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Fair Value versus Amortized Cost Measurement and the Timeliness of Other-Than-Temporary Impairments: Evidence from the Insurance Industry

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ABSTRACT: We investigate the impact of recurring fair value versus amortized cost measurement for accounting recognition purposes on the timeliness of insurers' other-than-temporary (OTT) impairments of non-agency residential mortgage-backed securities (NAMBS) around the 2007–2009 financial crisis. Unlike largely predetermined amortized cost measurement, recurring fair value measurement requires firms to invest in information and control systems to assess relevant economic conditions and estimate fair values quarterly. We expect these systems discipline insurers' OTT impairments. Exploiting statutory requirements that PC (life) insurers measure securities with NAIC designations from 3 to 5 at fair value (amortized cost) and disclose security-level accounting information, we predict and find that PC insurers record timelier OTT impairments of the same NAMBS with NAIC designations of 3 to 5 than life insurers. We predict and find weaker evidence of spillover effects to the timeliness of OTT impairments of the same NAMBS with NAIC designations of 1 or 2.

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Keywords: fair value; amortized cost; other-than-temporary impairment; timeliness; insurers.

I. INTRODUCTION

In Financial Accounting Standard (FAS) 115, the primary accounting standard governing investment securities, the Financial Accounting Standards Board (FASB, paragraph 112) "concluded that it is important to recognize in earnings all declines in fair value below the amortized cost basis that are considered to be other-than-temporary." In this study, we posit that because amortized cost is, in most circumstances, a predetermined accounting measurement approach that does not require reporting firms to pay attention to economic conditions affecting their financial instruments, reporting firms that measure securities using this approach may not invest sufficient resources in information and internal control systems to identify and measure other-than-temporary (OTT) impairments in a timely and reliable fashion. Robust systems are particularly important for illiquid securities and during periods of financial market stress, such as the 2007–2009 financial crisis. We hypothesize and provide evidence that firms required to measure securities at fair value on a recurring basis for accounting

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recognition purposes record timelier OTT impairments than firms that measure the same securities at amortized cost.[1] The timeliness of OTT impairments is important because most prior research finds that timelier loss recognition enhances financial institutions' internal, market, and regulatory discipline, thereby reducing the procyclicality of their investment and financing decisions (Stephanou 2010; Beatty and Liao 2011; Bushman and Williams 2012, 2015; Ryan 2017; Bhat, Ryan, and Vyas 2018), although Gallemore (2016) and Wheeler (2018) find opposing results for regulatory discipline.[2]

Specifically, we investigate the impact of recurring fair value versus amortized cost measurement on the timeliness of insurers' OTT impairments of non-agency residential mortgage-backed securities (NAMBS) from 2007 to 2011, i.e., as a consequence of the financial crisis. We examine OTT impairments of NAMBS during this period for two sets of reasons. First, NAMBS experienced a high frequency of credit downgrades (Ellul, Jotikasthira, Lundblad, and Wang 2015), financial institutions (including insurers) widely held these securities, and many parties criticized these institutions for not recording timely write-downs of financial assets (Dickey, King, and Shih 2008; Einhorn 2008). Supporting this criticism, Vyas (2011) finds that financial institutions (including insurers, which comprise 59 percent of his sample) recorded losses on financial assets with lags relative to declines in relevant credit indices during this period.

Second, after the initial issuances of NAMBS (which ceased in 2007 and have not yet recovered appreciably), these securities trade over the counter. Even in good times, the secondary market for NAMBS exhibits very low activity (Hu 2001, 117–119; Bond Market Association and American Securitization Forum 2006, 41–44). During the crisis, this market and related markets linked to ABX indices became disorderly, with the magnitude of price decreases substantially exceeding the deterioration of fundamentals (Bank of England 2008; Gorton 2009; Stanton and Wallace 2011; Dungey, Dwyer, and Flavin 2011). No centralized repository existed for the few NAMBS trades that occur until after the end of our sample period.[3] For these reasons, during our sample period, market information about NAMBS is highly limited, suggesting that fair value measurements based solely on that information usually are stale,[4] and that the best obtainable fair value measurements of these securities also involve fundamental valuations based on forecasts of the future credit and prepayment performance of the underlying assets. A well-known specialist third-party pricing service for NAMBS, MountainView IPS, indicates that it makes these forecasts using monthly trustee reports of the historical performance of the underlying assets, extensive other information, and modeling of the securitization waterfall.[5] Compared to measuring the fair values of NAMBS using only market information, insurers must devote considerably more resources to information and control systems that enable fundamental valuations of NAMBS.[6] In other words, insurers can satisfy fair value measurement requirements for NAMBS either cheaply, and likely inaccurately, using only market information, or more expensively and accurately also using fundamental valuation. Insurers must have sufficient incentives to choose the more expensive approach.

We examine OTT impairments by insurers, rather than by other firms, for three reasons. First, securities are insurers' primary asset. Second, insurers must report detailed accounting information for each security they hold in their statutory filings. Hence, we can observe the relative amounts and timing of different insurers' OTT impairments of the same securities, which provides a high level of experimental control. Third, under statutory accounting principles (SAP), property-casualty (PC)

[1] To reinforce our emphasis on measurement, we refer to recurring fair value measurement for accounting recognition, as opposed to disclosure, purposes as fair value measurement. Extant research on recognized versus disclosed fair values finds that the former are more value-relevant than the latter (Ahmed, Kilic, and Lobo 2006; Müller, Riedl, and Sellhorn 2015). These findings suggest that requirements to recognize fair values lead reporting firms to invest more resources in information and control systems than do requirements to disclose fair values. We discuss this point further in Section V.

[2] Most of this prior research examines banks, not insurers. However, Ellul et al. (2015) examine implications of fair value measurement by PC insurers and amortized cost measurement by life insurers of securities with National Association of Insurance Commissioners (NAIC) designations from 3 to 5 for the investment behavior of the two types of insurer, and their findings yield similar inferences regarding the effects of timely loss recognition on procyclicality. For example, they find that PC insurers were more likely to cut losses by selling non-investment grade securities early in the financial crisis. In untabulated analysis, we confirm that Ellul et al.'s (2015) results hold for our sample.

[3] The Financial Industry Regulatory Authority (FINRA) has required its members to submit their trades in asset-backed securities to the Trade Reporting and Compliance Engine (TRACE) since May 16, 2011. See: http://www.finra.org/industry/trace/trace-faq#SP/. However, NAMBS trades need not involve FINRA members, and the TRACE dataset does not include any NAMBS trades until April 17, 2013, after the end of our sample period. Even after this date, TRACE contains scant NAMBS trade data. In particular, we are only able to match 318 (20 percent) of our 1,590 sample NAMBS to TRACE, and we find very few trades for the 318 matched NAMBS until 2017; on average, these securities traded on 4.88 days during 2017.

[4] FINRA and the Interactive Data Corporation (IDC) now provide prices of NAMBS based solely on transacted prices. See: http://www.finra.org/industry/trace/structured-product-activity-reports-and-tables

[5] MountainView IPS describes its approach to fair valuing NAMBS at: http://www.mviewfs.com/structured-finance-securities-valuation.html

[6] Reporting firms may engage third parties to estimate fair values, although the firms remain responsible for evaluating whether third-party valuations are developed in accordance with generally accepted accounting principles (GAAP) fair value measurement guidance. See Accounting Standards Codification 820-10-35-54-K to M, and recent Securities and Exchange Commission (SEC) Cease-and-Desist orders in the matters of Pacific Investment Management Company LLC (Administrative Proceeding File No. 3-17701; see: https://www.sec.gov/litigation/admin/2016/ia-4577.pdf); and Covenant Financial Services, LLC, and Stephen Shafer (Administrative Proceeding File No. 3-17891; see: https://www.sec.gov/litigation/admin/2017/ia-4672.pdf). Reflecting this responsibility, we refer to insurers as estimating fair values throughout the paper. In Section V, we conduct empirical analysis distinguishing self-estimated and third-party estimated fair value measurements.

insurers and life insurers account differently for securities that are below investment grade, but not yet in or near default, i.e., securities with National Association of Insurance Commissioners (NAIC) designations from 3 to 5.[7] PC insurers measure these securities at the lower of cost or fair value. Because insurers rarely acquire non-investment grade securities, these securities generally have been downgraded after acquisition, so lower of cost or fair value equals fair value.[8] In contrast, life insurers measure these securities at amortized cost. However, PC insurers and life insurers are subject to the same SAP OTT impairment rules for securities. In principle, these rules require the two types of insurer to record OTT impairments of the same securities at the same times and, assuming the two types have identical intents and abilities to hold the securities, to write down the cost bases of the securities to the same amounts.

Reflecting this difference in measurement bases, we hypothesize that PC insurers record timelier OTT impairments of the same NAMBS with NAIC designations from 3 to 5 than do life insurers, all else being equal. Our primary basis for this hypothesis is that, unlike amortized cost, recurring fair value measurement requires reporting firms to assess the economic conditions affecting their financial instruments quarterly. This ongoing assessment requires firms to invest more resources in information systems that provide relevant and timely information to measure fair values, and in control systems that ensure the reliability of the measurements (Bhat and Ryan 2015). We expect these systems to discipline PC insurers' OTT impairments of NAMBS.

NAMBS are a homogeneous class of security subject to common economic conditions (e.g., house price depreciation), and for which fair value measurements involving fundamental valuations employ similar valuation inputs and models. Accordingly, we expect that PC insurers' fair value measurement of NAMBS with NAIC designations from 3 to 5 improves their understanding of NAMBS with NAIC designations of 1 and 2. We hypothesize that PC insurers record timelier OTT impairments of the same NAIC 1 and 2 designated NAMBS than life insurers. Owing both to the indirectness of this hypothesis and the likelihood that insurers devote more resources to OTT impairments of lower credit quality securities, we expect this spillover effect to be weaker than the direct effect posited in our first hypothesis.

We test our two hypotheses on a sample of NAMBS: (1) that are held by at least one PC insurer and one life insurer at the end of 2006 to control for all security-specific factors and, thus, enable comparisons across the types of insurer; and (2) for which the insurers do not acquire any more of the securities during 2007–2011, so that there is only one vintage of each security. We eliminate subsequent security-years in which the security is no longer held by one insurer of each type. The sample includes 5,796 security-year observations of 1,590 NAMBS held by 352 PC insurers and 648 life insurers.

We measure the timeliness of an insurer's OTT impairment of a NAMBS in a year as the insurer's cumulative OTT impairment of the security through the end of that year divided by its amortized cost of the security at the end of 2006, the last year-end prior to the financial crisis, minus the median of this ratio across all insurers holding the same security.[9] As expected, we find that for NAMBS with NAIC designations from 3 to 5, the OTT impairments recorded by PC insurers are significantly timelier than the impairments recorded by life insurers holding the same security. For NAMBS with NAIC designations of 1 and 2, we find significant, but weaker, evidence that PC insurers record significantly timelier OTT impairments than life insurers. We show that our inferences are robust to numerous additional analyses that address potential problems of inference and other issues.

To the best of our knowledge, our study is the first to show that fair value measurement leads to timelier recording of non-recurring write-downs of financial assets than does amortized cost measurement. This finding is akin to prior findings that fair value measurement leads to less gains trading in securities than does amortized cost measurement (Ellul et al. 2015), a longstanding concern of accounting policymakers (Wyatt 1991).

Our findings speak to the debate about the role of fair value accounting during the financial crisis. To date, this debate has centered on whether the use of fair value accounting information by users of financial reports yielded significant adverse feedback effects that exacerbated the crisis (Ryan 2008; Laux and Leuz 2009, 2010). Our results are consistent with fair value measurement also having implications internal to reporting firms, suggesting that it leads firms to invest more resources in information and control systems that, as a side benefit, increase the timeliness of OTT impairments of securities.[10] We

[7] NAIC designations are typically based on either credit analysis by the NAIC's Securities Valuation Office or credit ratings by approved nationally recognized statistical rating organizations, such as Standard & Poor's (S&P), Moody's, and Fitch. NAIC designations range from 1 (highest credit quality) to 6 (lowest credit quality). NAIC designations 1 and 2 are for investment grade investment securities. NAIC designation 6 is for securities that are in or near default.

