS downgrades during the crisis (2007Q3-2009Q4), holding constant the insurer's ABS positions entering the crisis. We hereafter refer to this measure as

[27] In Table IA1 in the Internet Appendix, we present the rating transitions of downgrades of the ABS held by insurers. Many of the downgrades were by several notches. For example, 1,238 ABS were downgraded to a BB rating class (for the sake of brevity, we aggregate BB+, BB or BB- in one class); 451 of them were rated as AAA before the downgrade. These dramatic shifts, which likely came as a surprise to insurers, significantly impacted the insurers' capital positions.

"ABS exposure." In many of our analyses, we isolate the differential effects of accounting rules from the impact of ABS downgrades, by focusing on a subsample of 189 life and 105 P&C insurers with large and similar ABS exposures. These samples represent, among insurers holding at least one downgraded ABS, the top 75% of life firms and the top 25% of P&C firms. The cutoff exposure is approximately -0.4 on the RBC ratio scale, suggesting these selected firms are all significantly impacted by ABS downgrades.

3.4 Accounting Treatments of Downgraded ABS

Our first identification strategy relies on the different accounting rules used by life (HCA) and P&C (MTM) insurers for speculative-grade bonds. Exclusion restrictions aside, we assess the relevance of this strategy by exploring the cross-sectional differences between P&C and life insurers in the use of fair, or market, value in booking recently downgraded ABS. Using year-end position data, we classify as "revalued" the positions for which the book and fair values are equal; others are classified as held at HCA. Table 3 reports the revaluation frequencies for two types of downgrades (a) from investment to speculative grades, and (b) from AAA to speculative grade (this being most severe and unexpected).

[Insert Table 3 here]

The results in Table 3 show striking differences between life and P&C insurers, confirming the economic basis for our between-insurance-type analysis. For example, consider row (2), which includes all downgrades from AAA to speculative grades in 2005-2010. Of 1,860 ABS positions that life insurers hold under HCA before the downgrades, 79% remain under HCA and only 9% are revalued after the downgrades. On the contrary, P&C firms hold 851 soon-to-be-downgraded ABS positions, of which 45% remain under HCA, 36% are revalued, and 20% are sold.

One drawback of the NAIC balance sheet data for this particular type of analysis is that the positions are available only at the year-end. It is plausible that revaluations occur at different times within the year and market prices subsequently drift, creating a bias against finding revaluations. This may have happened, for example, during 2009 when many of the extreme downgrades took place relatively early in the year. To address this issue, we consider a subset of downgrades that occurred in the fourth quarter, as these are temporally closer to the year-end measurement and the drift problem may be less important. As expected, the results are more striking; P&C firms keep only 16% of downgraded ABS under HCA, revalue 63% (six times as much as life), and sell 21%.[28]

The difference in revaluation frequency between life and P&C firms is not due to the difference in characteristics, such as credit quality, of their ABS. In Table IA2 in the Internet Appendix, we estimate several linear models for the probability that an ABS position is revalued controlling for credit quality, other distinct characteristics of the ABS (e.g. issue size), and time-varying characteristics (e.g. remaining maturity) at the end of downgrade year. We find that even with all these controls, P&C firms remain significantly more likely than life firms to revalue a downgraded position, confirming the importance of regulatory accounting rules in dictating insurers' actual accounting treatments. Together, the evidence supports the relevance of our first identification strategy and provides the economic basis for using life and P&C insurers, respectively, as representatives for institutions using HCA and those using MTM.

3.5 OTTI Recognition across U.S. States

Our second identification strategy relies on the fine variation in accounting practices among the same type of insurers across domicile states. As explained in Section 2.3, we classify states as either those that strictly implement the NAIC model regulation or those that permit some level of discretion to their commissioners. Here, we assess the economic relevance of our classification by exploring whether the recognition of market value for accounting purposes varies significantly across states of domicile, in line with our expectation.

Table 4 reports the average frequencies that life (Panel A) and P&C (Panel B) recognize OTTI for downgraded corporate bonds and ABS in the *pre-crisis period*. For each insurer-downgrade observation, OTTI is considered recognized if (a) OTTI is reported for the bond or ABS position at year-end, or (b) the book-adjusted carrying value of the bond or ABS position is reset to the reported fair value at year-end. Thus, our definition captures both MTM and OTTI under HCA, reflecting the maximum degree to which each insurer recognizes the change in market value of their downgraded holdings. For each insurer, we calculate the OTTI frequency as the percentage of all downgraded positions for which OTTI is recognized. We then average the insurer-level OTTI frequencies for all life or P&C firms domiciled in each state and finally average across all states in the high vs. low MTM groups.

[28] Similarly, Figure IA2 in the Internet Appendix shows that P&C firms revalue a significantly higher percentage of speculative-grade positions than do life firms in every year during our sample period.

[Insert Table 4 here]

The results confirm that the pre-crisis level of OTTIs for life firms domiciled in states that we define as "high MTM" is larger (around 17%) than those of life firms domiciled in states defined as "low MTM" (around 4-9%). These differences may result from the actual exercise of regulatory discretion by the commissioners in high MTM states and/or the worries of life firms in these states that if they do not properly recognize OTTIs, they may be penalized. On the contrary, there is no difference in the OTTI frequency between P&C firms in the high and low MTM states, consistent with the notion that a departure from the NAIC model regulation only occurs in the cases where the recognition of market value is discretionary. P&C insurers are required by the NAIC to use MTM. Overall, the evidence in Table 4 confirms that the exogenous variation in the degree of market value recognition does exist among life insurers domiciled in different U.S. states, thereby providing the economic basis for our within-life analysis.

4. Empirical Methodologies and Results

4.1 Selling of Downgraded ABS

In this section, we first test H1a by assessing whether the P&C firms' revaluation of downgraded ABS to market values indeed makes them more likely than their life counterparts to directly sell the downgraded ABS. We then test H1b in a similar manner but using the cross-state variation in market value recognition within the life insurance sector.

Since ABS downgrades are often predictable and insurers often sell the soon-to-be downgraded securities preemptively (see Plantin *et al.* (2008) for a theoretical argument and Ellul *et al.* (2011) for empirical evidence), we consider all ABS tranches following a downgrade from investment to speculative grades of *any tranche backed by the same asset pool*. We model the probability of selling each affected ABS by the end of the quarter in which the downgrade occurs as a linear model:

$$S_{i,j,k} = \kappa_0 + \kappa_P P_j + \kappa_V V_{i,j,k} + \kappa_X X_{i,k} + \kappa_Y Y_{j,k} + \kappa_W W_k + \varepsilon_{i,j,k} \tag{6}$$

where $S_{i,j,k}$ is an indicator variable that equals one if the insurer j sells any part of its holding in downgraded bond i by the end of event quarter k, and zero otherwise; P_j is an indicator variable that equals one if the insurer j is a P&C insurer, and zero otherwise; $V_{i,j,k}$ is an indicator variable that equals one if the insurer j revalues downgraded bond i at the year-end before event k, and zero otherwise; $X_{i,k}$ is a vector of bond i's static and time-varying characteristics, including initial ratings group dummies, just before event k; $Y_{j,k}$ is a vector of the insurer j's static and time-varying characteristics at the year-end just before event k; W_k is a vector of time-specific variables for downgrade event k; and, κ's are the corresponding vectors of coefficients to be estimated. Table 5 reports the results.

[Insert Table 5 here]

In columns (1) and (2) of Panel A, the coefficients of P&C dummy are positive and significant. Consistent with hypothesis H1a, P&C insurers, using MTM for speculative-grade ABS, have a higher propensity to sell an ABS position affected by a downgrade than do life insurers, using HCA. In column (1), we include rating group dummies, state dummies, and year dummies, thus identifying the result by comparing the selling propensities of life and P&C insurers domiciled in the same state and holding ABS in the same rating group and downgraded in the same year. In column (2), the common denominators are ABS's rating group and asset pool. The difference in selling propensity between life and P&C firms is similar in both columns, 2.8-3.3% which is about half of the unconditional selling probability of life firms.[29]

We include a host of control variables to capture ABS and insurer characteristics as well as the position's existing accounting treatment. First, the revaluation dummy controls for the likelihood that insurers, regardless of their type, are more likely to sell downgraded positions that have already been re-booked at market price, as doing so will not incur further losses but will help reduce the RBC. The significant and positive coefficient of the revaluation dummy confirms this intuition. Second, the significant difference in selling propensity between life and P&C firms cannot be explained by ABS-level characteristics, such as liquidity, since we include the tranche offering amount and its initial rating (before the first investment-to-speculative downgrade of the pool) as a control variable in all columns.[30]

A valid concern is that our above results may be driven by the fact that P&C firms, due to their lower leverage, are generally less impacted than life firms by the ABS downgrades. We address this concern by examining the subsample of life and P&C insurers with significant and

[29] The unconditional probability of selling downgraded ABS is 12.7% for P&C firms and 6.4% for life firms.
[30] In fact, the marginal effects of issue size show that large ABS issues are more likely to be sold, possibly due to their superior liquidity.

similar ABS exposures. We describe the construction of this subsample in Section 3.3. Panel B of Table 5 (columns (1) and (2)) confirms that our results in Panel A hold in this controlled sample, suggesting that they are likely explained by the use of HCA vs. MTM, rather than the large or small impact of collective ABS downgrades.

We next implement the same analysis within the life insurance sector. Our variable of interest, P_j in equation (6), is now the high MTM dummy, which indicates life insurers that are domiciled in the high MTM states according to each definition in Appendix C. Under H1b, we expect a positive coefficient for the high MTM dummy, which the results in columns (3) to (5) in both panels of Table 5 confirm. Since we include rating and pool fixed effects, the coefficient of interest is identified by comparing life insurers across high and low MTM states holding ABS in the same rating group and asset pool. The coefficient estimates demonstrate that life insurers domiciled in high MTM states sell more of their downgraded ABS than do other life insurers. This difference is both statistically and economically significant. Take the unconditional selling probability of 6.4% as the benchmark. The estimate in column (3) shows that the propensity to sell downgraded ABS positions is about 34 percent higher than average (0.022/0.064) for life insurers domiciled in high MTM states.

We next explore whether capital-constrained firms are more likely to divest downgraded ABS, which should be the case if insurers sell downgraded ABS to improve their capital positions. We expect that Insurers with low RBC ratios to start with would be pushed closer to regulatory (or other rating-related) thresholds, and thus have a greater need to respond. In all regressions, we include a low RBC ratio dummy (indicating insurers with RBC ratios in the lowest quartile within each type), and find that its coefficients are positive and significant in almost all columns in Panel A (all insurers) and all columns in Panel B (insurers with large ABS exposures) of Table 5. The economic effects, ranging from 2.0% to 7.5%, are significant given the relatively small unconditional selling probability. Moreover, as expected, these effects are stronger in the sample of insurers with large ABS exposures.

Overall, the results in Table 5, obtained from both the between-insurance-type and within-life analyses, consistently demonstrate that insurers that are required to use MTM (or, recognize OTTI) for downgraded ABS are more likely to sell their downgraded holdings than those that can continue to use HCA. This is consistent with General Hypothesis 1, and the general prediction of the theoretical literature.

