REACHING FOR YIELD IN THE BOND MARKET

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Reaching-for-yield—investors' propensity to buy riskier assets in order to achieve higher yields—is believed to be an important factor contributing to the credit cycle. This paper presents a detailed study of this phenomenon in the corporate bond market. We show that insurance companies, the largest institutional holders of corporate bonds, reach for yield in choosing their investments. Consistent with lower rated bonds bearing higher capital requirement, insurance firms' prefer to hold higher rated bonds. However, conditional on credit ratings, insurance portfolios are systematically biased toward higher yield, higher CDS bonds. Reaching-for-yield exists both in the primary and the secondary market, and is robust to a series of bond and issuer controls, including bond liquidity and duration, and issuer fixed effects. This behavior is related to the business cycle, being most pronounced during economic expansions. It is also more pronounced for firms with poor corporate governance and for which the regulatory capital requirement is more binding. A comparison of the ex-post performance of bonds acquired by insurance companies shows no outperformance, but higher systematic risk and volatility.

Key words: Reaching for yield; Financial crises; Credit cycles; Insurance companies
JEL Codes: G11, G22, G30

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A key principle of finance is that the evaluation of returns is only meaningful on a risk-adjusted basis. However, risk is often hard to measure. This creates an important limitation in the delegation of investment decisions. Financial intermediaries and investment managers that are evaluated based on imperfect risk metrics face an incentive to buy assets that comply with a set benchmark but are risky on other dimensions. In other words, imperfect benchmarks may create incentives to "reach for yield" in the context of fixed-income investing or reach for apparent "alpha" more generally. This could lead to excess risk taking in financial institutions, a persistent distortion of investments and, potentially, amplification of the overall risk in the economy. Indeed, reaching-for-yield is believed to be one of the core factors contributing to the buildup of credit that preceded the recent financial crisis (Yellen, 2011 and Rajan, 2010). Yet there is lack of clear empirical evidence on this phenomenon. This paper provides an economically important example of reaching-for-yield and connects it to investment decisions and incentives.

The incentive to search for apparent alpha is a broad phenomenon that is not limited to any specific asset class, but it is likely be more pronounced for illiquid and complex securities for which risk measurement is particularly problematic. In this paper, we study reaching-for-yield in the context of corporate bonds. The risk of corporate bonds and fixed income more generally is often assessed using credit ratings. The advantage of credit ratings as a risk measure is that—due to standardized and well-established scales—they are comprehensible and have broad coverage for many fixed income securities. Ratings are also not affected by liquidity or market conditions. Not surprisingly, ratings are commonly used for contracting and regulation purposes. However, ratings tend to be updated slowly (Cornaggia and Cornaggia, 2011), and depend on the accuracy of rating methodology and absence of agency conflicts (Becker and Milbourn, 2011).[1] In addition, bond's credit rating primarily reflects probability of default and losses given default and does not capture the risk premium associated with the default losses and other priced factors. More formally, for a bond i:

[1] In particular, several issues have been raised about rating of structured products (e.g., Benmelech and Dlugosz, 2009).

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$$
\begin{aligned}
Y_i - Rf &\approx E[Default\ Losses_i] + RP_i + \alpha_i \\
&= PD_i \times LGD_i + RP_i + \alpha_i \\
&= {PD_i}^{CR} \times {LGD_i}^{CR} + \left[(PD_i \times LGD_i - {PD_i}^{CR} \times {LGD_i}^{CR}) + RP_i \right] + \alpha_i
\end{aligned} \tag{1}
$$

where $(Y - Rf)$ is the yield spread over the Treasury bond, PD the market-assessed probability of default, LGD is the market-assessed loss-given-default, subscript *CR* indicates parameter implied by credit ratings, RP is the risk premium, and α is the abnormal return.[2] The proper performance benchmark that would not give managers an incentive to take priced risk should include true expected default losses and the risk premium. With such a benchmark, the investment manager would have an incentive to find underpriced, positive "alpha" bonds. But if investment managers are evaluated and/or regulated based on credit ratings—in which case the benchmark is $PD^{CR} \times LGD^{CR}$—they can beat the benchmark by raising "alpha" or reach for yield by taking on more priced risk not captured in the benchmark (summarized by the term in brackets).

We focus on insurance companies, the largest institutional holder of corporate and foreign bonds. According to the U.S. Flow of Funds Accounts, in 2010, their holdings represented $2.3 trillion, or more than bond holdings of mutual and pension funds taken together.[3] Regulation requires insurance companies to maintain minimum levels of capital on a risk-adjusted basis, often called "RBC" or risk-based capital. (On average, 91% of all securities holdings by insurance companies are in fixed income (Nissim, 2010) making the treatment of fixed income the core component of the RBC calculation.) To determine the capital requirement for credit risk, corporate bonds are sorted into six broad categories (National Association of Insurance Commissioners, "NAIC", risk categories 1 through 6) based on their credit ratings, with higher categories subject to higher capital requirements.

[2] The risk premium could be further decomposed in the risk premium associated with the default losses and an illiquidity premium: $Y - Rf \approx PD \times LGD + RP + LP + \alpha$. The risk premia may depend on how loss probabilities and magnitudes are associated with aggregate risk measures (factors).

[3] Investment decisions of insurance companies are also important because, like banks, insurance companies have liabilities to a broad population base.

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To test for reaching-for-yield we need an unambiguous risk benchmark. Due to the portfolio composition, the type of regulation and the presence of government guarantees, the insurance industry presents an important and clear setting for studying reaching-for-yield. The central hypothesis is that insurance companies may attempt to increase the yield in their bond portfolio through taking on extra priced risk, while leaving capital requirements unaffected. To test this prediction, we examine promised yield spreads and spreads on credit default swaps (CDS) [4] of insurance companies' investments, *conditional* on NAIC risk categories. Cox (1967) used the term "reaching for yield" to describe banks' tendency to lend to high risk borrowers as a way of increasing the promised yield. The reaching-for-yield in the context of insurance firms is similar because promised yields are used to determine earnings for insurance firms. (We discuss this in more detail in Section I.B.)

The holding data for the analysis comes from Lipper eMAXX and covers the 2004:Q1-2010:Q3 period, which we divide into before and after the financial crisis. The data has comprehensive coverage of quarterly fixed income holdings by individual insurance companies, mutual funds and pension funds.

Our basic finding for the pre-crisis period is illustrated in Figure 1. In this figure, insurance firms' investment behavior is benchmarked against other investors in our sample. Whereas insurance companies face capital requirements imposed by regulators based on credit ratings, this is not the case for mutual and pension funds. In terms of equation (1), the benchmark for the insurance firms is $PD^{NAIC} \times LGD^{NAIC}$, whereas the benchmark for mutual and pension funds is closer to $(PD \times LGD + RP)$. Because of this difference in risk-assessment for insurance firms, if insurers reach-for-yield we would find higher *relative* propensity to buy high yielding assets. (This is not to say that mutual and pension funds do not reach for yield, but reaching behavior for these institutions would be driven by factors other than credit ratings and, therefore, would manifest itself differently.) Figure 1, Panel A shows that, consistent with risk-weighted capital requirement, insurance companies exhibit a strong preference for safer bonds. However, just the opposite is true *within* regulatory risk categories (Figure 1, Panel B). For securities rated AAA, AA, or A

[4] An advantage of using CDS spreads in addition to yields is that they may be affected by illiquidity in a different way than positive net supply assets like bonds (Bongaerts, De Jong and Driessen, 2011).

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(NAIC risk category 1) insurance companies hold 72% of all bonds held by insurance companies, pension or mutual funds in the lowest yield-spread quartile, but 88% in the highest yield-spread quartile. The result is very similar for CDSs.

[FIGURE 1]

This basic finding is robust to controlling for a set of bond and issuer characteristics, including duration, issue size, year of issuance, bond liquidity, and credit rating, so it is unlikely to be driven by investor preferences over these characteristics.[5] Also, while Figure 1 looks at the investment decisions at issuance, we find similar results using secondary market trading. The secondary market setting enables us to focus *only* on insurance firms and control for issuer-times-quarter fixed effects, ruling out differences in institutional preferences and bond cross-sectional differences as explanations of our results.

As a contributing factor to credit cycles, reaching-for-yield is believed to be pro-cyclical. There are several reasons why reaching may be less attractive during a downturn. First, downgrade probabilities rise during economic recessions, so the ratings of some high risk bonds may be less stable. Reaching-for-yield could also be curtailed because of increased scrutiny of investment managers by owners or regulators (Gennaioli, Shleifer and Vishny, 2012), or because lower quality managers become unwilling to take risks they do not understand (Gurrieri and Kondor, 2012). A shift in the riskiness of the environment, or a shift in interest-rate regime can make reaching-for-yield less attractive. Finally, at least during the most recent crisis, yield spreads on all debt were very high, which might have diminished incentive to seeking high yield within risk categories. We test and confirm predictions about cyclicality in reaching-for-yield behavior. Insurance companies' propensity to pick high yield spread, high CDS spread

[5] As Longstaff, Mithal and Neis (2007) suggest, most of the variation in yields across corporate bonds is related to credit risk. Thus, it appears unlikely that insurance companies' high yields are a reflection of liquidity alone. This prior based on the bond pricing literature is confirmed in our tests of holdings at issuance: liquidity plays a limited role in bond selection.

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bonds within given NAIC risk category disappears in the second half of 2007 and comes back in the second half of 2009.[6]

There might be a concern that the documented investment pattern reflects insurance companies' superior investment ability or access to investment opportunities, i.e., that what seems to be reaching-for-yield is simply "alpha". Such alternative explanation would need to explain why reaching-for-yield is specific only to investment grade bonds and only to the period of credit expansion, and in that sense is not trivial. Regardless, we directly assess insurance investors' ability to generate alpha by examining bond portfolio returns. Consistent with our conclusions, we find that bonds preferred by the insurance companies have lower returns (although significantly so only in some specifications), higher volatility in and higher exposure to market returns (beta). We also show that bonds with higher insurers' holdings are more likely to be downgraded. This confirms that insurance firms get higher yields by assuming risk.[7]

Why do investors reach for yield? There are several possible explanations. We are interested in the cyclical search for priced credit risk that is grounded in a principal-agent problem resulting from imperfect risk measurement (which is what we call reaching-for-yield). Iannotta and Pennacchi (2012) show that when capital requirements reflect default risk but not covariances—in other words, capture $PD \times LGD$ but not the RP—banks can increase its shareholder value by investing in assets with relatively high systematic risk. In Gurrieri and Kondor (2012) behavior akin to reaching-for-yield arises as a result of unobservable heterogeneity in investment skill and career concerns for portfolio managers. A nice feature of the model is that it generates time-varying reaching behavior. Rajan (2010) points to the presence of incentives for financial intermediaries to give an appearance of superior performance that leads them to take on tail risk (e.g., earthquake insurance) in times when financing is plentiful. Investment

[6] This pattern echoes the changed risk appetite in money market mutual funds at the time, documented by Kacperczyk and Schnabl (2012).

[7] We also show that CDS spread is a good predictor of ratings downgrades: within NAIC1, the lowest CDS quartile has a 1% probability of a downgrade over the next quarter, but for the highest CDS quartile this probability is 6%.We define downgrade as a change in rating that moves an issuer from one NAIC to any lower NAIC. The overall frequencies are comparable to what rating agencies provide for historical transition densities (e.g. Moody's Investor Service 2002).

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incentives at the insurance firms—discussed in more detail in the next section—are largely consistent with the framework outlined by Rajan (2010); in particular, in absence of default, performance is evaluated based on promised yields. As Gurrieri and Kondor (2012), Rajan (2010) is not specific about which yield spread components are being mismeasured, however inability to properly assess risk by the ultimate investor is central to both frameworks, and both frameworks accommodate the type of risk mismeasurement that we see for the insurance firms.[8]

Reaching-for-yield could arise in unregulated financial industries (for example see Stein, 2013). For regulated industries the way the risk-taking is contracted is relatively transparent (for insurers, it is the risk-based capital requirement). Furthermore, for insurance firms risk is primarily measured by credit ratings, which we observe. Another advantage from an empirical stand point is that asset prices for insurance firms are liquid and observable. So looking at a regulated setting allows for a sharper identification. However, the distinction between reaching-for-yield as form of regulatory arbitrage and other motivations of reaching-for-yield is an important one.[9] For insurance firms, regulation shifts the principal-agent conflict from ultimate investor and financial manager to regulator and financial manager. But the same limitations on contracting (or regulating) risk-taking—which is the defining element of reaching-for-yield—are still in place. What is fundamentally different is that the presence of government guarantees introduces risk shifting incentives (Jensen and Meckling, 1976) (as long as the guarantees are not fairly priced).[10] Thus, due to presence of guarantees, insurers may desire to take on additional risk. Overall, these are not mutually exclusive channels, and they share the common element that investment managers face different incentives than owners or regulators.

Frazzini and Pedersen (2011) provide an alternative explanation in that reaching behavior (propensity to buy riskier assets) by financial intermediaries is just a reflection of ultimate investors'

[8] Gurrieri and Kondor (2012) model does not have a formal benchmark, and instead the portfolio is assessed based on the ex-post relative performance.
[9] Note that not all forms of regulatory arbitrage are pro-cyclical or directly connected to accumulation of risk.
[10] Acharya and Richardson (2009) describe such guarantee-driven risk-shifting in banks. Puri, Rocholl, and Steffen (2011) show the role of guarantees to risk-taking in the German Landesbanken.