[8] For this reason, we refer to PC (life) insurers' lower of cost or fair value measurement for NAMBS with NAIC designations below 2 (5) under SAP as fair value measurement.

[9] Our choice of this measure reflects our expectation that insurers had no incentive to overstate OTT impairments during the financial crisis and its aftermath, owing to the severity of the crisis and because they could subsequently reverse overstated OTT impairments only indirectly through the gradual accrual of interest revenue.

[10] Ryan (2018) surveys the 2018 working paper version of this paper, along with several other recent papers with implications for banks' financial reporting and financial stability; he concludes that our results "indicate that fair value measurement requirements yield enhanced internal discipline that leads insurers to make economic decisions likely to promote financial stability."

conjecture that these systems may also improve the overall transparency of firms' financial reporting, e.g., management discussion and analysis (MD&A) and footnote disclosures, a promising topic for future research in our view.

Our findings complement those of prior studies that firms exercise discretion over fair value measurements to achieve financial, regulatory, and tax reporting objectives. Closest to our study, Hanley, Jagolinzer, and Nikolova (2018) provide evidence of greater inflation of fair value measurements of securities by insurers that base the measurements on lower-level inputs than the consensus insurer, or that self-estimate the measurements rather than obtain them from third parties, and by public insurers than by private insurers. An important distinction between our study and Hanley et al. (2018) is that they examine the universe of insurers' fixed-income securities. NAMBS are much less liquid and have much more limited market information than this universe of securities.

II. INSTITUTIONAL BACKGROUND AND HYPOTHESIS DEVELOPMENT

Insurance Regulation and Statutory Accounting and Reporting

Under the McCarran-Ferguson Act of 1945, insurers are regulated at the state level. Insurers must provide state regulators and the NAIC with annual and quarterly statutory financial statements prepared in accordance with SAP. These financial statements contain detailed and standardized quantitative accounting information. SAP developed at the state level, but since 2001, the NAIC has codified SAP in its *Accounting Practices and Procedures Manual*. While not overriding state-level variation in SAP, this codification has led to considerable consistency in SAP across states. SAP and U.S. generally accepted accounting principles (GAAP) overlap in many of their requirements. Where they differ, SAP usually requires more conservative accounting and more disaggregated disclosures, as insurance regulators' main focus is the risk and solvency of insurers.

Since 1993, insurers are subject to risk-based capital requirements based on SAP. An insurer must hold capital in excess of a minimum amount, which is largely determined as the sum of the capital required for the insurer's individual exposures, taking into account the risk of these exposures. This minimum amount also increases with certain specified covariances across the insurer's individual exposures, as well as insurer-level risks. For fixed-income securities, the NAIC designations determine the risk-based capital requirements. Higher designations indicate greater credit risk and require higher capital. Because PC and life insurers account differently for securities with NAIC designations from 3 to 5 under SAP, the risk-based capital requirements for these securities differ for the two types of insurers to compensate for the different required accounting.

Statutory Accounting Principles for NAMBS

Statement of Statutory Accounting Principles No. 43R, *Loan Backed and Structured Securities* (SSAP 43R), is the SAP standard governing NAMBS as of the third quarter of 2009. SSAP 43R supersedes the identically titled prior standard SSAP 43. Ignoring OTT impairments, the two SAP standards contain identical requirements regarding the balance sheet measurements and income statement classifications for NAMBS. These standards require: (1) both types of insurer to measure securities with NAIC designations of 1 or 2 at amortized cost; (2) PC insurers to measure securities with NAIC designations from 3 to 5 at the lower of cost or fair value, and life insurers to measure these securities at amortized cost; (3) both types of insurer to measure securities with NAIC designations of 6 at lower of cost or fair value; (4) PC insurers to record gains and losses on securities, both realized and unrealized, in net income and statutory surplus; and (5) life insurers to record these gains and losses on securities in asset valuation reserves (AVRs), liability accounts that smooth life insurers' SAP income and statutory surplus, subject to the constraint that the accounts must remain within specified bounds.[11]

The main differences between SSAP 43 and SSAP 43R pertain to the criteria under which securities are OTT-impaired and the measurement of OTT impairments. SSAP 43 required a very weak OTT impairment approach based on undiscounted cash flows. A security was OTT-impaired if the undiscounted sum of expected cash flows was less than the security's amortized cost. The cost basis of an OTT-impaired security was written down to the undiscounted sum of the expected cash flows.

[11] A life insurer determines its firm-level AVR as the sum of the AVRs across its asset classes (e.g., fixed income, common stocks, and real estate). For each asset class in each year, the life insurer adds to the AVR for the class a basic contribution that equals its estimated annual after-tax losses based on baseline assumptions determined in 1992, and it may also add a voluntary contribution. If the insurer's AVR for an asset class is below the target, the 85th percentile of the modeled credit loss distribution, then the insurer adds 20 percent of the difference to the AVR for the class each year. These contributions reduce insurers' income and unassigned surplus. As long as an insurer's AVR for an asset class remains positive and below the specified maximum, the insurer's realized and unrealized gains (losses) add to (subtract from) the AVR for the class, with no immediate effect on the insurer's net income and unassigned surplus. Insurers' total adjusted capital equals their unassigned surplus plus their firm-level AVRs. Since total adjusted capital is the numerator of life insurers' risk-based capital ratio, their realized and unrealized gains (losses) increase (decrease) their risk-based capital ratios. See Bennett (2013) and Berry-Stölzle, Nini, and Wende (2014, footnote 15) for further details about AVRs.

In contrast, SSAP 43R's requirements as to whether securities are OTT-impaired and the measurement of OTT credit losses are very similar to those of FASB Staff Positions FAS 115-2 and FAS 124-2, *Recognition and Presentation of Other-Than-Temporary Impairments*.[12] Under SSAP 43R, a security is OTT-impaired if the insurer holding the security does not expect to receive the cash flows it previously expected to collect on the security, where the previous expectation is at acquisition for previously unimpaired securities and at the time of the most recent OTT impairment for previously impaired securities. If the insurer does not intend to sell and, more likely than not, will not be compelled to sell OTT-impaired securities prior to recovery of their amortized cost bases, then the insurer writes these cost bases down to the present values of the cash flows expected to be collected. Otherwise, the insurer writes these cost bases down to fair value.

For PC insurers, write-downs of the cost bases of securities reduce net income and statutory surplus to the extent that these losses have not previously been recorded in these line items under lower of cost or market accounting. For life insurers, write-downs of the cost bases of securities reduce their AVRs as long as these reserves remain positive and reduce unassigned surplus otherwise.[13] By construction, life insurers' AVRs are large enough to absorb their OTT impairments of securities and other realized and unrealized losses on investment assets under most conditions; it is unclear how frequently this was not the case for life insurers during our financial crisis-dominated sample period.[14] In Section V, we conduct analysis to ensure that our inferences are not attributable to potential differential effects of OTT impairments on risk-based capital ratios for the two types of insurer.

Fair Value versus Amortized Cost Measurement and the Timeliness of OTT Impairments

Ignoring sales, the amortized cost of a security equals its acquisition cost minus cumulative principal repayments, plus cumulative interest revenue, minus cumulative interest receipts, and minus cumulative OTT impairments. With the exception of the calculation of non-recurring OTT impairments, as well as interest revenue on certain risky securities,[15] amortized cost is a predetermined accounting measurement basis that does not incorporate current information about securities in a timely fashion.

In contrast, glossing over the subtleties of fair value measurement guidance, the fair value of a security should equal the holder's expectation of the present value of the future cash flows on the security based on current information about the expected future performance of the security and relevant economic conditions (Barth 2014). In cases where timely and accurate fair values are not directly observed, in order to accurately and reliably measure fair values, the reporting firm must invest in information systems to enable timely identification and use of information about security performance and economic conditions. Supporting this point, Bhat and Ryan (2015) provide evidence that banks' investments in credit risk modeling systems improve the quality of their fair value measurements, as evidenced by more returns-relevant unrealized fair value gains and losses.

In addition, firms must have control systems in place to ensure that they measure fair values reliably. Examples of such controls are pricing and valuation committees that include senior management personnel independent of firms' trading and investing functions, and that evaluate fair value measurements and fair valuation methodologies comparisons of fair value measurements of securities to the prices received when the securities are sold and other forms of backtesting, and comparisons of self-estimated fair value measurements with quotes from third-party pricing services or brokers.

As discussed in detail in Section I, for NAMBS, the available market information generally is limited during our financial crisis-dominated sample period, suggesting that the best obtainable fair value measurements involve fundamental valuation based on forecasts of the future credit and prepayment performance of the underlying assets. Such fair value measurements require far more resources to develop than measurements based solely on market information. Hence, insurers can satisfy fair value measurement and disclosure requirements for NAMBS either cheaply, using only the highly limited market information,

[12] Unlike FASB Staff Positions FAS 115-2 and FAS 124-2, SSAP 43R does not require insurers to record OTT non-credit losses, i.e., decreases of fair value below the present value of the cash flows expected to be collected, on OTT-impaired investment securities that they do not intend to sell and, more likely than not, will not have to sell prior to recovery of the securities' amortized cost bases. However, SSAP 43R effectively requires PC (life) insurers to record these non-credit losses as unrealized losses under lower of cost or fair value accounting for investment securities with NAIC designations 3–6 (6).

[13] We cannot directly observe whether life insurers recorded a portion of OTT impairments directly in statutory surplus. However, we were able to determine that the asset valuation reserve was zero for 61 of the 1,413 unique life insurer-years in the sample, 22 of which exhibit OTT impairments of NAMBS. It is likely that these impairments contributed to a portion of the sum of realized and unrealized losses for these insurers during these years being recorded directly in statutory surplus.

[14] As discussed in footnote 11, the target AVR for an asset class is the 85th percentile of the credit loss distribution for the class based on baseline assumptions determined in 1992. Berry-Stölzle, Nini, and Wende (2014) state, "In aggregate, the AVR was reduced substantially during 2008."

[15] Emerging Issues Task Force (EITF) 99-20 governs the GAAP accounting for interest revenue on beneficial interests in securitized financial assets, such as NAMBS, that are not of high credit quality. EITF 99-20 requires firms that hold these securities to revise estimates of future cash flows each period and, if these revisions do not yield OTT impairments, to recalculate the effective interest rates used to calculate interest revenue. Paragraphs 20–23 of SSAP 43R incorporate EITF 99 requirements into SAP.

or in more costly fashions that involve fundamental valuation. Insurers must have sufficient incentives to choose the latter approach.

Because PC insurers are required to measure NAMBS with NAIC designations from 3 to 5 at fair value, while life insurers measure these securities at amortized cost, based on the discussion above, we expect PC insurers to invest more resources than life insurers in information and control systems that provide timely and reliable information about the current performance of the securities and relevant economic conditions. We expect that this enhanced information increases PC insurers' awareness of the proper amount and timing of OTT impairments of the securities. During the financial crisis, such awareness was critical for illiquid securities such as NAMBS, which were subject to the market stress and severely adverse economic conditions. We formally state this expectation in the alternative:

H1 (*Direct Effect of Fair Value Measurement of the Same Securities*): PC insurers recorded timelier OTT impairments of the same NAMBS with NAIC designations from 3 to 5 during and shortly after the financial crisis than life insurers.