4.2 Gains Trading

In this section, we assess insurance companies' propensity to gains trade by examining the extent to which an insurer's decision to sell a bond position is motivated by its *unrealized gain*. For each position, we calculate the unrealized gain as the difference between the position's book-adjusted carrying value and fair value as a percentage of book-adjusted carrying value. If an institution gains trades, we should observe that it is more likely to sell a bond position with an unrealized gain than an otherwise similar position with an unrealized loss. Thus, to identify gains trading, we need assets that are (i) held under HCA, and (ii) have sufficient cross-sectional variation whereby some positions carry unrealized gains while others carry unrealized losses. The former essentially rules out equities. The latter rules out ABS and structured products, as most of them carry extremely large unrealized losses.[31] This leaves us with government and corporate bonds, which together account for over 70% of invested assets for both life and P&C insurers. Insurers can choose any combination of these two asset classes to gains trade, depending on the availability of unrealized gains in each.

4.2.1 Propensity to Gains Trade and ABS Exposure

We model the probability of selling each government or corporate bond position as a linear model:

$$S_{i,j,q} = \gamma_0 + (\gamma_z + \gamma_{zy} y_{j,q} + \gamma_{zc} c_q + \gamma_{zyc} y_{j,q} c_q) z_{i,j,q} + \gamma_X X_{i,q} + \gamma_Y Y_{j,q} + \gamma_W W_q + \varepsilon_{i,j,q} \qquad (7)$$

where $S_{i,j,q}$ is an indicator variable that equals one if the insurer j sells bond i in calendar quarter q, and zero otherwise; $z_{i,j,q}$ is the percentile (ranging from 0 to 1) of unrealized gain of bond i in the portfolio of insurer j at the year-end prior to quarter q; $y_{j,q}$ is a characteristic of insurer j that is expected to amplify/diminish the effect of $z_{i,j,q}$, measured at the year-end prior to quarter q; c_q is an indicator variable that equals one if quarter q lies in the crisis period, and zero otherwise; $X_{i,q}$ is a vector of bond i's static and time-varying characteristics, including rating group dummies, at the beginning of quarter q; $Y_{j,q}$ is a vector of financial and risk characteristics of

[31] In Table IA5 in the Internet Appendix, we report the distribution of the percentage unrealized gains (and losses) separately for life and P&C firms. Panel A is for ABS, Panel B is for corporate bonds, and Panel C is for government bonds. Panel A shows that over 90% of ABS positions carry unrealized losses in 2008 (with the median as large as -30%), and still over 75% do so in 2009. Panels B and C show that unrealized gains (of various magnitudes) are much more available for corporate and government bonds.

insurer j at the year-end prior to quarter q; W_q is a vector of calendar-quarter dummies which we interact with bond-type dummy (government vs. corporate)[32]; and, γ's are the corresponding coefficients to be estimated. Depending on the specification, we also include either domicile state fixed effects or firm fixed effects in $Y_{j,q}$.

Our coefficients of interest are the γ_z's, both the main term and the interaction terms. We interpret a positive coefficient as evidence for gains trading since it indicates that positions that carry higher unrealized gains are more likely to be sold. In the same manner, positive (negative) coefficients of the interaction terms indicate a large (smaller) degree of gains trading during the crisis ($c_q = 1$) and/or for insurers with a certain characteristic as captured by $y_{j,q}$.

We first test hypothesis H2a. We estimate our probability model for a sample of life and P&C insurers that are affected by ABS downgrades (i.e., sample of firms in Table 5 Panel A), and include in the model an interaction term between unrealized gain percentile and high ABS exposure dummy (an indicator variable for insurers we identify as having large ABS exposures). If H2a is true, then we expect the coefficient of the interaction term to be positive for the crisis period. Table 6 reports the results.

[Insert Table 6 here]

We start by investigating the crisis period, in isolation. In columns (1) and (4), the coefficients of the interaction between unrealized gain percentile and high ABS exposure dummy are positive and significant (at 1% for life and 10% for P&C insurers), indicating that both life and P&C insurers with high ABS exposures engage in greater degrees of gains trading than do other insurers of the same type. These results are identified by comparing the degree of gains trading between firms with high and low ABS exposures, holding constant bond characteristics including credit rating, firm characteristics including domicile state, and the calendar quarter in which the trading takes place. In economic terms (and relative to an otherwise similar position held by insurers with low ABS exposures), an interquartile increase in unrealized gain percentile increases the probability that a corporate or government bond position will be sold in a quarter

[32] We interact calendar-quarter dummies with bond-type dummy to identify gains trading from other alternative forces that may drive insurers to sell mostly government bonds or mostly corporate bonds. This is a concern since bond type is highly correlated with unrealized gain percentile; during the crisis, government bonds as a group carry significantly larger unrealized gains than corporate bonds. As robustness checks, in the Internet Appendix (Tables IA6, IA8, and IA11), we consider separately corporate bonds and government bonds and show that our main findings hold in both samples.

by 1.1% (0.021 x 0.5, or 30 percent increase from the mean of 3.7%) for life firms and 0.8% (0.015 x 0.5, or 13 percent increase from the mean of 6.1%) for P&C firms.

The coefficients of the control variables are generally intuitive. For example, in all models, the coefficients of the revalue dummy are significantly positive, suggesting that these positions may be held for trading rather than as a long-term investment. We also control for bond liquidity using bond age and issue size, and find that the probability of being sold is higher for more liquid bonds, consistent with the notion that insurers actively try to minimize any price impact.[33] Other significant control variables include an indicator that measures whether the bond is downgraded to a speculative grade, an indicator that captures whether the bond issuer files for bankruptcy, and depending on models, the proportion of risky assets in an insurer's portfolio (capturing the insurer's risk appetite or capacity to bear risk) as well as the insurer's ROE.

A criticism against looking at the crisis period in isolation is that certain firms may gains trade even in normal times (Carey (1994)) and hence what we show in columns (1) and (4) of Table 6 may have nothing to do with the sizeable ABS downgrades during the crisis. To address this criticism, we investigate gains trading in the entire sample period (2004-2010) and introduce the crisis dummy to compare insurers' behavior during the crisis with that in normal times. This type of specification has an important advantage in isolating the *incremental* behavior during the crisis from other common behaviors that may be present in all periods. The two variables of interest are (i) the interaction between the crisis dummy and unrealized gain percentile, which captures the incremental propensity of all insurers in each type to gains trade, and (ii) the triple interaction between (i) and high ABS exposure dummy, which captures the extent to which the gains trading differs between insurers with high and low ABS exposures.

Column (2) of Table 6 shows that life insurers are less likely to sell bonds with high unrealized gains in normal times (possibly to avoid paying taxes) but more likely to do so during the crisis, consistent with Laux and Leuz (2009, 2010)'s conjecture that financial institutions may gains trade to relieve financial stress.[34] More importantly, the triple interaction's coefficient shows that this gains trading behavior is significantly more pronounced among life insurers with high ABS exposures. Column (3), which includes firm fixed effects, confirms that this result is not driven by firm-level time-invariant unobserved heterogeneity, and columns (5) and (6) show

[33] See Edwards, Harris, and Piwowar (2007), Hong and Warga (2000) and Schultz (2001). Driessen (2005) uses bond age to identify the liquidity component of credit spreads.

[34] Our results also imply that reported income that includes realized gains and losses may not be reflective of insurers' financial performance, consistent with the findings of Nissim (2012).

that a similar effect is also present among P&C firms. Together, all results in Table 6 are consistent with hypothesis H2a, pointing to the importance of ABS downgrades in driving gains trading among insurance companies.

4.2.2 Propensity to Gains Trade and Capital Positions

We now test hypothesis H2b, which pertains to another important assumption: insurers gains trade to manage their RBC ratios (as opposed to net income, for example). In this test, we use a subsample of insurers that we identify as having large ABS exposures, as opposed to the entire sample of affected insurers as in Table 6. Doing so allows us to focus on the most relevant insurers and to hold relatively constant the impact of ABS downgrades without overly complicating the model with triple or quadruple interaction terms. Table 7 reports the results.

[Insert Table 7]

We first confirm whether we have enough power to identify gains trading among this subset of insurers with high ABS exposures. Focusing on the first and fourth rows, columns (1)-(3) of Table 7 show that we do for life firms; columns (5)-(7) show that we also do, albeit less so, for P&C firms. In all specifications, we include the same set of controls as in Table 6. We then take the model in columns (3) and (7), which include firm fixed effects, as our starting point, and add in columns (4) and (8) an interaction between unrealized gain percentile and low RBC ratio dummy (an indicator variable for insurers that have RBC ratios in the bottom quartile of each type). We also add the triple interaction with crisis dummy to identify the extent to which the differential propensity to gains trade between those with healthy and low RBC ratios increases during the crisis. If hypothesis H2b is true, then we expect the coefficient of this triple interaction to be positive, which turns out to be the case for both life and P&C firms. In normal times, insurers with low RBC ratios do not behave differently from others. During the crisis, however, they engage in higher degrees of gains trading. Take life insurers, for example. Among those with healthy RBC ratios (taking their behavior in normal times as a benchmark), an interquartile increase in unrealized gain percentile increases the probability that a corporate or government bond position will be sold in a quarter by 1.8% (0.035 x 0.5) during the crisis. The same effect would be 2.8% (0.056 x 0.5), significantly higher, if the position were instead held by life firms with low RBC ratios. This cross-sectional difference is also present between the healthy and the low RBC ratio groups of P&C insurers.

4.2.3 Life vs. P&C Insurance Companies

We now turn to the most important tests of our paper: do financial institutions that use MTM for downgraded assets engage in higher degrees of gains trading than others that use HCA? In this section, we use the distinction between P&C and life insurers as a proxy for institutions that use MTM vs. those that use HCA, respectively. In the next section, we will instead use the variation in degrees of market value recognition across life insurers domiciled in high vs. low MTM states.

Hypothesis H2c states that life firms will, on average, gains trade more than P&C firms. This is because the latter have already sold a larger number of downgraded ABS positions, and doing so alleviates the need to employ gains trading. The results in Table 6 and the first eight columns of Table 7 provide suggestive evidence. First, in Table 6, the effects of an interquartile increase in unrealized gain percentile on the probability that a bond position will be sold during the crisis are stronger for life firms (1.1%, or 30 percent increase from the mean of 3.7%) than for P&C firms (0.8%, or 13 percent increase from the mean of 6.1%). The latter is also statistically weaker. Second, while gains trading is widespread among life firms with large ABS exposures (columns (1)-(4) of Table 7), only P&C firms with large ABS exposures plus low RBC ratios exhibit significant degrees of gains trading (columns (5)-(8) of Table 7). This selective group consists of only 28 out of 105 P&C firms that have large ABS exposures (and over 1,000 P&C firms in our entire sample).