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preferences (and their inability to access leverage otherwise). [11] This could still carry negative welfare consequences, and in that sense it would be an interesting phenomenon, but the issue is more evident if there is a principal-agent problem, and we show evidence that is consistent with it by analyzing the cross-section of insurance firms.

Consistent with risk-shifting, we find that insurance firms for which the regulatory capital constraint is more binding tend to reach for yield more. Controlling for regulatory capital constraints, publicly listed firms do not appear to reach for yield more than privately held companies. This suggests that earnings management or short-run performance pressure—which would appear more important to managers of public firms—is unlikely to motivate the observed investment behavior of companies that reach-for-yield. However, among public firms, those with better corporate governance show less evidence of reaching-for-yield. Although these findings are based on data for relatively few firms, it provides support in favor of a role for agency frictions.

In the final set of results we evaluate welfare consequences of reaching-for-yield. We look at two channels through which reaching-for-yield could have broader implication for the economy: concentration of systemic risk in the insurance firms' portfolios, the potential effect on the allocation of credit supply. First, we examine insurance companies' stock returns during 2008. As documented by Koijen and Yogo (2012), insurance companies overall had been adversely affected during the crisis. Consistent with reaching for yield being associated with higher risk taking, we find bigger losses of equity value for those firms that had reached for yield more in their portfolio.

To assess the impact of insurance companies investment preferences on credit allocation, we compare the issuance of different investment grade bond issuers: those with high CDS spreads (whose bonds are favored by insurance companies) and those with low CDS spreads. We track bond issuance volumes by these two groups over time, and find that times with high issuance by riskier issuers coincides

[11] This is similar to Peltzman's (1975) "belted-milquetoast-turned-daredevil" effect.

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with times of pronounced reaching for yield by insurance firms. This evidence suggests an impact of insurance companies' investment behavior on credit issuance volumes and quality.

Our paper is related to the large literature on agency problems in delegated investment management, such as Chevalier and Ellison (1999) and to the literature on regulatory design (see Pigou (1938) and Laffont and Tirole 1993). However, our focus is on reaching-for-yield. In the context of securitization, Coval, Jurek and Stafford (2009) show that leading to 2008 senior, highly-rated CDO (collateralized debt obligations) notes appeared to have a substantial systematic risk exposure. The high pre-2007 demand for senior structured notes is therefore indicative of reaching-for-yield. However, Coval, Jurek and Stafford (2009) focus on the supply side. Our paper provides an explanation for why there might be a demand for such assets. Another difference is that we examine corporate bond markets, by far the largest category of non-government fixed income securities, for which generalization of findings on structured products is non-trivial.

The rest of the paper is divided in five sections. Section 1 discusses in deeper detail capital requirements and incentives for insurance firms. Section 2 presents the data. Section 3 presents the core results. Section 4 evaluates broader implications of reaching-for-yield, and Section 5 concludes.

I. Insurance Companies: Institutional Setting

A. Capital Requirement

Insurance companies' investment portfolio size and composition vary substantially depending on their main product. There are three main lines of insurance business: (i) life, (ii) property/casualty, and (iii) reinsurance. Life insurance companies have the largest assets under management. At the end of 2010, life insurance total financial assets represented $5,177 billion, as compared to $1,403 billion for property/casualty insurance companies (Table I). The core of insurance companies' financial assets is invested in medium- and longer-term fixed-income assets. Nearly 40% of the life insurers' financial assets are invested in corporate and foreign bonds, making them the largest institutional holder of this asset class. The precise information on the composition of bond holding by insurance firms is sparse, but

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according to Allstate's 2010 annual statement, corporate bonds represented 38% of its overall financial assets, while foreign government bonds only represented 3%.

[TABLE I]

Similar to the banks, insurance companies are subject to risk-adjusted capital requirements on their investments. Companies that fail to comply with the capital requirement may be taken over by state insurance departments.[12] In principle, insurance companies are regulated at the state level. For firms with multiple subsidiaries, each subsidiary is subject to state laws and regulations. However, the regulatory standards are coordinated through NAIC. As part of this study, we contacted the department of insurance in fifty states and received an explanation about state-level regulation of capital from all but three states (Georgia, New York and New Jersey). In summary, there is some variation at the state level on statutory capital (capital required in order to retain a business license), but every state uses risk-based capital weights formulated by NAIC.

[TABLE II]

Capital requirements for credit risk are determined as a weighted sum of investments in different risk-categories. Capital requirements are summarized in Table II; these risk factors had been constant over our sample period. Direct obligations of the U.S. government are exempted from capital requirements. The remaining securities are assigned to one of six risk categories (NAIC Category 1 through 6). For bonds, NAIC categories are determined based on the credit risk ratings. Issues rated AAA, AA or A are classified as Category 1. Each subsequent rating corresponds to a different NAIC risk category. Corresponding capital requirement increases exponentially. For each $100 invested in Category 1, the insurer has to have $0.30 of equity capital. For Category 2 (BBB), the capital requirement would be

[12] Weiss Ratings reports that between 2008-2011 there were 82 insurance companies that were taken over by the state regulator (www.weissratings.com/ratings/track-record/insurer-failures.aspx).

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$0.96, more than three times larger. Similar investment in Category 5 (CCC) would command $16.96 or nearly 57 times more of equity capital.[13]

B. Incentives to Reach for Yield

Capital requirements for insurance companies often lead insurers to have a target distribution of their corporate bond portfolio across NAIC risk categories. As with banks, one would expect that risk-weighted capital requirement would skew insurers' investment portfolio toward safer assets. Indeed, according to Allstate (one of the largest publically held U.S. insurance companies) annual statement, as of the end of 2010, 91.6% of its consolidated fixed income securities portfolio was rated investment grade. However, within the NAIC risk category, there is an incentive for the insurance firm and investments' manager to maximize the yield on their investments. Return on the investment portfolio is one of the primary sources of earnings for insurance companies. For example, Allstate, explicitly states in its 2010 report to shareholders that: "The return on our investment portfolios is an important component of our financial results." Allstate also emphasizes that their investment strategy balances "the pursuit of competitive returns" with liquidity needs given its overall corporate capital structure.

The pursuit of high returns is central to reaching-for-yield to arise, and in the insurance industry such incentives are present both at the company and at the manager level. According to the Insurance Asset Manager 2010 Annual Survey (World Trade Executive, 2011), in 2006 over 78% (or $3.25 trillion) of insurance investments were managed in-house. It is primarily insurance companies with assets under $3 billion who outsource their portfolio management. The decision to outsource investments also varies by asset class with high-grade corporate portfolio typically managed in-house. (See NAIC, 2011 for more details.) The compensation of in-house portfolio managers tends to be similar to that for other asset managers: annual investment management fees for core fixed-income mandates are generally in the range

[13] In addition to credit risk, total risk-based capital formula includes capital charges for equity risk, interest rate risk, affiliated and off-balance sheet risk, and other business risks. Each capital requirement component is computed separately. But rather than taking a simple sum of the components, the risk-based formula rewards a company for diversifying its risks (the discount is often referred to as the "covariance adjustment").

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of 10 to 25 basis points of assets under management. The investment manager's objective is to outperform the investment target. "If the manager outperforms the index by as much or more than the specified margin while meeting the other constraints, the investment manager would be considered to have successfully managed the investment portfolio." (NAIC, 2011)

It is important to note that promised yields—and not coupon yields—are relevant for the reported earnings of insurance firms. The insurance industry reports financial accounts to state regulators and the Internal Revenue Service using statutory accounting principles (SAP). Publicly owned insurance companies also report to the Securities and Exchange Commission (SEC) using general agreed accounting principles (GAAP). There is a significant overlap between the two accounting systems in the treatment of investment portfolios. Under GAAP, fixed income securities intended to be held to maturity are accounted for using the "amortized amount"; that is, the premium or discount at which a bond is bought, relative to its par value, is amortized evenly over time (as long as the bond is not in default). Under SAP, all bonds are treated this way. Due to the accounting treatment, two bonds with the same promised yield (and the same maturity) have the same impact on insurer's earnings, regardless of the coupon type, as long as they do not default.

Given the difference in products, there are some differences in the accounting practices between property/casualty and life insurers. Life insurance policies have a long term maturity and therefore a majority of its investments is held to maturity and valued at historical amortized amount (regardless of downgrades). Property/casualty contracts are typically one year or below; the payoff under these policies also can vary substantially. As a result, property/casualty companies tend to invest in safe short-term securities. Although the portfolio is different, the majority of investments for property/casualty is also held to maturity and—in absence of default—are treated at its amortized value. The only exception to this rule is that property/casualty companies value speculative grade corporate bonds (NAIC 3-6) at the lower

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of fair value or cost.[14] (As pointed out before, assets of property/casualty insurers are only a fraction of assets of life insurers, so they are less relevant for our analysis.) [15]

II. Data

The data for the analysis was compiled from multiple data sources and covers the 2004:Q1-2010:Q3 period. We have data on bond holdings from Lipper eMAXX. This database has a comprehensive coverage of quarterly fixed income holdings for insurance companies, mutual funds and pension funds. Insurance companies constitute approximately half of holdings, by number and by dollars, throughout our sample. The data contains both manager (e.g., Fidelity) and ultimate investor (e.g., Allstate). eMAXX classifies investors into categories based on type (e.g., mutual funds vs. insurance companies). The coverage of foreign bond buyers and hedge funds is limited. eMAXX does not cover households, banks, and governments. We also specifically focus on a set of large firms for which CDS spread data (see below) is more likely to be informative and accurate.

We exclude convertible bonds, preferred stock, other preferred securities, and government or government sponsored enterprises' bonds from our sample. Over the sample period, we observe over 4 million individual corporate bond holdings in a total of 10,045 bonds. The dollar value of holdings in the sample is $336 billion in 2004:Q1, rising to $472 in 2010:Q4, with a reported face value of $1 to $1.4 trillion, again depending on the quarter. The fraction of ownership covered by eMAXX is stable over time.

We examine bond holdings by insurance companies at issue as well as their trading over time. Our new issues sample consists of holdings data for 3,709 bonds issued by 320 firms between 2004:Q3 and 2010:Q4. As illustrated in Figure 2, most of the bond issuance in our sample is investment grade. NAIC risk categories1 and 2 include 2,467 issues with a total of $152 billion raised. Issues rated non-

[14] See Myhr and Markham (2004) for a discussion of insurance companies' accounting rules.

[15] Because of earning accounting, market values or even downgrades have almost no effect on insurance earning, only defaults do. But although defaults are infrequent, accounting is not the primary cause of reaching behavior. There must be some other friction that makes portfolio manager abstract from long-term expectations (market values) and focus on promised yields. In the introduction we discuss several potential explanations.

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investment grade, NAIC risk categories 3-6, amount to 1,242 issues (half the issue count for investment grade) and only a third in terms of issue volume.

[FIGURE 2]

We collect issue credit ratings and bond characteristics from Mergent FISD. Ratings are issued by S&P, Moody's or Fitch, and are combined into a single rating for each bond according to NAIC rules.[16] That is, if the bond is rated by two rating agencies, we use the lowest rating. If the bond is rated by all three rating agencies, we use the middle rating. Table II describes how ratings are organized into NAIC categories for the purpose of capital requirements. Because our focus is on yields and yields are not reported for floating coupon bonds, we exclude them from the sample. The majority of U.S. corporate bonds are fixed coupon bonds, so this is not something that significantly reduces our sample. We also collect promised yields at issue from Mergent FISD.

[TABLE II]

In tests of bond acquisitions by insurance companies when bonds are first issued, we consider the spread between the promised yield to maturity and a matched Treasury bond, reported by MergentFISD. When MergentFISD does not report a spread, we estimate it using the yield curve implied by other spreads reported at the same time and a bond's yield to maturity.

We also study bond acquisitions by insurance companies in the secondary market. To track yields over time, we employ the Trade Reporting and Compliance Engine (TRACE) database which reports dates, yields, prices at which bonds trade. We follow Bessembinder, Kahle, Maxwell and Xu (2009) and Dick-Nielsen (2009) in cleaning the data. We exclude trades that are canceled or corrected, and when multiple similar trades occur very close in time, we discard all but one transaction (assuming they reflect a pass-through transaction). For a given bond we calculate the median yield of all transactions taking place on the last active trading day in a given month, or quarter. We calculate bond returns as the relative change in transaction price including accrued interest (what Bessembinder et al. call "dirty prices") from

[16] For the period studied, NAIC allowed ratings from a subset of the SEC's nationally recognized statistical ratings organizations ("NRSROs") including Moody's, S&P and Fitch.

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the end of a month to the end of the next month, adding in any coupons paid during the month. We use time series data on several return factors: the value-weighted stock market index and the risk-free rate from Ken French's website[17], the difference in returns between investment grade and high yield corporate bonds using the Lehman/Barclays index, which we call the default premium, and Treasury returns to calculate the term spread. We also use the Pastor and Stambaugh (2003) liquidity factor, reported in WRDS.