As a homogeneous class of securities, NAMBS are subject to common economic conditions (e.g., house price depreciation). Hence, fundamental valuation-based fair value measurements for different NAMBS employ similar valuation inputs and models. Hence, we expect that PC insurers' fair value measurement of NAMBS with NAIC designations from 3 to 5 improves their understanding of the value and risk of NAMBS with NAIC designations of 1 and 2. Relatedly, PC insurers should have better understandings than life insurers of the likelihoods that the same NAMBS with NAIC designations of 1 and 2 will subsequently be downgraded to NAIC designations of 3 or worse, requiring PC insurers to measure the securities at fair value. Accordingly, we further hypothesize that PC insurers record timelier OTT impairments of NAIC 1 and 2 designated NAMBS than do life insurers.[16,17] Owing both to the indirectness of this spillover effect and to the higher likelihood of OTT impairments of non-investment grade securities, we expect the effect to be weaker than the direct effect postulated in H1.

H2 (*Spillover Effect of Fair Value Measurement of Similar Securities*): PC insurers recorded timelier OTT impairments of the same NAMBS with NAIC designations of 1 or 2 during and shortly after the financial crisis than life insurers. This spillover effect is weaker than the direct effect posited in H1.

Prior studies show that insurers exploit their discretion over fair value measurements to achieve financial and statutory reporting objectives (Vyas 2011; Ellul et al. 2015; Hanley et al. 2018). Therefore, in our empirical tests of both hypotheses, we control for insurers' statutory reporting (e.g., regulatory capital) incentives and other factors that may influence the timeliness of insurers' OTT impairments.

III. DATA AND RESEARCH DESIGN

Data Sources and Sample Construction

We construct a sample of NAMBS held by insurers during 2007–2011. We obtain most data from insurers' annual statutory filings as compiled by S&P Global Market Intelligence. Schedule D, Part 1 of these filings reports the actual (i.e., acquisition) cost, fair value, and a T-account roll-forward during the year for each fixed-income security held by the insurer at the end of the year. Other parts of Schedule D provide information about each fixed-income security acquired during the year (Part 3); sold, redeemed, or otherwise disposed of during the year (Part 4); and both acquired and sold during the year (Part 5).

[16] PC insurers' fair value measurement of NAMBS with NAIC designations from 3 to 5 might provide early warning of credit deterioration that also yields spillover effects on the relative timeliness of PC insurers' and life insurers' OTT impairments of NAMBS with NAIC designations of 6, even though both types of insurer measure these securities at lower of cost or fair value. We do not propose such a hypothesis, however, primarily because the latter securities constitute only 183 (3.2 percent) of our 5,796 security-year observations, with hardly any of these observations in 2007 and 2008 (see the first row of Table 3, Panel E), so the statistical power of these analyses is low. Reinforcing this lack of power, securities with NAIC designations of 6 are in or near default, which raises a distinct set of valuation issues, and they typically are very substantially OTT-impaired by both types of insurer. For example, by the end of 2010, our sample PC (life) insurers had recorded average cumulative OTT impairments of 30 (25) percent on securities with NAIC designations of 6. For completeness, however, we report empirical analyses for these securities.

[17] In principle, life insurers' fair value measurement of NAMBS with designations of 6 might yield spillover effects on their understanding of the value and risk of NAMBS with better NAIC designations. However, as noted in the prior footnote, NAIC designation 6 securities raise distinct valuation issues and are relatively few throughout our sample period, particularly in 2007 and 2008. Hence, any systems that life insurers developed for these securities likely developed late in our sample period.

TABLE 1

Sample Construction

Sample Screens	# Securities	# Firms			# Positions		
		All	*PC*	*Life*	*All*	*PC*	*Life*
Step 0: All insurers on S&P Global Market Intelligence database during 2007–2011	22,567	5,552	3,860	1,692			
Step 1: Remove insurer-years that do not hold NAMBS	22,567	1,723	1,188	535	172,397	46,726	125,671
Step 2: Remove insurer-securities with purchases after 2006	12,826	1,376	910	466	95,477	25,629	69,848
Step 3: Remove insurer-years with risk-based capital ratios outside 200% and 2000%	12,675	1,173	756	417	90,090	23,150	66,940
Step 4: Remove security-years without at least one PC insurer and one life insurer holding the security during the year	1,590	1,000	648	352	24,566	12,723	11,843

This table summarizes the sample construction. The sample period covers the years from 2007 to 2011. # *Securities* refers to the number of unique NAMBS held by any insurer. # *Firms* refers to the number of insurers. # *Positions* refers to the number of insurer-NAMBS-year observations. *All* refers to any insurer; *PC* refers to property-casualty insurers; and *Life* refers to life insurers.

Table 1 summarizes the sample construction. Beginning with the universe of 5,552 insurers (3,860 PC and 1,692 life) available on S&P Global Market Intelligence during 2007–2011, we eliminate insurer-years that do not hold NAMBS, which yields 1,723 insurers (1,188 PC and 535 life) that hold 22,567 NAMBS, for a total of 172,397 security-insurer-year observations. We impose three additional sample filters to yield well-specified hypothesis tests.

First, because we calculate the timeliness of the cumulative OTT impairment of a security by dividing that impairment by the security's actual cost at the end of 2006, we exclude NAMBS that the sample insurers entirely or partly acquired after 2006. This filter yields a 43 percent decrease in the number of NAMBS, a 21 percent decrease in the number of insurers, and a 45 percent decrease in the number of security-insurer-year observations.

Second, following prior studies (e.g., Ellul et al. 2015), we exclude insurer-years with risk-based capital ratios below 200 or above 2000 percent. Insurers in the former range face intense regulatory scrutiny that likely dominates their economic and accounting behavior. Insurers in the latter range are highly insulated from economic and accounting shocks. This filter yields a relatively small decrease in the number of observations. Untabulated analysis shows that our inferences are not affected by this filter.

Third, because we assess the relative timeliness of OTT impairments by PC insurers and life insurers, we exclude security-year observations in which the security is not held by both types of insurer. Owing to the typically highly concentrated holdings of NAMBS (a single insurer often holds an entire NAMBS tranche), this filter yields an 87 percent decrease in the number of NAMBS, a 15 percent decrease in the number of insurers, and a 73 percent decrease in the number of security-insurer-year observations. The last decrease is almost twice as large for life insurers (82 percent) as for PC insurers (45 percent), because a life insurer is more likely to hold a security that no PC insurer holds than *vice versa*. This filter controls for all security-specific factors.

The final sample in Table 1 includes 1,590 NAMBS securities held by 1,000 insurers (648 PC and 352 life) for 24,566 security-insurer-year observations (12,723 PC and 11,843 life). In total, the three additional sample filters eliminate 93 percent of the NAMBS, 42 percent of the insurers (34 percent of the PC insurers and 46 percent of the life insurers), and 86 percent of the security-insurer-year observations. The retention of significant numbers of both PC insurers and life insurers preserves the power of our tests and the generalizability of our findings.

Primary Measure of the Timeliness of OTT Impairments

We measure the timeliness of insurers' OTT impairments of NAMBS as follows. First, we divide insurer i's cumulative OTT impairment recorded on security s from the beginning of 2007 to the end of year t, denoted $CumImp_{i,s,t}$, by the insurer's actual cost of the security at the end of 2006, denoted $Cost_{i,s}$.[18] $Cost_{i,s}$ is unaffected by insurer i's accounting measurement approach for security s and is largely unaffected by the timing of insurer i's purchase of security s prior to the end of 2006, because the market values of NAMBS securities generally did not vary appreciably from par prior to the subprime crisis beginning in February 2007 (Ryan 2008). Hence, $CumImp_{i,s,t}/Cost_{i,s}$ should be comparable across insurers and securities.

[18] Appendix A provides definitions of all model variables.

TABLE 2

Summary of OTT Impairments

Year	# All Secs	# Firms	Avg # Firms per Sec	# Imp Secs	Avg # Firms per Imp Sec	Agg CumImp % on Imp Sec	Avg CumImp % on Imp Sec	Avg Std Dev Imp Sec	IQR Std Dev Imp Sec
2007	1,563	948	4.52	113	5.13	2.33	4.76	5.85	6.03
2008	1,366	879	4.44	309	5.04	10.66	13.49	16.02	17.80
2009	1,133	759	4.10	409	4.54	10.11	14.56	10.49	14.54
2010	940	665	3.94	390	4.26	13.26	16.60	9.86	12.94
2011	794	604	3.88	363	4.00	14.32	17.51	9.41	12.48

This table presents the following statistics for each sample year from 2007 to 2011: the number of sample NAMBS (#*All Secs*); the number of insurers holding at least one NAMBS (# *Firms*); the average number of firms holding the same NAMBS (*Avg # Firms per Sec*); the number of OTT-impaired NAMBS (# *Imp Sec*); the average number of insurers holding the same OTT-impaired NAMBS (*Avg # Firms per Imp Sec*); the sum of the cumulative OTT impairment recorded by all insurers on the same security from 2007 to the end of the year divided by the sum of the actual cost recorded by all insurers in 2006 (*Agg CumImp % on Imp Sec*); the average across insurers of the cumulative impairment recorded for the same security divided by the actual cost of the security recorded in 2006 (*Avg CumImp % on Imp Sec*); the average across securities of the standard deviation across insurers holding the same security in the year of the cumulative impairment recorded for the security divided by the actual cost of the security recorded in 2006 (*Avg Std Dev Imp Sec*); and the interquartile range across securities of the standard deviation across insurers holding the same security in the year of the cumulative impairment recorded for the same security divided by the actual cost of the security recorded in 2006 (*IQR Std Dev Imp Sec*). A NAMBS is deemed OTT-impaired during a year if at least one insurer has recorded an OTT impairment for the security.

Second, we calculate the median of $CumImp_{i,s,t}/Cost_{i,s}$ across all insurers holding security s at the end of year t, denoted $Median(CumImp_{.,s,t}/Cost_{.,s})$. Third, we calculate the timeliness of insurer i's cumulative OTT impairment of NAMBS s as of the end of year t, denoted $TM_{i,s,t}$, as 100 times $CumImp_{i,s,t}/Cost_{i,s}$ minus $Median(CumImp_{.,s,t}/Cost_{.,s})$. By construction, $TM_{i,s,t}$ equals 0 for securities not impaired by any insurer.

Table 2 presents annual descriptive information about the sample. The number of securities monotonically declines from 1,563 in 2007 to 794 in 2011 as the sample insurers dispose of securities or leave the sample, with cascade effects when either of these effects causes a security to no longer be held by both a PC insurer and a life insurer. The number of insurers declines monotonically from 948 in 2007 to 604 in 2011, causing the average number of insurers holding the same security to fall moderately from 4.52 in 2007 to 3.88 in 2011.

We define a security as OTT impaired in a year if at least one sample insurer has recorded an OTT impairment of the security from 2007 to the end of the year. The number of OTT-impaired securities in Table 2 rises sharply from 113 (7.7 percent of the sample) in 2007 to 409 (36.1 percent) in 2009, reflecting the worsening of the financial crisis, and then falls to 363 (45.7 percent) in 2011, reflecting sample attrition dominating the increasing percentage of OTT-impaired securities. The average number of insurers holding an OTT-impaired security falls monotonically from 5.13 in 2007 to 4.00 in 2011.

Table 2 reports two measures of the typical magnitude of OTT impairments in the sample each year. *Agg CumImp % on Imp Sec* equals the sum of $CumImp_{i,s,t}$ across insurers and securities divided by the sum of $Cost_{i,s}$ across insurers and securities in the year. *Avg CumImp % on Imp Sec* equals the mean of $CumImp_{i,s,t}/Cost_{i,s}$ across insurers and securities in the year. The two measures follow similar upward paths. For example, the latter measure increases monotonically from 4.76 percent in 2007 to 17.51 percent in 2011.