In column (9) of Table 7, we formally test the difference in gains trading between life and P&C insurers controlling for all other effects, including the direct effects of ABS exposures and RBC ratios, we have demonstrated so far. We include both insurance types in the estimation but introduce a P&C dummy to distinguish the degrees of gains trading between the two types. Our coefficient of interest is in the sixth row, for the triple interaction among crisis dummy, P&C dummy, and unrealized gain percentile. The estimate is negative and significant, consistent with hypothesis H2c. In economic terms, the marginal effect of an interquartile increase in unrealized gain percentile on the probability of being sold (in a quarter during the crisis) is about 1.2% smaller (-0.023 x 0.5) for a bond position held by P&C firms than an otherwise similar position held by life firms. This is highly significant given the unconditional probabilities of 4.2% and 8.0%, respectively, for life and P&C firms with large ABS exposures. Taken together, the results in Table 6 and especially in Table 7 provide clear evidence that P&C firms, using MTM for downgraded ABS, engage in lesser degrees of gains trading than life firms, using HCA.

4.2.4 Life Insurance Companies in High vs. Low MTM States

We now move to investigate the gains trading behavior *within* the life insurance sector, exploiting the variation in the implementation of NAIC rules across U.S. states. Hypothesis H2d predicts that life insurers domiciled in high MTM states will have a lower propensity to engage in gains trading, relative to life insurers domiciled in low MTM states. We test this hypothesis using the sample of life insurers with large ABS exposures. Table 8 reports the results.

[Insert Table 8]

In columns (1) to (3), we look at the crisis period in isolation, and the variable of interest is the interaction between high MTM dummy and unrealized gain percentile (the second row), which captures the difference in gains trading propensity between life insurers in high and low MTM states. In columns (4) to (6), we explore the entire sample period, taking normal times as a benchmark. Therefore, in these specifications, the variable of interest is the triple interaction between crisis dummy, high MTM dummy, and unrealized gain percentile (the fourth row).

All columns of Table 8 point to the same conclusion: while life insurers, in general, tend to gains trade during the crisis, those domiciled in high MTM states have a lower propensity to do so as compared to others domiciled in low MTM states. These results are robust across all alternative classifications of U.S. states in Appendix C. Take the estimates in column (4), for example. The positive and significant coefficient of 0.051 in the third row shows that gains trading is prevalent in this sample of life insurers (which we have shown earlier in Table 7). However, the negative and significant coefficient of the triple interaction term in the fourth row indicates that life insurers in the high MTM states gains trade to lesser degrees than the others. In economic terms, the marginal effect of an interquartile increase in unrealized gain percentile on the probability of being sold (in a quarter during the crisis) is about 0.9% smaller (-0.018 x 0.5) for a bond position held by life insurers in high MTM states than an otherwise similar position held by other life insurers. This is significant given that the corresponding unconditional probability is about 4.2%. Overall, these results are consistent with hypothesis H2d.

Together, the tests we have conducted for hypotheses H2a-H2d provide support for General Hypothesis 2. Financial institutions holding downgraded assets under HCA have a larger incentive to gains trade than other institutions holding these assets under MTM.

4.3 Robustness Checks

While our results as a whole consistently show the significant impact of regulatory accounting rules on insurers' trading behaviors, there may be alternative explanations for the different individual results, particularly those obtained from the comparison of life and P&C insurers.

First, we address three other alternatives that may explain why life firms are less likely to sell downgraded ABS but more likely to gains trade than P&C firms: (i) differences in asset management expertise (e.g. life firms can better manage complex and illiquid assets), (ii) differences in liability or payout structures (e.g. life firms have longer and less uncertain liabilities), and (iii) differences in tax circumstances (e.g. life firms suffer losses during the crisis but P&C firms do not). In Table IA13 in the Internet Appendix, we hold each of these aspects relatively constant in a subsample of life and P&C firms and investigate the propensity to sell ABS (Panel A, similar to Table 5) and the propensity to gains trade (Panel B, similar to column (9) of Table 7) in this subsample.[35] We find that the differences in trading behavior between life and P&C insurers remain largely the same as in our baseline analyses, suggesting that these alternatives do not drive our results.[36]

Second, we investigate a specific alternative hypothesis pertaining to the fact that life insurers' longer-term liabilities may permit higher illiquidity and risk bearing capacities. This hypothesis thus predicts that life insurers are more likely to hold illiquid and risky assets such as ABS, when the rest of the market is selling them. In Table IA14 in the Internet Appendix, we investigate this question by exploring the risk and liquidity characteristics of life and P&C insurers' investments in (unaffiliated) common stocks (Panel A) and government bonds (Panel B).[37] Life and P&C insurers use the same accounting rules for each of these asset classes; so, if the difference in illiquidity and risk bearing capacities, rather than the difference in accounting rules, drive our results, we should observe the differences in illiquidity and risk of the stock and government bond investments that show up during the crisis period. We do not find any evidence consistent with this prediction.

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[35] We thank an anonymous referee for suggesting these robustness checks. For example, we hold asset management expertise constant by investigating a subsample of life and P&C insurers that belong to a universal group with both types under the same umbrella. See the description of Table IA13 in the Internet Appendix for more details.

[36] We concede that using the sample of life and P&C firms with large and similar exposures does not fully address the concern that life firms have higher leverage than P&C firms and may respond differently to the downgrades (even if they are equally affected). Our within-life analyses, however, are clean from this concern.

[37] We use beta and Amihud ratio to measure systematic risk and illiquidity of common stocks. We use fraction of Treasury notes/bonds in the total government bond portfolio to measure illiquidity of government bonds. We acknowledge that the choice between Treasury and other government bonds may be driven by other considerations, such as the reaching-for-yield hypothesis of Becker and Ivashina (2013).

Finally, although our within-life identification is relatively clean from endogeneity concerns, one may still argue that the discretion afforded to state insurance commissioners may be correlated with the sophistication in asset management of state-domiciled insurers and it is the latter that drives our results. We address this concern in two ways. First, we simply note that states that tend to be associated with being "financial centers" show up in both the high MTM group (e.g. CA, DE, and NY) and the low MTM group (e.g. CT, IL, and MA); thus, asset management sophistication is unlikely to explain the differences in trading behavior between the two groups. Second, in Table IA17 in the Internet Appendix, we repeat our ABS selling and gains trading analysis on the subsamples of large and public insurers, arguably the more sophisticated group. We show that all our results hold for both subsamples.[38]

5. Price Distortions

The literature has convincingly demonstrated that fire sales of downgraded assets can generate significant price distortions (Ellul *et al*. (2011) and Merrill *et al*. (2013), for example). In this section, we conduct a similar investigation on bonds that are targeted for gains trading. Our goal is to provide relevant evidence for the debate on whether HCA helps to completely avoid market distortions and spillover effects during a financial crisis.[39]

We examine only corporate bonds since government bonds are highly liquid and thus unlikely to suffer any price pressure from the selective selling. Our identification relies on the cross section of similar corporate bonds that are subject to different degrees of gains trading. If a large number of insurers gains trade using the same bonds in an illiquid market, these bonds are likely to suffer significant price pressure.[40] To test this prediction, we estimate the following model of quarterly bond return:

$$R_{i,q} = \beta_0 + (\beta_{\bar{z}} + \beta_{\bar{z}c} c_q)\bar{z}_{i,q} + \beta_X X_{i,q} + \beta_W W_q + \xi_{i,q} \tag{8}$$

[38] This robustness check also shows that our results are valid for both small and large firms.
[39] In Figure IA3 in the Internet Appendix, we show that HCA is also associated with an overstatement of reported RBC ratio during the crisis, as market values are substantially lower than book values for many assets. Huizinga and Laeven (2012) find similar results for banks. In Table IA15, we show that the portfolio allocations to ABS evolve very differently between life and P&C insurers, as well as between life insurers domiciled in the high and low MTM states. Thus, the trading behaviors induced by different regulatory accounting rules also have portfolio and risk implications. See Ellul *et al.* (2014) for the analysis of trading behavior under different accounting regimes in the period leading up to the crisis.
[40] Schultz (2001) and Ellul *et al.* (2011) estimate that insurers collectively hold between one-third and forty percent of investment-grade corporate bonds.

where $R_{i,q}$ is the return of bond i in quarter q; $\bar{z}_{i,q}$ is the gains-trading selling pressure from a particular group of insurers that hold bond i at the beginning of quarter q; c_q is an indicator variable that equals one if quarter q lies in the crisis period, and zero otherwise; $X_{i,q}$ is a vector of bond static and time-varying characteristics in quarter q, W_q is a vector of time-specific variables for quarter q, and β's are the corresponding vectors of coefficients to be estimated.

We use the transaction prices from TRACE to calculate the quarterly return of a bond as the logged change in price from the last day of the previous quarter to the last day of the current quarter.[41] If a bond trades more than once in a day, we use the size-weighted average of trade prices on the last day of a quarter.[42] Our variable of interest is $\bar{z}_{i,q}$, which we proxy by standardized value-weighted average unrealized gain percentile across all relevant insurers holding bond i. Let $\text{Holding}_{i,j,q}$ denote the par value of bond i held by insurer j at the beginning of quarter q. Then, the value-weighted average unrealized gain percentile is calculated as:

$$\left[\frac{\sum_j (\text{Holding}_{i,j,q} \times \text{Unrealized gain pct.}_{i,j,q})}{\sum_j \text{Holding}_{i,j,q}}\right] \times \left[\frac{\sum_j \text{Holding}_{i,j,q}}{\text{Issue size}_{i,q}}\right]$$

where the sum is over all insurers j's in the high or low MTM groups of insurers. We then standardize the average unrealized gain percentile by subtracting its sample mean and dividing the result by its sample standard deviation, so that the selling pressure has zero mean and one standard deviation. The objective is to ensure that the sample variation is about the same across the high and low MTM groups, so that the coefficients of selling pressures from the two groups can be directly compared.

We distinguish the effect of gains trading from other effects of unrealized gains by interacting $\bar{z}_{i,q}$ with the crisis indicator c_q since the gains-trading selling pressure should only operate during the crisis when insurers are hit by the sizeable ABS downgrades. If gains trading

[41] This return measure is far from perfect. First, corporate bonds do not trade every day; so, the last day on which we observe trades for each bond is often a few days before quarter-end. For the bonds in our data that pass our screen, however, approximately 90% of the last trading days fall in the last month of the quarter. Second, the holding period over which we measure the bond return may be greater than one quarter. This problem affects less than 5% of the observations. We address these two problems, which result in irregular holding periods, by measuring the values of (some) control variables over the same period in which the bond return is measured.

[42] Trade prices tend to be more accurate for larger trades. See Bao, Pan, and Wang (2011), Feldhutter (2012), and Jotikasthira (2008) for evidence that prices vary significantly across transactions, even on the same day.

creates price pressure, then $\beta_{\bar{zc}}$ should be negative.[43] We include standard controls for the fundamental movement in the bond price, using maturity-matched Treasury and rating- and maturity-matched credit spread returns, and other bond characteristics, such as bond age and issue size. We use the interpolated constant maturity Treasury bond/note from the Fed to calculate the Treasury return. The spread return is the corporate bond index return minus the Treasury return, where we use the rating- and maturity-matched Bank of America-Merrill Lynch bond index as our primary source. We estimate the model (8) by OLS, and cluster the standard errors by bond issuer and calendar quarter. Table 9 reports the results.