CDS spreads—an alternative to yield spreads as a measure of market perceptions of issuer's credit risk—come from Credit Market Analysis, downloaded using Datastream. A CDS is essentially an insurance contract that guarantees the payoff in case a particular type of bond defaults. A higher spread — higher cost of insurance — is associated with higher default probability. The CDS spread is a quarterly premium (quoted on annualized basis) that the CDS buyer pays the seller. In exchange, the seller commits to pay the buyer bond's face value upon bond's default. We use the data for 5-year senior default spreads, the most liquid segment of the market. An advantage of using CDS spreads (in addition to yield spreads) is that they may be affected by illiquidity in a different way than bonds (Bongaerts, De Jong and Driessen, 2011). We focus on bond issuers that were part of the CDX Markit index, one of the primary tradable index families, between the index inception in 2003 and 2010.[18] The inclusion in the index is determined by liquidity rankings, constrained so that the index has a balanced industry representation.[19]

Analogous to yield spreads, CDS spreads capture priced risk not reflected in ratings. Table III compares sample bonds in NAIC categories 1 and 2 (investment grade) across CDS quartiles. We assign all issuers to CDS quartiles, from low (safest) to high (riskiest), among all firms in the investment grade ratings group in a given quarter. Quartile 4 (high CDS spreads within NAIC category) bonds are

[17] Based on Longstaff, Mittal and Neis (2007), some studies have used the swap rate instead of treasury rate as a benchmark for returns. We have tried this alternative throughout, with very similar results.

[18] Conditioning our sample on inclusion in the index at any point during the eight year period might generate a selection bias. A bond issued by a firm that is not a member of the CDX index in 2004, but will be included in the 2009, will appear in our sample. This should not affect the composition of ownership, but might hypothetically result in an upward bias for average realized returns on the bonds after issuance. We will not use average returns for our tests (but we will compare returns of subgroups).

[19] We include bonds that had been either part of investment grade (CDX.NA.IG) or non-investment grade index (CDX.NA.HY), Series 1 through 16. Series 1 of CDX Markit Index was rolled out in October 2003.

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characterized by higher yields-spreads, but not longer maturities, than low CDS bonds. The high CDS bonds' issuers have higher book leverage and lower return on assets. The size of issuers is not statistically different. This is consistent with the CDS spread capturing financial performance of the company that might not be fully reflected in the credit ratings. Table III is conditional on investment grade bonds, but as one can there is practically no differences in average credit ratings across the CDS categories.

[TABLE III]

We compute two measures of bond liquidity: the log of total transaction volume relative to outstanding par value in the preceding quarter (based on TRACE), and the log of the number of investors reporting changed positions in the bond over the preceding quarter (based on eMAXX). We also estimate bond durations, based on detailed cash flow (e.g., coupon times and amounts) data from Mergent FISD and yields (from Mergent FISD at issue or from eMAXX transactions for later dates).

Finally, we collect additional information about insurance companies. First, we gather daily stock return data for publicly listed insurers for the 2001 to 2011 period from CRSP, and calculate betas and volatilities as well as the stock returns during the crisis. The average stock return for the crisis period, defined as June 2008 to February 2009, is -46.3% and the standard deviation is 30.6%. We also collect regulatory capital for insurance companies from S&P CapitalIQ. Our measure of regulatory capital cushion surplus is the difference between required capital and reported capital, normalized with book value of assets. When a subsidiary company appears in our data, we use the ultimate parent's capital. Across 97 parent companies, the mean of 2004 capital surplus is 17% and the standard deviation is 11%.

To characterize insurers, we also define an indicator for publicly listed firms, and a lagged measure of leverage (the ratio of assets to equity) and size (the log of asset book value). Mean leverage is 8.8 and standard deviation 26.0 (this measure includes policy liabilities). Mean book assets is $70 billion. We collect data on governance from Dlugosz, Fahlenbrach, Gompers and Metrick (2006). For each public insurance company, we update their block count from 2001 (the last date they provide data for) using 13-F filings. We use total ownership in block holdings (as a fraction of outstanding shares) as a measure of governance. For each insurance company, we calculate the average yield on their investment grade

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portfolio as a measure of the institution's propensity to reach for yield. To avoid putting excessive weight on a few bond positions, we calculate the equal-weighted average Treasury spread of each insurer's pre-crisis bond acquisitions in NAIC 1 and 2 (that is, bonds rated AAA, AA, A and BBB).

III. Results

A. Benchmark Results: Holdings at Bonds Issuance

Our first set of results focuses on investment choices at the time of bond issuance. As mentioned earlier, the core of insurance assets are managed by life insurers. Unlike property/casualty companies, life insurers to do not anticipate paying benefits in the short run on their average policy, so most of their investments are held to maturity. As a result, life-insurance portfolios have little turnover. According to NAIC (2011), portfolio turnover is in the range of 20-25% per year or less for the core fixed-income insurers' holdings. That is why looking at investment choices at issuance is central for understanding their behavior. Overall, total new issues in our sample amount to approximately $2 trillion. We have holding data on 6,154 bonds of which 3,807 are issued during the 2004:Q3-2010:Q3 sample period.

We should note that the holding data is quarterly, and we do not observe exact dates when holdings change. Because a large fraction of the bonds appears in insurance companies' portfolio in the quarter immediately following bond issuance and because there is fairly little turnover, it is very likely that the bond positions we observe in the first quarter were acquired at issue. Thus, we treat yield at issuance (as reported in Mergent FISD) as is the relevant yield. The reporting date is not standardized for different investors. To allow for reporting delays, we also included bond holdings in the second calendar quarter following the date of bond issuance when the first quarter shows no holdings, but this does not change the results.

To test if insurance companies reach for yield, we first compare their bond acquisitions to those of other institutions. As mentioned in the introduction, the ideas is that, due to the regulatory framework, the benchmark for the insurance firms is $PD^{NAIC} \times LGD^{NAIC}$, whereas the implicit benchmark for mutual and pension funds is $(PD \times LGD + RP)$. So to beat the benchmark, insurance firms will reach for yield

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by taking on more priced risk not captured in the benchmark. Figure 3 documents the average yield spreads for bonds rated AAA to A- (NAIC 1) held by insurance firms, pension funds and mutual funds in the pre-crisis period (2004-2007:Q2) and crisis/post-crisis period (2007:Q3-2010). Comparing both to mutual funds and pension funds, it's clear that, during the pre-crisis period, insurance companies acquired higher yielding bonds. During and after the crisis, this is reversed as insurance companies buy the lowest yield portfolio of bonds (the ranking between pension funds and mutual funds is maintained). Of course, these simple comparisons do not control for any bond features other than yield, and discard all heterogeneity in yields. This can be addressed in regressions.

[FIGURE 3]

Regression results for bond purchases at issuance are reported in Tables IV (yield spreads) and V (CDS spreads). Each observation in the sample corresponds to a different bond. The dependent variable is a sum of insurance investors' holdings of a given bond scaled by the total recorded holdings in the eMAXX data; insurance companies' investment decision is benchmarked against aggregate holdings of mutual and pension funds. We cluster standard errors by issuer because same companies can have several issues over our sample. (In addition, CDS contracts are not specific to the deliverable.)[20] Both Table IV and V report results for pre-crisis (2004:Q3-2007:Q2, specifications (1)-(4)) and crisis period (2007:Q3-2010:Q4, specifications (5)-(7)).[21]

In Table IV the explanatory variable of interest is the yield spread at issuance. Specifications (1)-(3) show that, as compared to other institutional investors, the propensity of insurance companies to invest in new bonds is an increasing function of the yield. In other words, there is reaching-for-yield. The first column of Table IV reports the baseline regression. The coefficient on the yield spread is positive and significantly different from zero, indicating that in the pre-crisis period, within NAIC 1 and 2, bonds

[20] Our results are robust to double clustering on both time and bond; no results change from being statistically significant to insignificant. The number of time periods is low for clustering on that dimension.

[21] Because eMAXX has comprehensive coverage we detect new issues when a bond appears in the data for the first time. New issues for 2004:Q1 and 2004:Q2 are difficult to identify from the data because old bonds also appear for the first time in these quarters. Hence, the sample starts in 2004:Q3.

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with higher yields ended up with insurance investors, more than other bonds. The coefficient estimate implies that a 100 basis point increase in the yield (a standard deviation is 128 bps) corresponds to a 5.4% higher fraction of insurance holdings. This corresponds to a quarter of a standard deviation of the dependent variable.

In specifications (1)-(3), the sample is constrained to bonds rated investment grade at issuance (NAIC risk category 1 and 2). Because NAIC 1 and NAIC 2 have different capital treatment, we include a dummy variable equal one for bonds rated BBB+, BBB or BBB- (NAIC2) and zero otherwise. In columns (2) and (3) we add controls for bond and issuer characteristics. By focusing on investment grade bonds and having control for BBB bonds, we show that insurance firms—as compared to mutual and pension funds—concentrate their positions in high $[(PD \times LGD - PD^{CR} \times LGD^{CR}) + RP + \alpha]$. Because this result is about relative investment behavior of insurance firms, there might be a concern that, due to institutional features, insurance companies (or the control investor group) have preferences for certain bond or issuer characteristics.[22] In other words, they had different required risk premium (*RP*). Specific concerns include differences in liabilities structure. At least as compared to mutual funds, insurance firms have longer investment horizons and are unlikely to face redemptions. This might lead insurance firms to have preference for a different asset duration and higher tolerance for illiquidity.

To distinguish reaching-for-yield from the investors' preferences, in column (2), we control for bond duration, offering amount and liquidity. The offering amount captures the size of the issue (insurance companies may ignore small issues). Arguably, it also proxies for liquidity (larger bond issues are more liquid). We include two explicit liquidity controls based on post-issuance trading. These controls

[22] It is less clear why the result would be driven by the preference of the control investor group. Our tests are designed around risk-assessment framework that is specific to insurance firms. If mutual and pension funds reach-for-yield, it is likely that such investment behavior would be driven by factors other than credit ratings and, therefore, would manifest itself differently. Although mutual funds and pension funds might explicitly commit to invest all or part of their portfolio in investment grade (Chernenko and Sunderam, 2012), they are not evaluated by its investors solely on its compliance with the specified mandate. For example, as any funds, fixed income funds available through Fidelity or Vanguard offer detailed information on fund risk, including historical standard deviation and market beta. On the other hand, even basic statistics like risk adjusted capital of insurance firms are not easily available to the general public, reinforcing risk-assessment set by regulators.

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might raise reverse causality concerns: if insurers' trade less then bonds that they purchase will be ex-post less liquid. However, a reverse causality should bias against finding a significant coefficient on yield spreads. The negative coefficient on liquidity proxies is consistent with tolerance for illiquidity among insurance investors. Due to long-term liabilities structure, it makes sense for insurance investors to hold the least liquid bonds if they can get compensated for this. The limited explanatory power of the liquidity measures is consistent with limited scope to reach for yield by loading-up on illiquidity alone (see Longstaff, Mithal and Neis, 2007).

In column (3), we extend the set of controls to include ratings (AAA, AA, A, BBB) interacted with year of the bond issuance. (The dummy for NAIC 2 drops out in this specification.) Controlling for ratings is not fundamental to our test of reaching-for-yield. However, NAIC 1 risk category includes several rating notches. So a preference for higher yields could conceal a preference for a particular rating. However, Hilscher and Wilson (2013) show that there is a significant overlap of credit risk within investment grade bonds (a fact that can be easily extended to yield spreads). This suggests that preference for yields is not the same as preference for credit ratings. Moreover, there is no obvious reason to believe that insurance firms would have preference for buying bonds of a particular rating. Regardless, we rule out this possibility by including rating fixed effects. Fixed effects absorb a lot of the variation in the sample, raising the *R*-squared from 12% to 28%. (Both, issuance year and rating seem to contribute equally to the increase in the explanatory power.) But the coefficient of interest remains positive, economically large and statistically significant.

[TABLE IV]

Specification (4) is the same as specification (3), but applied to non-investment (speculative) grade issues as opposed to investment grade. The coefficient on the yield is now statistically insignificant, which is consistent the hypothesis that reaching-for-yield should be less appealing for lower ratings where the probability of downgrades and capital requirements are higher. (In the internet appendix, we derive this prediction in a simple two-period, two-asset model that formalizes the investment decisions of a portfolio manager.)

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In columns (5) through (7) we repeat the same analysis for the "crisis" period, defined as the period following second half of 2007 (2007:Q3-2010:Q4).[23] The idea is to allow for possible changes in investment behavior during the financial crisis. Specifically, we expect reaching-for-yield over this period to become weaker due to rise in downgrade probabilities, increase in scrutiny, rise in awareness of previously neglected risks, or a shift in risk-preferences. The coefficient on yield is reversed during the crisis. As discussed in the introduction, during the economic downturn, the incentives to reach for yield are likely to be much weaker. This is consistent with the time-varying pattern identified in the data. This finding also helps with the interpretation of our results because it means that time-invariant institutional differences—e.g., regulation, superior investment ability, or institutional investment preferences—cannot explain our findings.

The results reported in Table IV imply that insurance companies, relative to other investor categories, favor high-yield bonds conditional on the benchmark risk category. This is consistent with reaching-for-yield, i.e., a preference for riskier bonds within a given category. We next turn to CDS spreads. The market for CDS contracts, on the firms in our sample, is liquid and potentially attracts a broader investment base. Therefore, it can provide an informative alternative measure of risk.