Table 2 reports two measures of the variability of OTT impairments in the sample in each year. Both measures are based on the standard deviation of $CumImp_{i,s,t}/Cost_{i,s}$ across insurers for each security in a year, denoted $Std\ Dev_{s,t}$. *Avg Std Dev Imp Sec* (*IQR Std Dev Imp Sec*) equals the mean (interquartile range) of $Std\ Dev_{s,t}$ across securities in the year. Both measures increase from 2007 to 2008 and then fall monotonically to 2011, indicating that insurers' average percentage cumulative OTT impairments first diverge as the crisis develops and then converge as it resolves.

Empirical Model

To test H1 and H2, we regress our insurer-security-year-level measure of the timeliness of OTT impairments, $TM_{i,s,t}$, on an indicator[19] for property casualty insurer, PC_i; indicators for securities with NAIC designations of 1 and 2 ($NAIC\_1\_2_{s,t}$), from 3 to 5 ($NAIC\_3\_5_{s,t}$), and of 6 ($NAIC\_6_{s,t}$); interactions of PC and the NAIC designation indicators; and controls for insurer and security characteristics, X_c:

[19] All indicator variables in the paper take a value of 1 if the condition is present, and 0 otherwise.

$$TM_{i,s,t} = \alpha + \gamma_{3-5} NAIC\_3\_5_{s,t} + \gamma_6 NAIC\_6_{s,t} + \beta_{1-2}\left(PC_i \times NAIC\_1\_2_{s,t}\right) + \beta_{3-5}\left(PC_i \times NAIC\_3\_5_{s,t}\right) + \beta_6\left(PC_i \times NAIC\_6_{s,t}\right) + \sum_{c=1}^{N} \omega_c X_c + \mu_{state} + \varepsilon_{i,s,t}. \quad (1)$$

The equation omits $NAIC\_1\_2_{s,t}$ owing to the inclusion of an intercept. H1 posits that the coefficient β_{3-5} on $PC_i \times NAIC\_3\_5_{s,t}$ is positive. H2 posits that the coefficient β_{1-2} on $PC_i \times NAIC\_1\_2_{s,t}$ is positive, but less than β_{3-5}. In both hypotheses, PC insurers record timelier OTT impairments of the same NAMBS than life insurers. As discussed in footnotes 16 and 17, we make no hypothesis about the coefficient β_6 on $PC_i \times NAIC\_6_{s,t}$.

Many prior studies, most examining banks, but some examining insurers, provide evidence that financial institutions exploit the discretion or ambiguity in financial, regulatory, and tax reporting rules governing fair value measurement, OTT impairment, loan and claim loss reserves,[20] and other accounting areas to meet income, capital, and tax objectives; see Beatty and Liao (2014) for a review of the extensive banking literature, and Hanley et al. (2018) for a recent study of insurers' fair value measurement of securities. Based on these studies, the control variables, X_c, include the following insurer characteristics. $Size_{i,t}$ denotes the natural logarithm of total assets. $ROAE_{i,t}$ denotes 100 times net income divided by average equity. $Low\_RBCRatio_{i,t}$ denotes an indicator for risk-based capital ratio below the median for the same type of insurer in the year; this variable controls for potential differential effects of OTT impairments of securities with NAIC designations from 3 to 5 on PC insurers' and life insurers' risk-based capital ratios discussed in Section II. $Leverage_{i,t}$ denotes 100 times total liabilities divided by total assets. $Liquid_{i,t}$ denotes 100 times cash and cash equivalents divided by total assets. $Risky_{i,t}$ denotes 100 times securities with NAIC designations from 3 to 6 divided by total securities. $Public_{i,t}$ denotes an indicator for the insurer's ultimate parent being publicly traded.[21] All insurer characteristics are lagged by one year to ensure that they are not mechanically related to insurers' OTT impairments. Given the distinct business models of PC insurers and life insurers (Ryan 2007, Chapter 13), for the continuous insurer characteristics, we subtract the mean of the variable for the same type of insurer (PC or life) in the year; this adjustment does not affect any of our inferences. We calculate these means using the universe of insurers with data available on S&P Global Market Intelligence (i.e., not just the insurers in the final sample), so the means of the industry-adjusted variables for the sample observations generally are not zero.[22]

We also control for two security characteristics. $PartialSale_{i,s,t}$ denotes an indicator for the same insurer partially selling the same security during the year, implying that the insurer has first-hand recent experience of the security's market value. $Hldrs_{s,t}$ denotes the number of sample insurers that hold the same security in the same year, which captures the liquidity of the security.

Equation (1) includes fixed effects for the insurer's state of domicile, denoted μ_{state}, as each state has its own insurance regulator and regulatory environment. We estimate Equation (1) in annual cross-sections for each sample year from 2007 to 2011 using ordinary least squares (OLS). We calculate standard errors clustering observations of NAMBS held by an insurer.

IV. EMPIRICAL RESULTS

Univariate Tests of the Relative Timeliness of OTT Impairments across Insurer Types

Panel A of Table 3 reports the numbers of unique securities and total insurer-security observations for life insurers (left five columns) and PC insurers (right five columns) in each sample year from 2007 to 2011. Although the sample contains more PC insurers (648) than life insurers (352), the number of insurer-security-year observations are nearly equal for the two types of insurer in each year.

Using the same columnar structure as in Panel A, Panels B through E of Table 3 report the mean and standard deviation of $TM_{i,s,t}$, as well as the numbers of unique securities and total insurer-security observations, for various subsamples of OTT-impaired NAMBS for the two types of insurer in each sample year. Panel B reports these data for all OTT-impaired securities, while Panels C, D, and E report these data for OTT-impaired securities with NAIC designations from 3 to 5, of 1 or 2, and of 6, respectively. Statistically significant differences in the mean of $TM_{i,s,t}$ across the two types of insurers in the same year for each subsample are indicated by asterisks in the columns for PC insurers. Unless indicated otherwise, we refer to a statistic as significant if it is significant at the 5 percent level or better in two-tailed tests.

In Table 3, Panel B, for the subsample of all OTT-impaired securities, the mean of $TM_{i,s,t}$ is significantly higher in each year for PC insurers than for life insurers. These means differences are consistent with both H1 and H2, although the differences could result from only one of these hypotheses holding.

[20] Following the seminal paper by Petroni (1992), most studies examining accounting discretion by insurers exploit PC insurers' unique claim loss reserve triangles reported in their financial reports and statutory filings.

[21] Fifteen mutual or private insurers (1.5 percent of the sample) become public during our sample period.

[22] Our inferences are unaffected by controlling for Big 4 auditors, who audit 77.3 (84.5) percent of the sample insurers (insurer-security-year observations).

TABLE 3

Timeliness of OTT Impairments

Panel A: All Securities

	Life					PC				
	2007	**2008**	**2009**	**2010**	**2011**	**2007**	**2008**	**2009**	**2010**	**2011**
# Sec	1,563	1,366	1,133	940	794					
# Obs	3,370	2,891	2,246	1,826	1,510	3,696	3,178	2,401	1,877	1,571

Panel B: All OTT-Impaired Securities

	Life					PC				
	2007	**2008**	**2009**	**2010**	**2011**	**2007**	**2008**	**2009**	**2010**	**2011**
# Sec	113	309	409	390	363					
# Obs	265	693	848	792	692	315	865	1,008	869	759
Mean	−1.27	0.52	0.34	−0.05	−0.39	1.93***	4.64***	4.20***	3.88***	3.55***
Std Dev	10.80	18.25	12.95	12.21	11.63	5.98	16.33	13.75	12.87	12.77

Panel C: OTT-Impaired Securities with NAIC Designations from 3 to 5

	Life					PC				
	2007	**2008**	**2009**	**2010**	**2011**	**2007**	**2008**	**2009**	**2010**	**2011**
# Sec	9	46	138	135	124					
# Obs	16	103	296	327	276	40	97	312	318	236
Mean	−5.91	−2.61	−1.29	−0.61	−0.78	1.69	6.75**	5.36***	4.84***	4.05***
Std Dev	29.68	28.64	12.07	11.70	11.24	7.96	24.16	13.51	12.28	11.52

Panel D: OTT-Impaired Securities with NAIC Designations of 1 or 2

	Life					PC				
	2007	**2008**	**2009**	**2010**	**2011**	**2007**	**2008**	**2009**	**2010**	**2011**
# Sec	102	253	237	215	198					
# Obs	247	575	481	386	344	272	755	621	458	432
Mean	−0.64	1.15	0.80	0.37	−0.13	1.97***	4.46***	3.68***	3.10***	3.42***
Std Dev	6.43	15.36	11.35	9.34	9.16	5.67	15.02	12.96	11.59	12.86

Panel E: OTT-Impaired Securities with NAIC Designation of 6

	Life					PC				
	2007	**2008**	**2009**	**2010**	**2011**	**2007**	**2008**	**2009**	**2010**	**2011**
# Sec	2	10	34	40	41					
# Obs	2	15	71	79	72	3	13	75	93	91
Mean	−42.30	−2.29	3.94	0.30	−0.17	1.50	−0.42	3.68	4.43	2.91
Std Dev	59.84	26.69	22.50	22.50	20.51	2.60	17.05	19.76	19.21	15.29

***, ** Denote statistical significance at the 1 percent and 5 percent levels, respectively.

This table presents statistics for the timeliness measure *TM* by type of insurer (Life or PC) and by year. Panel A presents the number of securities (*# Sec*) and number of insurer-security observations (*# Obs*) for all sample securities. Panel B presents *# Sec, # Obs,* the mean of *TM* (*Mean*), and the standards deviation of *TM* (*Std Dev*) for all OTT-impaired securities. Panels C, D, and E present *# Sec, # Obs, Mean,* and *Std Dev* for OTT-impaired securities with NAIC designations from 3 to 5, of 1 or 2, and of 6, respectively. Significant differences in *Mean* for Life insurers and PC insurers are designated by asterisks next to *Mean* for PC insurers.

See Appendix A for the definition of *TM*.

In Table 3, Panel C, for the subsample of all OTT-impaired securities with NAIC designations from 3 to 5, the mean of $TM_{i,s,t}$ is significantly higher in 2008–2011 for PC insurers than for life insurers, consistent with H1. The insignificance in 2007 likely is attributable to the small number of unique OTT-impaired securities with NAIC designations from 3 to 5 in that year, which limits the power of the test of the difference of the means. The number of unique OTT-impaired securities with NAIC designations from 3 to 5 peaks in 2009, and the corresponding number of insurer/OTT-impaired security observations peaks in 2010 for both life insurers and PC insurers.

In Table 3, Panel D, for the subsample of all OTT-impaired securities with NAIC designations of 1 or 2, the mean of $TM_{i,s,t}$ is significantly higher for PC insurers than for life insurers in each sample year, consistent with the first part of H2. The higher statistical significance in this panel than in Panel C is attributable to the larger numbers of unique OTT-impaired securities and insurer/OTT-impaired security observations with NAIC designations of 1 or 2 than of 3 to 5 in each sample year, particularly in 2007 and 2008. Relatedly, the number of unique OTT-impaired securities with NAIC designations of 1 or 2 peaks in 2008 (not 2009, as for OTT-impaired securities with NAIC designations from 3 to 5), and the corresponding number of insurer/OTT-impaired security observations peaks in 2008 (not 2010), for both life insurers and PC insurers. The differential timing of these peaks reflects securities migrating to riskier NAIC designations as the financial crisis evolves.

In untabulated analysis, we calculated the difference across PC insurers and life insurers in the means of $TM_{i,s,t}$ for OTT-impaired securities with NAIC designations from 3 to 5 versus with NAIC designations of 1 or 2 in each year. These differences are statistically significantly positive in all years except 2007 and 2011, providing support for the second part of H2.