[Insert Table 9 here]

In columns (1)-(3), we conduct a between-insurance-type analysis. For each bond, we calculate the standardized average unrealized gain percentile separately across life insurers' positions and across P&C insurers' positions. Here, we consider life (P&C) insurers as low (high) MTM insurers. The first two columns present clear evidence that the corporate bonds disproportionately targeted for gains trading statistically and economically underperform otherwise similar bonds during the crisis. These effects are absent in normal times, consistent with the notion that gains trading is employed to raise statutory capital during times of stress. A one-standard deviation increase in low MTM insurers' or life insurers' average unrealized gain percentile decreases quarterly return by 0.63%, highly significant given that the interquartile range of abnormal return is about 4.56% during the 2007-2009 crisis. The effect is 0.19% for the high MTM insurers' or P&C insurers' average unrealized gain percentile. In column (3), we find that the pressure from life insurers is significantly stronger than that from P&C insurers; in fact, the latter largely disappears when both are included. This is consistent with our finding that gains trading is widespread among life but quite limited among P&C insurers.[44]

In columns (4)-(6), we conduct a within-life analysis and find similar results. Here, we calculate the standardized average unrealized gain percentile separately across positions of life

[43] This is because the corporate bond return and gains-trading selling pressure are contemporaneous. We find some evidence that the immediate underperformance persists for 5-6 quarters since the ABS downgrades spread through several quarters during the crisis and the pressure often remains for the same bonds. The underperforming bonds eventually outperform once the pressure subsides, creating a V-shape price pattern similar to that of downgraded corporate bonds shown by Ellul *et al.* (2011).

[44] On average, life (P&C) insurers buy about 4% (3%) of the same bonds back within 3 months after selling. Further, this number increases to about 30% (20%) if we consider substitute bonds with the same credit rating (for example, A) and with maturity within ±1 year of the bond sold. This appears rather like a wash sale, but for the sole purpose of realizing an accounting gain.

firms domiciled in high MTM states (high MTM insurers) and those of life firms in low MTM states (low MTM insurers). Columns (4) and (5) show that for both groups, their gains trading generates significant price impact during the crisis. In column (6), we find that the pressure from life firms domiciled in high MTM states dominates, again suggesting that the lower the degrees of market value recognition for downgraded ABS, the more widespread is gains trading and the larger price impact it generates. To put these results in perspective: the price pressure is generated by gains trading, which in turn originates, in part, from insurers' exposures to downgraded ABS held under HCA. Our evidence therefore demonstrates spillover effects from downgraded ABS to otherwise unrelated corporate bonds through the interaction between HCA and regulatory capital requirements.

6. Conclusions

The theoretical literature has argued that HCA insulates financial institutions from the price distortions associated with market stress. We challenge this view by providing new empirical evidence that HCA, interacting with regulatory capital requirements, increases financial institutions' incentive to "gains trade". We use the insurance industry as a laboratory to explore this interaction due to availability of detailed security-level data and the significant differences that exist in regulatory accounting rules: (i) life insurers have greater flexibility than P&C insurers to hold speculative-grade instruments under HCA, and (ii) the implementation of these rules for life insurers significantly differs across U.S. states.

Faced with severe downgrades among their ABS holdings during the financial crisis, insurers respond by selling the downgraded securities to reduce the required capital and/or gains trading to raise the statutory equity capital, among a few other alternatives. Life insurers, using HCA for downgraded securities, are less likely than P&C insurers, using MTM, to sell these securities and more likely to resort to gains trading. These differences in trading behavior are robust to plausible alternative explanations pertaining to structural business differences between life and P&C firms. Moreover, our analysis within the life insurance sector confirms the results: life insurers domiciled in "high MTM" states engage in less gains trading and more impaired-asset selling than insurers domiciled in "low MTM" states. Finally, we demonstrate price distortions associated with the HCA-induced trading incentives, suggesting that contrary to common theoretical predictions, HCA does not necessarily avoid illiquidity spillovers and financial contagion.

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Appendix A: Impacts of accounting rules on financial institutions' RBC ratios and optimal responses following the downgrades of financial assets

	Mark-to-Market Accounting	Historical Cost Accounting
Immediate price decline of downgraded instrument reflected in the balance sheet?	Yes	No*
Future price declines of downgraded instrument (to be) reflected in the balance sheet?	Yes	No
Numerator Effect: Impact on total adjusted capital (TAC)**	Immediate decrease	No impact*
Denominator Effect: Impact on required risk-based capital (RBC)**	Increase	Increase
Net: Impact on RBC ratio**	Decrease	Decrease (potentially with a smaller magnitude than under MTM, due to a lower numerator effect)
Accounting Perspective: Selling the downgraded asset?	(0) Indifferent between selling the downgraded asset and keeping it on the balance sheet.	(-) Selling the downgraded asset leads to the recognition of any price decline as capital losses, negatively impacting statutory equity capital (numerator)
Regulatory Capital Perspective: Selling the downgraded asset?	(+) Selling the downgraded asset for lower-risk assets reduces required risk-based capital (denominator)	(+) Selling the downgraded asset for lower-risk assets reduces required risk-based capital (denominator)
Net: Selling of the downgraded asset?	(+) Likely because of unambiguously positive net benefits from the two perspectives.	(-/+) Unclear because of ambiguous net benefits from the two opposing perspectives. Unlikely if price decline is sufficiently large and the negative effect from the accounting perspective prevails.
Need for supplemental measures to improve RBC ratio, including gains trading of unrelated assets held under historical cost accounting	Less because selling of the downgraded asset has partially raised the RBC ratio.	More. In the absence of selling the downgraded asset, the institution needs to sell other assets to reduce the required risk-based capital (denominator), or raise additional equity capital (numerator), or both, to raise the RBC ratio closer to its pre-downgrade value.

* If the institution recognizes Other-Than-Temporary Impairment (OTTI), then its assets and hence statutory (equity) capital will immediately decrease by the amount of OTTI, generating a negative numerator effect on its RBC ratio.

** The NAIC risk-based capital ratio, or RBC ratio, is calculated as follows:

$$\text{RBC Ratio} = \frac{\text{Total Adjusted Capital (TAC)}}{\text{Risk-Based Capital (RBC)}},$$

where TAC is made up primarily of capital and surplus and asset valuation reserve (AVR), if the institution maintains one, and therefore is essentially the same as statutory equity capital. RBC reflects business risk and asset risk where the latter is based largely on credit ratings of the assets.

Appendix B: Numerical Examples

We use the positions of Mid Century Insurance (company code = 21687) at the end of 2007 as the pre-downgrade positions in Case 1, and the positions of Metropolitan Tower Life Insurance (company code = 97136) at the end of 2007 as the pre-downgrade positions in Cases 2 and 3. We assume that the original ABS positions are in NAIC Class 1 and half of these positions are later downgraded to Class 4. We also assume that if the insurer sells the downgraded ABS, it will replace them with Class 1 bonds. The RBC ratio in each scenario is calculated according to the following formula:

$$\text{RBC Ratio} = \frac{\text{Total Adjusted Capital (TAC)}}{\text{Risk Based Capital (RBC)}} = \frac{\text{TAC}^*+\text{ABS}}{\text{RBC}^*+(\lambda \times \text{ABS})},$$

where TAC^* is the total adjusted capital, excluding the book value of ABS; ABS is the book value of ABS; RBC^* is the risk-based capital, excluding the portion required for holding ABS; and, λ is the percentage required capital for holding ABS (or new assets that replace the downgraded ABS.) For simplicity, the above formula and the following numerical examples ignore the size factor and covariance discount in the calculation of RBC; therefore, the results here are only an approximation. Please refer the Internet Appendix for the more precise and detailed calculation, as well as the full list of assumptions.

		Post-Downgrade	
	Pre-Downgrade	Not Sell	Sell
Case 1: P&C Insurer, MTM			
(1) ABS	446.44	290.19	290.19
(1.1) Expected impact from further price decline[#]	0.00	-50.09	0.00
(2) TAC^*	277.91	277.91	277.91
(3) TAC = (1) + (1.1) + (2)	724.36	518.01	568.10
(4) $\lambda \times$ ABS	1.82	17.71	1.18
(4.1) Expected impact from further price decline[#]	0.00	-3.06	0.00
(5) RBC^*	194.65	194.65	194.65
(6) RBC = (4) + (4.1) + (5)	196.47	209.30	195.83
RBC ratio = (3)/(6)	3.69	2.47	2.90
Case 2: Life Insurer, HCA			
(1) ABS	766.88	766.88	498.47
(2) TAC^*	430.15	430.15	430.15
(3) TAC = (1) + (2)	1,197.03	1,197.03	928.63
(4) $\lambda \times$ ABS	3.07	76.69	1.99
(5) RBC^*	281.15	281.15	281.15
(6) RBC = (4) + (5)	284.22	357.84	283.15
RBC ratio = (3)/(6)	4.21	3.35	3.28
Case 3: Life Insurer, HCA with OTTI			
(1) ABS	766.88	498.47	498.47
(2) TAC^*	430.15	430.15	430.15
(3) TAC = (1) + (2)	1,197.03	928.63	928.63
(4) $\lambda \times$ ABS	3.07	49.85	1.99
(5) RBC^*	281.15	281.15	281.15
(6) RBC = (4) + (5)	284.22	331.00	283.15
RBC ratio = (3)/(6)	4.21	2.81	3.28

[#] The precise rule for MTM is "the lower of book or market values." The insurer can only lose from a price decline but not gain from a price increase. We therefore value the expected impact of price decline as a short position in 1-year at-the-money put option on B-rated ABS.

Appendix C: Classifications of U.S. States into High and Low Mark-to-Market Groups

The following table lists the value of "High MTM Dummy" for different U.S. states, and relevant criteria and statistics, under three alternative classification schemes.

- Baseline and alternative 1 classifications are based on the Insurance Codes for each state. First, we search the insurance code to see whether the state meets Criterion A and assign the value of 1 if it does and zero otherwise. Criterion A: the state's insurance code explicitly states, or uses clear language to suggest that the Insurance Commissioner (or Insurance Division) has full discretion in determining the method of calculating (fixed income) assets' values. Second, if the state meets Criterion A, then we proceed to search the code to see whether the state also meets Criterion B and assign the value of 1 if it does and zero otherwise. (If the state does not meet Criterion A, we assign a value of "N/A" to Criterion B.) Criterion B: the state's insurance code does not explicitly state that the rules used by the Insurance Commissioner (or Insurance Division) shall not be inconsistent with the method approved by the National Association of Insurance Commissioners (as set forth in the latest edition of its publication "Valuation of Securities"). To be classified as a "High MTM" state (dummy = 1) under the baseline classification, the state has to meet both criteria. Alternative 1 classification expands the baseline classification to include three additional states whose insurance codes, based on our reading, are ambiguous on Criterion B.