In Table V we repeat the analysis using the median CDS spread in the quarter of issuance as the main explanatory variable. We expect the same sign on spreads as on yield spreads. In all of the benchmark specifications, the holdings of insurance companies load positively on the CDS spread. In column (1), which presents the baseline results, a one standard deviation increase in the CDS spread (141 bps pre-crisis) corresponds to a 2.3 percentage point increase in the insurance share of holdings at issue. The coefficient estimates are robust to the inclusion of controls for duration, issue size, and liquidity (columns 2). As before, this result only holds for investment grade bonds and disappears during the crisis.

[TABLE V]

[23] Arguably, the financial crisis was over before this period ends; the National Bureau of Economic Research dates the associated economic recession as December 2007 through June 2009. We revisit detailed time pattern below in Table VII.

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The results are significantly weakened by inclusion of rating-times-issue year fixed effects. First, as discussed in Section 1.B, insurers' earnings are dependent on promised yields and so it might be that this is exactly the variable they are trying to maximize. (As we show in Figure 4, the correlation between yields and CDS spreads is not perfect.) Another possibility is that is that CDS being measured at the issuer level is a much noisier measure than yield spreads which are measured at the bond level. For our purposes, if the CDS data is noisy, regression results will be affected by attenuation bias and the coefficient for CDS spreads biased toward zero.

[FIGURE 4]

Taken together, the results on insurance holdings of corporate bonds at issue suggest that, conditional on NAIC risk category, insurance companies have a preference for higher yield, higher priced risk bonds; that is, insurance companies tend to reach for yield. Two possible alternative interpretations should be considered: (i) high yields reflect premium for low liquidity (*LP*) and we are failing to capture it properly because liquidity risk cannot be accurately measure for the primary market; and (ii) that high yields are the result of bond-picking ability and market mispricing (α). We address each of these in turn.

The dependent variable in Tables IV and V is the holdings of insurance companies scaled by the total holdings of insurance companies, mutual funds and pension funds. The variable could be sensitive to shifts in the relative demand by these investor categories, e.g. due to fund flows or the ability to lever up in response to investment. For example, if insurance companies have the ability to raise funds in response to investment opportunities they might invest (relatively) more at times when yields are high. Mutual funds and pension funds have little to no leverage, so it is unlikely that they can time the market in this way. This also appears to be the case for the insurance industry.

Figure 5 shows the capital structure of U.S. insurance companies. In total, over 70% of insurance companies' liabilities are composed of the obligations generated by underwriting. Long-term debt represents 5% and short-term debt only 1% of liabilities. The minimal amount of debt indicates that time-varying investment patterns by insurance companies, as compared to mutual funds and pension funds, cannot be explained by fluctuation in capital structure.

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[FIGURE 5]

B. Benchmark Results: Secondary Market Trading

Most of the investment activity in fixed income occurs at issuance. However, there is a secondary market in corporate bonds. If our hypotheses are correct, then reaching-for-yield should also manifest itself in secondary market trading. There are several additional advantages to looking at secondary market trading. Because we can follow a bond over time, it allows us to rule out cross-sectional differences in characteristics. Furthermore, since illiquid bonds are rarely traded, and since we can control for better liquidity measures, reaching in the secondary market (controlling for liquidity measures) is unlikely to reflect a liquidity premium. We also no longer look at the insurance firms' investment decisions as compared to other institutional investors, but instead explore their preference for the same bond as its market-assessed risk profile evolves.

To test reaching-for-yield in the secondary market, we look at how the holdings of insurance companies change between successive quarters. The sample is now a *panel* (bond times quarter), as opposed to a cross-section. We use spread to maturity on the over-the-counter secondary market transactions reported in TRACE. The results are reported in Table VI. The dependent variable is the log quarterly change in the value of all insurance companies' holdings of a bond. (Maturing bonds are excluded). In order to control for time-invariant and time-varying issuer characteristics we include firm-times-quarter fixed effects. We also include controls for key time-varying bond characteristics: duration and liquidity. We include two measures of liquidity: the log of total transaction volumes relative to outstanding par value in the preceding quarter (based on TRACE), and the log of the number of investors reporting changed positions in the bond over the preceding quarter (based on eMAXX). Note however that the analysis includes firm-times-quarter fixed effects, controls for liquidity pick up within firm-quarter variation in liquidity, which may not be important.

[TABLE VI]

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The economic and statistical significance of the benchmark result, Table VI specification (1), indicates that insurance companies buy more (or sell less) of outstanding bonds that have a higher yield. A one hundred basis point increase in a bond's yield corresponds to a predicted increase in insurance acquisitions in the secondary markets of 2.5% of insurance holdings. This is consistent with findings at issue: insurance companies systematically buy high yield corporate bonds (within investment grade).

We find that the reaching-for-yield result is specific to the pre-crisis period. As mentioned earlier, the time variation in reaching-for-yield is important for the interpretation of our results. In Table VII, we extend the benchmark specification to include quarter dummies interacted with the spread. These time-varying coefficient estimates can capture the evolution of reaching behavior over time. Since there are relatively few new issues in some quarters, these coefficients may be hard to estimate precisely. Nevertheless, we find a consistent pattern in the quarter-by-quarter results. The coefficients indicate pronounced cyclicality in reaching-for-yield. We find consistently positive coefficients for the pre-crisis period, mixed signs during the crisis (as defined by the NBER recession indicator), and again positive coefficients after the crisis has abated.[24] The return of positive slope estimates in the short post-crisis period we have in our data suggests that reaching was not unique to the 2004-2007 period, but may in fact be a pattern that appears repeatedly during economic expansions. Because the post-crisis sample is short and our sample otherwise encompasses only one economic cycle, this is a tentative conclusion.

[TABLE VII]

C. Insurance Firms' Portfolio Performance

We find that insurance companies systematically prefer high yielding investment grade bonds, compared to other investors (pension funds and mutual funds). We argue these higher yields may reflect risk. But higher yields can also be the sign of bond underpricing (α). Could it be that the higher yield on bonds held by insurance companies are just a reflection of their superior bond-picking or just better access

[24] Notably, the drop in coefficient in 2005:Q2 coincides with the downgrade of GM and Ford to junk, an important shock to the bond market.

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to underpriced bonds? There are several reasons why this alternative interpretation is weak. First, we observe no reaching-for-yield in speculative grade bonds. The absence of reaching-for-yield in speculative grade is hard to reconcile with a general ability to identify underpriced bonds. Second, the reaching-for-yield that we document prior to the crisis disappears during the economic downturn. This observation appears inconsistent with investment ability as an explanation of reaching-for-yield; it seems unlikely that bond underpricing disappeared in the crisis, since there were massive falls in bond prices generally at that time. That said, we now address the hypothesis of superior investment ability directly by evaluating bond performance.

We focus on investment grade bonds issued between 2004 and 2007, the period when we observe reaching-for-yield. Each month, all newly issued bonds are sorted based on the fraction acquired by insurance companies (relative to mutual funds and pension funds). Bonds are then divided into two portfolios, above and below the median insurance share ("high insurance holdings" and "low insurance holdings".) Using coupon rates from Mergent FISD and end-of-the-month transaction prices from TRACE, we calculate equal-weighted monthly returns on bonds acquired within the last year. On average, the excess return is negative for the portfolio with high insurance holdings and positive for the low insurance holdings portfolio (the difference is not statistically significant at the conventional levels). The standard deviation of excess returns is higher for the high insurance holdings portfolio (150.8 bps) than for the low insurance holdings portfolio (88.2 bps). An *F*-test rejects that the two standard deviations are similar at the 1% significance level.[25]

We next turn to exposure to risk factors. Bond's realized return, *R*, for portfolio *j* in month *t* should be:

$$R_{jt} = R_t^F + \beta_j^R f_t^R + \beta_j^L f_t^L + \alpha_j + \varepsilon_{jt} \quad (2)$$

[25] The findings are robust to using 24-month holding periods, including the Fama-French SMB and HML factors (which neither portfolio loads on), using value weighted returns instead of equal weighted, and allowing for first order serially correlated errors.

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where R^F is the short-term risk-free rate, f^R is the vector of risk factors, and f^L contains liquidity factors. Any change in expected default losses that is idiosyncratic is picked up by the error term (ε), or if it is systematic, picked up by a factor. Factor loadings for the two portfolios are reported in Table VIII.

[TABLE VIII]

Results in Table VIII column (1) and (4) confirm that in a Fama and French (1989) bond return model, insurance companies' investment choices generate risky returns: the exposure to duration risk is significantly positive in both portfolios. For credit risk, only for the portfolio of bonds with high insurance holdings has a positive loading. In columns (2) and (5) we add the market return, and again the high insurance holdings portfolio is riskier. In columns (3) and (6) we include the Pastor and Stambaugh (2003) liquidity factor with the Fama and French (1989) model, and both portfolios load on liquidity (the high insurance holdings portfolio loads more).[26] In all three regressions for the portfolio of bonds with high insurance holdings, the point estimate for alpha is negative and significant. Thus, these regression results do not suggest any superior bond-picking ability ("ability to generate alpha") of insurance companies at least over the period of the analysis. When controlling for default premium and term spread, we can reject a non-negative alpha for the high insurance holdings portfolio at the 10% level. Regardless of model, the portfolio with low insurance holdings has an intercept close to zero. These results suggest that higher yields on the bonds that are preferred by insurance firms reflect market risk, but not ability.[27]

One potential critique with this interpretation is that the result is dependent on the accuracy of the asset pricing model specified in (2). An alternative assessment of the credit risk realization of corporate bonds is provided by ratings changes after issue. If insurers select riskier bonds then, conditional on NAIC risk category, bonds with high insurance holdings should experience a higher rate of downgrades. We test this in the data; the results are reported in Table IX.

[TABLE IX]

[26] This factor model is based on Bessembinder, Kahle, Maxwell and Xu (2009).
[27] Additional, variations on these tests are (i) to only use bond prices based on large transactions; (ii) to keep bonds in the portfolios for 6, 18, or 24 months; and (iii) to weight bonds by par. The results are largely similar and the conclusion about non-positive alpha for insurance companies remains.

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In column (1) we report results for downgrades during the first year after issuance of investment grade bonds for bonds issued during the pre-crisis period. The dependent variable is equal to one if the rating after a year is lower than the initial rating. As expected, we find that bonds with higher insurers' holdings are more likely to be downgraded. The effect is large: for a change of insurance share of 25% (approximately one standard deviation), the one year downgrade probability is predicted to be 2.5% higher. For a hypothetical change from no insurance ownership to only insurance ownership, we predict an 11% higher probability of downgrade over just the first year. In column (2), we extend the downgrade window to two years after issue, and find that the estimated predictive power of insurance share remains large and positive. In column (3), we replace the indicator variable with the change in ratings notches. Again, insurance purchases are predictive of poor ratings performance. Finally, we test whether this result holds in the post-crisis period, when reaching behavior is muted or absent. In this case, we do not expect insurers' portfolios to contain relatively riskier bonds. Indeed, in column (4) the coefficient estimate for insurers is insignificant (the same is true for two year downgrade rates).

D. Insurance Firms' Characteristics

To further understand the main drivers of reaching-for-yield, we now turn to *individual* insurance firms' investment decisions. Specifically, we want to test how reaching-for-yield relates to regulatory capital constraints, public listing status, corporate governance, and financial leverage. If some firms reach for yield in order to increase the amount of risk in their bond portfolio relative to the regulatory capital required, we would expect portfolio yields to be higher among firms with lower cushions of regulatory (risk adjusted) capital. If risk-shifting is the driver behind reaching for yield, we would expect portfolio yields to be higher among firms with higher financial leverage. If reaching for yield is a reflection of agency problems, we would expect firms with better corporate governance to have lower portfolio yields.

Table X reports results from panel regressions of insurance companies' corporate bond purchases at issue for each year from 2004-2007. To capture reaching for yield, we use the average yield for newly acquired investment grade bonds. The dependent variable is the equal-weighted average yield spread of

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acquired bonds in NAIC 1 and 2, or, alternatively, of only bonds in NAIC category 1. Due to lack of data on regulatory capital, we lose several observations, including the majority of private firms. We drop observations where a firm purchases fewer than 3 relevant bonds in a given year. We also drop observations for firms with less than $10 million in assets, and in regressions with public firms, those with less than $10 million in market capitalization. In the remaining sample, there are 50 parent companies with regulatory capital data for at least one year.

The explanatory variables of interest are (1) regulatory capital surplus (the difference between regulatory capital and required regulatory capital, normalized by book assets), and (2) the fraction of shares held in large blocks. Regulatory capital is intended to capture the extent to which an insurance company wishes to keep capital low. Blockholdings is meant to capture the oversight provided by equity holders of public insurance companies. Unlike many other available measures of governance, the share of block holders changes over time. These variables can tell us if low regulatory capital and/or weak corporate governance predicts high yields in the investment grade bond portfolio across insurance companies. The capital surplus ratio ranges from 1.3% to 3.5%, with an average of 16.3% and standard deviation of 10.0%. Total ownership in block holdings ranges from zero to 56.2%.