In Table 3, Panel E, the subsample of all OTT-impaired securities with NAIC designations of 6 is included for completeness. For reasons discussed in footnotes 15 and 16, the differences in the means of $TM_{i,s,t}$ are insignificant for this subsample.

Summary Statistics

Table 4 reports summary statistics for the Equation (1) variables for the pooled sample of 24,566 insurer-security-year observations from 2007–2011.[23] The table omits the medians and standard deviations of the indicator variables, which follow directly from the corresponding means. It also omits the differences of the means of the continuous insurer characteristic control variables for PC insurers versus life insurers; these variables are adjusted for their means for the same type of insurer in the year, so the differences of the means of these variables for PC insurers versus life insurers are not readily interpretable.

The mean of $TM_{i,s,t}$ in Table 4 is 0.60, i.e., the sample insurers, on average, record 0.60 percent larger cumulative OTT impairments divided by actual cost than the median insurer holding the same security in the same year. Consistent with the differences in the yearly means of $TM_{i,s,t}$ for PC insurers and life insurers reported in Table 3, the mean of $TM_{i,s,t}$ is significantly higher for PC insurers (1.16) than for life insurers (−0.01). NAMBS with NAIC designations of 1 or 2 (from 3 to 5) [of 6] constitute 85 percent (12 percent) [3 percent] of the sample observations. These percentages differ slightly, but significantly, for PC insurers and life insurers; PC insurers hold 1 percent more (less) NAMBS with designations of 1 or 2 (from 3 to 5), i.e., slightly less risky securities, than life insurers. Public insurers constitute 44 percent of the sample, with life insurers being slightly, but significantly, more likely to be public (45 percent) than PC insurers (43 percent). Three quarters of the insurer-security-year observations experience partial sales, with PC insurers being slightly, but significantly, more likely to engage in partial sales of securities (77 percent) than life insurers (73 percent). The mean of $Hldrs_{s,t}$ is 7.39 and is significantly higher for PC insurers (7.82) than for life insurers (6.94).

Compared to the universe of insurers, the sample insurers, on average, are more leveraged, larger, and less liquid, and they hold less risky securities. Compared to this universe, the sample insurers, on average, have similar profitability, although the sample PC insurers are more profitable and the sample life insurers are less profitable.

Multivariate Tests of the Relative Timeliness of OTT Impairments across Insurer Types

As a preliminary before testing H1 and H2, Table 5, Panel A reports the annual cross-sectional estimations of a nested version of Equation (1) that does not distinguish security-year observations by their NAIC designations.[24] With the exception

[23] We calculate the means of the Equation (1) variables across insurer-security-year observations regardless of whether the variables are defined at that level or at more aggregate levels.

[24] While cruder than our primary tests, these preliminary estimations are useful for two reasons. First, a substantial majority of the OTT impairments recorded by insurers in the early sample years involve securities downgraded within investment grade (NAIC designations of 1 or 2), whereas in the later sample years, these impairments increasingly involve securities downgraded to non-investment grade (NAIC designations from 3 to 6). Hence, these preliminary estimations better indicate the *average* relative timeliness of PC and life insurers' OTT impairments of NAMBS over the sample years. Second, we conduct various specification tests later in the paper using similarly nested models. Hence, these preliminary estimations provide a benchmark for these later tests.

TABLE 4

Summary Statistics

Variable	Mean	Median	Std. Dev.	Mean: PC	Mean: Life	Diff: PC − Life
PC	0.52	—	—	—	—	
TM	0.60	0.00	7.47	1.16	−0.01	1.17***
NAIC_1_2	0.85	—	—	0.86	0.85	0.01***
NAIC_3_5	0.12	—	—	0.11	0.12	−0.02***
NAIC_6	0.03	—	—	0.03	0.03	0.00
Low_RBCRatio	0.53	—	—	0.56	0.50	0.06***
Public	0.44	—	—	0.43	0.45	−0.02***
PartialSale	0.75	—	—	0.77	0.73	0.04***
Hldrs	7.39	5.00	7.74	7.82	6.94	0.88***
Leverage	8.64	12.03	12.03	5.54	11.96	—
Size	2.35	2.24	2.19	2.00	2.72	—
Liquid	−7.80	−8.21	6.00	−9.88	−5.55	—
Risky	−0.66	−0.99	7.17	−1.10	−0.19	—
ROAE	−0.03	1.56	24.04	3.33	−3.64	—

*** Denote differences in the means for PC and life insurers that are statistically significant at the 1 percent level.
This table presents the means, medians, standard deviations, means for PC insurers, means for life insurers, and the difference in the means for PC and life insurers for all the variables in Equation (1).
Definitions of the Equation (1) variables are provided in Appendix A.

of a few variable-years, the control variables are insignificant. The coefficient on PC_i is significantly positive in all five sample years. Hence, on average, PC insurers record timelier OTT impairments of the same NAMBS than life insurers in each of these years.

Panel B of Table 5 reports the estimation of the full Equation (1), which we use to test both hypotheses. The control variables remain insignificant, with a few exceptions. H1 posits that the coefficient $\beta_{3–5}$ on $PC_i \times NAIC\_3\_5_{s,t}$ is positive, i.e., that PC insurers record timelier OTT impairments of NAMBS with NAIC designations from 3 to 5, which they measure at fair value, than do life insurers, who measure these securities at amortized cost. Consistent with this hypothesis, and also with the univariate tests reported in Table 3, $\beta_{3–5}$ is significantly positive in 2008 through 2011. Also consistent with the univariate tests, $\beta_{3–5}$ is insignificant in 2007, reflecting the few unique securities with NAIC designations from 3 to 5 in that year.

In terms of economic significance, in Table 5, Panel B, $\beta_{3–5}$ peaks at 6.28 in 2008, indicating that by that year, life insurers had cumulatively recorded 6.28 percent smaller OTT impairments as a percentage of the acquisition cost of NAMBS with NAIC designations from 3 to 5 than PC insurers. Although $\beta_{3–5}$ decreases gradually in subsequent years, the number of OTT-impaired NAMBS with NAIC designations from 3 to 5 in our sample increases sharply from 2008 to 2009 (see Table 3, Panel C). The latter effect dominates the former, causing the incremental dollar amount of life insurers' smaller cumulative OTT impairments of these securities to peak in 2009 at $67 million, 68 percent of life insurers' reported OTT impairments of the securities of $99 million in 2009, and 5 percent of their acquisition cost of $1.4 billion for the securities.[25]

The first part of H2 posits that the coefficient $\beta_{1–2}$ on $PC_i \times NAIC\_1\_2_{s,t}$ is positive, i.e., that PC insurers record timelier OTT impairments of NAMBS with NAIC designations of 1 and 2 than life insurers, reflecting information spillover from PC insurers' fair value measurement of NAMBS with NAIC designations from 3 to 5. Largely consistent with this part of H2, and also with the univariate tests reported in Table 3, in Table 5, Panel B, $\beta_{1–2}$ is significantly positive in 2007–2009 and 2011.

In terms of economic significance, in Table 5, Panel B, the coefficient $\beta_{1–2}$ peaks at 1.15 in 2008, indicating that by that year, life insurers had cumulatively recorded 1.15 percent smaller OTT impairments as a percentage of the acquisition cost of NAMBS with NAIC designations of 1 or 2 than had PC insurers. The incremental dollar amount of the cumulatively smaller OTT impairments of these securities for life insurers also peaks in 2008 at $132 million, 107 percent of life insurers' cumulative

[25] We considered calculating economic significance at the insurer level under the assumption that the estimated coefficients for our (highly restricted) sample of NAMBS generalized to all NAMBS or even to all debt investment securities. As it is difficult to know whether this assumption is appropriate, particularly for all debt securities, we decided against making these calculations.

TABLE 5

Timeliness of PC versus Life Insurers

Panel A: Effect of Insurer Type without Distinguishing NAIC Designation

Variable	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
PC	0.29***	1.39***	1.81***	1.61***	1.61***
	(3.34)	(3.02)	(3.61)	(2.98)	(3.16)
Low_RBCRatio	0.15*	−0.19	−0.45	−0.07	−0.74*
	(1.63)	(−0.52)	(−0.86)	(−0.16)	(−1.67)
Leverage	−0.00	−0.01	−0.01	−0.02	−0.03
	(−0.97)	(−0.37)	(−0.46)	(−0.78)	(−1.37)
Size	0.00	0.07	−0.17	−0.02	0.02
	(0.20)	(0.52)	(−0.82)	(−0.19)	(0.15)
Liquid	0.00	0.00	0.03	−0.00	−0.03
	(0.58)	(0.05)	(1.25)	(−0.05)	(−0.78)
Risky	0.02*	0.04	0.02	−0.02	0.06
	(1.64)	(1.19)	(0.49)	(−0.44)	(1.47)
Hldrs	−0.00	0.00	0.01	0.01	0.00
	(−0.09)	(0.10)	(0.76)	(0.45)	(0.20)
PartialSale	−0.01	0.50	−0.48	−0.49	0.55
	(−0.15)	(1.54)	(−1.27)	(−0.91)	(0.56)
Public	−0.12	0.42	−0.25	−0.22	0.15
	(−1.27)	(0.95)	(−0.42)	(−0.49)	(0.31)
ROAE	0.00	−0.03	0.00	0.01	0.02*
	(1.34)	(−1.50)	(0.06)	(0.86)	(1.90)
Intercept	−0.46***	−2.08***	−1.37**	−1.62***	−2.57**
	(−3.09)	(−3.23)	(−2.04)	(−2.71)	(−2.43)
Observations	7,066	6,069	4,647	3,703	3,081
R^2	0.014	0.027	0.040	0.043	0.057
FE State	Yes	Yes	Yes	Yes	Yes
Clustering Firm	Yes	Yes	Yes	Yes	Yes

(continued on next page)

OTT impairments of the securities of $123 million in 2008, and over 1 percent of their acquisition cost of $11.5 billion for the securities.

The second part of H2 posits that the coefficient β_{1-2} on $PC_i \times NAIC\_1\_2_{s,t}$ is smaller than the coefficient β_{3-5} on $PC_i \times NAIC\_3\_5_{s,t}$, i.e., that the spillover effect of fair value measurement predicted in the first part of H2 (i.e., β_{1-2}) is weaker than the direct effect of fair value predicted in H1 (i.e., β_{3-5}). The difference of β_{3-5} and β_{1-2} in each year and t-tests of these coefficient differences are reported at the bottom of Table 5, Panel B. Largely consistent with the second part of H2, $\beta_{3-5} - \beta_{1-2}$ is significantly positive in 2008–2011.

In summary, the tests reported in Table 5 are largely consistent with PC insurers' (life insurers') fair value (amortized cost) measurement of the same NAMBS with NAIC designations from 3 to 5 leading PC insurers to record timelier OTT impairments of both these securities and NAMBS with NAIC designations of 1 and 2 than life insurers.