- Alternative 2 classification is based on realized average frequencies that life insurers in the state recognize Other-than-Temporary Impairment (OTTI) for downgraded corporate bonds and ABS. Only the downgrades from investment to non-investment grades during the pre-crisis period (2005-2007) are included. For each insurer-downgrade observation, OTTI is recognized if (a) OTTI is reported for the bond or ABS position at year end, or (b) the book-adjusted carrying value of the bond or ABS position is reset to the reported fair value at year end. For each insurer, %OTTI is calculated as the number of downgraded positions for which OTTI is recognized divided by the total number of downgraded positions. The insurer-level %OTTI's are then averaged across all life insurers domiciled in the state. States with the average %OTTI above the median are considered "High MTM" states (dummy = 1). Seven states in the following table, including HI, ID, ME, NH, NM, RI, and SD, do not have valid average % OTTI because life insurers in these states do not hold downgraded positions during the pre-crisis period. We do not treat these seven states as "High MTM" states for our analyses.

	Classification Based on Reading of State Insurance Code				Classification Based on Pre-Crisis OTTI Frequency	
State	Baseline	Alternative 1	Criterion A	Criterion B	Alternative 2	% OTTI
AL	0	0	1	0	1	12.44%
AR	0	0	0	N/A	1	14.74%
CO	0	0	0	N/A	1	21.51%
CT	0	0	0	N/A	0	4.62%
DC	0	0	0	N/A	1	15.38%
FL	0	0	1	0	0	5.56%
HI	0	0	1	0	0	-
IA	0	0	1	0	0	10.47%
IL	0	0	0	N/A	0	7.43%
KS	0	0	0	N/A	0	5.71%
KY	0	0	1	0	0	0.00%
LA	0	0	0	N/A	1	27.73%
MA	0	0	0	N/A	1	19.29%
MD	0	0	0	N/A	0	0.60%
ME	0	0	0	N/A	0	-
MN	0	0	0	N/A	0	9.63%
MO	0	0	0	N/A	0	3.92%

	Classification Based on Reading of State Insurance Code				Classification Based on Pre-Crisis OTTI Frequency	
State	Baseline	Alternative 1	Criterion A	Criterion B	Alternative 2	% OTTI
MS	0	0	0	N/A	0	0.00%
NC	0	0	0	N/A	0	4.17%
ND	0	0	0	N/A	0	0.00%
NE	0	0	1	0	0	9.77%
NH	0	0	0	N/A	0	-
NJ	0	0	0	N/A	1	10.94%
NM	0	0	0	N/A	0	-
OK	0	0	1	0	0	3.33%
OR	0	0	1	0	0	1.47%
PA	0	0	0	N/A	0	5.81%
RI	0	0	1	N/A	0	-
SD	0	0	1	0	0	-
TN	0	0	1	0	0	3.47%
UT	0	0	0	N/A	1	10.99%
VA	0	0	0	N/A	0	2.23%
VT	0	0	1	0	0	0.00%
ID	0	1	1	0/?*	0	-
WA	0	1	1	0/?**	1	16.25%
OH	0	1	1	0/?***	1	24.41%
AZ	1	1	1	1	1	19.37%
CA	1	1	1	1	1	25.00%
DE	1	1	1	1	1	21.68%
GA	1	1	1	1	1	14.29%
IN	1	1	1	1	1	11.23%
MI	1	1	1	1	1	23.05%
NY	1	1	1	1	1	11.41%
SC	1	1	1	1	1	20.00%
TX	1	1	1	1	1	12.22%
WI	1	1	1	1	1	11.42%

* “The director may adopt rules establishing standards and limitations for investments by insurers that are not otherwise specifically permitted or prohibited in this chapter. In the absence of a rule prohibiting such, all assets shall be valued according to rules promulgated by the national association of insurance commissioners (NAIC), NAIC's valuation of securities office or by NAIC's financial condition subcommittee.”
** “All bonds or other evidences of debt having a fixed term and rate held by any insurer may, if amply secured and not in default as to principal or interest, be valued as follows … [description of HCA] … or in lieu of such method, according to such accepted method of valuation as is approved by the commissioner. … [Further conditions] The commissioner shall have full discretion in determining the method of calculating values according to the rules set forth in this section, and not inconsistent with any such methods then currently formulated or approved by the National Association of Insurance Commissioners.”
*** “The Insurance Commissioner shall adopt rules in accordance with the Code to establish standards for the determination and calculation of values, for purposes of use in statutory financial statements submitted to the department of insurance, for those investments for which the National Association of Insurance Commissioners has not published valuation standards.”

Appendix D: Descriptions of Variables

Variable	Specific to	Definition
% risky assets	Insurer-year	Percentage of investment assets invested in any of the following asset classes: non-investment grade bonds, common and preferred stocks, non-performing mortgages, real estate, and other investments. According to Weiss Ratings and NAIC, the required capital percentages for these assets are greater than or equal to those of the least risky class of non-investment grade bonds (BB).
ABS exposure or High ABS exposure dummy	Insurer	Expected impact of ABS downgrades during the crisis (2007Q3-2009Q4) on RBC ratio given an insurer's ABS positions before the crisis. For each insurer, the new total adjusted capital or TAC (numerator) and RBC (denominator) are calculated to reflect the new credit ratings at the end of 2009 of all ABS positions held at the end of 2007Q2. ABS whose credit ratings are not available in Ratings IQuerry are assumed to experience the same average downgrades and price declines as those whose credit ratings are available in Ratings IQuerry; therefore, the changes in TAC and RBC are calculated first from ABS available in Ratings IQuerry and then scaled by the ratio of value of all insurer-reported ABS to value of ABS in Ratings IQuerry. Insurer-reported ABS are private-labeled ABS, identified using line numbers in the NAIC position data. Statutory accounting rules are strictly applied to each ABS position; HCA is used for all positions of life (P&C) insurers except those in NAIC Class 6 (Class 3-6) where MTM is used. Market price of a position is the average price of the last trades or reported market values of all insurance companies at the end of 2009. High ABS exposure dummy equals 1 for life (P&C) insurers with the expected decline on RBC ratio in the top 75% (25%) of all those that are affected by ABS downgrades, and 0 otherwise. The threshold is about the same for life and P&C insurers at approximately 0.4 in RBC ratio terms.
Bankruptcy dummy	Bond-quarter	Dummy variable equal to 1 if the issuer of the bond files for bankruptcy during the quarter, and 0 otherwise.
Bond age	Bond-quarter	Time from issuance to the beginning of quarter of interest or the beginning of quarter in which the interested transactions fall (depending on specifications), measured in years.
Bond return	Bond-quarter	Log of change in prices from the last day when there are any trades of a bond in the previous quarter to the last day in the current quarter, scaled by a factor of 100. If a bond trades more than once in a day, we use the size-weighted average of trade prices on the last day of a quarter.
Calendar quarter, Calendar quarter x Bond type, and year fixed effects	Quarter, Quarter-Bond type, or Year	Set of dummy variables for calendar quarters in which the observations fall. Set of dummy variables for calendar quarters in which the observations fall, by bond type (corporate or government bonds). Set of dummy variables for years in which the observations fall.
Capital and surplus	Insurer-year	The insurance company's statutory net worth (including paid-in capital and additional funds in surplus) in millions of dollars through the most recent year end. Capital and surplus and asset valuation reserve, if any, are the primary components of total adjusted capital (TAC), the numerator of RBC ratio.
Crisis dummy	Quarter	Dummy variable equal to 1 if the calendar quarters are in the 2007-2009 crisis period, and 0 otherwise. The crisis period is defined based on the volume of ABS downgrades, and covers 2007Q3 to 2009Q4.
Downgrade dummy	Bond-quarter	Dummy variable equal to 1 if the bond is downgraded from investment to speculative grades during the quarter, and 0 otherwise. S&P ratings are used wherever available. Moody's ratings are used when S&P ratings are unavailable.
Firm fixed effects	Insurer	Set of dummy variables for insurance companies to which the observations belong.
High mark-to-market (MTM) dummy	Insurer	Dummy variable equal to 1 if the life insurer is domiciled in a U.S. state in the high MTM group under each of the three alternative classifications in Appendix C, and 0 otherwise. States not in the high MTM group are considered "low MTM states."
Standardized high MTM insurers' and	Bond-quarter	Value-weighted average unrealized gain percentile across all qualified insurers' positions in the bond, scaled by the fraction of bond issue size held by qualified

Variable	Specific to	Definition
low MTM insurers' unrealized gain pct.		insurers and then standardized by subtracting the sample mean and dividing by the sample standard deviation. For high (low) MTM insurers' unrealized gain pct., qualified insurers must have positions in the bond at the beginning of the quarter, have high ABS exposure, i.e., their RBC ratios are expected to drop by 0.4 or more due to actual ABS downgrades during the crisis, and belong to the high (low) MTM group. In a between-insurance-type analysis, high (low) MTM insurers refer to P&C (life) insurers. In a within-life analysis, high (low) MTM insurers refer to life insurers domiciled in high (low) MTM states.
Issue size	Bond	Offering amount of the bond, measured in million dollars.
Leverage	Insurer-year	Debt as a percentage of total assets, all measured at book values.
Low RBC ratio dummy	Insurer-year	Dummy variable equal to 1 if the insurer's year-end RBC ratio is in the bottom quartile among all insurers of the same type (life or P&C), and 0 otherwise.
Maturity	Bond-quarter	Maturity of the bond at the beginning of quarter of interest or the beginning of quarter in which the interested transactions fall (depending on specifications), measured in years.
NAIC risk-based capital ratio (RBC ratio)	Insurer-year	Ratio of total adjusted capital (TAC), made up primarily of capital and surplus and applicable valuation reserves, to NAIC risk-based capital (RBC). RBC is the *minimum* amount of capital that the insurance company must maintain based on the inherent risks in its operations. RBC is calculated based on the NAIC's formula which reflects its assessment of risks of different asset classes and businesses. For example, a company with RBC ratio of 1.0 has capital equal to its RBC. Insurance companies with higher RBC ratios are considered better capitalized. Insurance companies with RBC ratio below 2.0 are subject to supervisory interventions. The levels of supervisory actions depend on the level of RBC ratio. Low RBC ratio dummy equals 1 for RBC ratios below the annual median, and 0 otherwise.
Pool fixed effect	Bond	Set of dummy variables for all ABS tranches issued on the same asset pool.
Rating group fixed effects	Bond-quarter	Set of dummy variables for credit rating groups, defined by the NAIC's capital requirement in the RBC ratio formula. The groups are, in order of credit quality, A and above, BBB, BB, and B and below. S&P ratings are used wherever available. Moody's ratings are used when S&P ratings are unavailable.
Revalue dummy	Position-year	Dummy variable equal to 1 if the position has the book value that is equal to its reported fair or market value, and 0 otherwise.
ROE	Insurer-year	Return on equity, measured as net income divided by book value of equity at the beginning of the year.
Sell dummy	Position-quarter	Dummy variable equal to 1 if part or all of the position is sold during a defined time period, and 0 otherwise. It is the dependent variable in linear probability models for selling ABS following rating downgrade and for selling government and corporate bonds conditional on their relative unrealized gains.
State fixed effects	Insurer-year	Set of dummy variables for insurers' domicile states.
Tranche size	ABS	Offering amount of the ABS tranche, measured in thousand dollars.
Unrealized gain pct.	Position-year	Percentile rank, ranging from 0 to 1, of the position's dollar unrealized gain within the insurer's portfolio at previous year end. A position's dollar unrealized gain is the difference between the insurer's reported fair value and book-adjusted carrying value of the position at previous year end, measured as percentage of book value.