[TABLE X]

In column (1), we report a simple regression of the average yield spread of investment grade bonds acquired on the insurance company's regulatory capital surplus and an indicator variable for whether it is publicly listed. The coefficient on regulatory capital surplus is negative and significant. A one standard deviation decrease in the capital surplus (10%) corresponds to an 11 basis points increase in the spread of an insurance company's bond portfolio. This is one-third of the cross-firm standard deviation of yield spreads. The results are consistent with the regulation hypothesis: Firms with lower capital surplus are more likely to reach for yield. This is also consistent with the finding of Ellul, Jotikasthira and Lundblad (2011) that more capital-constrained insurance firms tend to participate in fire sales around bond downgrades, likely reflecting an attempt to avoid higher capital requirements. The coefficient estimate on the public status indicator is insignificant, suggesting reaching for yield is not

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more pronounced among publicly traded firms. Thus, quarterly earnings pressure is not likely the main driver of reaching behavior.

In column (2) we regress the average spread on total blockholding ownership (since only public firms have this variable, sample size is reduced and the public indicator is unidentified). The coefficient estimate for block holdings is negative and significant, suggesting that strong owners reduce reaching.[28] An additional 15% held in blocks (a standard deviation) is associated with a 7.5 basis points increase in portfolio yields, similar to the magnitude associated with capital surplus. We interpret this as consistent with the hypothesis that private contracting frictions can drive reaching for yield. In column three, we add controls for leverage and size. Highly levered firms do not appear to buy higher yielding bonds. This suggests that risk shifting in the Jensen and Meckling (1976) sense may not be the driver of reaching for yield behavior.[29] Also, column (3) documents that large firms do reach for yield more, but not significantly. This is important econometrically because of the correlation between size and regulatory capital (small firms tend to have bigger capital cushions). The regulatory capital result remains significant in this regression.

In columns (4) through (6), we report the same set of regressions, but for the average yield spread on NAIC 1 bonds. This rules out that the previous regressions simply document a varying preference across these two-categories, and focuses on within a single category. A few observations are lost (firms with insufficient acquisitions of newly issued bonds rated AAA to A). Results are very similar. Overall, results in Table X provide support for reaching for yield driven by both capital requirements and private contracting frictions: Firms with aggressive capital management as well as those with weak governance take on more risk in the corporate bond market.

[28] Block holders may also be less diversified than dispersed owners, therefore being more reluctant for the firm to take on idiosyncratic risk. This would also explain firms with block owners being less risky. However, since we find that much of the risk taken on is systematic (see Table VII above), this may not be an important distinction (undiversified owners have no reason to be more averse to systematic risk).

[29] Because insurance companies do not use much leverage (apart from policy-related liabilities), this may not be the right setting for testing the general relevance of risk shifting vis-à-vis debt investors.

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IV. Implications of Reaching-for-Yield

We now turn to an assessment of the welfare consequences of reaching-for-yield. As we had shown, reaching-for-yield has a pronounced pro-cyclical pattern, being at its strongest during the peak of the credit boom and disappearing in the second half of 2007. Understanding the connection between reaching-for-yield and the business cycle is an important question. In what follows, we provide partial evidence for two channels through which reaching-for-yield could have broader implication for the economy: first, concentration of systemic risk in the insurance firms' portfolios; and, second, the potential effect on the allocation of credit supply.

A. Direct Implications: Insurance Company Exposure to Systemic Risk

In Table VIII we had shown that, when reaching for yield, insurance companies select bonds with higher systemic risk (higher beta). This is consistent with Iannotta and Pennacchi's (2012), Gurrieri and Kondor (2012), and Frazzini and Pedersen's (2011) models. In this section we extend this result by looking at the overall insurance firms' performance. Indeed, the 2008 financial crisis involved considerable portfolio losses for many insurance companies. Three companies (AIG, Hartford Financial Services and Lincoln National) received government support under the Troubled Asset Relief Program (TARP), and one (AIG) was partially taken over by the Federal Reserve in September 2008. If reaching for yield reflects higher risk taking, in a cross-section, we might expect bigger losses of equity value for insurance companies that had reached more in their bond portfolios. This appears to be the case. In Figure 6, we plot the stock returns of public insurance companies for the nine months June 2008 to February 2009 against the average spread of the same companies NAIC 1 bonds. The returns range from -99% (AIG) to 38% (Industrial Alliance Insurance and Financial Services). As predicted, there is a strong negative relation between crisis stock performance and the amount of reaching for yield.

[FIGURE 6]

In Table XI, we examine crisis returns in a multivariate setting. The specification in column (1) replicates the pattern observed in Figure 6, and shows that the negative relation between pre-crisis

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reaching and crisis returns is statistically significant. For a standard deviation increase in bond spreads(18 basis points), a firm is predicted to have lost 14.6% more equity value in the crisis (half of the cross-firm standard deviation of crisis returns). In column (2), we use the average pre-crisis offering yield instead of the yield spread, with similar results (the standard deviation for yields is higher, implying that the economic magnitude is slightly larger).

[TABLE XI]

In columns (2) and (3), we replicate the result for excess returns, defined as the raw return minus equity beta multiplied by -47.5% (the market's return in the period). This is likely over-controlling since higher risk in an insurance company's investment portfolio could affect the systematic risk (beta) of its shares. The results indicate that reaching is associated with negative excess returns during the crisis. In other words, the insurers with most reaching for yield pre-crisis showed negative returns in the crisis period, even beyond what their systematic risk would have predicted. In columns (5) and (6) we use raw returns as dependent variable, and allow for the coefficient on beta to be statistically determined. We also include controls for stock price volatility and a TARP recipient (AIG, Hartford Financial Services, Lincoln National) indicator. The negative correlation remains.

The negative returns during the crisis that we document for firms more engaged in reaching for yield can represent not only losses on the riskier bond portfolios but also losses due to higher risk choices elsewhere (e.g., reaching for yield in structured products). In either case, the results suggest that reaching for yield is not innocuous in terms of the ultimate risks taken on by insurance companies.

B. Indirect Implications: Corporate Bond Issuance

Because insurance companies are large participants in the corporate bond market, reaching for yield may generate a shift in the supply of credit to individual firms. Whether such a shift will manifest in the price or quantity of credit presumably depends on the demand elasticity of issuers. If firms change issuance to respond to supply conditions, the response may be more visible in quantities than in yield

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spreads.[30] We therefore focus on volumes. To examine this, we sort all NAIC 2 corporate bond issuers (that is, firms that previously issued a bond) into quartiles based on their previous quarter CDS spreads. We then calculate the share of bond issuance, by number or by value, within NAIC 2 (we use this category as there is more consistent issuance in NAIC 2 than NAIC 1 throughout our sample period), which is done by issuers in the top half of CDS spreads. We compare this to the time series of insurance companies' reaching for yield, as identified in Table VII. This time series are depicted in Figure 7.

[FIGURE 7]

The pattern in Figure 7 shows a positive association between high CDS firms' issue share and insurance reaching for yield. The correlation between reaching and the high CDS share is 0.24 (amount) and 0.37 (number), statistically significant at the 10% level. This indicates that high yield issuers within the BBB rating category issue more (relative to low yield issuers in the same rating category) at times when insurance companies reach for yield. These correlations are based on few observations and reflect a period of upheaval in credit markets, so they should be interpreted as suggestive only. Taken as such, the time series pattern is consistent with an issuance response by corporations. In other words, the flow of corporate credit appears to be affected by reaching for yield.

V. Conclusions

It has been argued that reaching-for-yield—investors' propensity to buy riskier bonds in order to achieve higher yields—may be an important driver behind dislocations in credit market during financial booms, such as 2004-2007. How reaching-for-yield works and where it manifests is not well understood. In this paper, we examine reaching-for-yield in the corporate bond market by looking at investment decisions of insurance companies, the largest institutional investor in this market. Insurance companies have capital requirements tied to the credit ratings of their investments. We show that, conditional on

[30] There is prior evidence that corporate bond issuers are willing and able to adjust issuance to market conditions (Kashyap, Stein and Wilcox, 1993; Becker and Ivashina, 2011).

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ratings, insurance portfolios are systematically biased toward higher yield, higher CDS bonds. This result holds both at issue and in the secondary market.

We address several alternative interpretations of our findings. One concern is that high yield is correlated with some bond characteristics that might be attractive to insurance companies for other reasons. Such explanations would have to fit the time-series variation we document in reaching-for-yield. Furthermore, when looking at secondary market trading, we follow a bond over time, thus ruling out any cross-sectional differences in characteristics. Another concern is that insurance companies might have the ability to make superior investments in fixed income ("generate alpha"). If high yield bonds are underpriced on average, this investment ability would result in portfolios tilted toward higher yielding bonds. However, we implement a direct test of portfolio "alphas" and show that, as a group, insurance companies that reach for yield do not generate higher performance, but do appear to hold riskier bonds, and bonds with higher exposure to systematic risk factors.

We provide some evidence on the drivers of reaching-for-yield, suggesting that low regulatory capital and weak corporate governance are associated with more aggressive reaching. We conclude that regulation as well as private contracting frictions can drive this behavior.

It is suspected that reaching-for-yield may contributes to the cyclicality of credit supply and, therefore, to the real economic cycle. Consistent with this statement, we find that reaching-for-yield appears to be pro-cyclical, disappearing in the second half of 2007 and coming back in 2009. We further provide evidence for two channels through which reaching-for-yield appears to affect the broader economy. Specifically, periods of reaching for yield by insurance companies appear to lead to higher issuance of risky assets by corporations.

Reaching-for-yield shows cross-sectional variation. Those insurance firms that had the highest tendency to reach for yield in the period preceding the 2007-2008 financial crisis then tended to perform the worst in the recession period. Although insurance firms appear to be less sensitive to runs than banks, like banks, they have liabilities to a broad population base making concentration of risk within insurance portfolio of a macroeconomic concern.

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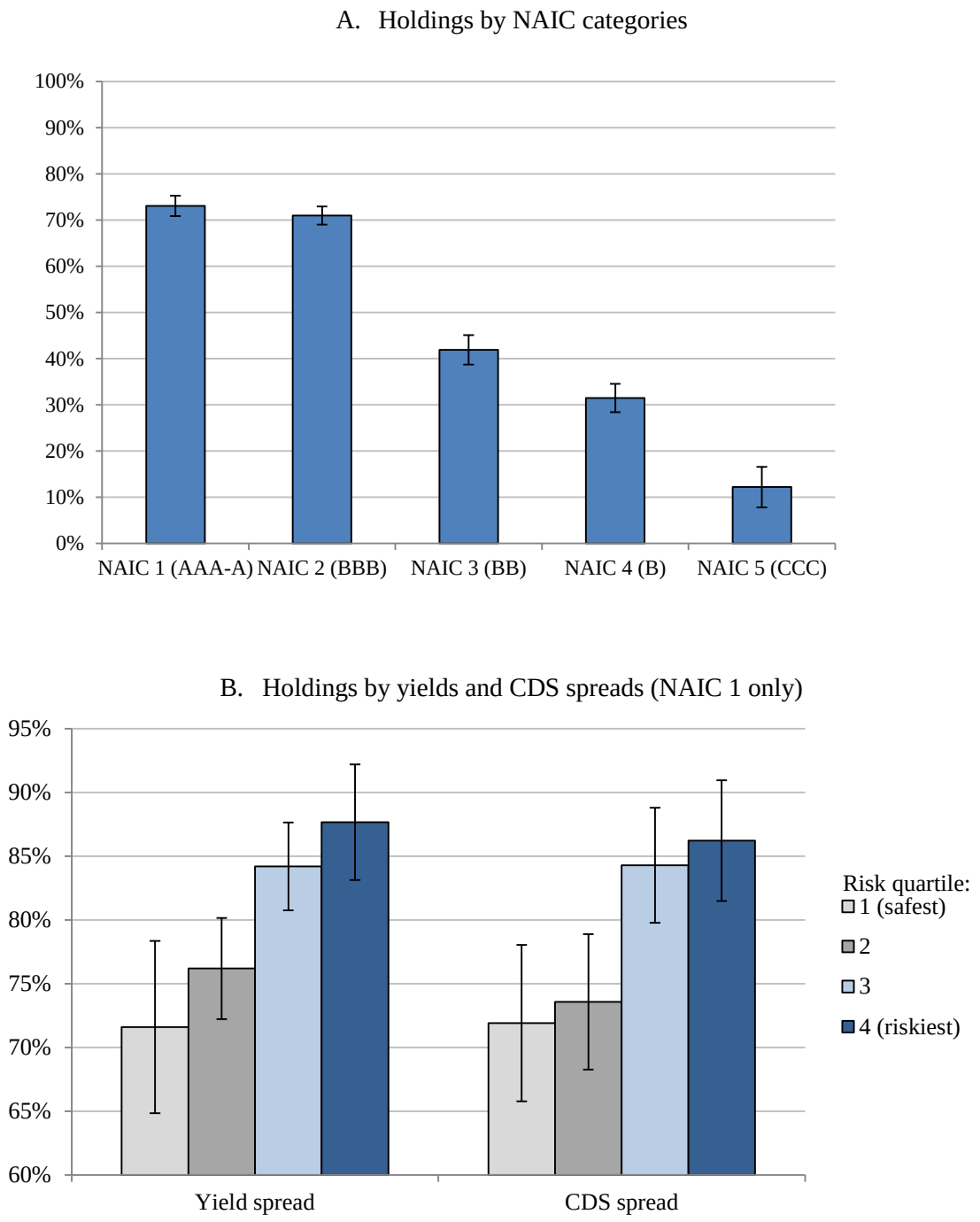

Figure 1. Insurance Companies Holdings of Newly Issued Bonds. This figure plots the fraction of newly issued bonds acquired by insurance companies between 2004:Q2-2007:Q2, sorted by NAIC risk categories (Panel A), promised yields and CDS spreads (Panel B). The fraction of holdings is computed with respect to the total dollar holdings by insurance companies, pension and mutual funds. We report equally-weighted averages across bonds. Bars correspond to 95% confidence intervals (based on the standard deviation across individual bonds). In panel A, bonds are sorted by NAIC categories (except NAIC 6 which has few issues).In Panel B, investment grade bonds (NAIC 1 and 2) are sorted into quartiles of offering yield or CDS Spread.