V. SUPPLEMENTAL ANALYSES AND ROBUSTNESS TESTS

Relative Timeliness of OTT Impairments of NAMBS with NAIC Designations from 3 to 5 versus of 1 or 2 within Each Insurer Type

A potential problem of inference confronting this study is that PC and life insurers have distinct business models (Ryan 2007, Chapter 13). Compared to PC insurers, life insurers typically hold longer duration liabilities, and so invest in longer maturity and less liquid securities and have longer intended holding periods for securities. Our security-level research design

TABLE 5 (continued)

Panel B: Effect of Insurer Type Distinguishing NAIC Security Designations

Variable	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
*PC * NAIC_3_5*	3.45	6.28**	4.78***	3.63***	2.78***
[β_{3-5}]	(1.13)	(2.06)	(5.42)	(4.05)	(3.19)
*PC * NAIC_1_2*	0.21***	1.15***	1.13***	0.78	1.12**
[β_{1-2}]	(2.80)	(2.65)	(2.47)	(1.59)	(2.23)
*PC * NAIC_6*	29.26	2.04	0.39	3.59	2.38
[β_6]	(1.27)	(0.29)	(0.14)	(1.09)	(0.82)
NAIC_3_5	−2.37	−1.79	−1.07*	−0.43	−0.24
[γ_{3-5}]	(−0.81)	(−0.75)	(−1.87)	(−0.73)	(−0.39)
NAIC_6	−27.99	−2.47	2.31	0.11	0.30
[γ_6]	(−1.22)	(−0.42)	(1.16)	(0.04)	(0.13)
Low_RBCRatio	0.13*	−0.21	−0.57	−0.12	−0.79*
	(1.74)	(−0.58)	(−1.09)	(−0.29)	(−1.79)
Leverage	−0.00	−0.01	−0.01	−0.02	−0.03
	(−0.95)	(−0.29)	(−0.36)	(−0.74)	(−1.35)
Size	−0.00	0.06	−0.18	−0.02	0.00
	(−0.01)	(0.47)	(−0.88)	(−0.20)	(0.03)
Liquid	0.00	0.00	0.03	−0.01	−0.04
	(0.55)	(0.04)	(1.05)	(−0.17)	(−0.89)
Risky	0.02	0.05	0.02	−0.03	0.06
	(1.62)	(1.19)	(0.35)	(−0.57)	(1.44)
Hldrs	−0.00	0.00	0.01	−0.00	−0.00
	(−0.74)	(0.05)	(0.32)	(−0.21)	(−0.20)
PartialSale	−0.01	0.55*	−0.45	−0.21	0.81
	(−0.15)	(1.76)	(−1.22)	(−0.46)	(0.92)
Public	−0.09	0.40	−0.25	−0.24	0.19
	(−1.07)	(0.92)	(−0.42)	(−0.53)	(0.37)
ROAE	0.00	−0.02	0.00	0.01	0.02*
	(1.38)	(−1.49)	(0.05)	(0.78)	(1.91)
Intercept	−0.37***	−1.83***	−0.63	−1.20**	−2.56***
	(−2.82)	(−2.87)	(−1.02)	(−2.25)	(−2.66)
t-test: ($\beta_{3-5} - \beta_{1-2}$) > 0	3.24	5.13**	3.64***	2.84***	1.66***
Difference for PC insurers versus life insurers in the difference of the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 versus of 1 or 2	(1.06)	(1.71)	(4.76)	(3.54)	(1.97)
t-test: ($\beta_{3-5} + \gamma_{3-5} - \beta_{12}$) > 0	0.87	3.34**	2.57***	2.42***	1.43***
Difference in the timeliness of PC insurers' OTT impairments of NAMBS with NAIC designations from 3 to 5 versus of 1 or 2	(0.96)	(1.83)	(4.84)	(4.08)	(2.21)
Observations	7,066	6,069	4,647	3,703	3,081
R^2	0.074	0.032	0.050	0.052	0.060
FE-State	Yes	Yes	Yes	Yes	Yes
Clustering-Firm	Yes	Yes	Yes	Yes	Yes

***, **, * Denote t-statistics that are statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table examines the difference in the timeliness of OTT impairments of NAMBS for PC insurers versus life insurers. It reports annual cross-sectional estimations of Equation (1) for the full sample. Panel A reports estimations of a nested version of Equation (1) that does not distinguish security-year observations by NAIC designations. Panel B reports estimations of the full Equation (1). This panel reports a two-tailed t-test of the difference for PC insurers versus life insurers in the difference of the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 versus with designations of 1 or 2 (i.e., ($\beta_{3-5} - \beta_{1-2}$) > 0). The panel also reports a two-tailed t-test of the difference of the timeliness of PC insurers' OTT impairments of NAMBS with NAIC designations from 3 to 5 versus with NAIC designations of 1 or 2 (i.e., ($\beta_{3-5} + \gamma_{3-5} - \beta_{1-2}$) > 0); both components of this difference are measured relative to the timeliness of OTT impairments of NAMBS with NAIC designations of 1 or 2 for life insurers, as this timeliness cannot be recovered from the estimation of Equation (1). Equation (1) includes fixed effects for the state of domicile of each firm insurer. Standard errors are calculated clustering observations by insurer.

Definitions of the Equation (1) variables are provided in Appendix A.

controls for life insurers' tendency to invest in different securities than do PC insurers, but it does not control for life insurers expecting to recover more of the deterioration of the fair value of impaired securities over their longer holding periods. Under this possibility, SAP may require PC insurers to record more frequent or larger OTT impairments than life insurers.

In this section, we address this potential problem of inference by conducting analyses within each insurer type. Specifically, we compare the timeliness of OTT impairments of NAMBS with NAIC designations of 1 or 2, which both PC and life insurers measure at amortized cost, to the timeliness of OTT impairments of NAMBS with NAIC designations 3 to 5, which PC insurers measure at fair value and life insurers measure at amortized cost. For essentially the same reasons that underlie the development of H1 and H2 provided in Section II, we expect that PC insurers' OTT impairments of NAMBS with NAIC designations from 3 to 5 are timelier than their OTT impairments of NAMBS with NAIC designations of 1 or 2. In contrast, we expect no such difference for life insurers.

To test this expectation for PC insurers, the bottom of Table 5, Panel B reports t-tests of the sum of the coefficients in Equation (1) that capture the timeliness of PC insurers' OTT impairments of NAMBS with NAIC designations from 3 to 5 (i.e., the coefficient γ_{3-5} on *NAIC_3_5* plus the coefficient β_{3-5} on $PC_i \times NAIC\_3\_5$) minus the coefficient that captures the timeliness of PC insurers' OTT impairments of NAMBS with NAIC designations of 1 or 2 (i.e., the coefficient β_{1-2} on $PC_i \times NAIC\_1\_2$); both of the components of this difference are measured relative to the timeliness of life insurers' OTT impairments of NAMBS with NAIC designations of 1 or 2, which is captured in the intercept of Equation (1) and so cannot be recovered from the estimation of that equation. As expected, these coefficient differences are significantly positive in 2008–2011,[26] consistent with PC insurers recording timelier OTT impairments of NAMBS with NAIC designations from 3 to 5 than of NAMBS with NAIC designations of 1 or 2 in those years. In terms of economic significance, PC insurers' cumulative OTT impairments through 2008 divided by acquisition cost are 3.34 percent larger for NAMBS with NAIC designations from 3 to 5 than for NAMBS with NAIC designations of 1 and 2.

The coefficient γ_{3-5} on *NAIC_3_5* in Table 5, Panel B captures the timeliness of life insurers' OTT impairments of NAMBS with NAIC designations from 3 to 5 relative to the timeliness of their OTT impairments of NAMBS with NAIC designations of 1 or 2. In contrast to the result for PC insurers, γ_{3-5} is insignificant in all sample years except 2009, when the coefficient is significantly *negative* at the 10 percent level. Hence, with this marginally significant and wrong-signed exception, for life insurers, as expected, we find statistically insignificant differences in the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 versus NAIC designations of 1 or 2. This evidence is inconsistent with the distinct business models of PC and life insurers explaining our findings.

Requiring a Minimum Investment Horizon

In this section, we alternatively address the longer investment horizon of life insurers than of PC insurers by replicating the primary analyses reported in Table 5, Panel B on the subsample of NAMBS for which at least one PC insurer and one life insurer do not sell all their holdings of the security in the following one or two years, reasonable horizons over which insurers could feasibly evaluate their intent to hold securities. Depending on the year, the one-year (two-year) horizon reduces the sample size by about 10 to 20 (30 to 35) percent compared to the full sample. The untabulated results show that our inferences are unchanged for H1 and the first part of H2, and only slightly weaker for the second part of H2, inconsistent with the longer investment horizon of life insurers than of PC insurers explaining our findings.

Partitioning on Insurers' Resources

A second potential problem of inference is that we cannot directly observe PC insurers' information and control systems. To provide evidence that these systems constitute the mechanism underlying the association between fair value measurement and the timeliness of OTT impairments, we exploit the sizable magnitude of the costs necessary to develop information and control systems, which implies that an insurer's ability to invest in these systems may be limited by its available resources. We partition the sample into terciles based on a proxy for insurers' financial resources leading into the financial crisis, namely, statutory surplus at the beginning of 2007. We expect to obtain the strongest results when insurers' resources are adequate, but not plentiful, i.e., in the middle tercile. In this tercile, we expect the requirement that PC insurers measure securities at fair value, rather than at amortized cost, to cause these insurers, but not life insurers, to reallocate a portion of their limited resources from other possible investments to information and control systems. In contrast, we expect both PC and life insurers with low statutory surplus to have sufficiently low resources to be reluctant to invest in these systems. We expect that additional

[26] As discussed in Section IV, this insignificance in 2007 is likely attributable to the relatively few NAMBS with NAIC designations from 3 to 5 held by PC insurers in that year, which reduces the power of the test.

incentives like fair value measurement requirements are not required to motivate both types of insurers with ample resources (i.e., high statutory surplus) to invest in the systems.[27]

Table 6 presents the estimation of the full Equation (1) for the terciles each year. To conserve space, the table reports only the estimated coefficients on the interactions of PC_i and the NAIC designations in Equation (1) for each of the terciles, as well as t-tests of differences of these coefficients across the terciles. As expected, in the middle tercile, the coefficient $\beta_{3–5}$ on $PC_i \times NAIC\_3\_5_{s,t}$ is significantly positive in 2008–2011. $\beta_{3–5}$ is significantly larger in the middle tercile than in the low tercile in 2007–2010 (10 percent level in 2007), and it is significantly larger in the middle tercile than in the higher tercile in in all years from 2008 to 2010. Similarly, in the middle tercile, the coefficient $\beta_{1–2}$ on $PC_i \times NAIC\_1\_2_{s,t}$ is significantly positive in 2007–2011 (10 percent level in 2011). $\beta_{1–2}$ is significantly larger in the middle tercile than in the low tercile in 2008 (10 percent level) and 2009, and it is significantly larger in the middle tercile than in the high tercile in 2009 and 2010.

In summary, we find the strongest support for H1 and H2 in the middle tercile of statutory surplus, consistent with differential information and control systems being the mechanism driving our primary results reported in Table 5, Panel B. Our inferences are robust to the use of other proxies for firm resources, such as size and three-year average income.

Public versus Private Insurers

A third potential problem of inference is that our analysis is based on PC and life insurers' differential use of fair value and amortized cost measurement for statutory accounting purposes. This approach raises no issues for private insurers, which comprise 56 percent of the full sample. However, insurers with public parents may classify NAMBS as available for sale for financial reporting purposes and, thus, recognize the securities at fair value in aggregate on the balance sheet, although the income statement remains on an amortized cost basis.[28] In addition, these parents must disclose the aggregate fair values of major categories of securities classified as either available for sale or held to maturity. Hence, for public insurers to satisfy financial reporting requirements, the insurers must devote some resources to the information and control systems necessary to measure NAMBS at fair value. The amount of these resources may be low for fair values based solely on limited market information or high for fair values also involving fundamental valuation.

Despite this fact, we expect our hypotheses to hold for public insurers, albeit to a lesser extent than for private insurers, for three reasons. First, PC insurers' recognition of NAMBS at fair value and the security-level disclosures required in statutory reports, which affect regulatory capital ratios and, thus, regulatory scrutiny, incentivize more extensive information and control systems than the aggregate accounting and disclosures required in financial reports. For example, as discussed in Section III, insurers must disclose a detailed T-account roll-forward during the year for each fixed-income security in their statutory filings. In contrast, in their financial reports, insurers often disclose major categories of securities that are defined much broader than NAMBS; for example, it is common to include all asset-backed securities other than agency mortgage-backed securities in a single category. Second, insurers' risk-based capital ratios and overall scrutiny by regulators depends on their statutory accounting numbers, rendering these numbers of key concern to insurers. This concern was heightened during our sample period of the financial crisis and its aftermath. Third, Hanley et al. (2018) provide evidence that public insurers' statutory reporting incentives lead them to manipulate their fair value estimates, in particular, to inflate fair values through internal estimation and to evade detection by reporting the use of Level 2 fair value measurement inputs.