Table 1: Summary Statistics of Insurance Companies' Financial Variables

This table presents (pooled) descriptive statistics on important financial variables for the panel of life insurers (Panel A) and property and casualty (P&C) insurers (Panel B) from the end of 2007 to the end of 2009. Included in the sample are insurers that hold at least one corporate bond issue and one government bond issue, and have invested assets at least $13 million and RBC ratio between 2 and 20. Thirty three bond insurers such as AMBAC, MBIA, etc. and insurers in the AIG group are also excluded. Variable descriptions are in Appendix D.

Panel A: Life firms

	Mean	10thPct	Median	90thPct	Std.Dev.
Number of firm-years	1,224				
Invested assets ($ million)	7,240	41	758	15,923	21,704
Capital and surplus ($ million)	765	10	104	1,707	2,196
Leverage	0.84	0.61	0.90	0.96	0.17
Return on equity (ROE)	0.02	-0.22	0.05	0.24	0.28
NAIC risk-based capital ratio (RBC ratio)	9.40	4.33	8.22	15.86	5.48
Holding of investment-grade bonds (%)	72.41	51.78	75.69	90.45	17.53
Holding of risky assets (%)	13.98	1.99	10.71	28.17	14.12

Panel B: Property & Casualty firms

	Mean	10thPct	Median	90thPct	Std.Dev.
Number of firm-years	3,637				
Invested assets ($ million)	958	26	152	1,481	4,589
Capital and surplus ($ million)	435	13	66	620	2,347
Leverage	0.59	0.41	0.61	0.74	0.14
Return on equity (ROE)	0.07	-0.04	0.08	0.19	0.13
NAIC risk-based capital ratio (RBC ratio)	9.02	4.00	7.90	15.22	5.00
Holding of investment-grade bonds (%)	73.61	44.82	78.39	94.53	19.94
Holding of risky assets (%)	15.93	0.00	10.77	39.21	17.19

Table 2: Summary Statistics of Insurance Companies' Holding of ABS Securities

This table summarizes the year-end holding of asset-backed securities (ABS) of insurance companies. ABS positions are identified by matching insurers' bond holding positions at year-end to a list of ABS identified from S&P's Ratings IQuery using 9-digit CUSIP. S&P's Ratings IQuery comprehensively covers initial ratings and histories for all securitized issues rated by S&P from 1991 to 2010. The statistics on the number and size of ABS holdings are reported only for firms investing in at least one ABS. The size of the ABS holdings is the par (or fair) value of the identified ABS held by a firm relative to the par (or fair) value of all of the firm's fixed income positions. The mean, median, 10th percentile, and 90th percentile are calculated across firms at each year-end.

		Number of Firms		Number of ABS Securities Held by Each Firm				% ABS Holding (Par Value)				% ABS Holding (Fair Value)			
	Year	All	Holding ABS	Mean	10th Pct	Median	90th Pct	Mean	10th Pct	Median	90th Pct	Mean	10th Pct	Median	90th Pct
Life	2004	481	391	34.99	1	10	82	4.72%	0.57%	3.45%	9.24%	4.62%	0.57%	3.58%	9.29%
	2005	447	380	46.12	2	12	105	5.07%	0.63%	3.89%	10.96%	5.05%	0.65%	3.97%	10.95%
	2006	429	368	60.02	2	14	146	6.45%	0.65%	4.79%	14.23%	6.43%	0.68%	4.79%	14.14%
	2007	413	351	72.88	2	16	175	7.44%	0.75%	5.95%	15.88%	7.06%	0.72%	5.78%	14.84%
	2008	408	342	76.69	2	17	209	7.33%	0.68%	6.08%	15.75%	5.40%	0.58%	4.38%	11.80%
	2009	403	337	72.70	2	16	220	6.48%	0.52%	4.95%	13.58%	4.91%	0.46%	3.69%	10.46%
	2010	384	319	68.20	1	15	198	5.41%	0.40%	4.26%	11.61%	4.28%	0.35%	3.48%	9.09%
Property & Casualty	2004	1,151	741	7.81	1	5	17	4.07%	0.56%	3.36%	8.31%	4.05%	0.56%	3.31%	8.38%
	2005	1,132	764	9.52	1	6	20	4.45%	0.63%	3.28%	8.78%	4.42%	0.62%	3.26%	8.69%
	2006	1,132	785	11.20	1	6	24	5.15%	0.56%	3.80%	11.49%	5.10%	0.55%	3.74%	11.22%
	2007	1,173	820	12.30	1	7	26	5.48%	0.63%	3.83%	11.57%	5.25%	0.63%	3.71%	11.16%
	2008	1,240	825	12.17	1	6	26	4.92%	0.55%	3.18%	10.78%	3.73%	0.44%	2.43%	8.13%
	2009	1,224	777	10.87	1	4	23	3.47%	0.30%	2.09%	7.81%	2.62%	0.27%	1.71%	6.01%
	2010	1,215	645	8.59	1	3	18	2.89%	0.22%	1.56%	6.81%	2.31%	0.18%	1.29%	5.21%

Table 3: Accounting Treatment of Downgraded ABS

This table reports frequency statistics on insurance companies' accounting treatment of downgraded ABS that are previously held at modified historical costs. Two types of downgrade are considered: (a) from investment to non-investment grades, and (b) from AAA to non-investment grade. Rows (1) and (2) include all downgrades from 2005 to 2010, and rows (3) and (4) include only the downgrades in the fourth quarter of each year. Over the year in which the downgrade occurs, each position held at historical cost at the beginning of year is re-classified into one of the following three groups: (i) kept at historical cost (HCA), (ii) kept but revalued to the year-end fair value (revalued), and (iii) sold. The percentages of these groups are reported separately for each type of downgrade and for life and P&C insurance companies.

	Life				Property & Casualty			
	Number of Positions	Treatment after Downgrade			Number of Positions	Treatment after Downgrade		
		HCA	Revalued	Sold		HCA	Revalued	Sold
All downgrades in 2005-2010								
(1) Investment to non-investment	5,161	71%	15%	14%	1,588	40%	39%	21%
(2) AAA to non-investment	1,860	79%	9%	12%	851	45%	36%	20%
Downgrades in the fourth quarter of each year								
(3) Investment to non-investment	1,207	74%	14%	13%	327	20%	60%	20%
(4) AAA to non-investment	514	79%	10%	11%	220	16%	63%	20%

Table 4: OTTI Recognition for Downgraded Corporate Bonds and ABS in High and Low Mark-to-Market States

This table presents average frequencies that life (Panel A) and P&C (Panel B) insurers recognize Other-than-Temporary Impairment (OTTI) for downgraded corporate bonds and ABS across U.S. states classified as 'high MTM states' and 'low MTM states'. Only the downgrades from investment to non-investment grades during the pre-crisis period (2005-2007) are included. For each insurer-downgrade observation, OTTI is recognized if (a) OTTI is reported for the bond or ABS position at year end, or (b) the book-adjusted carrying value of the bond or ABS position is reset to the reported fair value at year end. For each insurer, %OTTI is calculated as the number of downgraded positions for which OTTI is recognized divided by the total number of downgraded positions. The insurer-level %OTTI's are then averaged across all life or P&C insurers domiciled in each state and finally averaged across all states in the high vs. low MTM groups under three different alternative classifications (Baseline, Alternative 1 and Alternative 2). These classifications of U.S. states into the high and low MTM groups are defined in Appendix C. Number of states is the number of states that have at least one life or P&C insurer and are classified into either the high or the low MTM groups. For life (P&C) insurers, seven (six) of these classified states, including HI, ID, ME, NH, NM, RI, and SD (AL, AR, ME, MS, NM, and UT), do not enter the average % OTTI calculation and the *t*-test of difference between the two groups because life (P&C) insurers in these states do not hold downgraded positions during the pre-crisis period.

	Baseline		Alternative 1		Alternative 2	
	No. States	% OTTI	No. States	% OTTI	No. States	% OTTI
Panel A: Life firms						
Low MTM	35	8.69%	32	7.82%	25	4.12%
High MTM	10	16.97%	13	17.53%	20	17.17%
High - Low		8.28%		9.70%		13.05%
p-value		(0.001)		(0.000)		(0.000)
Panel B: P&C firms						
Low MTM	36	66.39%	33	66.60%	26	69.22%
High MTM	10	66.42%	13	66.01%	20	62.91%
High - Low		0.03%		-0.58%		-6.30%
p-value		(0.498)		(0.547)		(0.883)

Table 5: Probability of Selling ABS following Downgrade

This table reports coefficient estimates for linear models of the probability that an ABS position is sold following an investment-to-non-investment downgrade of any tranche backed by the same asset pool as the ABS in question. Panel A includes ABS positions held by any insurer at the beginning of the year in which such downgrade occurs. Panel B is restricted to the ABS positions held by life and P&C insurers with high ABS exposure, i.e., those whose RBC ratios are expected to drop by about 0.4 or more due to actual ABS downgrades during the crisis. The dependent variable equals one if the company holding the downgraded ABS sells any amount of it by the end of the quarter in which the downgrade occurs, and zero otherwise. Both life and P&C insurers are included in columns (1) and (2), where P&C dummy indicates if the position is held by a P&C insurer, and where the insurer-level controls variables, e.g., ln(capital and surplus), % risky assets, Leverage, and ROE, are demeaned within each type. Columns (3) to (5) include life insurers only. High MTM dummy equals one if the life insurer is domiciled in a U.S. state classified as being in the high MTM group under each of the three alternative classifications as indicated in the column heading (Baseline, Alternative 1, and Alternative 2). These classifications are defined in Appendix C. The same set of control variables is also included in Panel B but not report for brevity. Full table is in the Internet Appendix. All variables are defined in Appendix D. Standard errors, clustered at firm or state level, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

Panel A: Full sample

	Life and P&C		Life Only		
	(1)	(2)	(3)	(4)	(5)
			Definition for "High MTM Dummy"		
			Baseline	Alternative 1	Alternative 2
P&C dummy	0.033***	0.028***			
	(0.012)	(0.010)			
High MTM dummy			0.022**	0.014*	0.020**
			(0.008)	(0.008)	(0.008)
Low RBC ratio dummy	0.032*	0.020	0.069***	0.069***	0.073***
	(0.017)	(0.013)	(0.019)	(0.020)	(0.020)
Revalue dummy	0.061***	0.077***	0.070***	0.071***	0.069**
	(0.019)	(0.017)	(0.026)	(0.026)	(0.026)
ln(tranche size)	0.004	0.006*	0.005	0.005	0.005
	(0.003)	(0.003)	(0.004)	(0.004)	(0.004)
ln(capital and surplus)	-0.006*	-0.004	0.003	0.004	0.003
	(0.003)	(0.003)	(0.003)	(0.003)	(0.002)
% risky assets	0.000	0.000	-0.001	-0.001	-0.001*
	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Leverage	0.004	-0.016	-0.082	-0.084	-0.090
	(0.059)	(0.050)	(0.081)	(0.082)	(0.081)
ROE	0.007	0.009	0.008	0.009	0.012
	(0.029)	(0.019)	(0.019)	(0.019)	(0.018)