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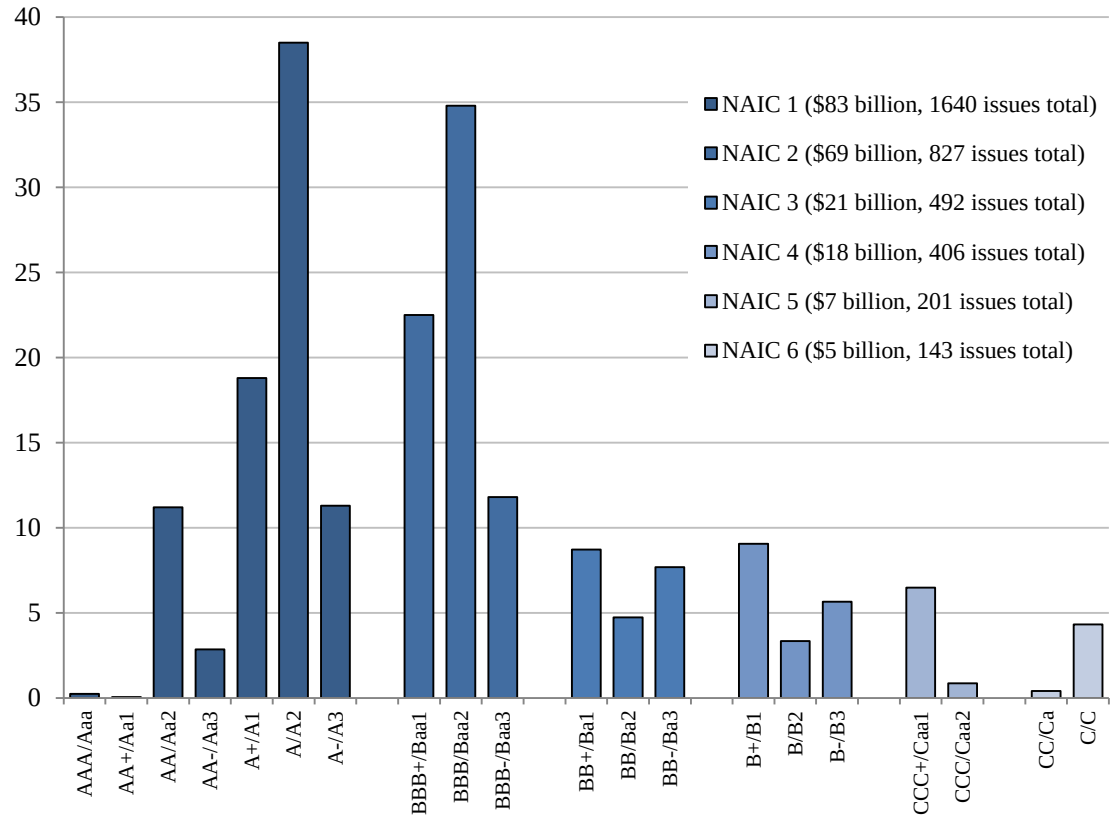

Figure 2. Newly Issued U.S. Corporate Bonds, 2004:Q3-2010:Q4.

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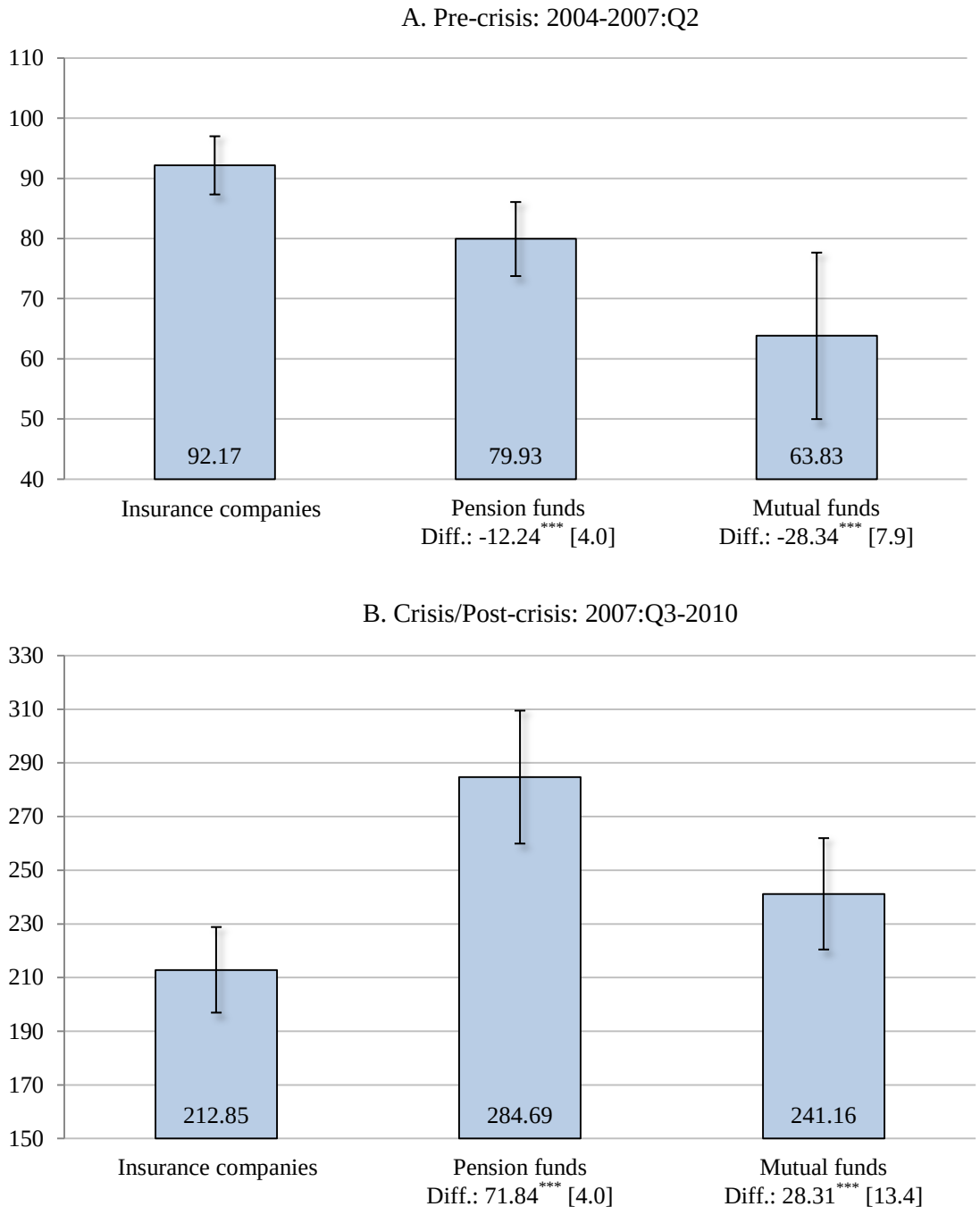

Figure 3. Reaching for Yield. This figure compares the value-weighted average yield spread on NAIC category 1 (rating AAA to A-) corporate bonds acquired by insurance companies, mutual funds, and pension funds. Bars indicate 95% confidence intervals for the average, based on cross-sectional variation. For pension and mutual funds, we report differences as compared to insurance companies and standard errors (in brackets). ***, * indicate statistical significance at 1% and 10% level, respectively.

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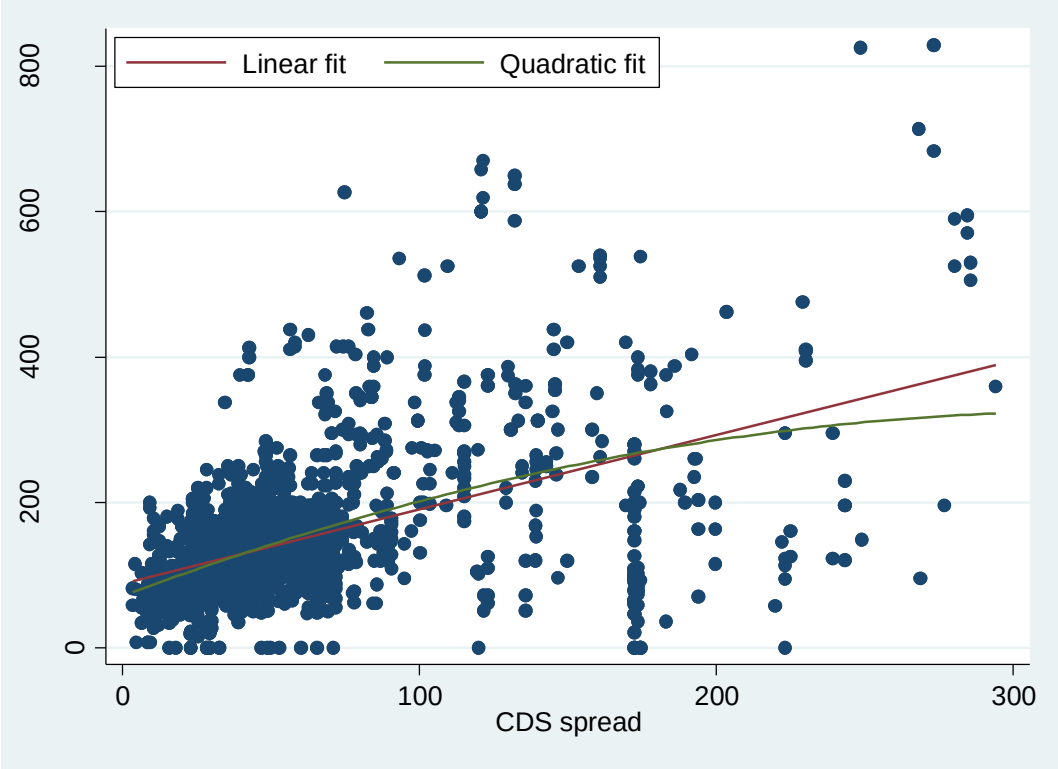

Figure 4. Relation between CDS Spread and Yield to Maturity at Bond Issuance. This plotted sample corresponds to NAIC risk categories 1 and 2 and excludes CDS spreads in excess of 300 basis point. The main dependent variable in our analysis (insurance bond holdings) is quarterly. To convert CDS data to quarterly frequency we use median CDS spread.

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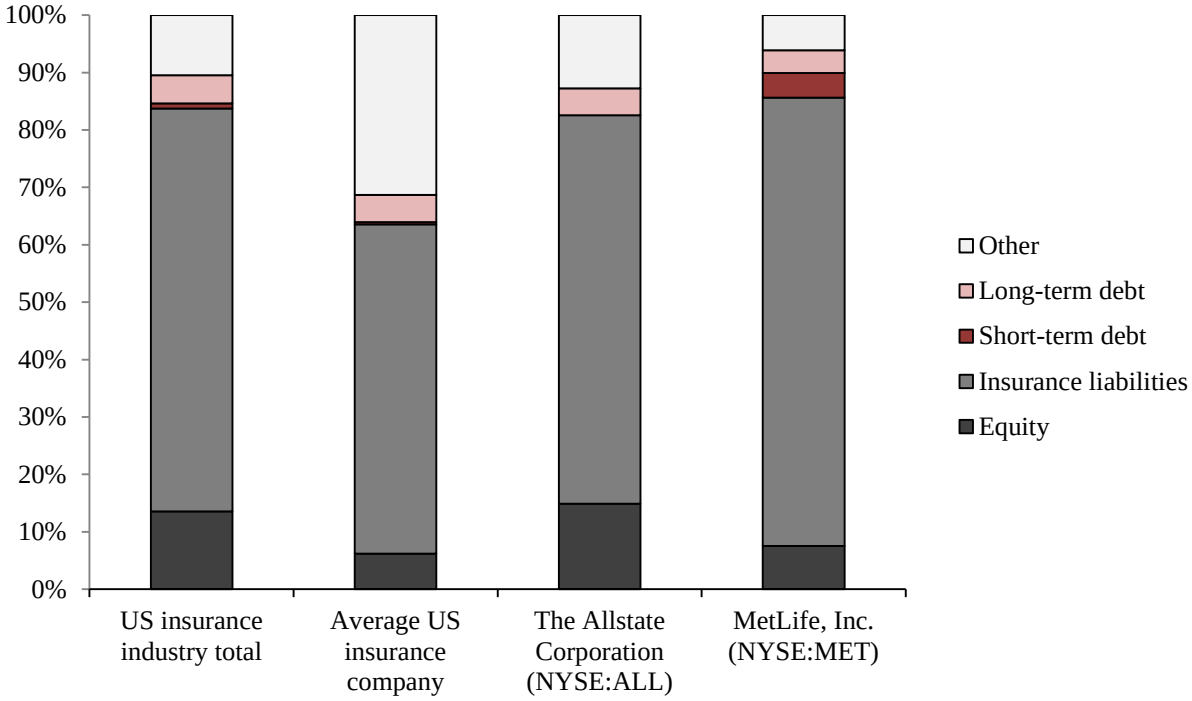

Figure 5. Insurance Companies' Capital Structure. The figure presents capital structure detail for U.S. insurance companies with more than $100 million dollars of assets, for the 2010 fiscal year. The figure was compiled using Capital IQ.