To address this issue, we conducted analyses distinguishing between private and public insurers. Table 7 reports the estimations of the nested version of Equation (1) reported in Table 5, Panel A expanded to include an indicator for a public (parent) insurer, *Public,* linearly and interacted with *PC*. We report the nested model results both because we obtain support for both H1 and H2 in our primary analyses and to avoid reduction of statistical power from partitioning of the sample on the indicator *Public*.

Consistent with the results reported in Table 5, Panel A and with one or both of H1 and H2 holding, the coefficient β_{PC} on PC_i in Table 7 is significantly positive in 2007–2011, indicating that, on average, private PC insurers record timelier OTT impairments of the same NAMBS than private life insurers in each of these years. The sum of β_{PC} and the coefficient $\beta_{PC*Public}$ on $PC_i * Public$ is also significantly positive in 2007–2011 (weakly in 2010), indicating that, on average, public PC insurers

[27] To the best of our knowledge, no prior study reports findings that directly support our expectations. However, many prior studies model or empirically document analogous U-shaped relations between either investment (including in information system security) or innovation and financing constraints (e.g., Hausken 2006; Cleary, Povel, and Raith 2007; H. Kim, H. Kim, and Lee 2008). These U-shapes typically result because different sources of benefits and/or costs dominate at different levels of financing constraints. Notably, the last of these studies documents that firms with middle levels of financing constraints reallocate resources in fighting information systems security threats; these findings are analogous to our expectation that PC insurers in the middle statutory surplus tercile reallocate resources to investments in information systems from other possible investments.

[28] We examined the 2009 financial reports of the 50 public life insurers in our sample that held the most NAMBS that year. While it is sometimes difficult to determine from the aggregated categories of investment securities disclosed in financial report footnotes, four of these 50 insurers (Prudential, National Western Life, Reliance Standard Life, and HCC Life Insurance) appear to have classified some or all of their NAMBS as held to maturity.

TABLE 6

Partitioning Sample on Statutory Surplus

Variable	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
Low Statutory Surplus Tercile					
*PC * NAIC_3_5*	−7.06***	3.29	1.81	1.49	0.54
[$\beta_{3–5,\ low}$]	(−2.52)	(0.76)	(1.25)	(0.72)	(0.23)
*PC * NAIC_1_2*	0.15	0.13	0.17	1.76	−0.00
[$\beta_{1–2,\ low}$]	(1.32)	(0.29)	(0.19)	(1.33)	(−0.00)
*PC * NAIC_6*	89.40***	−4.84	2.31	−0.62	−3.02
[$\beta_{6,\ low}$]	(489.40)	(−0.16)	(0.50)	(−0.13)	(−0.57)
Medium Statutory Surplus Tercile					
*PC * NAIC_3_5*	1.57	19.29***	8.34***	7.87***	4.65***
[$\beta_{3–5,\ medium}$]	(0.35)	(2.85)	(4.64)	(5.23)	(2.97)
*PC * NAIC_1_2*	0.37***	2.20**	3.28***	2.48***	1.74*
[$\beta_{1–2,\ medium}$]	(3.32)	(1.93)	(3.33)	(2.47)	(1.72)
*PC * NAIC_6*	—	−12.81	−5.76	−1.20	0.60
[$\beta_{6,\ medium}$]		(−0.87)	(−0.74)	(−0.27)	(0.13)
High Statutory Surplus Tercile					
*PC * NAIC_3_5*	6.28*	3.14	3.89***	2.09*	1.44
[$\beta_{3–5,\ high}$]	(1.63)	(0.80)	(3.31)	(1.85)	(1.20)
*PC * NAIC_1_2*	0.21	1.03**	0.25	−0.00	0.13
[$\beta_{1–2,\ high}$]	(1.42)	(2.24)	(0.40)	(−0.00)	(0.19)
*PC * NAIC_6*	0.07	1.96	−0.77	9.04**	4.89
[$\beta_{6,\ high}$]	(0.41)	(0.60)	(−0.24)	(2.10)	(1.51)
t-test: $\beta_{3–5,\ medium} - \beta_{3–5,\ low}$	8.63*	16.00**	6.54***	6.38***	4.11
Difference for PC insurers versus life insurers in the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 for insurers with medium versus low statutory surplus	(1.64)	(1.99)	(2.84)	(2.51)	(1.48)
t-test: $\beta_{3–5,\ medium} - \beta_{3–5,\ high}$	−4.71	16.15**	4.46**	5.78***	3.21*
Difference for PC insurers versus life insurers in the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 for insurers with medium versus high statutory surplus	(−0.80)	(2.08)	(2.08)	(3.08)	(1.63)
t-test: $\beta_{1–2,\ medium} - \beta_{1–2,\ low}$	0.23	2.07*	3.11**	0.72	1.74
Difference for PC insurers versus life insurers in the timeliness of OTT impairments of NAMBS with NAIC designations of 1 or 2 for insurers with medium versus low statutory surplus	(1.42)	(1.69)	(2.33)	(0.43)	(0.95)
t-test: $\beta_{1–2,\ medium} - \beta_{1–2,\ high}$	0.16	1.17	3.03***	2.48**	1.61
Difference for PC insurers versus life insurers in the timeliness of OTT impairments of NAMBS with NAIC designations of 1 or 2 for insurers with medium versus high statutory surplus	(0.85)	(0.96)	(2.60)	(2.05)	(1.32)

***, **, * Denote t-statistics that are statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table examines the difference in the timeliness of OTT impairments of NAMBS for PC insurers versus life insurers across terciles formed based on a proxy for the insurers' financial resources during the financial crisis and its aftermath: statutory surplus at the beginning of 2007. The top portions of the table report the coefficients on the interactions of PC with the NAIC designations from annual cross-sectional estimations of the full Equation (1) for each tercile. The bottom portions of the table report two-tailed t-tests of the difference for PC insurers versus life insurers in the difference of the timeliness of OTT impairments of NAMBS with NAIC designations from 3 to 5 for the medium versus low terciles and for the medium versus high terciles (i.e., $\beta_{3–5,\ medium} - \beta_{3–5,\ low}$ and $\beta_{3–5,\ medium} - \beta_{3–5,\ high}$, respectively) and of NAMBS with NAIC designations of 1 and 2 for the medium versus low terciles and for the medium versus high terciles (i.e., $\beta_{1–2,\ medium} - \beta_{1–2,\ low}$ and $\beta_{1–2,\ medium} - \beta_{1–2,\ high}$, respectively). Equation (1) includes fixed effects for the state of domicile of each firm insurer. Standard errors are calculated clustering observations by insurer.

Definitions of the Equation (1) variables are provided in Appendix A.

TABLE 7

Public versus Private Insurers

Variable	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
PC ∗ *Public*	−0.06	0.01	−0.42	−0.67	−0.88
[$\beta_{PC * Public}$]	(−0.32)	(0.01)	(−0.54)	(−0.92)	(−1.27)
PC	0.31**	1.38***	1.97***	1.87***	1.96***
[β_{PC}]	(2.41)	(2.57)	(3.69)	(3.20)	(3.14)
Public	−0.09	0.41	−0.05	0.09	0.55
[β_{Public}]	(−0.68)	(0.63)	(−0.06)	(0.16)	(0.90)
t-test: ($\beta_{PC * Public} + \beta_{PC}$) > 0	0.25**	1.39**	1.54**	1.20*	1.08**
Difference of timeliness of OTT impairments of NAMBS for public PC insurers versus public life insurers	(2.31)	(2.07)	(2.04)	(1.62)	(1.85)
Observations	7,066	6,069	4,647	3,703	3,081
R^2	0.014	0.027	0.040	0.044	0.057

***, **, * Denote t-statistics that are statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively.
This table examines the relative timeliness of OTT impairments of NAMBS for PC insurers and life insurers, distinguishing public from private insurers (*Public* equal to 1 and 0, respectively). Similar to the estimations reported in Table 5, Panel A, this table reports estimations of a nested version of Equation (1) adding *Public* linearly and interactively with *PC*. The table reports a two-tailed t-test of the difference of the timeliness of OTT impairments of NAMBS for public versus private PC insurers versus life insurers (i.e., ($\beta_{PC * SelfEst} + \beta_{PC}$) > 0). Coefficients on the control variables are suppressed. Equation (1) includes fixed effects for the state of domicile of each firm insurer. Standard errors are calculated clustering observations by insurer. Definitions of the Equation (1) variables are provided in Appendix A.

record timelier OTT impairments of the same NAMBS than public life insurers in each of these years. In contrast, $\beta_{PC*Public}$ and the coefficient β_{Public} on *Public* are insignificant in each year, indicating no differences in the timeliness of public and private PC insurers' OTT impairments and in public and private life insurers' OTT impairments, respectively. $\beta_{PC*Public}$ is appreciably negative in 2009–2011, however, rendering the coefficients of interest appreciably higher in absolute magnitude and significance for private insurers than for public insurers in those years.

Statutory Disclosures of Fair Values

A fourth potential problem of inference is that all insurers must disclose fair value measurements for all securities in statutory reports, regardless of how the securities are measured for statutory accounting purposes. Hence, insurers must devote some resources to the information and control systems that are necessary when insurers are required to measure NAMBS at fair value for statutory accounting purposes. As discussed previously, the amount of these resources invested will be considerably lower for fair values based solely on the limited available market information than for fair values also involving fundamental valuation. Regarding this problem of inference, we posit that (1) the *recognition* of NAMBS with NAIC designations of 3 to 5 at fair value required in statutory reports for PC insurers incentivizes these insurers to devote more resources to information and control systems than does the *disclosure* of the fair values of NAMBS required in statutory reports for all insurers; and (2) insurers' statutory accounting numbers, not their statutory disclosures, are the focus of regulatory scrutiny. Our overall set of results is consistent with this position.

Partitioning on the Risk-Based Capital Ratio

Because PC insurers record unrealized losses on NAMBS with NAIC designations from 3 to 5 in net income and statutory surplus, a potential secondary basis for H1 is that PC insurers' unassigned surplus and risk-based capital ratios generally do not decrease if they record OTT impairments of these securities, implying that these insurers do not have capital-related disincentives to record OTT impairments of the securities. In contrast, life insurers generally have such incentives. Specifically, for NAMBS with NAIC designations from 3 to 5, OTT impairments of the securities decrease life insurers' unassigned surplus if their AVRs are not sufficiently large. Moreover, OTT impairments of securities always decrease the numerator of life insurers' risk-based capital ratios, total adjusted capital, by reducing one or both of their AVRs and unassigned surplus. Differential regulatory capital effects are not a potential basis for H2, however, because both PC insurers and life insurers have capital-related incentives not to record OTT impairments for NAMBS with NAIC designations of 1 or 2.

The primary results reported in Table 5, Panel B suggest that this potential secondary basis for H1 does not explain our findings. Specifically, Equation (1) includes an indicator for low risk-based capital ratios within each type of insurer, *Low_RBCRatio,* that controls for differential effects of OTT impairments of securities with NAIC designations from 3 to 5 on regulatory capital across the two types of insurers. The coefficient on *Low_RBCRatio* is weakly significantly positive in 2007, weakly significantly negative in 2011, and insignificant in 2008–2010, suggesting that such differential regulatory capital effects have, at most, a weak and inconsistent effect on the differential timeliness of OTT impairments by the two types of insurer.