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	Life and P&C		Life Only		
	(1)	(2)	(3)	(4)	(5)
			Definition for "High MTM Dummy"		
			Baseline	Alternative 1	Alternative 2
Rating group fixed effects	YES	YES	YES	YES	YES
Pool fixed effects	NO	YES	YES	YES	YES
Year fixed effects	YES	NO	NO	NO	NO
State fixed effects	YES	NO	NO	NO	NO
Standard error cluster	FIRM	STATE	STATE	STATE	STATE
Observations	11,339	11,339	8,446	8,446	8,446
R-squared	0.071	0.014	0.019	0.018	0.018
Number of pools		2,120	2,011	2,011	2,011

Panel B: Subsample of life and P&C firms with high ABS exposure

	Life and P&C		Life Only		
	(1)	(2)	(3)	(4)	(5)
			Definition for "High MTM Dummy"		
			Baseline	Alternative 1	Alternative 2
P&C dummy	0.040**	0.034***			
	(0.019)	(0.010)			
High MTM dummy			0.022**	0.015*	0.025***
			(0.009)	(0.009)	(0.009)
Low RBC ratio dummy	0.060**	0.049**	0.075***	0.075***	0.082***
	(0.028)	(0.019)	(0.022)	(0.023)	(0.023)
Bond control variables	YES	YES	YES	YES	YES
Firm control variables	YES	YES	YES	YES	YES
Rating group fixed effects	YES	YES	YES	YES	YES
Pool fixed effects	NO	YES	YES	YES	YES
Year fixed effects	YES	NO	NO	NO	NO
State fixed effects	YES	NO	NO	NO	NO
Standard error cluster	FIRM	STATE	STATE	STATE	STATE
Observations	8,894	8,894	7,957	7,957	7,957
R-squared	0.064	0.016	0.021	0.020	0.020
Number of pools		2,054	1,985	1,985	1,985

Table 6: Do Exposures to Downgraded ABS Induce Gains Trading?

This table reports coefficient estimates for linear models of the probability that an insurance company, holding at least one downgraded ABS, will sell a corporate or government bond position. The dependent variable is a dummy that equals one if the insurer holding the bond at the beginning of the quarter sells the bond during the quarter, and zero otherwise. The regressions are run separately for life insurers (columns (1) to (3)) and P&C insurers (columns (4) to (6)). The variables of interest are unrealized gain pct., defined as the percentile rank of each bond position's unrealized gain in each insurer's portfolio, and its interactions with crisis dummy and high ABS exposure dummy. Unrealized gain is calculated as the fair value minus the book-adjusted carrying value at the latest year end before the calendar quarter of interest. Crisis dummy equals one for the periods from the third quarter of 2007 to the end of 2009. High ABS exposure dummy equals one for insurers whose RBC ratios are expected to drop by about 0.4 or more due to actual ABS downgrades during the crisis. Corp dummy equals one for corporate bond positions, and gov dummy equals one for government bond positions. The bond characteristics are interacted with the bond type dummies. All variables are defined in Appendix D. Standard errors, either two-way clustered by insurer and calendar quarter or one-way clustered by calendar quarter, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	Life			Property & Casualty		
	(1)	(2)	(3)	(4)	(5)	(6)
	Crisis	All	All	Crisis	All	All
<u>Main variables</u>						
(1) Unrealized gain pct.	-0.004	-0.023***	-0.023***	-0.003	-0.002	-0.000
	(0.008)	(0.007)	(0.005)	(0.004)	(0.005)	(0.004)
(1) x (2)	0.021***	0.001	0.000	0.015*	-0.003	-0.009*
	(0.006)	(0.006)	(0.003)	(0.009)	(0.007)	(0.005)
Crisis dummy x (1)		0.022**	0.021**		0.001	-0.000
		(0.010)	(0.009)		(0.006)	(0.005)
Crisis dummy x (1) x (2)		0.020***	0.019***		0.017*	0.022*
		(0.008)	(0.005)		(0.010)	(0.011)
<u>Related insurance characteristics</u>						
(2) High ABS exposure dummy	0.000	-0.001		0.015**	0.015*	
	(0.005)	(0.008)		(0.007)	(0.008)	
(3) Low RBC ratio dummy	0.024***	0.011**	0.008	0.002	0.004	0.012**
	(0.007)	(0.005)	(0.005)	(0.005)	(0.005)	(0.006)
(4) Revalue dummy	0.062***	0.047***	0.048***	0.013*	0.014*	0.017**
	(0.012)	(0.010)	(0.012)	(0.007)	(0.008)	(0.007)
Crisis dummy x (2)		0.001	0.001		-0.001	-0.004
		(0.007)	(0.003)		(0.007)	(0.007)
Crisis dummy x (3)		0.009	0.007		-0.002	-0.004
		(0.007)	(0.005)		(0.005)	(0.004)
Crisis dummy x (4)		0.019	0.017		-0.009	-0.009
		(0.012)	(0.015)		(0.014)	(0.011)

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	Life			Property & Casualty		
	(1)	(2)	(3)	(4)	(5)	(6)
	Crisis	All	All	Crisis	All	All
Bond control variables						
Corp dummy x ln(bond age)	-0.006***	-0.007***	-0.006***	-0.006**	-0.007***	-0.005***
	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.001)
Corp dummy x ln(maturity)	-0.011***	-0.008***	-0.009***	-0.002	0.001	-0.004*
	(0.002)	(0.001)	(0.001)	(0.002)	(0.002)	(0.002)
Corp dummy x ln(issue size)	0.012***	0.011***	0.009***	0.009***	0.009***	0.007***
	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)
Corp dummy x Bankruptcy dummy	0.262***	0.274***	0.275***	0.179***	0.200***	0.200***
	(0.020)	(0.028)	(0.028)	(0.066)	(0.063)	(0.046)
Corp dummy x Downgrade dummy	0.040***	0.078***	0.079***	0.133***	0.154***	0.153***
	(0.015)	(0.022)	(0.022)	(0.030)	(0.028)	(0.026)
Gov dummy x ln(bond age)	-0.034***	-0.033***	-0.032***	-0.032***	-0.036***	-0.035***
	(0.007)	(0.006)	(0.004)	(0.007)	(0.005)	(0.004)
Gov dummy x ln(maturity)	-0.017***	-0.017***	-0.015***	-0.000	-0.004	-0.004**
	(0.004)	(0.004)	(0.002)	(0.004)	(0.003)	(0.002)
Other insurance control variables						
ln(capital and surplus)	0.001	0.001	0.009**	-0.000	-0.000	0.014
	(0.001)	(0.001)	(0.004)	(0.002)	(0.002)	(0.012)
% risky assets	0.000	0.000**	0.000	0.000*	0.000**	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Leverage	0.026	0.017	0.063	0.016	0.003	-0.003
	(0.024)	(0.023)	(0.042)	(0.024)	(0.020)	(0.056)
ROE	0.004	-0.002	0.005	-0.030*	-0.038***	-0.023
	(0.006)	(0.004)	(0.003)	(0.017)	(0.012)	(0.014)
Rating group fixed effects	YES	YES	YES	YES	YES	YES
Calendar quarter x Bond type fixed effects	YES	YES	YES	YES	YES	YES
State fixed effects	YES	YES	NO	YES	YES	NO
Firm fixed effects	NO	NO	YES	NO	NO	YES
Standard error cluster 1	FIRM	FIRM	QTR	FIRM	FIRM	QTR
Standard error cluster 2	QTR	QTR	-	QTR	QTR	-
Observations	790,559	1,854,938	1,854,938	305,876	742,777	742,777
R-squared (within)	0.027	0.022	0.014	0.026	0.023	0.013

Table 7: Is an Objective of Gains Trading to Manage RBC Ratio? Does the Extent of Gains Trading Differ between Life and P&C Firms?

This table reports coefficient estimates for linear models of the probability that an insurance company, whose RBC ratio is expected to drop by about 0.4 or more due to actual ABS downgrades during the crisis, will sell a corporate or government bond position. The dependent variable is a dummy that equals one if the insurer holding the bond at the beginning of the quarter sells the bond during the quarter, and zero otherwise. The regressions are run separately for life firms (in columns (1) to (4)) and for P&C firms (in columns (5) to (8)). Both types of insurance companies are pooled together in column (9), with P&C dummy to indicate that the position is held by a P&C firm. Columns (1) and (5) include only the crisis period, from the third quarter of 2007 to the end of 2009, and the other columns cover the period from 2004 to 2010. The variables of interest are unrealized gain pct., defined as the percentile rank of each bond position's unrealized gain in each insurer's portfolio, and its interactions with crisis dummy, low RBC ratio dummy, and P&C dummy. Low RBC ratio dummy equals one for insurers whose beginning-of-year RBC ratios are in the lowest quartile. Bond and other insurance control variables, as in Table 6, are included but not reported for brevity. Full table is in the Internet Appendix. All variables are defined in Appendix D. Standard errors, either two-way clustered by insurer and calendar quarter or one-way clustered by calendar quarter, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	Life				Property & Casualty				All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Crisis	All	All	All	Crisis	All	All	All	All
Main variables									
(1) Unrealized gain pct.	0.020*	-0.023***	-0.023***	-0.027***	0.010	-0.006	-0.006	-0.005	-0.027***
	(0.010)	(0.005)	(0.004)	(0.005)	(0.012)	(0.006)	(0.005)	(0.004)	(0.005)
(1) x (2)				0.003				-0.002	0.003
				(0.004)				(0.011)	(0.005)
(1) x P&C dummy									0.023***
									(0.008)
Crisis dummy x (1)		0.044***	0.043***	0.035***		0.020*	0.018	0.012	0.035***
		(0.011)	(0.011)	(0.010)		(0.012)	(0.012)	(0.014)	(0.010)
Crisis dummy x (1) x (2)				0.021*				0.028*	0.023**
				(0.012)				(0.016)	(0.011)
Crisis dummy x (1) x P&C dummy									-0.023**
									(0.011)

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	Life				Property & Casualty				All
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Crisis	All	All	All	Crisis	All	All	All	All
<u>Related insurance characteristics</u>									
(2) Low RBC ratio dummy	0.032***	0.011**	0.010	-0.004	-0.012	0.003	0.018*	0.019	0.001
	(0.010)	(0.006)	(0.006)	(0.006)	(0.009)	(0.010)	(0.009)	(0.011)	(0.006)
(3) Revalue dummy	0.091***	0.063***	0.058***	0.052***	0.012	0.023*	0.024**	0.024**	0.042***
	(0.018)	(0.011)	(0.015)	(0.013)	(0.015)	(0.014)	(0.010)	(0.010)	(0.009)
Crisis dummy x (2)		0.014	0.011*	0.007		-0.008	-0.011	-0.025*	-0.002
		(0.009)	(0.006)	(0.006)		(0.011)	(0.009)	(0.013)	(0.006)
Crisis dummy x (3)		0.031	0.037	0.021		-0.012	-0.009	-0.009	-0.003
		(0.021)	(0.026)	(0.029)		(0.021)	(0.015)	(0.015)	(0.016)
Crisis dummy x P&C dummy									0.010
									(0.007)
Bond controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Other insurance controls	YES	YES	YES	YES	YES	YES	YES	YES	YES
Rating group fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
Calendar quarter x Bond type fixed effects	YES	YES	YES	YES	YES	YES	YES	YES	YES
State fixed effects	YES	YES	NO	NO	YES	YES	NO	NO	NO
Firm fixed effects	NO	NO	YES	YES	NO	NO	YES	YES	YES
Standard error cluster 1	FIRM	FIRM	QTR	QTR	FIRM	FIRM	QTR	QTR	QTR
Standard error cluster 2	QTR	QTR	-	-	QTR	QTR	-	-	-
Observations	647,893	1,512,622	1,512,622	1,512,622	62,655	151,038	151,038	151,038	1,663,660
R-squared (within)	0.028	0.022	0.015	0.015	0.046	0.037	0.015	0.015	0.013

Table 8: Does the Extent of Gains Trading Differ among Life Firms in Different U.S. States?