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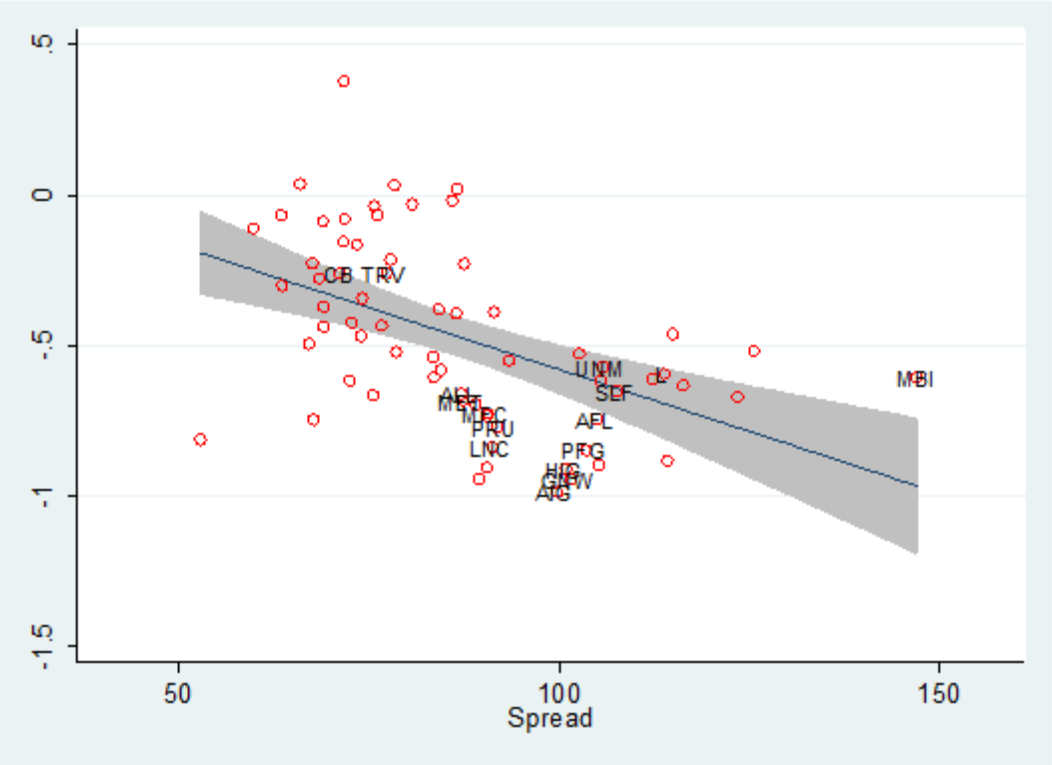

Figure 6. Insurance Companies' Stock Price Performance During Financial Crisis. The figure plots stock returns for the period June 2008- February 2009 relative to their bond investment choices pre-crisis. Spread is the value-weighted average spread of NAIC1 (AAA-A) corporate bonds acquired in the 2004:Q3-2007:Q2 period. The figure was compiled using CRSP data on sock returns, holdings data from eMAXX and yield data from MergentFISD. The picture displays tickers for 16 largest firms in out sample based on 2004 assets; top-1 firm is AIG (NYSE: AIG) and top-16 is MBIA (NYSE: MBI).

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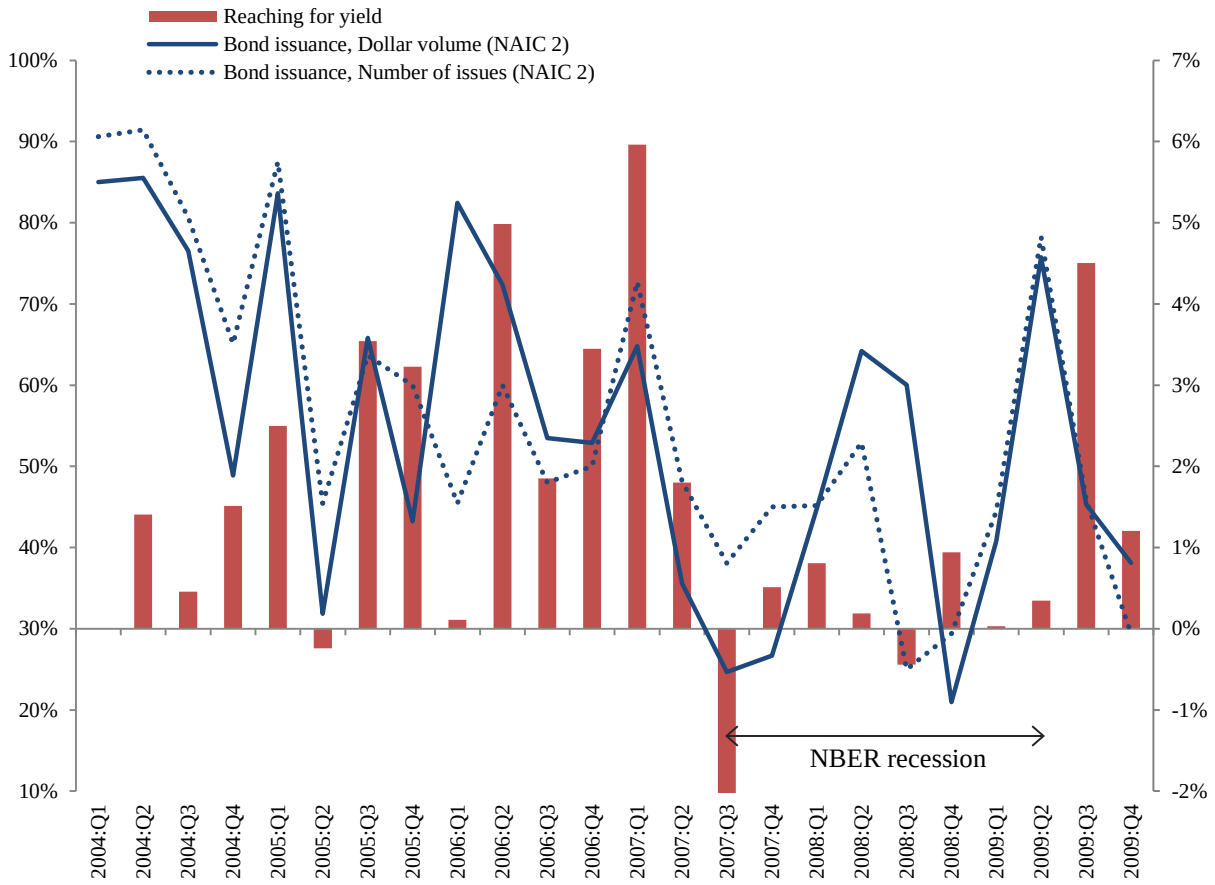

Figure 7. Reaching for Yield and Bond Issuance. The figure presents insurance companies' preference for high yielding bonds (bars, right axis) and the relative bond issuance of high CDS corporates (lines, left axis) within NAIC 2 (ratings between BBB- and BBB+). The insurance preference is based on quarter-specific coefficients on yield spreads in Table VII. The time series of bond issuance reports the fraction of bonds issued by firms in the top half of issuers based on their CDS spread. The cutoff for CDS spreads is determined quarter-by-quarter.

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Table I
Assets Distribution

This figure is based on U.S. Flow of Funds Accounts. The numbers are in billions of U.S. dollars and correspond to amounts outstanding as of the end of 2010:Q4. Mutual funds include money market funds.

	Life insurance companies		Property/casualty insurance companies		Mutual funds		Private pension funds	
Total financial assets	5,176.8		1,403.4		7,963.4		6,079.6	
Treasury securities	161.6	(3%)	91.4	(7%)	296.0	(4%)	486.7	(8%)
Corporate and foreign bonds	2,022.7	(39%)	299.2	(21%)	1,255.0	(16%)	482.5	(8%)
Agency- and GSE-backed securities	357.0	(7%)	109.4	(8%)	786.7	(10%)	170.9	(3%)
Mortgages	318.0	(6%)	4.1	(0%)	--		15.1	(0%)
Municipal securities and loans	77.5	(1%)	369.8	(26%)	525.9	(7%)	--	
Corporate equities	1,423.2	(27%)	228.0	(16%)	4,801.4	(60%)	1,983.3	(33%)
Mutual fund shares	183.8	(4%)	32.1	(2%)	--		2,228.2	(37%)
Total:		88%		81%		96%		88%

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Table II
NAIC Risk-Based Capital Requirement

This summarizes National Association of Insurance Companies (NAIC) post-tax capital requirement factors (NAIC Risk-Based Capital Newsletter, 10/12/2001). Default rates are from Fitch Ratings Global Corporate Finance 2010 Transition and Default Study.

NAIC categories	Credit ratings		Capital charge	5-year cumulative default rates (1990-2010)
Federal government			Exempt	
NAIC 1 (highest)	AAA, AA, A	Investment Grade	0.3%	0.00%, 0.09%, 0.69%
NAIC 2	BBB	Investment Grade	0.96%	2.62%
NAIC 3	BB	High Yield/Speculative Grade	3.39%	6.76%
NAIC 4	B	High Yield/Speculative Grade	7.38%	8.99%
NAIC 5	CCC	High Yield/Speculative Grade	16.96%	34.38%
NAIC 6 (lowest)	CC or below	High Yield/Speculative Grade	19.50%	

Table III

Bond and Issuer Characteristics across CDS Quartiles (Investment Grade Bonds)

This table presents the median of selected issuer and bond characteristics throughout the sample period, for investment grade issuers. The characteristics are at bond issuance. Each entry reports the median and, in parenthesis, the standard deviation of a characteristic. For credit ratings, the standard deviation is in notches (the difference between A and A- is one notch).

Quartile	Yield spread	Maturity	CDS spread	Credit rating	Assets (billion USD)	Book leverage	Return on assets
1 (safest)	65.4	9.8	16.9	A	25.7	0.24	0.067
	(21.1)	(13.2)	(14.1)	(2.3)	(120)	(0.13)	(0.047)
2	112.3	9.0	43.5	A	21.5	0.28	0.053
	(22.0)	(11.5)	(18.8)	(1.8)	(125)	(0.16)	(0.052)
3	170.9	10.0	57.8	A-	15.4	0.30	0.044
	(24.7)	(12.1)	(32.6)	(1.8)	(167)	(0.16)	(0.061)
4 (riskiest)	344.2	9.2	156.8	A-	13.7	0.31	0.022
	(124.3)	(9.6)	(287.5)	(1.8)	(170)	(0.20)	(0.085)

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Table IV
Reaching for Yield: Primary Market, Yield Spreads

We look at the investment decision immediately following bond issuance. With the exception of specification (4), the sample is composed of investment grade issues (NAIC Categories 1 and 2). Specification (4) corresponds to non-investment/speculative grade. *Yield spreads* correspond to the yield difference between a bond and a Treasury. *Duration* is computed using bond information from Mergent FISD. *Trading volume* is the log of the value of transactions in TRACE in the first quarter of trading divided by total par value outstanding. *Number of trades* is the log of the number of investors reporting a change in holdings in first quarter of trading. Credit ratings fixed effects are AAA, AA+, AA, AA-, etc.. Standard errors clustered by issuer and are reported in brackets. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Insurance companies' holding as a fraction of insurance, mutual and pension funds holding amount						
	Benchmark (2004:Q3-2007:Q2)				Crisis (2007:Q3-2010:Q4)		
	Investment grade			Speculative	Investment grade		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Yield spread	0.054*	0.074***	0.048**	0.030	-0.036*	-0.051***	-0.043***
	[0.029]	[0.025]	[0.023]	[0.019]	[0.016]	[0.014]	[0.017]
NAIC Category 2 (BBB+, BBB, BBB-)	-0.006	-0.010	--	--	-0.055	0.055	--
	[0.051]	[0.022]			[0.070]	[0.033]	
Duration (years)	--	0.007**	0.008**	0.017*	--	0.028	0.003
		[0.003]	[0.004]	[0.009]		[0.008]	[0.005]
Offering amount	--	-0.006	-0.002	-0.060***	--	-0.000	-0.026
		[0.005]	[0.006]	[0.016]		[0.028]	[0.030]
Trading volume	--	-0.022**	-0.015	-0.002	--	-0.031*	-0.041**
		[0.011]	[0.012]	[0.21]		[0.018]	[0.018]
Number of trades	--	0.007	-0.005	0.023	--	-0.022	0.018
		[0.018]	[0.023]	[0.027]		[0.026]	[0.029]
Fixed effects:							
Rating * Year (interacted)	No	No	Yes	Yes	No	No	Yes
Observations	600	468	468	190	373	304	304
Clusters (issuers)	141	137	137	84	104	100	100
R-squared	0.03	0.12	0.28	0.43	0.07	0.18	0.23