To further rule out the possibility that differential effects of OTT impairments of NAMBS with NAIC designations from 3 to 5 on PC insurers' and life insurers' risk-based capital ratios explain the results from our tests of H1, in untabulated analysis, we partition the sample into terciles based on insurers' risk-based capital ratios either at the end of 2006 or at the beginning of each year. We find the strongest support for both of our hypotheses in the high tercile, inconsistent with our results being attributable to differential effects of OTT impairments of these securities on risk-based capital ratios.

Eliminating PC and Life Insurers with a Common Parent

No NAMBS in the final sample is held by both a PC insurer and a life insurer owned by a common parent. However, it is likely that a PC insurer and a life insurer with a common parent share information systems. To ensure that the systems of PC and life insurers are fully distinct, in untabulated analysis, we replicated the full sample estimations reported in Table 5, Panel B eliminating the 36 percent of the observations for which PC and life insurers are owned by a common parent. Despite this loss of observations, the inferences are very similar to those drawn in Section IV from the full sample estimations.

Analysis of the Credit Downgrade Subsample

A possibility that would work against our hypotheses is that downgrades of NAMBS to lower (non-investment grade) NAIC designations indicate (significant) deteriorations in the credit quality of the securities and, thus, (significantly) increased likelihoods that holders should record OTT impairments of the securities. Hence, these downgrades may induce life insurers to invest in information and control systems for the securities. To rule out this possibility, in untabulated analyses, we replicated the full sample estimations reported in Table 5, Panel B on the subsample of NAMBS whose NAIC designations experienced downgrades after 2006. The inferences are again very similar to those from the full sample estimations.

Fair Value Estimation Method

Beginning in 2009, insurers must disclose in statutory filings whether security-level fair values are "internal" or "external" estimates. While Hanley et al. (2018) provide evidence that this distinction is important for the accuracy of the disclosed fair values of the universe of fixed-income securities held by insurers, this distinction is neither the key nor an unambiguous one for NAMBS, for several reasons related to the illiquidity of the secondary market for these securities. This illiquidity implies that third-party estimates based solely on the limited available market information[29] are likely to be less timely and accurate than self-estimates that are also based on fundamental valuation. As explicitly envisioned in GAAP fair value measurement guidance, insurers likely measure the fair values of illiquid NAMBS using a combination of internal and external inputs or approaches.[30] Last, GAAP requires that insurers evaluate whether external fair value estimates comply with fair value measurement guidance, a more difficult task for less liquid securities. The key distinction is instead whether insurers base their fair value measurements solely on the limited available market information or also on fundamental analysis that uses a richer set of information and models the securitization waterfall.

In our sample, 12.9 percent of the fair value measurements of NAMBS for all insurers are reported as internal estimates, over double the 5.6 percent reported by Hanley et al. (2018) for the universe of insurers' securities. Table 8 reports estimations of the nested version of Equation (1) reported in Table 5, Panel A expanded to include an indicator for NAMBS for which the insurer internally estimated fair values, *SelfEst,* linearly and interacted with *PC*. Because insurers report the data underlying *SelfEst* beginning in 2009, we use the values of *SelfEst* in 2009 to proxy for the unreported values in 2007 and 2008. We find that the inferences from our primary analyses hold both for internal and external fair value estimates, with insignificant

[29] See footnote 4.

[30] For example, ASC 820-10-35-24B contemplates reporting firms fair valuing items traded in inactive markets using "multiple valuation techniques" that yield a "range of values" within which the "fair value measurement is the point within that range that is most representative of fair value in the circumstances." Similarly, ASC 820-10-55-90 to 98 contains implementation guidance for a senior NAMBS for which the reporting firm "has multiple indications of the market rate of return that market participants would take into account when measuring fair value, [and so] it evaluates and weights the respective indications of the rate of return, considering the reasonableness of the range indicated by the results."

TABLE 8

Self-Estimation of Fair Values

Variable	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
PC ∗ *SelfEst*	−0.18	0.28	0.43	2.70	1.50
[$\beta_{PC * SelfEst}$]	(−1.14)	(0.28)	(0.49)	(0.90)	(0.49)
PC	0.33***	1.55***	1.73***	1.54***	1.57***
[β_{PC}]	(2.89)	(2.70)	(3.30)	(2.88)	(3.09)
SelfEst	0.08	−0.74	−0.40	1.64*	1.11
[$\beta_{SelfEst}$]	(0.50)	(−1.15)	(−0.72)	(1.87)	(1.29)
t-test: ($\beta_{PC * SelfEst} + \beta_{PC}$) > 0	0.15	1.83**	2.16***	4.23*	3.07
Difference for PC insurers versus life insurers in the timeliness of OTT impairments of NAMBS with self-estimated versus externally estimated fair values	(1.09)	(1.79)	(2.43)	(1.42)	(1.01)
Observations	5,259	4,952	4,647	3,703	3,081
R^2	0.020	0.028	0.040	0.049	0.059

***, **, * Denote t-statistics that are statistically significant at the 1 percent, 5 percent, and 10 percent levels, respectively.

This table examines the difference in the timeliness of OTT impairments of NAMBS for PC insurers versus life insurers, distinguishing securities with reported fair values that were self-estimated by the insurers versus externally estimated by third parties (*SelfEst* equal to 1 and 0, respectively). Insurers report the data underlying *SelfEst* only beginning in 2009. The table reports the results for each year from 2007 to 2011 assuming that the values of *SelfEst* in 2007 and 2008 equal the value in 2009. Similar to the estimations reported in Table 5, Panel A, this table reports estimations of a nested version of Equation (1) adding *SelfEst* linearly and interactively with *PC*. The table reports a two-tailed t-test of the difference of the timeliness of OTT impairments of NAMBS with self-estimated versus externally estimated fair values for PC insurers versus life insurers in (i.e., ($\beta_{PC * SelfEst} + \beta_{PC}$) > 0). Coefficients on the control variables are suppressed. Equation (1) includes fixed effects for the state of domicile of each firm insurer. Standard errors are calculated clustering observations by insurer. Definitions of the Equation (1) variables are provided in Appendix A.

differences across the two sources of estimates. Specifically, the coefficient β_{PC} on PC_i is significantly positive in 2007–2011, indicating that in each of these years, PC insurers that recognize NAMBS at external fair value measurements, on average, record timelier OTT impairments of the same NAMBS than private life insurers that recognize NAMBS at external fair value measurements. The coefficient $\beta_{PC*SelfEst}$ on PC_i ∗ *SelfEst* is insignificant in each year, indicating that the timeliness of PC insurers' OTT impairments do not differ when they recognize OTT impairments using internal versus external measurements.

VI. CONCLUSION

FAS 115's requirements for other-than-temporary (OTT) impairments are intended to ensure that reporting firms incorporate sufficiently adverse and persistent declines in fair value into the cost bases of their securities. We posit, however, that because amortized cost is, in most circumstances, a predetermined accounting measurement approach that does not require reporting firms to pay attention to economic conditions affecting their financial instruments, reporting firms may not invest in the information and internal control systems necessary to identify and measure OTT impairments in a timely and reliable fashion. In this study, we hypothesize and provide evidence that firms required to measure securities at fair value on a recurring basis for accounting recognition purposes record timelier OTT impairments than do firms that measure the same securities at amortized cost.

We conduct this investigation in the context of statutory accounting by insurers because: (1) statutory accounting principles require PC insurers to measure securities with NAIC designations from 3 to 5 at fair value, but life insurers to measure these securities at amortized cost; (2) both PC and life insurers are subject to the same OTT impairment accounting rules; and (3) statutory reporting rules require both types of insurer to provide detailed security-level accounting information in their annual and quarterly statutory filings. We develop a sample of NAMBS held by at least one PC insurer and one life insurer during our 2007–2011 sample period, and observe the relative amounts and timing of different PC and life insurers' OTT impairments of the same NAMBS during this period.

We hypothesize and provide evidence that requirements for PC insurers to measure NAMBS with NAIC designations from 3 to 5 at fair value lead them to record timelier OTT impairments of the same securities during our sample period than life insurers, who measure these securities at amortized cost. We further hypothesize and provide evidence that PC insurers' fair value measurement of NAMBS with NAIC designations from 3 to 5 improves their understanding of similar NAMBS with NAIC designations of 1 and 2, leading PC insurers to record timelier OTT impairments of NAIC 1 and 2 designated NAMBS

than life insurers. This spillover effect of fair value measurement of similar securities is weaker than the direct effect of fair value measurement of identical securities. We show that our inferences are robust to numerous additional analyses that address potential problems of inference and other issues.

To the best of our knowledge, our study is the first to show that fair value measurement leads to timelier recognition of any type of non-recurring write-downs of financial assets than amortized cost measurement. Our findings are consistent with the requirement to measure securities at fair value leading reporting firms to invest more in information and control systems that enhance the overall quality of their financial statements, not just the quality of their fair value estimates. We conjecture that these systems may also improve the overall transparency of firms' financial reporting, e.g., MD&A and footnote disclosures, a promising topic for future research in our view.

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APPENDIX A

Variable Definitions

Variable	Definition
$Hldrs_{s,t}$	Number of insurers holding security *s* in year *t*.
$Leverage_{i,t}$	100 times total liabilities for insurer *i* in year *t* divided by total assets for insurer *i* in year *t* minus the mean of this variable for all insurers of the same type (PC or life) in year *t*.
$Liquid_{i,t}$	100 times cash equivalents for insurer *i* in year *t* divided by total assets for insurer *i* in year *t* minus the mean of this variable for all insurers of the same type (PC or life) in year *t*.
$Low\_RBCRatio_{i,t}$	Indicator variable that takes a value of 1 if the risk-based capital ratio for insurer *i* in year *t* is below the median for all insurers of the same type (PC or Life) in year *t,* and 0 otherwise.
$NAIC\_1\_2_{s,t}$	Indicator variable that takes a value of 1 if security *s* has a NAIC designation of 1 or 2 in year *t,* and 0 otherwise.
$NAIC\_3\_5_{s,t}$	Indicator variable that takes a value of 1 if security *s* has a NAIC designation from 3 to 5 in year *t,* and 0 otherwise.
$NAIC\_6_{s,t}$	Indicator variable that takes a value of 1 if security *s* has a NAIC designation of 6 in year *t,* and 0 otherwise.
$PartialSale_{i,s,t}$	Indicator variable that takes a value of 1 if insurer *i* partially sells security *s* during year *t,* and 0 otherwise.
PC_i	Indicator variable that takes a value of 1 for a PC insurer, and 0 for a life insurer.
$Public_i$	Indicator variable that takes a value of 1 for an insurer whose ultimate parent is publicly traded, as evidenced by a ticker symbol on S&P Global Market Intelligence, and 0 otherwise.
$Risky_{i,t}$	100 times insurer *i*'s securities with (non-investment grade) NAIC designations from 3 to 6 in year *t* divided by insurer *i*'s total securities in year *t* minus the mean of this variable for all insurers of the same type (PC or life) in year *t*.
$ROAE_{i,t}$	100 times net income for insurer *i* in year *t* divided by average equity for insurer *i* in year *t* minus the mean of this variable for all insurers of the same type (PC or life) in year *t*.
$SelfEst_{i,t}$	Indicator variable that takes a value of 1 for NAMBS for which insurer *i* internally estimated fair values in year *t,* and 0 otherwise. Available only from 2009 to 2011; 2007 and 2008 values assumed to equal 2009 value.
$Size_{i,t}$	Natural logarithm of total assets for insurer *i* in year *t* minus the mean of this variable for all insurers of the same type (PC or life) in year *t*.
$TM_{i,s,t}$	100 times insurer *i*'s cumulative OTT impairment recorded on security *s* from 2007 to the end of year *t* divided by insurer *i*'s actual cost of the security at the end of 2006 minus the median of this variable across all insurers holding security *s* at the end of year *t*.

The table defines all the variables included in our empirical models in alphabetical order.