This table reports coefficient estimates for linear models of the probability that a life insurance company, domiciled in different U.S. states, will sell a corporate or government bond position. Included in the sample are life insurers whose RBC ratios are expected to drop by about 0.4 or more due to actual ABS downgrades during the crisis. The dependent variable is a dummy that equals one if the life insurer holding the bond at the beginning of the quarter sells the bond during the quarter, and zero otherwise. The variables of interest are unrealized gain pct., defined as the percentile rank of each bond position's unrealized gain in each insurer's portfolio, and its interactions with crisis dummy and high MTM dummy. High MTM dummy equals one for life insurers domiciled in U.S. states classified as being in the high MTM group under each of the three alternative definitions indicated in the column heading (Baseline, Alternative 1, and Alternative 2). These classifications are defined in Appendix C. Bond and other insurance control variables, as in Table 6, are included in all models but not reported for brevity. Full table is in the Internet Appendix. All variables are defined in Appendix D. Standard errors, either two-way clustered by insurer and calendar quarter or one-way clustered by calendar quarter, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	Crisis			All		
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	Alternative 1	Alternative 2	Baseline	Alternative 1	Alternative 2
Main variables						
(1) Unrealized gain pct.	0.026**	0.028**	0.022*	-0.023***	-0.023***	-0.025***
	(0.012)	(0.013)	(0.012)	(0.005)	(0.005)	(0.005)
(1) x High MTM dummy	-0.017**	-0.017**	-0.012**	-0.001	-0.000	0.004
	(0.007)	(0.008)	(0.006)	(0.004)	(0.004)	(0.003)
Crisis dummy x (1)				0.051***	0.052***	0.048***
				(0.013)	(0.013)	(0.012)
Crisis dummy x (1) x High MTM dummy				-0.018**	-0.018**	-0.017***
				(0.007)	(0.007)	(0.005)
Related insurance characteristics						
(2) Low RBC ratio dummy	0.032***	0.032***	0.029***	0.010	0.010	0.010
	(0.010)	(0.010)	(0.011)	(0.006)	(0.006)	(0.006)
(3) Revalue dummy	0.091***	0.091***	0.091***	0.059***	0.059***	0.059***
	(0.018)	(0.018)	(0.020)	(0.015)	(0.015)	(0.014)
Crisis dummy x (2)				0.012**	0.013**	0.008
				(0.006)	(0.006)	(0.005)
Crisis dummy x (3)				0.036	0.036	0.037
				(0.026)	(0.026)	(0.026)
Crisis dummy x High MTM dummy				0.016***	0.016***	0.010**
				(0.005)	(0.005)	(0.005)
Bond controls	YES	YES	YES	YES	YES	YES
Other insurance controls	YES	YES	YES	YES	YES	YES
Rating group fixed effects	YES	YES	YES	YES	YES	YES
Calendar quarter x Bond type fixed effects	YES	YES	YES	YES	YES	YES
State fixed effects	YES	YES	YES	NO	NO	NO
Firm fixed effects	NO	NO	NO	YES	YES	YES
Standard error cluster 1	FIRM	FIRM	FIRM	QTR	QTR	QTR
Standard error cluster 2	QTR	QTR	QTR	-	-	-
Observations	647,893	647,893	647,893	1,512,622	1,512,524	1,512,524
R-squared (within)	0.028	0.028	0.028	0.015	0.015	0.014

Table 9: Impact of Gains Trading on Corporate Bond Returns

This table reports OLS coefficient estimates for regressions of quarterly corporate bond return on gains-trading selling pressure from insurance companies in either the low MTM group or the high MTM group. For each bond i in quarter q, low (high) MTM insurers' unrealized gain pct. is calculated as

$$\left[\frac{\sum_j (\text{Holding}_{i,j,q} \times \text{Unrealized gain pct.}_{i,j,q})}{\sum_j \text{Holding}_{i,j,q}}\right] \times \left[\frac{\sum_j \text{Holding}_{i,j,q}}{\text{Issue size}_{i,q}}\right]$$

where the sum is over all insurer j's with high ABS exposure and in the low (high) MTM group. Standardized low (high) MTM insurers' unrealized gain pct. is then obtained by subtracting the low (high) MTM insurers' unrealized gain pct. by its sample mean and dividing the result by its sample standard deviation. In columns (1) to (3), life (P&C) insurers are low (high) MTM insurers. In columns (4) to (6), life insurers domiciled in high (low) MTM states according to the baseline definition in Appendix C are high (low) MTM insurers. To be included, a bond must be held by at least one low-MTM and one high-MTM insurers at the beginning of the quarter. Corporate bond return is the logged change in price from the previous quarter to the current quarter, winsorized at 2.5% and 97.5%. Treasury return is the logged return on maturity-matched Treasury bond, proxied by the interpolated constant maturity Treasury bond from the Fed. Spread return is the logged return on maturity- and rating-matched corporate bond index minus Treasury return. Corporate bond index return is calculated using Bank of America-Merrill Lynch bond index, adjusted for duration difference between the index and each individual bond. Bond controls, including ln(bond age), ln(issue size), ln(maturity), downgrade dummy, and bankruptcy dummy, are included in all models but not reported for brevity. Full table is in the Internet Appendix. All other variables are defined in Appendix D. Standard errors, two-way clustered by bond issuer and calendar quarter, are in parentheses. *, **, and *** refer to statistical significance at 10%, 5%, and 1% levels.

	All: Life (Low MTM Insurers) vs. P&C (High MTM Insurers)			Life Only: Low MTM States (Low MTM Insurers) vs. High MTM States (High MTM Insurers)		
	(1)	(2)	(3)	(4)	(5)	(6)
(1) Standardized low MTM insurers' unrealized gain pct.	0.131		0.131	0.090		0.099
	(0.130)		(0.126)	(0.108)		(0.084)
Crisis dummy x (1)	-0.634**		-0.620***	-0.544***		-0.414***
	(0.247)		(0.239)	(0.202)		(0.160)
(2) Standardized high MTM insurers' unrealized gain pct.		0.033	-0.007		0.080	-0.012
		(0.053)	(0.037)		(0.106)	(0.067)
Crisis dummy x (2)		-0.193*	-0.065		-0.506***	-0.142
		(0.104)	(0.066)		(0.191)	(0.089)
Treasury return	0.717***	0.725***	0.717***	0.648***	0.648***	0.648***
	(0.048)	(0.047)	(0.048)	(0.057)	(0.057)	(0.057)
Spread return	0.691***	0.699***	0.692***	0.611***	0.612***	0.611***
	(0.061)	(0.059)	(0.061)	(0.059)	(0.059)	(0.059)
Bond controls	YES	YES	YES	YES	YES	YES
Rating group fixed effects	YES	YES	YES	YES	YES	YES
Calendar quarter fixed effects	YES	YES	YES	YES	YES	YES
Wald test: (1) = (2)			1.73			1.19
Wald test: Crisis dummy x (1) = Crisis dummy x (2)			7.23***			3.08*
Observations	51,345	51,345	51,345	86,153	86,153	86,153
R-squared	0.410	0.408	0.410	0.380	0.380	0.380

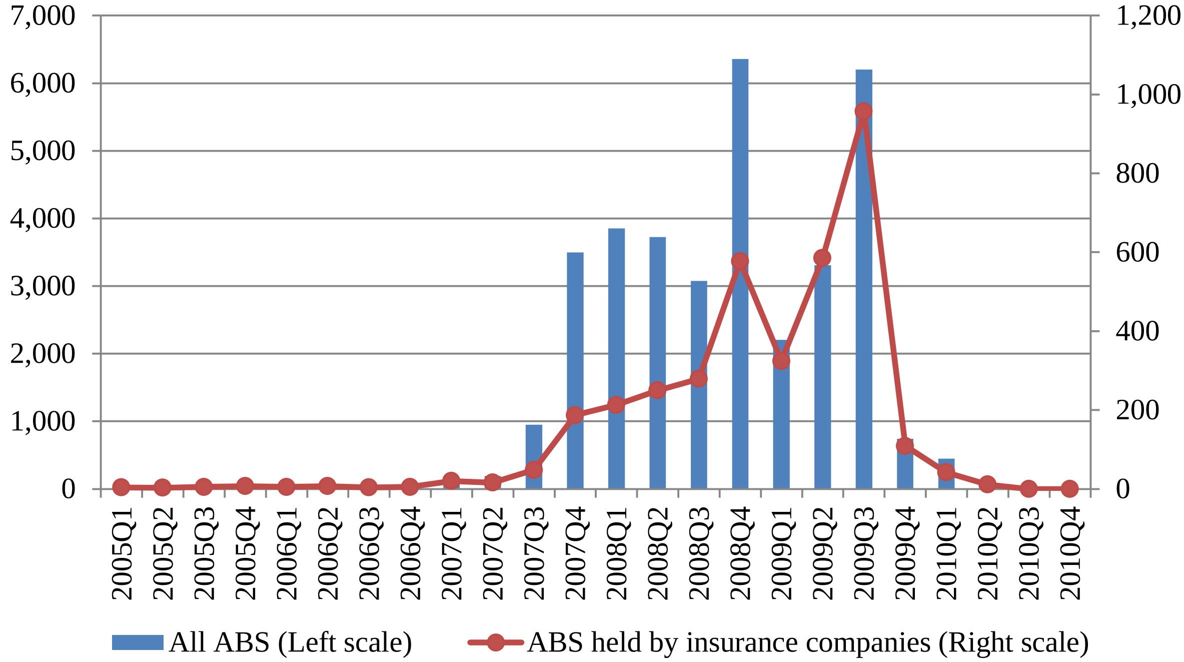

Figure 1: Number of Downgrades of ABS by S&P from Investment to Speculative Grades

This figure presents the number of downgrades of ABS securities from an investment grade rating to a speculative grade rating by S&P on quarterly basis. The bars show the number of all downgraded ABS securities included in S&P's Ratings IQuery. The connected dots show the number of downgraded ABS securities that are held by at least one insurance company.