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Table V
Reaching for Yield: Primary Market, CDS Spreads

We look at the investment decision immediately following bond issuance. With the exception of specification (4), the sample is composed of investment grade issues (NAIC Categories 1 and 2). Specification (4) corresponds to non-investment/speculative grade. *Duration* is computed using bond information from Mergent FISD. *Trading volume* is the log of the value of transactions in TRACE in the first quarter of trading divided by total par value outstanding. *Number of trades* is the log of the number of investors reporting a change in holdings in first quarter of trading. Credit ratings fixed effects are AAA, AA+, AA, AA-, etc.. Standard errors clustered by issuer and are reported in brackets. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Insurance companies' holding as a fraction of insurance, mutual and pension funds holding amount						
	Benchmark (2004:Q3-2007:Q2)				Crisis (2007:Q3-2010:Q4)		
	Investment grade			Speculative	Investment grade		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
CDS spread	0.016*	0.018**	0.001	-0.001	-0.001***	-0.001***	-0.001***
	[0.008]	[0.007]	[0.001]	[0.001]	[0.000]	[0.000]	[0.000]
NAIC Category 2 (BBB+, BBB, BBB-)	-0.070	-0.046	--	--	-0.058	0.040	--
	[0.048]	[0.039]			[0.060]	[0.035]	
Duration (years)	--	0.011**	0.011*	0.009	--	0.008**	0.006
		[0.005]	[0.006]	[0.008]		[0.004]	[0.004]
Offering amount	--	-0.013	0.003	-0.060***	--	-0.013	-0.046
		[0.017]	[0.012]	[0.020]		[0.026]	[0.030]
Trading volume	--	-0.029**	-0.024*	-0.003	--	-0.031**	-0.035**
		[0.014]	[0.013]	[0.024]		[0.015]	[0.016]
Number of trades	--	0.022	0.012	0.033	--	0.003	0.024
		[0.022]	[0.024]	[0.027]		[0.025]	[0.029]
Fixed effects:							
Rating * Year (interacted)	No	No	Yes	Yes	No	No	Yes
Observations	453	360	360	174	348	280	280
Clusters (issuers)	118	115	115	32	99	35	35
R-squared	0.02	0.06	0.26	0.42	0.11	0.20	0.32

Table VI
Reaching for Yield: Trading in the Secondary Market

This table reports results from panel regressions of secondary market activity of insurance companies in investment grade corporate bonds. The dependent variable is the log quarterly change in the value of all insurance companies' holdings of a bond (changes in holdings due to bonds maturity are excluded). Observations where the dependent variable is above 1 are excluded. Similarly, bonds where total holdings are never above 10 million are excluded. The sample is constrained to investment grade issues (NAIC Categories 1 and 2). *Yield spread* is the yield to maturity at which the bond has last transacted minus the end of quarter yield on the Treasury matched on duration. *Trading volume* is the log of the value of transactions in TRACE for a given bond, divided by total par value outstanding, lagged one quarter. *Number of trades* is the log of the number of investors reporting a changed position in the previous quarter in eMAXX. Standard errors clustered by issuer and are reported in brackets. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Log change in value of insurance companies' total holdings since previous quarter		
	Benchmark (2004:Q3-2007:Q2)		Crisis (2007:Q3-2010:Q4)
	(1)	(2)	(3)
Yield spread	0.025**	0.024**	0.000
	[0.010]	[0.010]	[0.001]
NAIC Category 2 (BBB+, BBB, BBB-)	-0.069	-0.017***	-0.123
	[0.049]	[0.006]	[0.078]
Duration	0.004	0.005	0.003***
	[0.007]	[0.004]	[0.001]
Trading volume	--	0.005	0.008
		[0.004]	[0.006]
Number of trades	--	-0.016***	-0.001
		[0.005]	[0.004]
Fixed effects:			
Firm-quarter	Yes	Yes	Yes
Observations	2,397	2,283	2,435
Clusters (issuers)	50	50	46
R-squared	0.36	0.37	0.39

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Table VII
Reaching for Yield: Time Series Variation

This table reports results from panel regressions of secondary market activity of insurance companies in investment grade corporate bonds. The dependent variable is the log quarterly change in the value of all insurance companies' holdings of a bond (maturing bonds are excluded). The sample is constrained to investment grade issues (NAIC Categories 1 and 2). The coefficient on yield is allowed to vary by quarter. Standard errors clustered by issuer and are reported in a separate column. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Log change in value of insurance companies' total holdings since previous quarter	
	Coeff.	Std. error
Interaction terms (yield spread*quarter):		
2004:Q2	0.014	[0.0122]
2004:Q3	0.005	[0.0116]
2004:Q4	0.015	[0.0158]
2005:Q1	0.025**	[0.0102]
2005:Q2	-0.002	[0.0058]
2005:Q3	0.035***	[0.0103]
2005:Q4	0.032***	[0.0086]
2006:Q1	0.001	[0.0068]
2006:Q2	0.050***	[0.0086]
2006:Q3	0.019**	[0.0091]
2006:Q4	0.034**	[0.0077]
2007:Q1	0.060***	[0.0066]
2007:Q2	0.018	[0.0066]
2007:Q3 (NBER recession)	-0.031***	[0.0060]
2007:Q4 (NBER recession)	0.005	[0.0070]
2008:Q1 (NBER recession)	0.008	[0.0073]
2008:Q2 (NBER recession)	0.002	[0.0050]
2008:Q3 (NBER recession)	-0.004	[0.0086]
2008:Q4 (NBER recession)	0.009**	[0.0035]
2009:Q1 (NBER recession)	0.000	[0.0028]
2009:Q2 (NBER recession)	0.003	[0.0064]
2009:Q3	0.045***	[0.0142]
2009:Q4	0.012	[0.0128]
2010:Q1	0.002	[0.0112]
2010:Q2	0.020***	[0.0076]
2010:Q3	0.012	[0.0098]
Firm-quarter fixed effects:	Yes	
Observations	6,486	
R-squared	0.27	

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Table VIII
Bond Performance: Return Analysis

This table examines bonds secondary market performance for 2004-2007. The test focuses on newly issued investment grade bonds. The dependent variable is monthly excess return (returns in excess of the risk-free rate) measured in basis points. Returns are constructed using prices from non-cancelled transactions reported in TRACE. We exclude any bond trades below $1 million to make sure that we capture institutional, and not retail transactions. Monthly returns are computed using median trade price at the last day of the month and factor in bond coupons. For a given month, the sample includes bonds acquired within 1-year window. We report equally-weighted excess returns for the portfolio with the highest (above the median) and lowest (below the median) insurance holdings measured at issuance. The risk-free rate and market return are from Ken French's website. *Default premium* is the difference in returns between investment grade and high yield corporate bonds (the Lehman/Barclays index). *Term spread* is the difference in returns between the five-year Treasury bond and the three-month Treasury bill. *Liquidity factor* is the return factor of Pastor and Stambaugh (2003). ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Bond portfolio	High insurance holdings			Low insurance holdings		
	(1) Fama and French (1989)	(2)	(3)	(4) Fama and French (1989)	(5)	(6)
Intercept ("Alpha")	-36.0*	-49.7***	-67.9**	-8.8	-16.5	-22.4*
	[18.4]	[18.4]	[20.3]	[8.8]	[10.1]	[11.8]
Stock market excess return	--	0.211**	--	--	0.120**	--
		[0.086]			[0.047]	
Default premium	0.302*	0.273	0.224	0.083	0.066	0.051
	[0.176]	[0.171]	[0.159]	[0.082]	[0.074]	[0.073]
Term spread	0.364***	0.414***	0.403***	0.297**	0.324***	0.321**
	[0.074]	[0.060]	[0.064]	[0.045]	[0.040]	[0.043]
Liquidity factor	--	--	0.184***	--	--	0.059*
			[0.061]			[0.031]
Observations	48	48	48	48	48	48
R-squared	0.27	0.39	0.49	0.47	0.58	0.61
Mean excess return	-21.1			2.2		
Std. dev.	150.8 (Diff.: 62.6***)			88.2		
Mean return – IG index	-28.9			-7.6		
Std. dev.	159.4 (Diff.: 33.4*)			126.0		

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Table IX
Bond Performance: Downgrades

This table examines ratings changes for newly issued corporate bonds. The sample is constrained to investment grade issues (NAIC Categories 1 and 2). The aggregate credit rating of a bond is based on ratings by S&P, Moody's and Fitch. If a bond has two ratings, the lower is used, and if it has three ratings, the median is used. *Downgrade indicator* is equal to 1if the (aggregate) credit rating fell by at least one notch over the specified time interval, and 0 otherwise. *Ratings change* is the future (aggregate) rating minus the (aggregate) rating at issue and ranges from -15 to +3. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

	Benchmark (2004:Q3-2007:Q2)			Crisis (2007:Q3-2010:Q4)
Dependent variable:	Downgrade indicator	Downgrade indicator	Ratings change	Downgrade indicator
	1 year out	2 years out	2 years out	1 year out
	(1)	(2)	(3)	(3)
Insurance companies' holdings at issue	0.108**	0.231***	-0.833**	0.208
	[0.055]	[0.073]	(0.417)	[0.180]
NAIC Category 2 (BBB+, BBB, BBB-)	0.070	0.063	-0.393	-0.175*
	[0.096]	[0.115]	(0.487)	[0.095]
Constant	0.104**	0.226***	-0.301	0.173*
	[0.043]	[0.061]	(0.327)	[0.089]
Observations	901	901	901	474
Clusters (issuers)	155	155	155	0.185
R-squared	0.014	0.022	0.025	0.065

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Table X
Governance and Reaching for Yield

This table reports results from cross-sectional regressions of purchases of insurance companies of NAIC 1 and 2 (i.e., investment grade) corporate bonds. We look at purchases of bond issued during the period 2003Q4-2007Q2. Each observation is one insurance company and year. The dependent variable, *Yield spread*, is the average yield spread (the difference between bonds acquired by a given insurance company and duration-matched Treasury), averaged for a firm-year. When a firm acquires stakes in less than 3 bonds in a given year, it is dropped. *Regulatory capital surplus* is capital surplus normalized by an insurer's assets. *Block-holder ownership* measures the fraction of outstanding shares held by block-holders. *Public firm* is a dummy indicating whether the firm is publically traded. *Leverage* is the ratio of liabilities to equity, and is capped at 20. *Size* is the log of assets (book value). Firms with less than $10 million in asset value are dropped. Additionally, firms with less than $10 million in market capitalization are dropped in columns 2, 3, 5, and 6. Robust standard errors, clustered by firm, are reported in brackets. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Average yield spread, corporate bonds in NAIC 1-2			Average yield spread, corporate bonds in NAIC 1		
	(1)	(2)	(3)	(4)	(5)	(6)
Insurance firms characteristics:						
Regulatory capital surplus	-109.3***	--	-116.2*	-93.1***	--	-114.2**
	[29.6]		[70.4]	[26.6]		[42.0]
Block-holder ownership	--	-84.9***	-54.4**	--	-73.4***	-49.6**
		[18.2]	[20.0]		[16.1]	[19.8]
Public firm	1.58	--	--	2.63	--	--
	[5.37]			[4.88]		
Leverage	--	--	12.2	--	--	-1.1
			[30.8]			[25.4]
Size	--	--	2.44	--	--	-0.24
			[2.86]			[2.33]
Observations	379	177	158	373	175	155
R-squared	0.09	0.17	0.29	0.09	0.14	0.19

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Table XI
Reaching for Yield and Insurance Companies' Performance

This table reports results from regressing insurance companies' stock returns during the financial crisis (June 2008 to February 2009) on their pre-crisis portfolio choices. Each observation in the analysis corresponds to a different insurance firm (this is a pure cross-section). In columns (1), and (3), the dependent variable is the raw return; in column (2), the dependent variable is the excess return calculated using a market model with betas estimated based on 2002-2010 data. *Average yield spread* is the value-weighted average spread for bonds acquired by a given insurance company at issuance. The bond sample is constrained to NAIC 1 corporate bonds issued between 2004:Q3 and 2007:Q2. *TARP recipient* indicates three insurance companies that received support under the Federal Reserves Troubled Asset Relief Program in the fall of 2008. *Stock beta* and *Stock volatility* are estimated using daily data for 2001-2011 period. Robust standard errors are reported in brackets. ***, **, * indicate statistical significance at 1%, 5% and 10% level, respectively.

Dependent variable:	Return (1)	Excess return (2)	Return (3)
Insurance firms characteristics:			
Average yield spread	-0.824***	-0.359*	-0.399**
	[0.191]	[0.188]	[0.184]
TARP recipient	--	--	-0.058
			[0.068]
Stock beta	--	--	-0.114
			[0.070]
Stock volatility	--	--	-4.76***
			[1.435]
Observations	67	67	67
R-squared	0.25	0.06	0.52

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